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# A DIFFERENTIAL GEOMETRIC APPROACH TO FLUID MECHANICS

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**Abstract-** The paper presents a formulation of some of the most basic entities and equations of fluid mechanics, the continuity equation and the Navier-Stokes equations in a modern differential geometric language using calculus of differential forms on manifold (exterior calculus).

**Index Terms-** differential geometry, manifolds, exterior calculus, fluid mechanics, Navier-Stokes equations

## I. INTRODUCTION

Modern differential geometry is a powerful mathematical tool and pervades many branches of physics. Physical theories are often naturally and concisely expressed in terms of differential geometric concepts, using exterior calculus, the calculus of differential forms on manifolds, this calculus of forms provides an intrinsic, coordinate-free approach particularly relevant to concisely describe a multitude of physical models. Even more importantly, equations stated in modern differential geometric terms are not bound to the use of special classes of coordinate systems, such as Cartesian or orthonormal ones. It provides useful and powerful concepts such as differential forms and operators for working with forms and with them a generalization of vector calculus expressions like rotation, gradient and divergence and of various integral theorems like Gauss' divergence theorem or Stokes integral theorem on planes to just one integral theorem. Exterior calculus can thereby be understood as a generalization of vector calculus. In contrast to it, however, exterior calculus is defined on arbitrary manifolds. Exterior calculus is a concise formalism to express differential and integral equation on smooth and curved spaces in a consistent manner, while revealing the geometrical invariants at play.

Modern differential geometry often allows for a clearer, more geometric approach to study physical problems than vector calculus.. In general, it is desirable to express equations in a coordinate and metric free manner, using only differential forms and operators for working with forms, thus simplifying coordinate system changes.

The goal of this work is to give a geometric framework which allows us to describe the fluid systems. Writing equations of fluid mechanics in terms of differential forms enables one to clearly see the geometric features of the fluid field. In this paper we present the modern language of differential geometry to study the fluid mechanics.

## 2. DIFFERENTIAL GEOMETRY

This section aims to introduce the basics of modern differential geometry.

### 2.1. Differentiable manifolds

Manifolds will be our models for space because they offer the most generic coordinate-free model for space.

**Definition 2.1.** Let  $M$  be a set of elements called points. We say that  $M$  is a  $n$ -dimensional *smooth manifold* if there exists an *atlas*, that is a collection of pairs  $(U_i, \phi_i)$  (called "*charts*") such that:

1. Each  $U_i$  is a subset of  $M$  and the  $U_i$  cover  $M$ .
2. Each  $\phi_i$  is a bijection of  $U_i$  onto an open subset  $V_i$  of  $\mathbb{R}^n$ . And for any  $i, j$ ,  $\phi_i(U_i \cap U_j)$  is open in  $\mathbb{R}^n$ .
3. For any  $i, j$ , the map  $\phi_j \phi_i^{-1}: \phi_i(U_i \cap U_j) \rightarrow \phi_j(U_i \cap U_j)$  is a  $C^\infty$  isomorphism.

**Definition 2.2.** A map  $f: M \rightarrow N$  between smooth manifolds is called *differentiable map* if it is continuous and for each point  $p \in M$  there is a chart  $(U, \phi)$  on  $M$  with  $p \in U$  and a chart  $(V, \psi)$  on  $N$  with  $f(p) \in V$  such that the composite  $\Phi = \psi \circ f \circ \phi^{-1}$  is differentiable. The map  $f$  is called a *diffeomorphism* if it is smooth and bijective with a smooth inverse. Two manifolds are called *diffeomorphic* if there exists a diffeomorphism between them. We denote by  $\text{Diff}(M, N)$  the set of diffeomorphisms from  $M$  to  $N$ . The set  $\text{Diff}(M, N)$  is a group under composition of mappings, called group of diffeomorphisms.

**Definition 2.3.** Let  $\phi: M \rightarrow N$  be differentiable map from a manifold  $M$  to a manifold  $N$ , for any  $f \in C^\infty(N, \mathbb{R})$ . The map  $\phi^* f$  ( $\phi^*: C^\infty(N, \mathbb{R}) \rightarrow C^\infty(M, \mathbb{R})$ ) given by  $(\phi^* f)(x) = (f \circ \phi)(x)$ ;  $x \in M$ , is called the *dual map* of  $\phi$  (or the pull-back of  $f$  by  $\phi$ ).

**Definition 2.4.** Let  $M$  be a differentiable manifold,  $p_0$  be a point of  $M$  and  $I$  be an open interval in  $\mathbb{R}$  containing  $0$ . A (differentiable) curve passing through  $p_0$  in  $M$  is a differentiable mapping  $\sigma: I \rightarrow M$ ;  $t \mapsto \sigma(t)$  such that  $\sigma(0) = p_0$ . A tangent vector at  $x$  is an

equivalence class of differentiable curves having the same tangency at  $x$ . Let  $\sigma: I \rightarrow M$  be a differentiable curve on a manifold  $M$ , with  $\sigma(0) = x \in M$ , and let  $D$  be the set of functions of  $M$  which are differentiable at  $x$ , the tangent vector to the curve  $\sigma$  at  $x$  is map:  $\sigma': D \rightarrow \mathbb{R}$ , given by  $\sigma'(\phi) = \left. \frac{d}{dt}(\phi \circ \sigma) \right|_{t=0}$ ;  $\phi \in D$ , for every chart  $\phi$  containing  $x$ . The tangent space to  $M$  at the point  $x \in M$  written  $T_x M$  is the set of equivalence classes of curves at  $x$ .

**Definition 2.5.** Let  $\phi: M \rightarrow N$  be a differentiable map between smooth manifolds  $M, N$ . The differential (or the push forward) of  $\phi$  at  $x \in M$  is the linear map  $\phi_* = d\phi_x: T_x(M) \rightarrow T_{\phi(x)}(N)$ , defined for  $f \in C^\infty(N, \mathbb{R})$  and  $X \in T_x(M)$  by  $d\phi_x(X)(f) = X_x(\phi^*(f)) = X_x(f \circ \phi)$ .

A very useful geometrical construct technically known as the tangent bundle of a differentiable manifold  $M$ . This is what the physicist calls velocity space.

**Definition 2.6.** The tangent bundle of a manifold  $M$  is the (disjoint) union of the tangent spaces. The tangent bundle projection is the  $(C^\infty)$  surjective mapping  $\pi_M: TM \rightarrow M; (x, X_x) \mapsto x$ , given by  $\pi_M(x, X_x) = x; \forall (x, X_x) \in TM$ . A  $C^k$  cross-section of tangent bundle

$TM$  is a mapping  $s$  of class  $C^k$  of  $M$  into  $TM$  such that the composition of  $s$  with the tangent bundle projection is the identity on  $M$ .  $s: M \rightarrow TM; x \mapsto X_x \in T_x M$ , which are called differentiable vector fields, with  $s \circ \pi = Id_M$ . Thus, a vector field on a manifold  $M$  is a mapping  $X: M \rightarrow TM; z \mapsto X(z) = (z, X_z); X(z) \in T_z M, \forall z \in M$ , which assigns to each point  $z \in M$  a pair composed of a point  $z$  and a tangent vector at this point  $z$ , such that  $\pi \circ X = id|_M: M \rightarrow M; z \mapsto \pi(X(z)) = z$ . The set of all vector fields on  $M$  denoted by  $\mathfrak{X}(M)$ . The set of all smooth scalar fields is denoted by  $\mathcal{F}(M)$ . A time-dependent vector field is a differentiable map:  $X: \mathbb{R} \times M \rightarrow TM; (t, x) \mapsto X_t(x) = X(t, x), X_t \in \mathfrak{X}(M)$  and  $X(t, x) \in T_x M$ .

**Definition 2.7.** An integral curve of vector field  $X$  on a manifold  $M$  is a differentiable map  $c: I \rightarrow M; t \mapsto c(t)$ , where  $I$  is an interval in  $\mathbb{R}$ , such that  $c'(t) = X(c(t))$  for all  $t \in I$ .

**Definition 2.8.** A one-parameter group of diffeomorphisms of a manifold  $M$  is a smooth map  $\phi$  from  $\mathbb{R} \times M$  onto  $M$ ,  $\phi: \mathbb{R} \times M \rightarrow M; (t, x) \mapsto \phi_t(x)$ , such that  $\phi_t: M \rightarrow M; (x \mapsto \phi_t(x)); \forall t \in \mathbb{R}$  is a diffeomorphism,  $\phi_0$  is identity on  $M$  and  $\phi_{s+t} = \phi_s \circ \phi_t$ . Any one parameter group of diffeomorphism  $\{\phi_t\}$  on  $M$  induce a vector field  $X \in \mathfrak{X}(M)$ .

**Definition 2.9.** Let  $M$  be a  $n$ -dimensional manifold. The dual space  $T_x^* M$  to the tangent space  $T_x M$  at the point  $x$  of a manifold  $M$  is called the cotangent space, and it's element called cotangent vectors (covectors) based at  $x$ . The cotangent bundle of a manifold  $M$  is the (disjoint) union of the cotangent spaces. The tangent bundle projection is the  $(C^\infty)$  surjective mapping  $\pi^*: T^* M \rightarrow M; (x, \omega_x) \mapsto x$ , given by  $\pi^*(x, \omega_x) = x; \forall (x, \omega_x) \in T^* M$ . A  $C^k$  cross-section of cotangent bundle  $T^* M$  is a mapping  $s$  of class  $C^k$  of  $M$  into  $T^* M$  such that the composition of  $s$  with the cotangent bundle projection is the identity on  $M$ .  $s: M \rightarrow T^* M; x \mapsto \omega_x \in T_x^* M$ , which are called a field of covector (or differential forms of degree 1), with  $\pi^* \circ s = id|_M$ . 1-forms are important geometric objects. They can represent, among other things, force, momentum, and phase velocity.

**Definition 2.10.** Let  $M$  be a differentiable manifold and  $TM$  its tangent bundle. We call  $T_s^r(M) = T_s^r(TM)$  the Tensor bundle of type  $(r, s)$  over  $M$ , which is the collection of all tensors of type  $(r, s)$  at all points of  $M$ .

**Definition 2.11.** A tensor field  $T$  of type  $(r, s)$  on a manifold  $M$  is a differentiable cross-section of the tensor bundle.  $T: M \rightarrow T_s^r(M); x \mapsto T(x) \in T_s^r(x)$ . A tensor field  $T$  is symmetric (resp. skew-symmetric) if  $T(x)$  is symmetric (resp. skew-symmetric), for every  $x \in M$ .

## 2.2. Differential forms and exterior calculus on a manifold

Many important objects in continuum mechanics are made to be integrated. mass density, internal energy density, body forces, surface tractions, and heat influx are just a few important examples, are differential forms. Differential forms provides the language for expressing the equations of mathematical physics in a coordinate-free form, one of the fundamental principles of relativity. In this paper, differential forms are used to model fluid system.

**Definition 2.12.** Let  $M$  be a differentiable manifold, and the spaces  $TM, T^* M$  denote the tangent and cotangent bundle of  $M$  respectively. The  $p$ th exterior bundle over  $M$  is

$$\Lambda^p(M) = \Lambda^p(T^* M) := \{(x, \omega_x) | x \in M, \omega_x \in \Lambda^p(T_x^*(M))\}.$$

**Definition 2.13.** Let  $M$  be a differentiable manifold. A differential form of degree  $p$  (or  $p$ -form) on  $M$  is a differentiable cross section:  $\omega: M \rightarrow \Lambda^p(T^* M); x \mapsto \omega(x) = (x, \omega_x)$ . In other words differential  $p$ -form is skew-symmetric  $p$ -linear mapping.

**Definition 2.14.** For each  $p \geq 0, q \geq 0$  with  $p + q \leq n$  and for any  $p$ -form  $\omega \in \Omega^p(M)$ ,  $q$ -form  $\theta \in \Omega^q(M)$  there is an operation called wedge product,  $\wedge: \Omega^p(M) \times \Omega^q(M) \rightarrow \Omega^{p+q}(M); (\omega, \theta) \mapsto \omega \wedge \theta$ .

**Definition 2.15.** The exterior derivative  $d$  of a differential  $p$ -form on a manifold  $M$  is a mapping:  $d: \Omega^p(M) \rightarrow \Omega^{p+1}(M); \omega \mapsto d\omega$ , where  $d\omega$  is a differential  $(p + 1)$ -form defined over the same manifold  $M$ . The exterior derivative satisfies the following properties:

- i. If  $f \in \Omega^0(M)$ , then  $d(f) = df, df(X) = X(f)$  for  $X \in \mathfrak{X}(M)$ .
- ii.  $\forall \omega \in \Omega^p(M), \forall \theta \in \Omega^q(M): d(\omega \wedge \theta) = d\omega \wedge \theta + (-1)^p \omega \wedge d\theta$ .
- iii. For every form  $\omega \in \Omega^p(M), d(d\omega) = 0$ .

**Definition 2.16.** Let  $M$  and  $M'$  be two differentiable manifolds and  $\phi: M \rightarrow M'$  be differentiable mapping. the *pullback*  $\phi^*: \Omega^p(M') \rightarrow \Omega^p(M)$  is a map define as follows: For any  $p$ -form  $\omega$  on  $M'$ , the pullback  $\phi^*\omega$  of  $\omega$  by  $\phi$  is a  $p$ -form on  $M$  given by:  $(\phi^*\omega)(x, X_1, \dots, X_p) = \omega(\phi(x), \phi_*X_1, \dots, \phi_*X_p); X_1, \dots, X_p \in T_x(M)$ . The pullback has the following properties:

- i. The pullback  $\phi^*$  is a linear,  $\forall \omega, \theta \in \Omega^p(M): \phi^*(\omega + \theta) = \phi^*\omega + \phi^*\theta$ .
- ii.  $\forall \omega \in \Omega^p(M), \forall \theta \in \Omega^q(M): \phi^*(\omega \wedge \theta) = \phi^*\omega \wedge \phi^*\theta$ .
- iii.  $\phi^*(f\omega) = (f \circ \phi)\phi^*\omega, f \in C^\infty(V)$ .
- iv. Pullback commutes with exterior derivative,  $d(\phi^*\omega) = \phi^*(d\omega)$ .

**Definition 2.17.** Let  $X_1, \dots, X_{p-1} \in \mathfrak{X}(M)$  denote a set of vector fields on  $M$  and  $\omega \in \Omega^p(M)$  be any  $p$ -form on  $M$ . The *contraction* of  $\omega$  by the vector field  $X$  is an operator  $i_X: \mathfrak{X}(M) \times \Omega^p(M) \rightarrow \Omega^{p-1}(M); (X, \omega) \mapsto i_X\omega$ , it maps a  $p$ -form into a  $(p - 1)$ -form, defined by:  $(i_X\omega)(X_1, \dots, X_{p-1}) = \omega(X, X_1, \dots, X_{p-1})$ .

The arguably most important derivative on manifolds is the Lie derivative. It describes how a geometric object (a vector field, a tensor, a form) changes when it is dragged along some vector field  $X$ .

**Definition 2.18.** Consider a 1-parameter group  $\{\phi_t\}$  of diffeomorphism of differentiable manifold  $M$ , if  $\omega \in \Omega^p(M)$  is any  $p$ -form. The *Lie derivative*  $L_X\omega$  of  $\omega$  with respect to the vector field  $X \in \mathfrak{X}(M)$  is the differential operator  $L: \mathfrak{X}(M) \times \Omega^p(M) \rightarrow \Omega^p(M); (X, \omega) \mapsto L_X\omega$ , defined by  $(L_X\omega) = \left. \frac{d}{dt} \phi_t^*\omega \right|_{t=0}$ . It has the following properties:

- i.  $\forall \omega \in \Omega^p(M), \forall \theta \in \Omega^q(M): L_X(\omega \wedge \theta) = L_X\omega \wedge \theta + \omega \wedge L_X\theta$
- ii.  $\left. \frac{d}{dt} \phi_t^*\omega \right| = \phi_t^*L_X\omega = L_X(\phi_t^*\omega)$ .
- iii.  $f \in \Omega^0(M)$ , then  $L_Xf = Xf = \left. \frac{\partial}{\partial t} f(\phi_t) \right|_{t=0}$ .
- iv.  $\forall \omega \in \Omega^p(M), \forall X \in \mathfrak{X}(M): L_X\omega = i_Xd\omega + di_X\omega, \forall X \in \mathfrak{X}(M)$ .
- v. The Lie derivative of constant function is equal to zero.

The concept of invariance along the flow of a vector field will therefore be of considerable importance in the following.

**Definition 2.19.** Let  $M$  be a manifold and  $X \in \mathfrak{X}(M)$  a vector field on  $M$ . A differential form  $\omega \in \Omega^p(M)$  is *invariant* under the flow of  $X$  when  $L_X\omega = 0$ .

**Definition 2.20.** A *volume form* on an  $n$ -manifold  $M$  is an  $n$ -form  $\omega \in \Omega^n(M)$  such that  $\omega(x) \neq 0; \forall x \in M$ . For a volume form  $\omega$ ,  $d\omega = 0$ . A manifold  $M$  is called *orientable* if and only if there is volume form on it.

In the following, we provide two important theorems about the integration of differential forms on manifolds.

**Theorem 2.1** (Stokes' Theorem). Let  $\omega$  be an  $(n - 1)$ -form on an orientable  $n$ -manifold  $M$ . Stokes' theorem states that the integral of an  $(n - 1)$ -form  $\omega$  over the boundary  $\partial M$  of  $M$  equals the integral of the exterior derivative of this form  $d\omega$  over  $M$ .

$$\int_{\partial M} \omega = \int_M d\omega. \tag{2.2.1}$$

Another simple but, nevertheless, very useful result of integral of differential forms concerns behavior of integrals with respect to mappings of manifolds.

**Theorem 2.2** (Change of Variables Theorem). Suppose  $M$  and  $N$  are oriented  $n$ -manifolds and  $\phi: M \rightarrow N$  is an orientation-preserving diffeomorphism. If  $\omega \in \Omega^n(N)$  has compact support, then  $\phi^*\omega$  has compact support and

$$\int_N \omega = \int_M \phi^*\omega. \tag{2.2.2}$$

**Remark 2.1.** With slight abuse of notation, one often writes for the change of variables formula

$$\int_{\phi(M)} \omega = \int_M \phi^*\omega. \tag{2.2.3}$$

### 3. THE GEOMETRIC SETUP

With the differential geometrical tools we have developed, now we give a geometric models of basic kinematics used in modeling the fluid flow.

#### 3.1. The fluid space

The first step is to model the fluid region. In an attempt to give an invariant formulation of fluid mechanics, the placement of a fluid in space, the space the fluid flows in is assumed to be a smooth manifold  $M$ . A fluid particle is a point in the manifold. Points in a domain  $D \subset M$  represent the geometric positions of material particles, these points are denoted by  $x \in M$  and called the particle labels.

#### 3.2. Fluid motions

The next step is the geometric notion of the fluid motion. Consider fluid moving in  $M$ , our manifold  $M$  whose points are supposed to represent the fluid particles. As  $t$  increase, call  $\phi_t(x)$  the curve followed by the fluid particle, which is initially at  $x \in M$ . For fixed  $t$ ,

each  $\phi_t$  will be a diffeomorphism of  $M$ . Thus the fluid motion is a smooth one-parameter family of diffeomorphisms  $\phi_t: M \rightarrow M$ ; with  $\phi_0 = Id$ .

Suppose  $M$  is a differentiable  $n$ -manifold and  $t \rightarrow \phi(t)$  is a one-parameter family of diffeomorphisms of  $M$ . Intuitively,  $M$  is the space in which the fluid moves. For each value of  $t$ , define a vector field  $X_t \in \mathfrak{X}(M)$  as follows:

For  $x \in M$  ( $x$  be a point in  $M$ ),  $X_t(x)$  is the tangent vector to the curve  $u \rightarrow \phi_u \phi_t^{-1}(x)$  at  $u = t$ , physically,  $X_t$  is the velocity field corresponding to the fluid motion defined by  $\phi_t$ , that is,  $X_t(x)$  is the velocity vector of the particle that, at time  $t$ , is at the point  $x$ .

$$X(\phi_t(x), t) = \frac{\partial \phi_t}{\partial t}(x). \tag{3.2.1}$$

Geometrically, the velocity vector describes the path the particle would have taken if it had continued on with uniform motion. For  $f \in F(M)$ ,  $X_t$  in terms of its action on functions on  $M$  is:

$$X_t(f) = (\phi_t^{-1})^* \frac{\partial}{\partial t} (\phi_t^*(f)); \text{ for } f \in F(M). \tag{3.2.2}$$

Consider fluid flow on a manifold  $M$  described by a time-dependent vector field  $X$ . A flow is called *steady* (or *stationary*) if its vector field satisfies

$$\frac{\partial X}{\partial t} = 0, \tag{3.2.3}$$

i.e.  $X$  is constant in time. This condition means that the "shape" of the fluid flow is not changing. Even if each particle is moving under the flow, the global configuration of the fluid does not change.

Given a fluid flow with velocity (vector) field  $X(x, t)$ , a *streamline* at a fixed time  $t$  is an integral curve of  $X$ ; that is, if  $c(s)$  is a streamline parameterized by  $s$  at the instant  $t$ , then  $c(s)$  satisfies

$$\frac{dc}{ds} = X(c(s), t), \quad t \text{ fixed.} \tag{3.2.4}$$

On the other hand, a trajectory is the curve traced out by a particle as time progresses, that is, is a solution of the differential equation

$$\frac{dc}{dt} = X(c(t), t), \tag{3.2.5}$$

with given initial conditions. If  $X$  is independent of  $t$  then, streamlines and trajectories coincide.

#### 4. GEOMETRIC FORMULATION OF FLUID EQUATIONS

In this section, we present some of the basic equations of fluid mechanics in invariant form by using tools and language of modern differential geometry.

##### 4.1. Continuity equation

Let  $D \subset M$  be a sub region of  $M$  ( $M$  denotes a differentiable  $n$ -manifold). Consider a fluid moving in a domain  $D \subset M$  and suppose  $\omega$  is a fixed-volume element differential form on  $M$ . Then, the total mass of the fluid in the region  $D$  at time  $t$  is

$$m(D, t) = \int_D \rho_t \omega, \tag{4.1.1}$$

where  $\rho_t$  is the function  $\rho_t: x \mapsto \rho(x, t)$  on  $M$ , describes the mass-density of the fluid at time  $t$ .

One of the most important properties of the fluid dynamics is the principle of mass conservation, which states that the total mass of the fluid, which at time  $t = 0$  occupied a nice region  $D$ , remains unchanged after time  $t$ .

Thus, the total mass of the fluid at time  $t = 0$  occupied a region  $D$  is maintained with time, i.e.

$$\int_{\phi_t(D)} \rho_t \omega = \int_D \rho_0 \omega, \tag{4.1.2}$$

where  $\phi_t$  is the one-parameter family of diffeomorphisms.

Equation (4.1.2) is the integral invariant for conservation of mass. By the change of variable formula (theorem 2.2), the left hand side of this relation is equal to

$$\int_D \phi_t^*(\rho_t \omega) = \int_D \rho_0 \omega. \tag{4.1.3}$$

Since the right-hand side of (4.1.3) is independent of  $t$ , we can differentiate (4.1.3) with respect to  $t$  we get

$$\frac{\partial}{\partial t} \int_D \phi_t^*(\rho_t \omega) = \int_D \frac{\partial}{\partial t} (\phi_t^*(\rho_t \omega)) = 0. \tag{4.1.4}$$

From definition and properties of Lie derivative we have

$$\frac{\partial}{\partial t} (\phi_t^*(\rho_t \omega)) = \phi_t^*(L_{X_t}(\rho_t \omega)) + \phi_t^*\left(\frac{\partial}{\partial t}(\rho_t \omega)\right),$$

then (4.1.4) takes the form

$$\int_D \left[ \phi_t^*(L_{X_t}(\rho_t \omega)) + \frac{\partial}{\partial t}(\rho_t \omega) \right] = 0, \tag{4.1.5}$$

by change of variable theorem (theorem 2.2), which equals

$$\int_{\phi_t(D)} \left[ L_{X_t}(\rho_t \omega) + \frac{\partial}{\partial t}(\rho_t \omega) \right] = 0; \quad \forall D. \tag{4.1.6}$$

Since  $D$  is an arbitrary open set, this can be true only if the integrand is zero ; that is

$$L_{X_t}(\rho_t \omega) + \frac{\partial}{\partial t}(\rho_t \omega) = 0. \tag{4.1.7}$$

This is the equation of continuity in invariant form. This equation allows interpreting  $\rho_t \omega$  as a density form on the fluid that is dynamically conserved along the flow  $\{\phi_t\}$ .

If the fluid is incompressible (i.e.  $\rho$  is a constant function), then the continuity equation takes the following form

$$L_X(\rho\omega) = 0. \tag{4.1.8}$$

From properties of the Lie derivative (property (i)) this reduces to

$$(L_X\rho)\omega + \rho L_X\omega = 0. \tag{4.1.9}$$

Since  $\rho$  is a constant function, (the Lie derivative of constant function is equal to zero) the first term on the left-hand side of equation (4.1.9) is vanish, then equation (4.1.9) take the following form

$$L_X\omega = 0. \tag{4.1.10}$$

This is the geometric form of continuity equation for incompressible fluid. Hence this equation implies that  $X$  preserves the volume form i.e.  $\phi_t^*(\omega) = \omega$ .

#### 4.2. Equation of motion

The most general equation for description of fluid phenomena is the Navier-Stokes equation, which as special case, comprises Euler's equation of motion. Let  $M$  be a differentiable  $n$ -manifold,  $\theta$  be a differential 1-form on  $M$ ,  $\omega$  be a volume-element differential form on  $M$  and  $D$  be a domain in  $M$ . Consider a fluid moving in a domain  $D \subset M$ . For any continuum there are two types of forces acting on a piece of material:

- First there are external or body forces:

Suppose that  $F$  is a vector field representing the volume forces on a domain  $D$ , then the  $\theta$ -component of the volume forces acting on the domain  $D$  are

$$\text{Force}_{\text{vol}} = \int_D \rho\theta(F)\omega, \tag{4.2.1}$$

where  $\rho$  is a function on  $M$  giving the density of mass.

- Second there are forces of stress (discipline of continuum mechanics can also encounter forces that come from the region surrounding a bit of fluid, expressed by the stress tensor):

Let  $T$  be a tensor field on  $M$  representing this stress. At  $x \in M$ ,  $T$  is a skew-symmetric tensor field on  $M$  define in the following form:

$$\theta^{n-1}(X_1, X_2, \dots, X_{n-1}) = \theta(T(X_1, X_2, \dots, X_{n-1})), \quad X_i \in T_x(M), \tag{4.2.2}$$

then we define the stress tensor of the fluid inside  $D \subset M$  in terms of the multilinear map:

$$T = T(X_1, X_2, \dots, X_{n-1}): T_x(M) \times \dots \times T_x(M) \rightarrow T_x(M). \tag{4.2.3}$$

For  $x \in M$ ,  $X_1, X_2, \dots, X_{n-1} \in T_x(M)$ ,  $\theta(T(X_1, X_2, \dots, X_{n-1}))$  is an  $(n-1)$  covector on  $M$ . Then  $\theta(T)$  defining for each  $\theta$  an  $(n-1)$ -differential form on  $M$ . If  $D$  is a domain in  $M$  with boundary  $\partial D$ , then the total  $\theta$ -component of the stress force is

$$\text{Force}_{\text{str}} = \int_{\partial D} \theta(T). \tag{4.2.4}$$

By applying Stokes' theorem (theorem 2.1), to  $\int_{\partial D} \theta(T)$  we get

$$\text{Force}_{\text{str}} = \int_{\partial D} \theta(T) = \int_D d\theta(T). \tag{4.2.5}$$

From (4.2.1) and (4.2.5) the  $\theta$ -component of the force acting on the domain  $D$  at fixed time is

$$\text{Force}_{\text{tot}} = \int_D [\rho\theta(F)\omega + d\theta(T)] = \int_{\phi_t(D)} [\rho_t\theta(F_t)\omega + d(\theta(T(z_t)(i_z\omega)))] \tag{4.2.6}$$

where  $\phi_t$  is the one-parameter family of diffeomorphisms.

Suppose a group of particles making up the fluid starts out at  $t = 0$  to occupy the domain  $D$ . At time  $t$ , they will be in domain  $\phi_t(D)$ , their  $\theta$ -component of total momentum will be

$$\text{Momentum}_{\text{tot}} = \int_{\phi_t(D)} \theta(X_t)\rho_t\omega, \tag{4.2.7}$$

by the change of variables theorem (theorem 2.2), which is equal to

$$\text{Momentum}_{\text{tot}} = \int_D \phi_t^*(\theta(X_t)\rho_t\omega). \tag{4.2.8}$$

The rate of change of momentum

$$\begin{aligned} \frac{d}{dt} \int_D \phi_t^*(\theta(X_t)\rho_t\omega) &= \int_D \frac{d}{dt} [\phi_t^*(\theta(X_t)\rho_t\omega)] \\ &= \int_D \phi_t^*(X_t(\theta(X_t)\rho_t\omega)) + \int_D \phi_t^*(\theta(\frac{\partial X_t}{\partial t})\rho_t\omega + \theta(X_t)\frac{\partial \rho_t}{\partial t}\omega), \end{aligned} \tag{4.2.9}$$

by the change of variables theorem (theorem 2.2) we get

$$\frac{d}{dt} \int_D \phi_t^*(\theta(X_t)\rho_t\omega) = \int_{\phi_t(D)} [X_t(\theta(X_t)\rho_t\omega + \theta(\frac{\partial X_t}{\partial t})\rho_t\omega) + \theta(X_t)\frac{\partial \rho_t}{\partial t}\omega]. \tag{4.2.10}$$

By applying Newton's law of motion (principle of balance of momentum): the rate of momentum of a portion of the fluid equals the total force applied to it. By equating (4.2.6) to the expression (4.2.10) for the force acting on this bunch we get

$$\int_{\phi_t(\mathcal{D})} [\rho_t \theta(F_t) \omega + d(\theta(T(z_t)(i_x \omega)))] = \int_{\phi_t(\mathcal{D})} [X_t(\theta(X_t) \rho_t \omega + \theta(\frac{\partial X_t}{\partial t}) \rho_t \omega) + \theta(X_t) \frac{\partial \rho_t}{\partial t} \omega]. \quad (4.2.11)$$

Since this relation is to hold for all domain  $\mathcal{D}$ , we have

$$\rho_t \theta(F_t) \omega + d\theta(T_t) = X_t(\theta(X_t) \rho_t \omega) + \theta(\frac{\partial X_t}{\partial t}) \rho_t \omega + \theta(X_t) \frac{\partial \rho_t}{\partial t} \omega. \quad (4.2.12)$$

This is the geometric version of Navier-Stokes equation of fluid motion, which is coordinate-free.

Finally, we notice that the fluid mechanics can be formulated in a geometric language. The fluid space is smooth manifold, the (dynamics) fluid motions is one-parameter family of diffeomorphisms and equations of fluid mechanics written in terms of differential forms are invariant under diffeomorphisms.

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# Technique for the Reconstruction of Oral Commissure: Review of Literature and Description of a Novel Approach

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## I. INTRODUCTION

Lips help to perform unique actions such a drinking, eating, speech and sound production and blowing by their unique sphincter action. On top of that, they are an important component for facial esthetics. Its functions can be jeopardized by different factors which produce lip defects. Lip tumors that produce lip defects are either congenital such as vascular malformations and hemangiomas or acquired such as basal cell carcinoma, squamous cell carcinoma and leukoplakia.

In addition to this, solar radiation injury also affects the lower vermillion. Lip trauma also plays a major role in producing defects. Trauma can be due to road traffic accidents, violence , war trauma.etc Whatever the reason of the defect may be, the main goal for a maxillo-facial surgeon is to restore the function in the form of restoring competence and adequate articulation, esthetics in the form of restoring symmetry of lips in repose, adequate stomal diameter and avoidance of conspicuous scar as far as possible thus restoring patient's self-confidence.

Depending upon the size and location of the defect, age and gender of the patient various reconstructive procedures have been developed.

### Commissure reconstruction-

Various reconstructive procedures have been developed for the commissure reconstruction like mentioned below.

For commissures the Estlander flap (figure 1) , with the pedicle located medially, is rotated into the defect as a single staged procedure<sup>(2)</sup>. Blunting or rounding of the commissure can be expected along with the violation of the upper lip making secondary commissuroplasties often necessary<sup>(2)</sup>. With the drawback of the facial scar and blunting of the commissure this procedure was not opted for the reconstructive procedure.

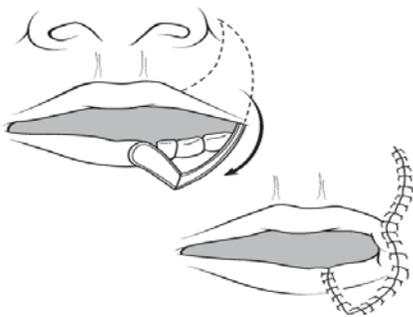


Figure 1<sup>(17)</sup> - ESTLANDER FLAP<sup>(4-17)</sup> :-

"v" shaped incision diagrammed around lower lip lesion, and lesion is removed, proposed flap designed in upper lip and is designed with height 1-2mm greater than the defect.<sup>(4)</sup>

Abbe flap ( figure 2) has also been utilized for the reconstruction of the lateral aspect of the lower lip involving the commissure, however this procedure requires the outline to be placed on the upper lip to the half the size of the defect<sup>(2)</sup>. This leads to the shortening of upper and lower lips by the equal amounts, thereby carrying the risk of relative microstomia<sup>(2)</sup>. Esthetic drawbacks

include pin-cushioning and possible vermilion border malalignment. (2)Also, this procedure requires manipulation of larger area thereby increasing the invasion and it also lead to the visible facial scar .Thus, due to the disadvantages related to this reconstructive procedure, Abbe flap was also not considered in our treatment plan.

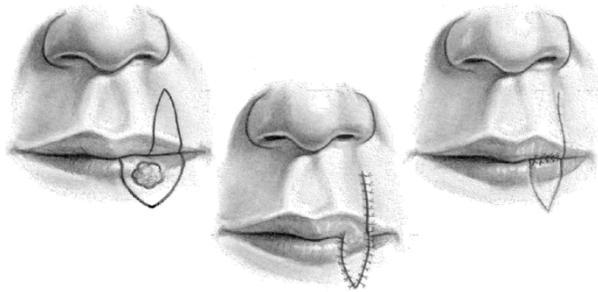


Figure 2(4)- ABBE FLAP:-  
"V" shaped incision marked around the lesion and the lesion is removed this is followed by flap design which is of equal height as defect but 50% of width, resulting in equal width reduction of both upper and lower lips.(4)

Reconstruction of both the lips involving the commissure can be accomplished by means of primary reconstruction (figure 3) using a horizontal incision in the cheek and de-epithelisation of two triangular areas(1) . But with this technique there are also chances of some degree of gaping of the commissure, thus requiring correction by commissuroplasty(1). Though this technique is lesser invasive than the rest of the reconstructive procedure, it do results into the visible facial scar, which was not acceptable by the patient and thus this procedure was also not opted.

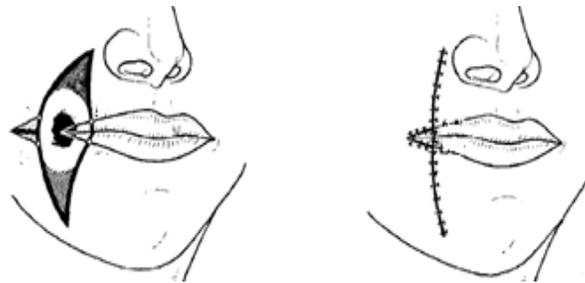


Figure 3<sup>1</sup>- PRIMARY RECONSTRUCTION:-  
Crescent shaped excision of the tumour, horizontal incision of equal height as of incised defect is made along the lateral of the flap of the triangle. The areas above and below the horizontal incision are de-epithelised and the defect is closed by merging the margins. (1)

Reconstruction of the labial commissure by primary reconstruction using sliding U-shaped cheek flap(14)(figure 4) :- This procedure is more invasive than the defect itself .This technique requires a square or rectangular tumor gap. With our case the defect was not of square or rectangular shaped. This procedure also carries the risk of facial scars and so this procedure was also not opted for the same reason of esthetics.

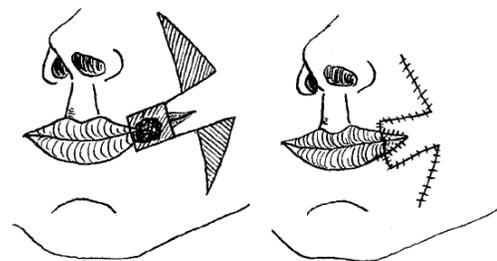


Figure 4(14)- PRIMARY RECONSTRUCTION:-  
Incision is carried out along the lesion in a way that the defect produced is rectangular or square. Triangular flaps are designed in cheek both above and below the defect and are advanced to cover the defect and sutured(14).

Masseter muscles as split muscle flaps have been used as a restorative procedure ( Lexer 1867<sup>6</sup>) . However this procedure , inspite of producing acceptable results, always has a chance of injuring the marginal mandibular branch of the facial nerve(6) . Moreover, this procedure would be inappropriate for small commissure defects as it would require manipulation of a larger donor area. This procedure requires more invasion and also yields scar formation and so was not opted .

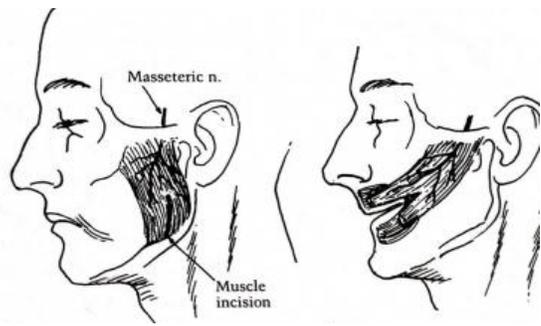


Figure 5- MASSETER MUSCLE SPLIT FLAP<sup>(6)</sup>:-  
This procedure involves two stages. In stage one Fascia lata graft is placed periorally, which reinforces the oral commissure and provides an attachment site for the masseter muscle. Second stage involves the splitting of the middle third of the masseter muscle and is imbricated to the incorporated fascia lata.<sup>(6)</sup>

Orbicularis Oris muscle has also been taken into consideration for the reconstruction of lip commissure<sup>(3)</sup>, but they bear the disadvantage that parts of the orbicularis muscle have to be transected and transported causing disorientation and denervation of the muscle fibres<sup>(3)</sup>. Despite reinnervation of the transected orbicularis muscle in most techniques, the muscle fibres remain disoriented and lip movement is often asymmetrical. Moreover there can be loss of sensibility to the lower lip<sup>(3)</sup>. There is also a certain tendency for blunting of the oral commissures<sup>(3)</sup>. In addition to being an invasive procedure, it also results in unacceptable scar formation and thus was not selected as a treatment option.

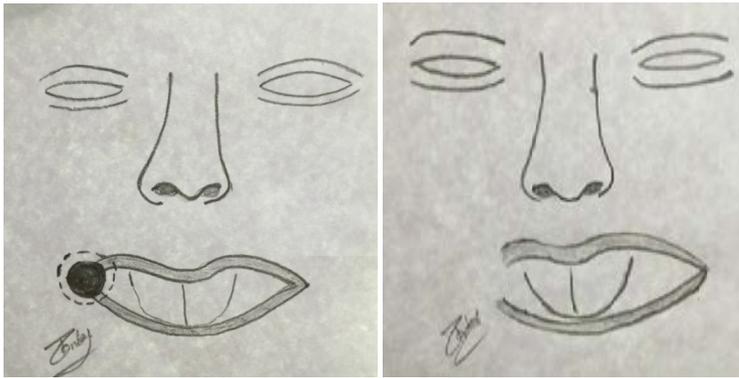


Figure- A

Figure- B

FIGURE 6.- ORBICULARIS ORIS FLAP:-  
Incision is marked around the lesion (Figure A) and the lesion is excised completely (Figure B).<sup>(3)</sup>  
Incisions are then marked along the white line (mucocutaneous junction) of the lips up to the desired length (Figure C), determined by the size of the defect, the flaps are raised and stretched to the defective site (commissure) and sutured (Figure D).<sup>(3)</sup>

Figure- C

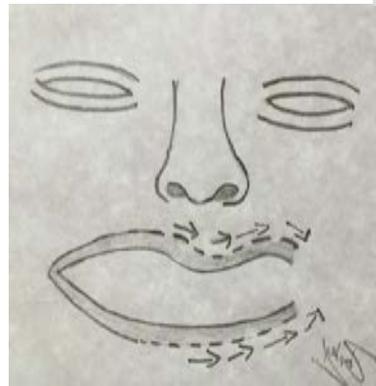
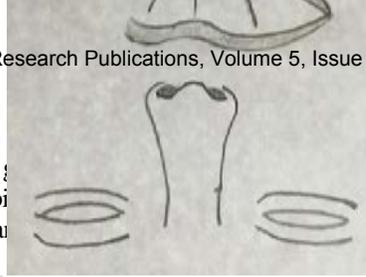


Figure- D

Application of nasolabial flap in the oral commissure reconstruction has also been described. The main advantage is that its donor site lies adjacent to the defect, thereby reducing distant donor site morbidity<sup>(5)</sup>, it also serves a good esthetic purpose because of its color and texture similarity to the defect site<sup>(16)</sup>. Moreover it can be used in cases with facial skin laxity<sup>(5)</sup>. Since the defect is small in size this technique brings about the best results by providing sufficient bulk and also by hiding the suture line along the natural skin crease it prevents visible scar<sup>(16)</sup>. The adequate blood supply increases the viability of this flap thereby making it one of the best available options. Intraoral reconstruction with the nasolabial flap is a simple and fast procedure and minimizes the morbidity relating to speech

and swallowing impairment to a ;  
whom we can avoid a higher morbidity  
Thus, due to its high esthetic and



ideal for more elderly patients with systemic disorders, amongst  
I flap was selected as a treatment option .

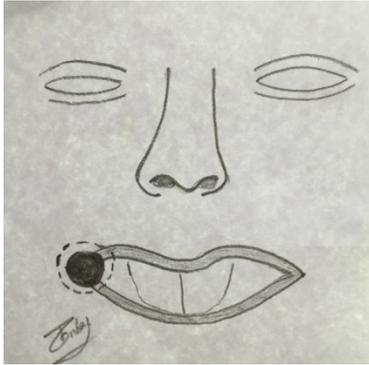


FIGURE- D



Figure- F

**FIGURE 7- NASOLABIAL FLAP:-**  
Incision marking around the lesion (Figure- D)  
followed by excision of the entire lesion which leads to  
the commissural defect (figure- E).  
Flap designing( Figure - F), Flap is raised, tunnel  
is made near to the defect and the part of the flap that  
will be tunneled is de-epithelialised (Figure-G)  
Flap is passed through the tunnel and sutured to  
reconstruct the defect ( Figure- H)

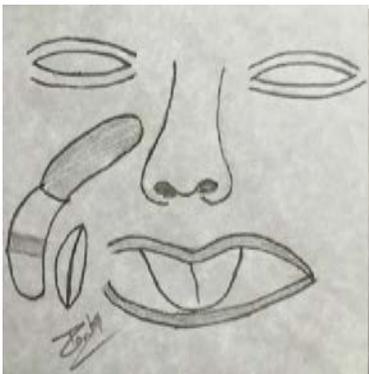


FIGURE-G

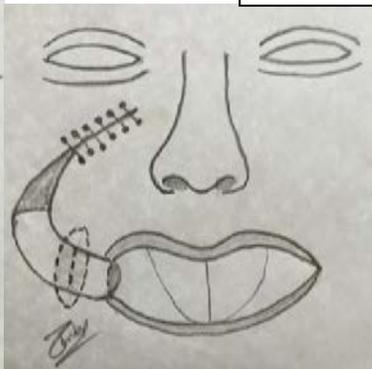


FIGURE-H

## II. CASE REPORT-

A 52 years old male patient was referred to department of Oral And Maxillofacial Surgery,D.D.U. Nadiad on 1<sup>st</sup> July 2014 for a non-healing ulcerative growth on right commissure of lip ( figure 8 ) extending inwards to involve the underlying part of the buccal mucosa. An excision biopsy was taken and sent for histopathological examination. Diagnosis of squamous cell carcinoma was established histologically. Ct scan revealed mucosal thickening with enhancement seen along right buccal mucosa and orbicularis oris muscle with bilateral subcentimeter size level Ib and II lymph nodes.



FIGURE 8-  
Lesion involving the right commissure of the mouth and the buccal mucosa

All preoperative investigations were done and patient was operated under general anaesthesia. Wide local excision of the lesion was performed along with modified neck dissection-II followed by the reconstruction of the defect with the Nasolabial fold. The entire procedure was performed with utmost aseptic care. Specimens were sent for the histological examination which revealed squamous cell carcinoma of the buccal mucosa and tumor category of  $T_1N_0$ . The maximum depth of invasion was 0.2cm, absence of lymphovascular or perineural invasion. On histopathological examination base of resection, right submandibular salivary gland with muscle tissues and lymph nodes were negative for metastasis.

### III. TECHNIQUE :-

Excision of the lesion led to a defect along the right commissure (angle) of the mouth. The main concern was to restore the function, which would have otherwise led to reduced function of the oral sphincter resulting in an inability to hold the water or blow, along with esthetics (as patient was overtly concerned of his appearance).

Depending upon the conditions, we opted for the nasolabial flap for reconstructing the defect as it had the advantages of better esthetics, color and texture similarities to the tissues adjacent to the defect and restoration of functions and minimum morbidity to the donor site.

### IV. FLAP DESIGN:-

A fusiform shaped flap of 1.5cm width and 5cm length (figure 9) was marked with its mesial border along the nasolabial groove and superior border below the medial canthus along the nasofacial junction. Inferior border was marked above the commissure.

Incision was carried out through the skin, subcutaneous fat to the level underlying musculature. An inferiorly based single staged nasolabial flap was designed and a pedicled musculocutaneous flap was raised



FIGURE 9-  
Flap design

A tunnel was prepared (figure-10), by placing an incision just lateral to the defect. The tunneled segment of the flap was de-epithelialised. The flap was then passed through the tunnel into the defect (figure-2), the superior aspect of the flap was rolled upon itself to form the inner and outer aspect of the commissure and sutured with vicryl-3.0 with superior margin (figure-11). The donor site was properly irrigated and closed in layers with vicryl-3.0 sutures for deep dermal closure and ethylon 5.0 for approximating the skin edges.



FIGURE 10-  
Tunneling of the flap into the  
defect.



FIGURE 11 -  
Tension free suturing of the  
flap.

## V. REVIEW OF LITERATURE.

The first evidence of lip reconstruction is seen as far back as 1000bc in Sushruta Samhita. In the western world Celsus was credited as first to describe the closure of a lip defect on the first century A.D. Dieffenbach(1845), Bernard(1851), Fries(1971) described the reconstruction of subtotal or total defects of the lower lip by transposition flaps from the lower cheek<sup>(10)</sup>. Abbe cross lip flap involving tissue borrowing from the opposing lip was first describe by Sabattini 1838 ( lipreconstruction)<sup>(4)</sup>. Lower lip can be reconstructed using local flap - cheek advancement flaps ( Von Burrow,..1855; webster et al .., 1960)<sup>(11)</sup>, or rotating the flap using the residual flap (Karapandzic. 1974; McGregor, 1983)<sup>(11-12)</sup> or nasolabial tissue ( Nakajima et al., 1984<sup>(11,12)</sup>; Fujimori .., 1980<sup>(11)</sup>..) a regional pedicled( Baker et al., 1995; Converse and converse, 1977; Bakamjian, 1971)<sup>(11)</sup> or free flaps ( Krol and Evans, 2000; Koshima et al... 2000; Wei et al, 2001)<sup>(11)</sup> or lip switch flaps ( Estlander, 1872 Abbe, 1898 <sup>(12)</sup>. Esser in 1918 first described the biloped platysma myocutaneous flap for total lower lip reconstruction and nasal tip reconstruction <sup>(11)</sup>. Converse (1959) and kanzanjian (1974) stressed the importance of local flaps of the cheek, the nasolabial area or of lower lip to be used preferred for the repair of lateral defects of the upper lip before distant flaps of the forehead, scalp or neck are utilized<sup>(10)</sup>. Koshima et al (2004) first described the application of superficial circumflex illiac artery perforator flap for the reconstruction of complex lower lip defect. <sup>(13)</sup>

Estlander(1872) ,Converse (1976) described the reconstruction of lateral defect using triangular rotation flap from the opposite lip pedicled on the labial artery, however it required a second procedure to reconstruct the shape of the lip and the elongation of the oral commissure. <sup>(10)</sup>

Reconstruction for not unduly large commissure defects Brusati 1976 described a U- shaped cheek flap.<sup>(14)</sup>

Application of nasolabial flap in the reconstruction dates back in 600 B.C. in Sushruta Samhita<sup>(4,8,15)</sup>. Theirsch first described the application of this flap for the reconstruction of the oral defects<sup>(15)</sup>. Esser reported the application of a cutaneous nasolabial flap transferred in two stages to increase its stability<sup>(15)</sup>. Wallace and Rose later reported modification of this basic flap, allowing for single stage transfer<sup>(15)</sup>.

## VI. DISCUSSION

Reconstruction of lip and its commissure depends upon the size and extent of the defect, patient's general health condition and the surgical skill of the operating surgeon.

Various reconstructive procedures have been developed like Karapandzic, Abbe, Fan flaps and mobilization of cervical. These procedures have a drawback of significant microstomia and necessity of a second stage. Microvascular free flaps such as the radial forearm or the anterolateral thigh have also become an acceptable reconstructive procedure. However, these techniques require trained personnel, microsurgical setup and are usually associated with an increased operative time and a longer hospital stay.

The main advantages of this flap were its sufficient surface area, adequate blood supply and esthetic results. We were able to completely cover up the defect with the available flap due to its bulk provided by the facial musculature. Its adequate blood supply ensured the flap's viability by preventing its breakdown and fistula formation. As per the patient's request we were able to achieve his expectations in terms of esthetics, as the scar lines rested under the natural crease of the face. Moreover, it did not cause speech impairment and since it was easily accessible from the same surgical field, it was quick to harvest and thus was not overly time-consuming.

In summary, the nasolabial flap is a secure and reliable reconstructive option which produced satisfactory aesthetic and functional results.



FIGURE 12-  
POSTOPERATIVE PHOTOGRAPH:-  
SATISFACTORY RESULTS ACHIEVED IN  
TERMS OF ESTHETICS AND ORAL  
COMPETENCE.



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# The Mediating Role of Trust in the relationship between Perceived Organizational Support and Silence

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**Abstract-** The purpose of this study is to assess the mediating effect of trust in the relationship between perceived organizational support and silence. Data from a cross-sectional study of 268 public and private sector academicians serving in ten educational institutions in North India were analysed. Mediation analysis revealed that trust plays a mediating role in the relationship between perceived organizational support and organizational silence. This study is cross-sectional in nature. Further research with longitudinal and experimental studies needs to be carried out to support the results. Data has been collected through self-rating questionnaires. 360 degree feedback could be used in future studies. Top management at organizations must inculcate a supportive culture in the work environment by rewarding employees for their achievements and valuing their efforts. Employees must be involved in decision process through a participative leadership style. The performance management system must be transparent and employees must be prepared for promotions through succession planning and employee development programs.

**Index Terms-** acquiescent silence, defensive silence, organizational trust, perceived organizational support, pro-social silence

## I. INTRODUCTION

Previous studies have established the role of trust in the effective functioning of an organization (Cunningham and Gresso, 1993; Darrough, 2006; Fukuyama, 1995; Hartzler, 2003; Hoy, Tarter and Witkoskie, 1992; Kremer and Tyler, 1996; Tschannen-Moran and Hoy, 1998). Trust is one of the most crucial factors determining the long term stability of an organization (Cook and Wall, 1980). It is only when employees have long lasting relationships with the organization, management, supervisor and co-workers that they are able to perform their best. Trust also benefits the organization in terms of enhanced performance (Avram and Cooper, 2007; Chraif and Stefan, 2010; Mishra, 1996; Thoreson, Bono and Patton, 2001), citizenship behaviour (Cropanzano and Mitchell, 2005; Podsakoff, MacKenzie, Moorman and Fetter, 1990; Podsakoff, Whiting, Podsakoff and Blume, 2009; Rubin, Bommer and Bachrach, 2010), identification (Shockey-Zalabak, Ellis and Winograd, 2000) and reduced conflicts (Creed and Miles, 1996). Unfortunately, recent research has indicated that trust in both public and private institutions is on a declining trend (Carnevale, 1995; Coleman, 1990; Kramer, 1999; Nye, Zelikow and King, 1997; PEW 1996, 1998). This could be attributed to the unmet

needs and expectancies of individuals that these institutions can reduce (Nye, 1997).

There is empirical support for the association between trust and Perceived Organizational Support (POS) (Celep and Yilmazturk, 2012; Dirks and Ferrin, 2002; James B. DeConinck, 2010; Rhoades and Eisenberger, 2002, Toh and Srinivas, 2011). POS is known to enhance commitment, identification, success and citizenship behaviour (Eisenberger, Fasolo and Davis-LaMastro, 1990, Kets de Vrie, 2001, Rhoades and Eisenberger, 2002; Riggie, Edmondson and Hansen, 2009); in the organization.

Organizational scholars have indicated that lack of voice could be attributed to the lack of trust in the organization. Organizational silence is considered unhealthy and leads to inefficiency (Dan, Jun, Jiu-Cheng, 2009; Maria, 2006; Nikmaram et al., 2012).

In the present study, it is proposed that POS influences organizational silence. In spite of the attention that POS has gained in the last few years, there is little evidence of its association with organizational silence. Therefore, further research is needed on the variables affected by POS. Because, trust is such an important ingredient in the relationships among the organization, supervisors and employees, a theoretical framework is proposed to discuss the mediating role of trust in the relationship between POS and organizational silence.

An important contribution of the present study is that it is among the first to shed light on the mediating role of trust in the relationship between POS and silence.

## Statement of the Problem

The present study focuses on the relationship among POS, organizational silence and trust among academicians in select educational institutions in north India.

## Significance of the Research

This study contributes toward the knowledge on POS, organizational silence and organizational trust. The present study also contributes to the knowledge by adding literature on POS and organizational silence and how they correlate with organizational trust. This issue is essential to be studied since it can contribute to a more comprehensive understanding of POS and organizational silence, since both are relatively novel fields of study. The study contributes to the knowledge by adding literature on the Indian studies as well as educational institutions.

## Research Questions

There are several research questions that were asked in addressing the problem statement:

- Does perceived organizational support correlate with organizational silence?
- Does perceived organizational support correlate with organizational trust?
- Does organizational silence correlate with organizational trust?
- Does organizational trust mediate the relation between perceived organizational support and organizational silence?

## II. LITERATURE REVIEW

### Perceived Organizational Support

POS indicates employees' innermost feelings about the organization's care and emphasis. Employees who perceive organizational support feel that the organization is helpful, respectful, caring, co-operative and recognizes employees' contributions.

POS is defined as the belief among the employees that the organization cares for and values their contribution to the success of the organization. POS is also defined as employees' perception concerning the extent to which the organization values their contribution and cares about their well-being (Krishnan and Mary, 2012). Wann-Yih and Htaik (2011) and Eisenberger, Huntington, Hutchison and Sowa, (1986) defined POS as an employees' formation of global beliefs pertaining to how much the organization cares about their well-being and values their contributions. Cropanzano and Mitchell (2005) conceptualize POS as the quality of social exchange between an employee and his/her organization. POS provides employees with information about his/her relationship to the workplace (Shore and Shore, 1995).

As per the Organizational support theory, employees observe the treatment meted out to them by the organization in order to assess the extent to which the organization is supportive; values and appreciates their contribution (Eisenberger, Huntington, Hutchison and Sowa, 1986). Hence, inclusion, participation, rewards, development, opportunities for growth, promotions relate positively to POS (Allen, Shore and Griffeth, 2003; Hutchison, 1997; Wayne, Shore, Bommer and Tetrick, 2002). Similarly, the way supervisors and leaders treat employees also affects POS (Eisenberger et al., 2002; Levinson, 1965; Rhoades et al., 2001; Wayne, Shore and Liden, 1997). However, it is the treatment offered by the organization that has a stronger impact on POS (Eisenberger, Cummings, Armeli and Lynch, 1997). Thus, high POS is associated with enhanced commitment (Eisenberger, Fasolo and Davis-LaMastro, 1990; Eisenberger, Huntington, Hutchison and Sowa, 1986; Makanjee, Hartzer and Uys, 2006; Muse and Stamper, 2007; Panaccio and Vandenbergh, 2009; Rhoades et al., 2001; Rhoades and Eisenberger, 2002), organizational identification, organizational success, citizenship behaviour, decreased withdrawal behaviours, work performance (Eisenberger, Fasolo and Davis-LaMastro, 1990, Rhoades and Eisenberger, 2002; Riggle, Edmondson and Hansen, 2009), work engagement (Eisenberger and Stinglhamber, 2011; Kinnunen, Feldt and Mäkikangas, 2008; Sulea et al., 2012), career success (Suazo, Turnley and Mai-Dalton, 2005), motivation to adopt new IT (Mitchell, Gagne,

Beaudry and Dyer, 2012), perceived organizational justice, trust (Dirks and Ferrin, 2002; Rhoades and Eisenberger, 2002), organizational respect, high status (Tyler, 1999), job satisfaction, reduced turnover intention, reduced turnover (Edmondson and Boyer, 2012; Guzzo, Noonan and Elron, 1994; Kim and Barak, 2014; Rhoades and Eisenberger, 2002; Riggle, Edmondson and Hansen, 2009; Wayne, Shore and Liden, 1997), reduced job strains (Rhoades and Eisenberger, 2002), reduced psychological stress (Loi, Ao and Xu, 2014) and reduced role stress (Kim and Barak, 2014).

This could be explained due to the fact that employees, who perceive support feel honoured, protected and acknowledged. Thus, in return they exhibit raised assistance, identification, gratitude and persistent work (Chiang and Hsie, 2012). Secondly, POS fulfils socio-emotional needs for positive self-esteem, approval and affiliation (Armeli, Eisenberger, Fasolo and Lynch, 1998). Thirdly, POS generates a feeling of concern among employees for the organization's prosperity and thus employees assist the organization in the attainment of goals and objectives (Chew and Wong, 2008; Dhar, 2012; Eisenberger et al., 2001). Hence, organizations that are supportive of their employees gain a competitive advantage over others (Pfeffer, 2005).

### Organizational Silence

Organizational silence is a collective phenomenon (Morrison and Milliken, 2000). When several employees choose to remain silent about organizational issues, the employee silence aggregates to become a collective behaviour called organizational silence (Dan, Jun, Jiu-Cheng, 2009).

Organizational silence refers to employees' choice to withhold their opinions and concerns about organizational problems (Morrison and Milliken, 2000). It involves withholding genuine expressions about organizational circumstances by certain organizational members from those who are in a position to change those circumstances (Fletcher and Watson, 2007). Organizational silence is defined as intentionally withholding work-related ideas, information and opinions (Brinsfield, 2009; Tangirala and Ramanujam, 2005; Vakola and Dimitris, 2005). Alparslan (2010) defined it as a behavioural issue where individuals do not express their thoughts, opinions and suggestions that will help reveal disruptions, improve organizational activities and create new process/product/service. Employee silence occurs when employees do not share or discuss important information such as recommendations, fears, doubts and concerns with others in the organization (Dyne, Ang and Botero, 2003). Morrison and Milliken (2000) noted that instances where employees unintentionally keep information to themselves due to their lack of opinion or absent-mindedness cannot be categorized as employee silence.

Samarin (1965) and Scott (1993) noted that silence is not merely the absence of speech or voice but is meaningful. It is indicative of one's attitude or state and is a form of communication (Samovar et al., 1981). Silence is negatively associated with voice and both can be viewed as opposites (Milliken and Lam, 2009; Milliken, Morrison and Hewlin, 2003; Morrison, Wheeler-Smith and Kamdar, 2011, Tangirala and Ramanujam, 2008). However, even though both are opposites, they are separate constructs (Brinsfield, Edwards and Greenberg, 2009; Dyne, Ang and Botero, 2003; Kish-Gephart, Detert,

Trevino and Edmondson, 2009); they can co-exist and are rarely absolute (Morrisson, 2011). Therefore, a high level of voice may imply a low level of silence and vice-versa.

Employee Silence is of four types (Alparslan, 2010; Brinsfield, 2009; Cakici, 2010; Dyne, Ang and Botero, 2003, Perlow and Repening, 2009; Pinder and Harlos, 2001), (1) acquiescent silence occurs when employees are unaware of the existence of alternative options to remaining silent (Vakola and Dimitrias, 2005). It is a type of passive behaviour and is a result of disengagement. Pinder and Harlos (2001) suggest that apathy and hopelessness may be the reasons for acquiescent silence. (2) Defensive silence occurs when employee remains quiet due to the fear of negative consequences (Pinder and Harlos, 2001). Dyne, Ang and Botero (2003) suggest that defensive silence is the result of an employee's efforts to shelter himself/herself from adverse consequences. Defensive silence is a well-planned approach to protect oneself and involves intricate thought processes (Milliken and Morrison, 2003). (3) Pro-social silence occurs when an employee intentionally withholds job-related information, feelings and thoughts for the larger good of the organization as a whole (Pinder and Harlos, 2001). Pro-social silence is a result of one's goodwill for others whereas defensive silence is an outcome of one's efforts to protect himself/herself (Zheng, Ke, Shi and Zheng, 2008). (4) Protective silence occurs when employees remain silent in order to maintain good relations with the organization and other employees (Alparslan, 2010; Perlow and Repening, 2009). It is regarded as one of the most important causes of silence.

#### Organizational Trust

Since the last few decades, trust has attracted considerable attention due to its influence on the overall functioning and health of an organization. Organizational trust is one of the most important factors determining the long term stability of a firm (Cook and Wall, 1980). Harmony is crucial to organizational efficiency and it can be maintained only when employees have long-lasting positive relationships with each other as well as with the organization. Hence, trust has been regarded as a base for firm performance (Avram and Cooper, 2007) as the effective functioning of organization depends on the trust that people place on them (Cunningham and Gresso, 1993; Darrough, 2006; Fukuyama, 1995; Hartzler, 2003; Hoy, Tarter and Witkoskie, 1992; Kremer and Tyler, 1996; Tschannen-Moran and Hoy, 1998).

Organizational trust is an atmosphere in which people have reciprocal feelings of confidence, warmth and acceptance (Gibbs, 1972). Mayer, Davis and Schoorman (1995) defined organizational trust as the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party. Tschannen-Moran and Hoy (1999) defined trust as an individual's or group's willingness to be vulnerable to another party based on the confidence that the latter party is benevolent, reliable, competent, honest and open.

- Benevolence is the confidence that one's well-being will be protected by trusted party.
- Reliability is the extent to which one can count on another person or group.

- Competency is the extent to which the trusted party has knowledge and skill.
- Honesty is the character, integrity and authenticity of the trusted party and openness is the extent to which there is no withholding of information from others.

Trust is positively associated with job performance (Chraif and Stefan, 2010; Mishra, 1996; Thoreson, Bono and Patton, 2001), success (Kets de Vrie, 2001), identification (Shockey-Zalabak, Ellis and Winograd, 2000), mental and physical health (S. Tanase et al., 2012) and employee citizenship (Cropanzano and Mitchell, 2005; Podsakoff, MacKenzie, Moorman and Fetter, 1990; Podsakoff, Whiting, Podsakoff and Blume, 2009; Rubin, Bommer and Bachrach, 2010).

High level of trust in the supervisor significantly contributes to psychological safety (Edmondson, 1999) and loyalty among employees (Davis, Schoorman, Mayer and Tan, 2000). Trust has gained widespread attention in the domain of human resource management and organizational behaviour; however, further research is needed on its relationship with organizational silence.

#### Perceived Organizational Support and Organizational Silence

There have been few empirical studies conducted on the relationship of POS with silence. Most of the findings relate POS with a high level of voice and subsequently a low level of silence in the organization. A study by Li Rui and Ling Wen Quan (2010) on perceived supervisor support found that it is positively associated with job attitude and enthusiasm thereby motivating employees to speak up and break their silence. Thus, POS could eliminate silence.

Another study by Şahin Çetin (2013) among 223 teachers serving in primary schools in Ankara, Turkey found a positive relationship between voice and POS. This finding was in line with studies by Ashford, Rothbard, Piderit and Dutton (1998), Erenler (2002), Milliken, Morrison and Hewlin (2003) and Tucker et al. (2008) that related high level of voice with POS.

Yau-De Wang and Hui-Hsien Hsieh (2013) conducted a study among 408 employees serving in high-technology firms in Taiwan. Results indicated that the association of instrumental climate, caring climate and independence climate with acquiescent silence and defensive silence was mediated by perceived organizational support. Thus, it can be concluded that POS is a significant predictor of employee silence.

#### Perceived Organizational Support and Organizational Trust

Very few empirical studies have explored the relationship between support and trust in organizational settings. Previous research has established a positive association between support and trust (Dirks and Ferrin, 2002; Rhoades and Eisenberger, 2002). James B. DeConinck (2010) conducted a study among 234 advertising managers in United States of America. Results revealed that POS, trust and Perceived Organizational Justice are correlated and that POS mediates the relationship between POJ and trust. Similar results were obtained by Soo Min Toh and Ekkirala S. Srinivas (2011) who conducted a study among 174 local Omani nationals enrolled in an executive management program. It was found that task cohesiveness is significantly related to trust and information sharing. Also, it was found that task cohesiveness was associated with higher levels of trust when POS was also high. Another study by Cevat Celep and Ozge Eler

Yilmazturk (2012) among 315 teachers serving in 18 public primary schools in Golcuk, Turkey revealed that organizational trust, trust to management, trust to work setting and trust to work team had a significant impact on POS. Majority of the studies on POS and trust have revealed a positive association between the variables.

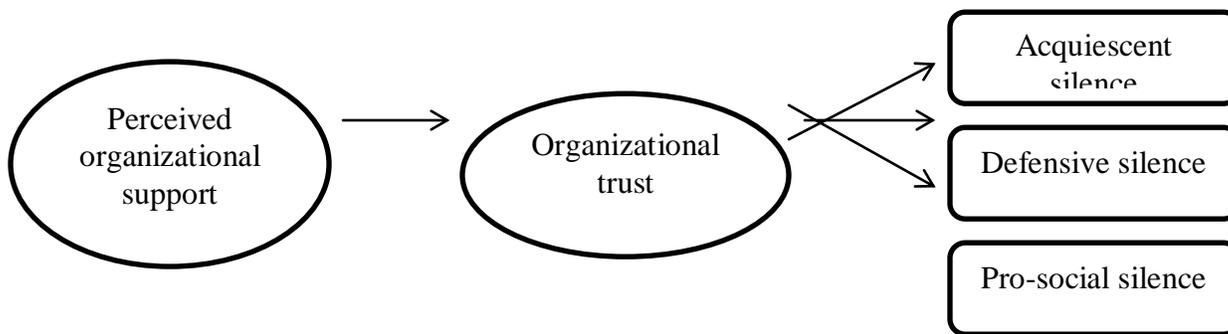
#### Organizational Silence and Organizational Trust

There is a dearth of studies on the relationship between organizational silence and trust. A study by Ioannis Nikolaou, Maria Vakola and Dimitris Bourantas (2011) among employees serving in Information Technology companies in Greece found that organizational silence and trust are negatively correlated. Another study by Tijen Tulubas and Cevat Celep (2012) conducted a study among 459 faculty members serving in Universities in Turkey. It was found that faculty members' silence was significantly affected by trust in supervisor. Hence,

organizational silence and organizational trust are negatively correlated.

#### Conceptual Framework

Literature review has found relationship between POS and organizational silence (Li Rui and Ling Wen Quan, 2010, Yau-De Wang and Hui-Hsien Hsieh, 2013), POS and organizational trust (Celep and Yilmazturk, 2012; Dirks and Ferrin, 2002; James B. DeConinck, 2010; Rhoades and Eisenberger, 2002; Toh and Srinivas, 2011), and organizational silence and trust (Nikolaou, Vakola and Bourantas, 2011, Tulubas and Celep, 2012). This study proposes a conceptual framework which examines the relationship between POS, organizational silence and organizational trust. This study employs trust as the mediating variable between the relationship of POS and organizational silence. The conceptual framework is shown in figure 1.



**Figure 1. Research Model for this study**

#### Hypotheses

Based on the literature review, the present research investigates the relationship among POS, organizational silence and organizational trust. The following are the main hypotheses of the present study.

1. Perceived organizational support significantly correlates with acquiescent silence (1.1), defensive silence (1.2) and pro-social silence (1.3).
2. Perceived organizational support positively correlates with organizational trust.
3. Organizational trust positively correlates with acquiescent silence (3.1), defensive silence (3.2) and pro-social silence (3.3).
4. Organizational trust mediates the correlation between perceived organizational support and acquiescent silence (4.1), defensive silence (4.2) and pro-social silence (4.3).

Mohali, Panchkula and Delhi. The rest of the responses were collected from academicians serving in institutes at Jalandhar and Rupnagar in Punjab and Kurukshetra and Gurgaon in Haryana.

#### Perceived Organizational Support

The Survey of Perceived Organizational Support (SPOS; Eisenberger, Huntington, Hutchison and Sowa, 1986) was used to measure POS. SPOS measures the employees' perception of the organizations' willingness to change as it is related to employee participation in all stages of the innovation-decision process. This study employs the shorter version of the scale comprising 8 items of which four are reverse scored. Respondents indicate the extent of agreement with each statement on a five point likert scale (1 = strongly disagree, 5 = strongly agree). Its reliability is high with 0.95 cronbach alpha.

#### Organizational Silence

Organizational silence is measured using the Organizational Silence scale developed by Dyne, Ang and Botero (2003) comprising 15 items and three sub-scales that measure acquiescent (5 items), defensive (5 items) and pro-social silence (5 items). Its reliability is high with 0.853 cronbach alpha for acquiescent silence, 0.897 for defensive silence and 0.823 for pro-social silence. Respondents answered on a 5-point likert (1 = strongly disagree, 5 = strongly agree).

### III. METHOD

#### Sample

A cross-sectional survey design was used to test the proposed hypotheses. The respondents for this study comprised academicians serving in 10 educational institutions in various places in north India and were selected using snowball sampling method. Majority of the respondents were serving in Chandigarh,

**Organizational Trust**

Organizational Trust was measured using the Organizational Trust scale (OT) developed by Paliszkievicz (2010). The OT scale comprises 12 items in five-point likert scale (1 = strongly disagree, 5 = strongly agree). The scale is highly reliable with 0.87 cronbach alpha.

**Procedure**

The questionnaire was administered to respondents at their workplace. The duration for questionnaire completion is 8 to 10 minutes. 300 questionnaires were distributed of which 275 were returned. 7 questionnaires were rejected as they were partially filled. 268 questionnaires were finally selected for the analysis.

**Data Analysis**

Simple regression analysis was used to test the significance of the relationship and impact of POS on organizational silence and organizational trust. Mediation analysis was used to test the

mediating effect of trust on the relationship between POS and organizational silence.

**IV. RESULTS**

This various analyses used in the study include descriptive analyses, regression analyses and mediation analyses.

**Demographic Characteristics of the Sample**

The target respondents in this study are academicians serving in educational institutions in north India. Total sample size is 268.

Table 1 below shows the characteristics of the respondents in the study. Within the sample, 47.4% were academicians serving in public institutions. 44.4% were males. 38.1% of the respondents were in the age group of 31 to 40 years. 68.3% of respondents were married. 61.2% of the respondents were postgraduates. 36.9% of the respondents had a work experience of 8 years and above.

**Table 1 Respondents' Characteristics (N=268)**

	Variable	Frequency	Percentage
Ownership	Public	127	47.4%
	Private	141	52.6%
Gender	Male	119	44.4%
	Female	149	55.6%
Age	21 to 30 years	66	24.6%
	31 to 40 years	102	38.1%
	41 to 50 years	73	27.2%
	50 + years	27	10.1%
Marital Status	Married	183	68.3%
	Unmarried	85	31.7%
Education	Bachelors	27	10.1%
	Masters	164	61.2%
	Ph.Ds	77	28.7%
Years of work experience	Less than 2 years	45	16.8%
	3 to 5 years	39	14.6%
	6 to 8 years	85	31.7%
	More than 8 years	99	36.9%

**Descriptive Analyses**

Table 2 below shows the means and standard deviations of the variables under study. The mean score for POS as measured by the Survey of Perceived Organizational Support (SPOS) scale is 30.05 (S.D. = 5.07). This score indicates that most of the academicians perceive their organization as being supportive.

Respectively, the analysis of the Organizational Silence responses for all respondents indicates that the mean score of

acquiescent silence is 10.38 (S.D. = 2.91), defensive silence is 11.51 (S.D. = 3.23) and pro-social silence is 13.57 (S.D. = 3.57). This indicates the level of organizational silence in select educational institutions is low.

The mean score of Organizational Trust as measured by the 15 items of the Organizational trust scale is 35.72 (S.D. = 9.90). This indicates that trust placed by respondents on their organization, co-workers and supervisors is moderately high.

**Table 2 Mean and Standard Deviation among the variables**

Variable	Mean	SD
Perceived Organizational Support	30.05	5.07
Acquiescent Silence	10.38	2.91
Defensive Silence	11.51	3.23
Pro-social Silence	13.57	3.57
Organizational Trust	35.72	9.90

Regression Analyses

This study presents the simple regression analysis to indicate that POS is a significant predictor of organizational silence and trust.

Perceived Organizational Support and Organizational Silence

The first hypothesis in this study is that there is significant relationship between POS and acquiescent silence (1.1),

defensive silence (1.2) and pro-social silence (1.3). Results as shown in table 3 indicated that POS predicts acquiescent silence,  $\beta = -0.513$ ,  $S_{\beta} = .030$ ,  $t = -9.757$ ,  $p < 0.01$ , defensive silence,  $\beta = -0.233$ ,  $S_{\beta} = .038$ ,  $t = -3.915$ ,  $p < 0.01$  and pro-social silence,  $\beta = -0.289$ ,  $S_{\beta} = .041$ ,  $t = -4.916$ ,  $p < 0.01$ . It was found that POS and organizational silence are negatively correlated.

**Table 3 Correlation coefficient, R square, Standardized Beta Coefficients, Standard Error and t for Paths from Perceived organizational support to Organizational silence**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Dependent variable	Predictor variable	B	Std. Error	$\beta$		
Acquiescent silence	POS	-0.294	0.030	-0.513	-9.757	.000
F = 95.194		R = 0.513		R <sup>2</sup> = 0.264		
Defensive silence	POS	-0.148	0.038	-0.233	-3.915	.000
F = 15.326		R = 0.233		R <sup>2</sup> = 0.054		
Pro-social silence	POS	-0.203	0.041	-0.289	-4.916	.000
F = 24.169		R = 0.289		R <sup>2</sup> = 0.083		

Perceived Organizational Support and Organizational Trust

As shown in table 4 below, the regression analysis indicated that organizational trust is significantly predicted by POS,  $\beta = 0.326$ ,  $S_{\beta} = 0.113$ ,  $t = 5.621$ ,  $p < 0.01$ . The data indicates that

academicians who perceive their organization as being supportive are more likely to trust the organization more. So, this finding supports the second hypothesis that there is a significant positive relationship between POS and organizational trust.

**Table 4 Correlation coefficient, R square, Standardized Beta Coefficients, Standard Error and t for Paths from Perceived organizational support to Organizational trust**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Dependent variable	Predictor variable	B	Std. Error	$\beta$		
Organizational Trust	POS	0.636	0.113	0.326	5.621	.000
F = 31.600		R = 0.326		R <sup>2</sup> = 0.106		

Organizational Silence and Organizational Trust

The third hypothesis in this study is that there is significant relationship between organizational silence and organizational trust. This hypothesis is supported by the finding in which organizational trust is significantly predicted by acquiescent silence,  $\beta = -0.353$ ,  $S_{\beta} = .017$ ,  $t = -6.163$ ,  $p < 0.01$ , defensive

silence,  $\beta = -0.228$ ,  $S_{\beta} = .019$ ,  $t = -3.811$ ,  $p < 0.01$  and pro-social silence,  $\beta = -0.211$ ,  $S_{\beta} = .022$ ,  $t = -3.512$ ,  $p < 0.01$ . Results found that acquiescent (3.1), defensive (3.2) and pro-social silence (3.3) and trust are negatively correlated as shown in table 5 below.

**Table 5 Correlation coefficient, R square, Standardized Beta Coefficients, Standard Error and t for Paths from Organizational silence to Organizational trust**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Dependent variable	Predictor variable	B	Std. Error	$\beta$		
Acquiescent silence	Organizational trust	-0.104	0.017	-0.353	-6.163	.000
F = 37.984		R = 0.353		R <sup>2</sup> = 0.125		
Defensive silence	Organizational trust	-0.074	0.019	-0.228	-3.811	.000
F = 14.523		R = 0.228		R <sup>2</sup> = 0.052		
Pro-social silence	Organizational trust	-0.076	0.022	-0.211	-3.512	.001
F = 12.335		R = 0.211		R <sup>2</sup> = 0.044		

Mediation Analysis

To test hypothesis that trust mediates the relationship between POS and organizational silence, mediation analysis was

performed following procedures suggested by Andrew F. Hayes (2012) using PROCESS V. 14, a modelling tool designed for SPSS. For mediation to be established, there are four conditions,

(1) the mediator must be significantly related to the independent variable (2) the mediator must be significantly related to the outcome variable, (3) the independent variable must be significantly related to the outcome variable and (4) the independent variable must indirectly affect the outcome variable through its effect on the mediator. As per the test for mediation in PROCESS, the mediating effect is established when there is no absolute zero in the range from the boot lower limit confidence interval to the boot upper limit confidence interval in the indirect effect.

*Trust mediates the Relationship between Perceived Organizational Support and Organizational Silence*

Table 6 below shows the indirect effect of POS on organizational silence through its effect on organizational trust. It was found that trust mediated the relationship of POS with acquiescent silence (boot LLCI = -0.0689, boot ULCI = -0.0171), defensive silence (boot LLCI = -0.0667, boot ULCI = -0.0101) and pro-social silence (boot LLCI = -0.0715, boot ULCI = -0.0043). Thus, it is concluded that organizational trust mediates the relationship between perceived organizational support and organizational silence.

**Table 6 Indirect Effect of Trust on paths from POS to Organizational silence**

Mediator	Effect	Boot Standard Error	Boot Lower Limit Confidence Interval	Upper Limit Confidence Interval
<i>Acquiescent silence</i>				
Organizational Trust	-0.0389	0.0131	-0.0689	-0.0171
<i>Defensive silence</i>				
Organizational Trust	-0.0351	0.0143	-0.0667	-0.0101
<i>Pro-social silence</i>				
Organizational Trust	-0.0298	0.0168	-0.0715	-0.0043

was mediating effect of trust in the relation of POS with acquiescent (4.1), defensive (4.2) and pro-social silence (4.3).

**V. DISCUSSION**

The purposes of the present research were to explore the relationships among POS, organizational silence and organizational trust.

Hypothesis 1 in this study was supported, as there was a significant impact of POS on organizational silence. The results indicated that there was a significant negative relation of POS with acquiescent (1.1), defensive (1.2) and pro-social silence (1.3). This finding is in agreement with the results obtained by Li Rui and Ling Wen Quan, (2010) and Yau-De Wang and Hui-Hsien Hsieh (2013). Thus, academicians who perceive support, have a low level of silence.

Hypothesis 2 stating that POS would positively correlate with organizational trust was supported by the findings. The results indicated that academicians with high POS were reported to have higher organizational trust. This finding is in line with previous studies done by Celep and Yilmazturk (2012), Dirks and Ferrin (2002), James B. DeConinck (2010), Rhoades and Eisenberger (2002) and Toh and Srinivas (2011). This finding supported the argument that academicians who feel supported are likely to have more trust in their organizations.

Consistent with hypothesis 3, acquiescent (3.1), defensive (3.2) and pro-social silence (3.3) were found to negatively correlate with organizational trust. This indicated that academicians who placed more trust on their organization were more vocal about their opinions, views and experiences regarding organizational matters. This finding was in line with the studies by Nikolaou, Vakola and Bourantas (2011) and Tulubas and Celep (2012) in which a moderate negative relation was found between silence and trust.

Mediation analysis established the mediating role of trust in the relationship between POS and organizational silence as the indirect effect measured through PROCESS (Andrew F. Hayes, 2012) was significant. Thus, Hypothesis 4 was supported as there

**VI. IMPLICATION OF THE STUDY**

This study presents empirical findings on negative relationship of POS and organizational trust with organizational silence and positive relationship between POS and organizational trust. There are several implications for this study. Since POS and high level of organizational trust eliminate organizational silence, the management must do more activities to enhance these two variables. Firstly, the top management must inculcate a culture where multilateral communications and dialogue among employees is encouraged. Secondly, the employees' sense of fairness must be addressed through strong company values by rewarding individual as well as team efforts. There must be competitive pay systems that are transparent; inclusive of monetary rewards and salary increases. Thirdly, the workload must be made manageable. Fourthly, employees must be involved in the developmental and decision process of the organization. This could be done through a participative leadership style where employees' views are solicited as and when necessary. Fifthly, the employees must be prepared for promotion through succession planning and employee development programs so that they can realize their potential. This would also enhance their engagement and loyalty. Lastly, employees must be valued and their efforts appreciated. The value of their work must be communicated to them from time to time.

**VII. LIMITATIONS & RECOMMENDATIONS**

There are several limitations as well as recommendations to this study. Firstly, the sample size is small. It is therefore suggested for future research to increase the number of respondents. Secondly, the sample of the present study includes

only academicians in north India, so the findings of the present study cannot be generalized to other geographical regions. For further study, it is recommended that the relationship of the variables in the current study with a host of other variables such as workplace spirituality be studied. Also, it is recommended to include employees from various sectors for future studies. Thirdly, the measurement technique in the present study was through self-rating questionnaires. Since, there is a great tendency among individuals to give responses that are socially acceptable, the genuine responses may not have been captured by these questionnaires. Thus, methods like 360 degree feedback would help to make the studies more realistic and practical. Fourthly, this study is cross-sectional in nature; thus further research through longitudinal studies needs to be conducted to confirm the results.

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# Complicated Infective Endocarditis (IE) with Large Right Ventricle Vegetation in Congenital Heart Disease (CHD): Managed Conservatively

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**Abstract-** Congenital cardiac diseases are recognized as a major predisposing substrate for infective endocarditis(IE) worldwide, due to wide spread epidemiological changes observed in last decades in children with infective endocarditis(IE), resulting from increased survival rate of children with congenital heart disease (CHD) due to advancement in surgical interventions together with decreasing incidences of Rheumatic valvular heart disease (RHD) in the pediatric age due to involvement of new modified antibiotics policy, surgical management and enhancement of public awareness. Around 70% of cases of infective endocarditis (IE) occur in children with congenital heart disease (CHD), in whom majority of cases are ventricular septal defect (VSD). Here endothelial damage followed by presence of bacteremia are two important determining factors for Infective endocarditis (IE). These children had some form of underlying hemodynamic instability, such as a pressure gradient or turbulent flow between two cardiac chambers or the great vessels that create shear forces of abnormal high-velocity jet. Thrombogenesis occurred at damaged site leading to formation of nonbacterial thrombotic endocarditis (NBTE). In the presence of bacteremia, bacteria adhere to the NBTE lesion, trapped within the vegetation, protected from phagocytic cells and ultimately forming more enlarging vegetations. Present case of infective endocarditis (IE) is a ventricular septal defect, complicated by infective endocarditis diagnosed on the basis of Duke criteria, had a large vegetation of more than 10 mm in right ventricle managed successfully upon conservative approach, regardless of having surgical indication according to recent American heart association guidelines, indicating surgical interventions for more than 10 mm vegetation. However, the most important measure is prevention, based on good oral hygiene and antibiotic prophylaxis prior to high-risk invasive procedures in susceptible populations.

**Index Terms-** Congenital heart disease (CHD), Infective endocarditis (IE) ventricular septal defect (VSD), Rheumatic valvular heart disease (RHD), Nonbacterial thrombotic endocarditis (NBTE).

## I. INTRODUCTION

Congenital cardiac diseases are still recognized as a major predisposing substrate for infective endocarditis(IE) worldwide. In spite that Infection, Poverty, malnutrition, poor general hygiene and inadequate health care are leading contributors for high prevalence of infective endocarditis (IE) within pediatric age groups specially in developing countries. However wide spread epidemiological changes had been observed during the last decades in children with infective endocarditis(IE), it was happened because of the increased survival rate of children with congenital heart disease (CHD) due to incorporation of advanced surgical interventions as well as decreasing incidences of rheumatic valvular heart disease (RHD) in the pediatric age group with involvement new modified antibiotics policy, surgical management and enhancement of public awareness.

Over all incidence of Infective endocarditis (IE) accounts for 0.5–1 of every 1000 hospital admissions including all congenital heart disease (CHD) patients (excluding postoperative endocarditis)<sup>(1)</sup>. Amongst these ventricular septal defects (VSD), aortic valve abnormalities, patent ductus arteriosus (PDA), or tetralogy of Fallot (TOF) continued to be affected in majority of cases<sup>(2)</sup>. Around 70% of cases of infective endocarditis (IE) at pediatric ages occur in children with congenital heart disease (CHD), in whom majority of cases of belongs to ventricular septal defect (VSD)<sup>(3)</sup>. The incidence of infective endocarditis (IE) in children with ventricular septal defect (VSD) was 1–2.4 per 1000 reported<sup>(4)</sup>.

Here we report a case of a child presenting with acyanotic CHD [ventricular septal defects] complicated with infective endocarditis with large vegetation of more than 10 mm requiring surgical excision but treated conservatively without any surgical intervention.

## II. CASE REPORT

We describe the case of a 5 year-old boy, of lower socioeconomic status, without any known history (there was no record of medical check-ups) or previous diagnosis of a heart defect. He was brought to the emergency department with prolonged history of intermittent fever, coughing, dyspnea, weakness in left side of body and weight loss, with other

symptoms as vomiting and difficulty in walking. General Physical examination showed multiple untreated dental caries, with pallor, while on systemic examination hepatosplenomegaly and signs of congestive heart failure (CHF) with left sided hemiparesis were observed. On cardiac auscultation revealed a harsh pan systolic murmur at the left sternal border and precordial systolic thrill on bulged precordium. Laboratory tests showed anaemia Hb 5.8 mg/dl and neutrophilic leucocytosis: 22 103/ $\mu$ l, 79% neutrophils, and C-reactive protein 5.6 mg/dl. Transthoracic echocardiography with Doppler study revealed a 6 mm peri-membranous restrictive VSD with moderate regurgitation and a vegetation of more than 10 mm in Right ventricle along the jet of VSD flow with preserved Left ventricular function (figure 1). Presentation of left sided hemiparesis to be showed as suspiciously involvement of central nervous system for which CT angiography of brain was performed, finding was within normal limit.

Keeping with all above facts in mind along with on the basis of modified Duke's criteria, diagnosis of Right ventricle infective endocarditis with 6 mm peri-membranous restrictive VSD with left sided hemiparesis with anaemia with hepatosplenomegaly with sign of congestive heart failure was made. Subsequently blood culture was taken and empirical intravenous antibiotic therapy was begun with ceftriaxone, vancomycin (30 mg/kg/day) and gentamicin (3 mg/kg/day), together with oral anti-congestive therapy with diuretics (furosemide 1 mg/kg and 25 mg spironolactone every 12 hours) and an angiotensin-converting enzyme inhibitor (enalapril 0.2 mg/kg every 12 hours). *Streptococcus orallis* was isolated in blood culture collected before antibiotics and it was susceptible to the penicillin, clindamycin, vancomycin, and ceftriaxone antibiotics. The initial clinical course was favourable during the first week of hospital stay with subsidence of fever, improvement in the hemiparesis and congestive heart failure (CHF). However fever was reoccurred during second weeks of hospital stay together with signs and symptoms of congestive heart failure (CHF) then Rifampicin (15 mg/kg/day) was added to the antibiotic regime and diuretic therapy was intensified. Transesophageal echocardiography was performed at this stage still showed right ventricle vegetation of more than 10 mm along the jet of VSD flow. Then child was discussed with cardiothoracic surgeon for surgically resection of vegetation of more than 10 mm, in spite of deterioration of clinical condition while child remained on optimized anti-congestive therapy with modified drugs. But intervention was deferred in view of unstable patient and features of septicemia with persistent of fever.

Despite addition of Rifampicin in antibiotic regime, persistent of fever was not subsided, and signs of congestive heart failure (CHF) were not improved. Then antibiotics were changed to fourth generation cephalosporin (cefepime), the dosage and form of administration of other therapy was unchanged. Cultures of blood samples collected before the change in antibiotics were negative.

When child was shifted on second antibiotic regime he showed improvement in vitals with subsidence of fever. Repeat echocardiography was performed after 1 week of completion antibiotics still showed right ventricle vegetation but smaller than previously noticed (7mm) along the jet of VSD flow. Antibiotics were continued for total six weeks, (4 weeks with vancomycin

gentamicin and five weeks with cefepime, and rifampicin). There was marked improvement in the changes of echocardiography performed after completion modified antibiotics showed disappearance of vegetation in Right ventricle along with improvement in LV function. At that time, the patient is clinically stable without sign of hemiparesis (CNS) and congestive heart failure. The last transthoracic echocardiogram showed absolute normal biventricular function with 6 mm peri-membranous ventricular septal defects (VSD).

### III. DISCUSSION

Infective endocarditis (IE) is not rare but potentially fatal complication among congenital heart disease (CHD) specially in pediatric patients, because it includes 20% in-hospital mortality specifically higher in complicated cases<sup>(5)</sup>. Association between congenital heart disease (CHD) and infective endocarditis (IE) represents a lifetime risk, as all forms of CHD except ostium secundum atrial septal defect predispose to infective endocarditis (IE). The defects most commonly involved are tetralogy of Fallot, ventricular septal defects (VSD), aortic valve disease, transposition of the great arteries and systemic-pulmonary shunt<sup>(2)</sup>.

There are two important factors in the pathogenesis of Infective endocarditis (IE) first is endothelial damage followed by presence of bacteremia, even if transient. In children with heart disease, have some form of underlying hemodynamic instability, such as a pressure gradient or turbulent flow between two cardiac chambers or the great vessels that create shear forces of abnormal high-velocity jet. This stream of blood (jet) damage the endothelium followed by Thrombogenesis at damaged site along with deposition of sterile clumps of platelets, fibrin, and occasionally red blood cells, leads to formation of nonbacterial thrombotic endocarditis (NBTE)<sup>(6)</sup>. In the presence of Bacteraemia, bacteria adhere to the NBTE lesion, together with platelets and fibrin results in enlargement of the vegetation. The organisms trapped within the vegetation are protected from phagocytic cells and other host defence mechanisms. As in our patient, one cause of transient bacteraemia is poor oral hygiene and untreated dental caries, whether or not dental procedures are performed along with 6 mm peri-membranous ventricular septal defects (VSD).

*Staphylococcus aureus* is the most common causal agent in acute infective endocarditis (IE) in developed countries. But Infection by viridans group or alpha-haemolytic streptococci (which includes *S. mitis*) is also common, particularly in children with dental disease, leading to sub-acute disease, as presented in our case<sup>(7)</sup>. More recently, there has been a marked increase in the incidence of infective endocarditis (IE) caused by fungi or microorganisms of the HACEK group (*Haemophilus*, *Actinococcus*, *cardiobacterium*, *Eikenella* and *Kingella*) in newborns and immunocompromised patients<sup>(2)</sup>. Increased incidence of these organisms in this sub population determined by enhancement of survivability due to involvement of advanced technology in their medical as well as in surgical management.

The modified Duke criteria are now the most widely used to diagnosis (infective endocarditis) IE, and it is based on the patient's medical history, physical examination and complementary diagnostic exams, including two or more blood

cultures positive for the microorganisms typical of infective endocarditis (IE) and echocardiographic evidence of endocardial involvement<sup>(8)</sup>.

Initial empirical treatment is anti-staphylococcal penicillin together with an aminoglycoside, effective against the most common microorganisms (*S. viridians*, *S. aureus* and Gram-negative bacteria). Antibiotic regime and duration of therapy depends on the etiological agent isolated. Average treatment duration ranges between four and eight weeks<sup>(9)</sup>.

Surgery plays a crucial role in more severe cases, notably when there is congestive heart failure (CHF) refractory to medical therapy or secondary to valve dysfunction, perivalvular abscess or vegetation's larger than 10 mm according to Recent guidelines<sup>(9,10,11)</sup>.

Our patient was discussed with surgical intervention for resection of this large vegetation on Right ventricle but decision was deferred due to unstable patient and features of septicaemia with persistent fever, later on addition of new antibacterial strategy vegetation was disappeared as own as without any intervention.

Finally the prevention of IE is as important as diagnosis and treatment, because even transient bacteraemia is very important determining factor for infective endocarditis (IE), for which good oral hygiene and regular dental check-ups are essential. The latest guidelines recommend a more rational use of prophylactic antibiotic therapy prior to interventional procedures, limiting their use to patients with predisposing cardiac conditions<sup>(8,11)</sup>.

#### IV. CONCLUSION

Infective endocarditis (IE) at pediatric ages is generally associated with congestive heart disease (CHD). The Duke criteria help in the diagnosis of endocarditis. Antibiotic therapy is the cornerstone of treatment, Depending on the clinical and laboratory responses, antibiotic therapy may require modification and should last for four to eight weeks and be administered intravenously. However, the most important measure is prevention, based on good oral hygiene and antibiotic prophylaxis prior to high-risk invasive procedures.

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FIGURE



Transesophageal echocardiogram in short-axis view, showing peri-membranous VSD (arrow) with large vegetation (arrow) in a Right ventricle (FIGURE:1) and disappearance of vegetation after treatment (FIGURE:2).

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# Agile Testing

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**Abstract-** In this paper, basic principles of agile testing, advantages & disadvantages of agile testing is discussed.

**Index Terms-** Software Development Life Cycle (SDLC)

## 1 Introduction

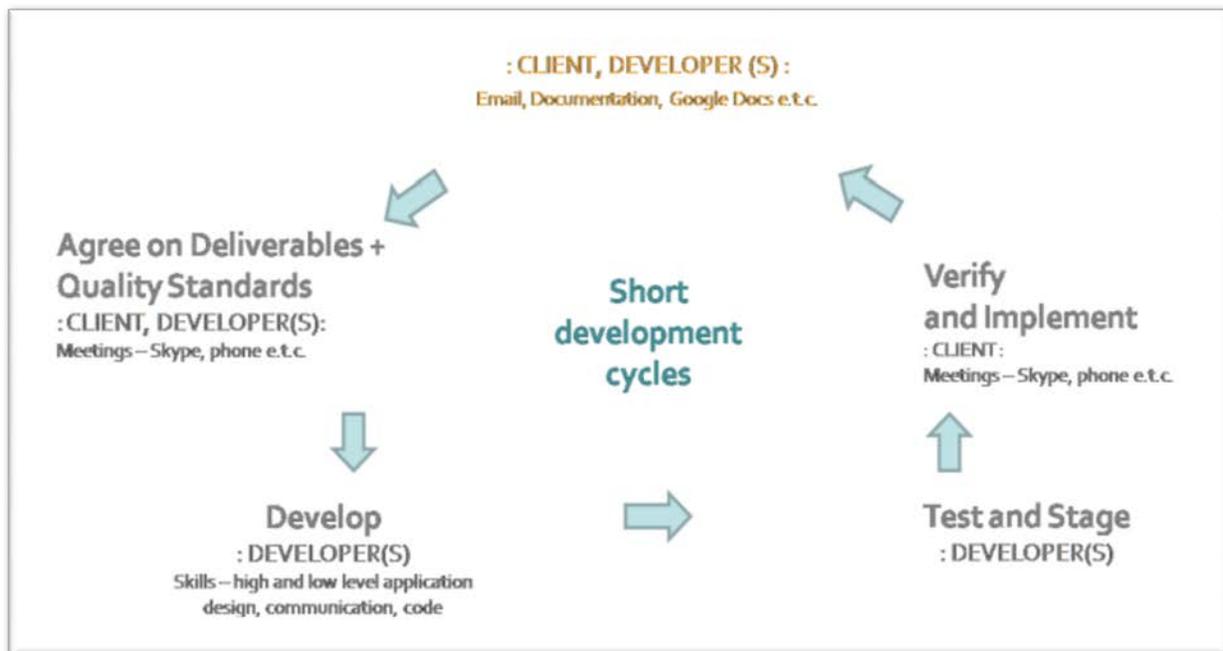
Before moving to the topic in context of testing, first understand “Agile”!!!

So as per normal goggling & self explanatory word - Agile means “Able to move easily and quickly”

Now days, Agile methodology is very eye catching terminology in software industry. Most of us already aware about know how’s of Agile. But intention of this white paper is “To make readers correlate the practical aspects to their theoretical knowledge and to fetch relevant information about Agile Testing in single piece of document”.

The Agile methodology works on the principle of evolvement of requirements and solutions with collaboration of customers and self-organizing team (*both Development and test*). Here self organizing team could be cross functional team which has special expertise of tester to contribute and to provide customer needs in terms of project milestone to the customer at regular intervals.

While talking about the Agile, it is also important to refer Scrum. Scrum is a repetitious and incremental approach which defines adoptable and flexible strategy, where team works to achieve common goal. In the ongoing project, scrum’s key feature is to recognize the change in the requirement from the customer, due to evolvement of customer requirements. Using the traditional way (water-fall approach), these unpredictable changes are not easy to handle. By using Scrum, it gives focus on maximizing the way to deliver quickly and respond to the changed/emerging requirements.

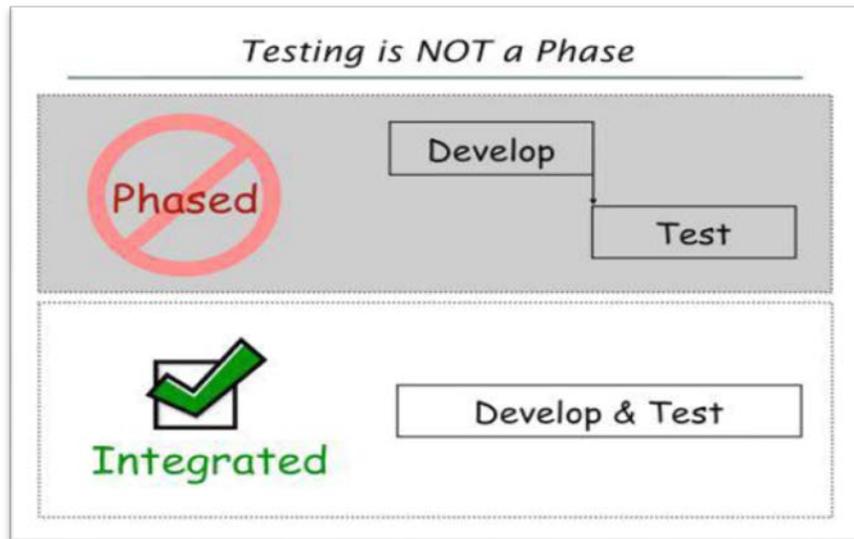


## 2 Agile Testing

Now going into more details of Agile testing, one of the important factors is, Testers in team use their expertise to draw example of customer expected behavior and with collaboration with developers, prepare the specification for coding. The beauty of agile methodology is, testing and coding are done in parallel and iteratively. This way leads to the value where each feature/requirement tends to the maturity of production. The highlight of agile testing is that it covers all types of testing. Understanding the testing in the Agile model makes usage of basic principles which are used widely.

Basic Principles considered for Agile Testing:

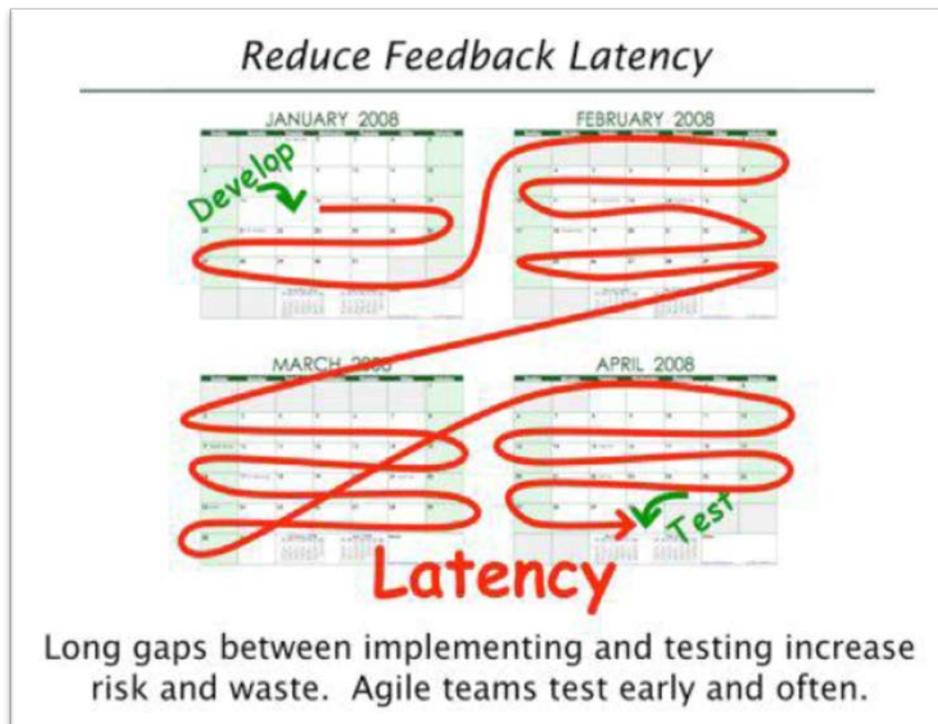
- **Testing is not a different Phase:** Here we encounter that testing is not a phase instead it is a way of life in agile team. By this way, we can ensure that requirements implemented during the iteration are actually correct. In another way, continuous testing is the only way to ensure continuous progress which is an asset of the Agile methodology.



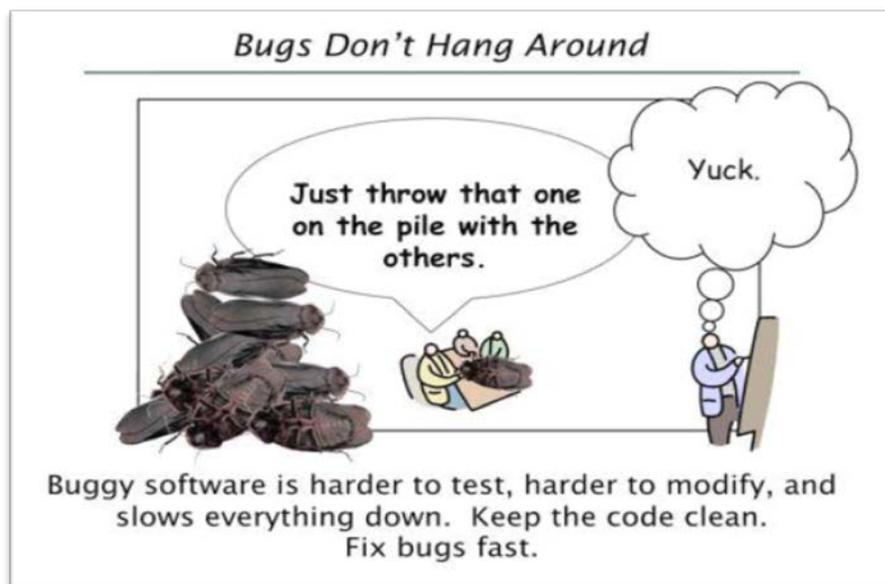
- **Every one test:** In traditional software development life cycle, there is a defined testing team which is only responsible for testing the deliverables & features. However in agile team, developers and business analyst also test to meet the team delivery. This is how agile team ensures the tested iterative delivery.



- **Testing moves the project forward:** While using conventional SDLC, testing is considered as quality gate and QA and testers are like quality gatekeepers. But here agile team provides feedback on regular basis. Which itself call product to meet business requirements. In this methodology, developers and testers mindset/relationship must be replaced with spirit of collaboration. This is completely different practice of mindset and behavior.
- **Shortening feedback loops:** A feedback loop can be considered as measure of time when a programmer writes a line of code and when someone or something executes that code and provide how it works/behaves. So in conventional way, this feedback loop is very high and can be measured in months. That is way long. Shorter feedback loops increase agility. In Agile project, software can be tested on early basis. Agile team works on several testing methodology to uncover the different types of information from the software.

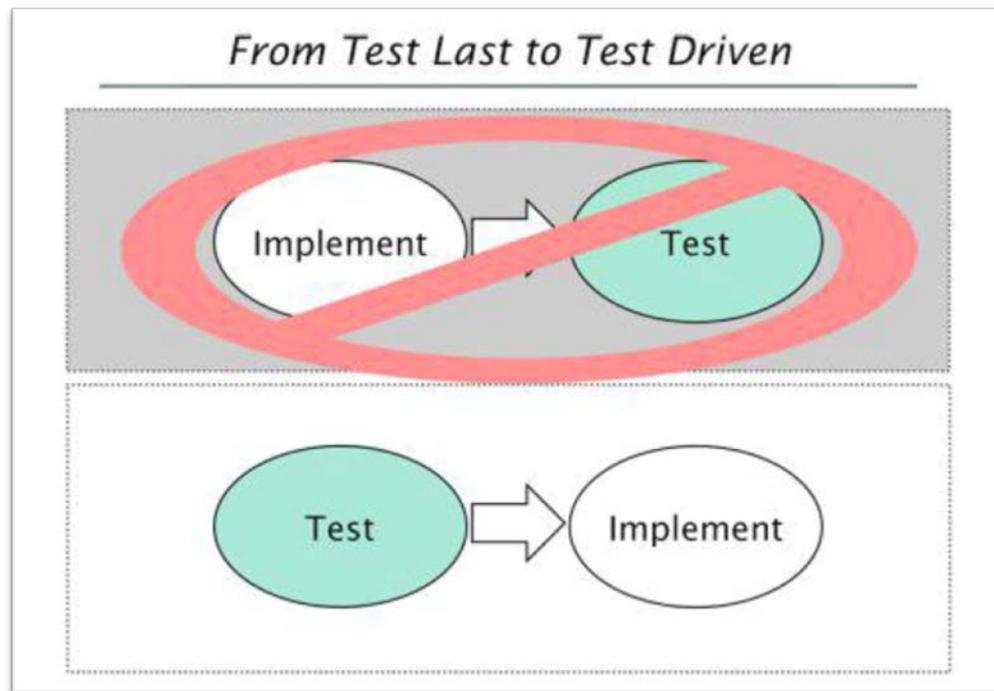


- **Clean Code:** Defects raised are fixed within the same iteration and thus keeping the code clean. This is also an example of agile team discipline that they have. This can also be explained by example; if a bug is retained in the code, it's like cooking in a dirty and scattered kitchen, it takes longer to wade through the mess to do the cooking and finally food may or may not be edible.



- **Lightweight Documentation:** Agile testers use following instead of lengthy documentation:
  - a) Reusable checklist for test suggestion
  - b) Focus on essence of test rather incidental details
  - c) Use lightweight documentation tool
  - d) Leveraging document for multiple usage
- **Test Driven Development:** In the conventional way, test is developed from the requirement documents. Design and requirement documents come first then after test. So in this way, testing is performed at the end. This is called test-last approach. Talking in agile, tests are defined with the requirement rather than after and using those test for driving the

development efforts. This tends to clear focus on the goal. This test first approach can be seen through test driven development.



### 3 Advantages of Agile Methodology

With the collaborative approach, we have following advantages of using the Agile Methodology:

- a) Changes and enhancement in the requirement adheres easily in between the project without any budget constraint.
- b) Working software is delivered on regular basis caused customer satisfaction.
- c) If we talk about agile testing, it saves time and money.
- d) Less documentation is required.
- e) Quality control by taking regular feedback from the customer.
- f) Using the collaborative way of daily meetings, helps in identifying the issues in advance.

### 4 Disadvantages of Agile Methodology

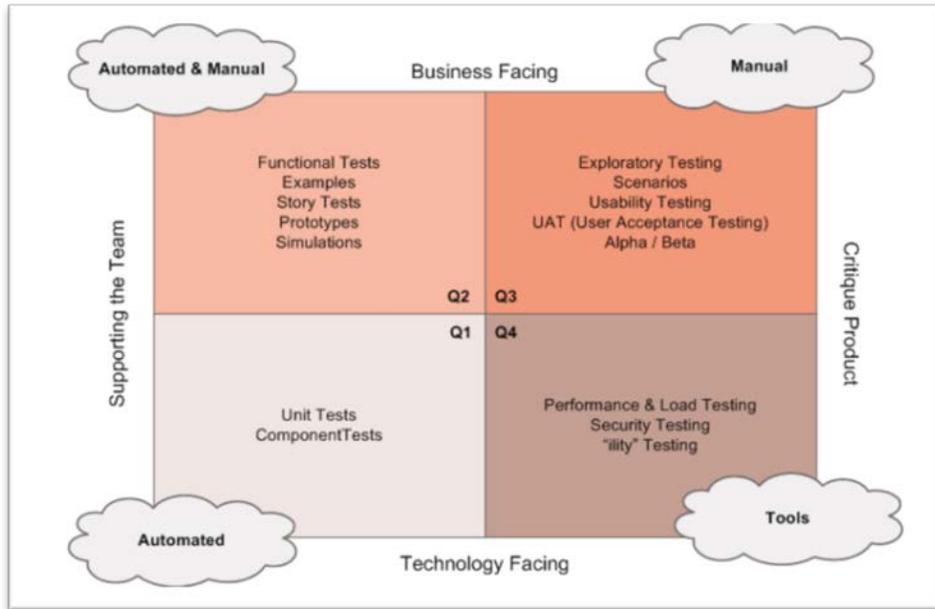
However there are some considerable disadvantages as well.

- a) Low emphasis on designing and documentation part.
- b) If the customer requirements are not clear then it is easy to get taken off the track for project.
- c) One disadvantage is, only senior developer/testers are capable of taking decision on the basis of requirements. New comers will not be the effective part for the project unless combine with experience one.
- d) Difficulties in the assessing the efforts for large software deliverables at the beginning of the project.

### 5 Conclusion

Now considering the best practices for Agile testing, following points are important which can be linked from Agile testing quadrants.

- a) Automated unit/integration test of components
- b) Automated system level regression test
- c) Test/acceptance test driven development
- d) Exploratory testing
- e) Collaborative testing



## 6 Acknowledgement

I would like to acknowledge my co-workers for supporting and encouraging me throughout the course work.

## 7 References

[1] Multiple Testing Websites, [2] ISTQB Advanced Testing, [3] Scrum Master Web links

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# SIM Applet Security

## Secure communication between application & server

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**Abstract** — This paper delineate the most imperative feature of SIM industry; rather all communication industries i.e. SECURE COMMUNICATION. The research done herein is primarily focused on secure communications between a SIM application often called SIM Applet and the supporting/controlling server. The work done here will assist a SIM applet architect, developer, business solution designer to know how to ensure secure communication between applet & server.

**Index Terms** — SIM (Subscriber Identity Module), OS(Operating System), OTA (Over the Air), Security Domain (SD), ISD (Issure Security domain), SSD (Suplematary security domain), APSD (Application security domain), MNO (Mobile Network Operator), RAM (Random access memory)

### 1 INTRODUCTION

Applications; a word which is becoming much common in today's technological world and when this word is connected with mobile or SIM industry it becomes even more common. There were days when every user service was embedded as a feature in operating system. With more and more people joining the mobile phone ecosystem, these features kept on growing exponentially & became more and more diverse. As a result the operating system's size grew exponentially. Eventually, the memory size of operating system became a decisive concern. Talking about SIM card, keeping the size of silicon (microcontroller chip over which lots of things exist: chip OS + SIM OS + File system of OS + user space) constant; the more the size of OS, the less is the space available for user. So now the world was ready for facing the new challenge to minimize the size of operating system as low as possible. To meet these requirements the services were pulled from OS and build as stand alone java applets. Now the final SIM card could be easily made customizable as per user's diverse needs. Some one needs more user space and fewer applications, while the other group of users desires to have bunch of applications and considerable user space. The SIM world has a solution to all such needs.

On the contrary; Mobile apps are also growing with equal pace. They offer a cut throat competition to SIM java applets.

SIM applets over mobile apps offer an inherited advantage of being more secure and when the word secure comes it becomes an indispensable aspect for; be it a SIM applet or mobile app.

All in all, there are three primary requirements for a SIM applet:

- Applet size
- Security
- Performance

All the requirements are contrary to each other i.e. the more security you code into your application the more heavy it becomes. Performance depends on usage of RAM area by OS/application. Hence somehow a tradeoff needs to be made between all primary artifacts to make the SIM applet acceptable to the end user.

Our current telecommunication market is stuffed with numerous SIM applets where interaction with server is required. This server is often established and owned by service provider, in many cases network provider also.

The scope of this paper is confined to security attributes; to be more specific secure communication between administrative Server and SIM applet.

## 2 RESEARCH ELABORATION

Before going into the details of SIM applet security it is mandatory to know about Security Domains (SD).

A SIM operating system existing on a java card often has one or more security domain (specification provided by Global platform GP). Security domain is the on card representative of an offcard entity. GP specifies three types of security domains:

- ISD: Issuer Security domain
- SSD: Supplementary security domain
- CASD: Controlling Authority security domain

Key points for security domains:

- ✓ Security Domains support security services such as key handling, encryption, decryption, digital signature generation and verification for their providers.
- ✓ ISD is a mandatory security domain for card issuer.
- ✓ SSD is an optional security domain for application provider or card issuer
- ✓ CASD is a special type of SSD who mainly enforces security policy for all applications loaded on the card. There can be multiple CASD in one card.
- ✓ Each security domain has their own isolated keys which can be used for securely wrapping the data.

In context to this paper the main area of concern will be first and last point.

Now, SIM applets involving interaction with a server can secure the communication with the server in several ways:

1. **APPLET DEPLOYED ON SIM SECURITY DOMAIN**
2. **APPLET USING ITS OWN APPLICATIVE SECURITY**
3. **APPLET USING SD SECURITY + APPLICATIVE SECURITY**

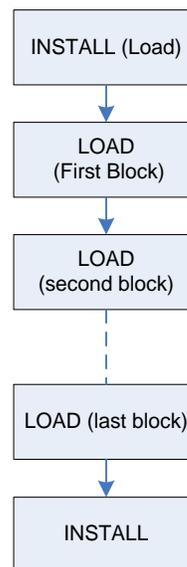
An applet can be directly made to use the security domain keys owned by MNO.

### How to deploy applet on security domain?

An applet is simply a java code written using standard java-card libraries (Reference to java card library). On compilation this javacode gives an output file as .cap. This cap file is loaded & installed on card using three commands specified by Global platform card specification [1]:

- a. Load (Install)

- b. Load (Load)
- c. Install



In these command a parameter is given by which an applet can specify its associated security domain. For command details refer [1]. With this parameter set and defined, an applet gets associated with the security domain and thus can use its security features.

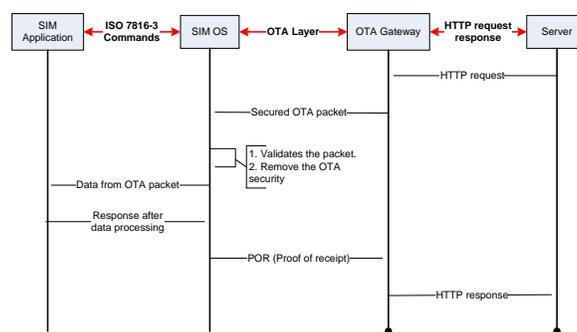
The basic working is:

1. Server communicates in the form of HTTP requests response pair while SIM OS communicates as per ISO commands.
2. Since the mode of communication is different so a gateway is required which accept one form of communication from one entity and convert it into a form acceptable for the other entity.
3. Server sends a HTTP request to the gateway.
4. Gateway converts the request into an OTA requests often called OTA packet. Since it is coming from server so it is called incoming packet. OTA is over the air, standards defined in [2]. Just to brief; via OTA, a SIM card can be accessed remotely by an authorized entity. After converting into OTA packet; the gateway wraps the OTA security over the packet and forward it to SIM OS.
5. SIM OS have an inbuilt OTA interpreter which vali-

dates the packet i.e. decrypts the data, checks the security of packet, verifies the checksum for authenticity etc. Once the packet is fully verified the OS accepts the packet. OS removes the OTA security from the packet and forward the plain data to intended application. *Please note that there can be multiple applications residing on same SIM OS. So the question is how do the OS find out to which application the packet is intended to? The answer is TAR (Toolkit application reference). Each application has its defined address known as TAR. For details of TAR refer [2]*

6. Application executes its code, prepares response data and send to SIM OS.
7. SIM OS adds the desired security in response and send to server in the form of transport carrier called proof of receipt (POR).
8. Any OTA packet intended to SIM can define whether it requires POR or not, POR only on error or POR on error/success both. Also it can define whether POR should be plain or secured. It can even define which security to be applied to POR. SIM OS takes this information from incoming packet and adds the desired security in POR i.e. response packet.
9. Secured POR is send to server via gateway.
10. Gateway validates the security of POR and after interpretation forward the desired information to server.
11. With this; the communication between application and server becomes secured **without explicitly writing any code for security inside applet thereby reducing the applet size and complexity.**

Below mentioned is the pictorial representation for the above explanation:



There are cases where the SD's security cannot be used by application and/or an additional security specially needs to be built inside the applet. The cases include:

1. Service provider needs applet developer to explicitly build an additional security inside applet i.e. service provider needs double security; SD security + applet additional security.
2. The applet functionality is such that it requires some input from end user. For eg: case where an applet takes few details like name, gender, area of interest etc. from user; passes the entered info to server. Depending on this the server sends the next request accordingly.

The formal is simply a requirement which needs to be fulfilled in order to be complaint to requester needs. But the latter is more a **Limitation**.

Limitation in context to TS 43.019 [3] a SIM API standard to which a java card is complaint for interoperable reasons.

As specified in standard,

*“The EnvelopeResponseHandler content must be posted before the first invocation of a ProactiveHandler.send method or before the termination of the processToolkit, so that the GSM applet can offer these data to the ME (eg 9Fxx/9Exx/91xx). After the first invocation of the Proactiv Handler.send method theEnvelopeResponseHandler is no more available”*

To explain the above statement:

- EnvelopeResponseHandler - Via this handler the SIM applet provide the response for the received OTA envelope.
- Proactiv Handler - Via this handler the SIM applet issues a proactive SIM commands; defined in [4].

A brief for proactive commands: This is a way by which a SIM can interact with ME and via ME to the end user, to network or any other involved entity.

If an application code is such that it does not involve any interaction with end user/network i.e. does not involve the issuing of proactive SIM commands then the response can simply be given in POR thereby SD security can be used **BUT** if to send response to server, the SIM has to interact with user or issue proactive command then SD security cannot be used. In such a case the application should have its own security called applicative security.

Let's try to make the point clearer by taking an example applet. Suppose an applet is designed to accept two commands coming from server:

1. Cmd1: Server will send some data to be stored in applet internal buffers for future use.
2. Cmd2: Server want to know the gender of the applet user + current location of the applet user.

For both cmd1 and cmd2 server needs the response back in case of success/error. Both incoming (cmd1 envelopes) and outgoing (response) should be secured.

Now coming to working; when cmd1 is received by applet; the applet executes its code; stores the data in its buffers and send secured response via POR using envelopeResponseHandler.

When cmd2 is received by applet, applet has to take input from user and network both. For this applet needs to issue proactive commands ('Get input' for taking input from user and 'Provide location information' for fetching current location from network). The proactive commands will be issued using ProactivHandler. As per [3] once the proactiveHandler is used the envelopeResponseHandler will be lost. So a SIM applet can use either of one handler at a time. The moment the proactivHandler is picked for issuing the proactive command the envelopeResponseHandler is lost and the applet has no access to SD security. Hence the response cannot be wrapped with SD security. Here the applet has to apply applicative security for sending secure response to server.

Working for communication using application security:

1. Server sends a secured HTTP request to the gateway.
2. Gateway converts the request into an OTA requests and forward it to SIM OS.

3. SIM OS removes OTA header and forward the data to intended application.
4. Application validates the security on data. Decrypts the data and executes applet code.
5. Application prepares response data, adds the applicative security and send to SIM OS.
6. SIM OS forward the response POR to gateway.
7. Gateway further forwards the data from POR to server.
8. Server decrypts the data and interprets the response from applet.
9. With this; the communication between application and server becomes secured **using applicative security.**

There are cases where the service provider requires both SD security + applet additional security. Working in such case is:

1. Server sends a secured HTTP request to the gateway.
2. Gateway converts the request into an OTA requests and adds the OTA security then forward it to SIM OS.
3. SIM OS validates the packet, removes the OTA security from the packet and forward the encrypted data to intended application.
4. Application validates the security on data. Decrypts the data and executes applet code.
5. Application prepares response data, adds the applicative security and send to SIM OS.
6. SIM OS adds the OTA security over already secured response data and send to server in the form of POR.
7. Secured POR is send to server via gateway.
8. Gateway validates the security of POR, removes the SD security and forwards the applicative secured data to server.
9. With this; the communication between application and server becomes SD + applicative security secured.

Clearly in such communication using additional applicative security; the server and applet should be agreed with security + key to be used. The system can work in pre-shared keys i.e. server and applet already holds the keys before initiating the

communication session. For pre-shared keys the keys should be included in applet during SIM card manufacturing. Such a system becomes quite rigid i.e. each time an applet is deployed with another server i.e. another MNO the keys need to be embedded during SIM manufacturing. This includes lot of operational cost. To avoid this; the data can be stored in few files defined by applet developer. Data in these files can be updated remotely again using OTA concept. Keeping data in files is somehow considered less secure so there is one more option. The keys can be exchanged between server and applet in run time remotely via OTA.

Thus there are many ways of key handling and sharing between server and applet. Depending on business level agreement between the involved entities an appropriate way is used.

### 3 ADVANTAGES OF DIFFERENT OPTIONS

#### Applet deployed on SIM SD

Advantages:

1. Reply on OS inbuilt security i.e. standard secure messaging
2. Simple card architecture
3. Minimising applet size as no applicative security

Disadvantages:

1. Agreement between gateway and server necessarily required.
2. Applet cannot send a secure message to server, response can be secured via POR

#### Applet using Applicative security

Advantages:

1. No dependency on MNO OTA platform, a simple SMSC will work
2. Applet can send secure message to server
3. Simple card architecture

Disadvantages:

1. Increased applet size due to additional applicative security
2. Increased size of message payload

3. Server needs to be designed specially to handle applicative security

#### 4 End Note

Every applet deployment method has its own pros and cons. It is on applet developer, service provider that how they use the different option to earn their maximise business profit together gratifying the users needs and desires.

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# Fibrolytic enzyme activities in axenic cultures of *Piromyces sp.* from ruminants and non ruminants

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**Abstract** - In the present study, twenty-three strains of *Piromyces sp.* obtained from ruminants and non-ruminants were grown in Medium 10 in the presence of paddy straw as the sole source of fermentable carbon. The activity of extra-cellular fibrolytic enzymes such as avicelase, filter paper cellulase,  $\beta$  1, 4 endoglucanase,  $\beta$  glucosidase and acetyl esterase were estimated in the various axenic cultures. The activity of the exoglucanase on avicel (avicelase activity) and filter paper was found to be significantly higher ( $P < 0.05$ ) in the *Piromyces* strains isolated from Nilghai, the Indian elephant and the camel. In the four strains of the *Piromyces* isolated from the domestic ruminants, the activity of the exoglucanase on avicel (avicelase activity) and filter paper was found to be the lowest as compared to all other strains of *Piromyces* isolated from the wild herbivores, camel/horse ( $< 4.0 \mu\text{moles/mg protein}$ ).

**Index Terms**- gut fungi, xylanase, endo glucanase, acetyl esterase

## 1. INTRODUCTION

Under Indian conditions the domestic ruminants are fed on low quality roughages like straws and stovers wherein the main component is lignocellulose. These roughages are poorly digested in the rumen leading to low production efficiency. The efficient breakdown of lignocellulose in the rumen usually requires a battery of glycosyl hydrolases (GH) including endoglucanases (endo 1,4- $\beta$ -D glucan hydrolases EC 3.2.1.4), which cleave  $\beta$ -1,4-glycosidic bonds randomly within the cellulose chain; cellobiohydrolases or exoglucanases (exo 1,4- $\beta$ -D glucan cellobiohydrolase EC 3.2.1.91), which cleave cellobiose from the ends of the cellulose chain; and  $\beta$ -glucosidases ( $\beta$ -D glucosidase EC 3.2.1. 21), which convert cellobiose and other low molecular mass cellodextrins into glucose. The cleaved cellobiose and short chain cellodextrins are then converted to glucose by  $\beta$  glucosidases to stop end product inhibition. All the three types of GH have isolated from different rumen cellulolytic microorganisms. The anaerobic fungi have the potential to contribute substantially to fibre degradation in the alimentary tract of host animals due to their ability to produce a wide range of enzymes with hydrolytic capacity. Molecular evidence shows that the hydrolytic enzymes of anaerobic fungi are either associated with fungal cellulosome attached to the

fungal cell wall or secreted outside the mycelia as individual free enzymes. In order to improve the digestibility of low quality roughages several methodologies have been adopted. One of the approaches is obtaining a superior fiber degrading consortia of microbes and dosing them into the ruminants. In this study we have isolated *Piromyces* spp. of the gut fungi from faeces of various animals and evaluated their enzyme profile *in vitro* in axenic cultures.

## 2. OBJECTIVES

To study the activity of various carbohydrate active enzymes secreted by axenic cultures of *Piromyces* spp. isolated from various animals

## 3. METHODOLOGY

### Organisms

*Piromyces* strains were isolated from the domestic and captive zoo ruminants and non ruminant animals include: BBP1(from buffalo), BTP1 (from cattle), LCP1 (from African elephant), ACP1 and ACP2 (from Black buck), CDP1 (from camel), GCP1 (from giraffe), CHP1(from goat), HAP1 and HAP2 (from hippopotamus), ECP1 (from horse), EMP1 and EMP2 (from Indian elephant), BGP1 and BGP2 (from Mithun), BTrP1 and BTrP2 (from Nilgai or blue bull), RUP1, (from rhinoceros), OAP1 ( from sheep), CAP1, CAP2 and CAP3 (from spotted deer) and ZEP1 (from Zebra) were identified based on the monocentric growth pattern, large globose sporangia and monoflagellated zoospores. These characteristics of *Piromyces* strains corroborated with the strains described by

### Medium

Cultures of the various fungi were grown in tubes containing modified medium 10 of Caldwell and Bryant (1985). The Hungate tubes containing 9mL of medium wherein cellobiose and glucose was replaced with paddy straw cut to 2-3mm length. The paddy straw was used as the sole energy source for the growth of the fungi. All incubations were carried out at 39°C without shaking and all experiments were performed in triplicate.

### Cellulolytic activity of anaerobic fungi

Paddy straw was used as growth substrates for the production of cellulolytic enzymes. The 100 mL syringes containing M10 medium (Caldwell and Bryant), were incubated

with the axenic cultures at 39°C for 24 h. Enzyme activities were measured at the end of 24 h. Five uninoculated syringes were used as negative controls. After incubation for 24 h the medium was centrifuged at 15000 g for 15 min, and the supernatant was tested for the presence and the activity of the various enzymes. The reaction mixture used for the estimation of carboxymethyl cellulase (CMCase) and xylanase contained: 1.0 ml phosphate buffer (pH 6.8, 0.1 M), 0.5 ml substrate (1% carboxymethyl cellulose and 0.25% xylan from oat spelt for carboxymethylcellulase and xylanase respectively) and 0.5 ml enzyme; incubated at 39°C for 1 h for CMCase and 30 min for xylanase. Glucose and xylose released during incubation were estimated (Miller, 1959). The activities of carboxy methyl cellulase and xylanase were expressed as  $\mu\text{mole}$  of glucose and xylose released per min under the assay conditions. The optical density (OD) was recorded at 575nm using a spectrophotometer (model UVS-2700, Labomed INC, USA) with glucose as standard.

The activity of microcrystalline cellulase (MCCase) was assayed with Avicel (Sigma Aldrich Chemical Co., Bangalore, India) and filter paper as substrate. The substrate Avicel (1.0g) was suspended in 100 mL of 0.1mol L<sup>-1</sup> phosphate buffer, pH 6.8, and kept at 4°C for 48 h for swelling. The assay mixture comprised of 1 mL of enzyme, and 1mL of substrate that was incubated for 1 h at 39° C with continuous shaking. The reaction was terminated by the addition of 3.0 mL of dinitrosalicylic acid reagent and the residual avicel was removed by centrifugation. A measured quantity of the reaction mixture was boiled for 10 min in a water bath. After cooling to room temperature, 1 mL of sodium potassium tartarate was added and the optical density (OD) was recorded at 575 nm using a spectrophotometer (model UVS-2700, Labomed INC, USA) with glucose as standard.

The activity of  $\beta$ -Glucosidase was determined by measuring the absorbance at 410 nm of the p-nitrophenol released from the substrate p-nitrophenyl glucopyranoside (Himedia Ltd, Mumbai, India). The assay mixture contained 0.1 mL of enzyme, 0.9 mL of substrate (1 g L<sup>-1</sup> p-nitrophenylglucopyranoside dissolved in 0.1 mol L<sup>-1</sup> phosphate buffer, pH 6.8) and 1 mL of 0.1 mol L<sup>-1</sup> phosphate buffer (pH 6.8). After incubation for 10 min at 39° C the reaction was terminated by cooling the mixture on ice and the OD was measured at 410 nm using a spectrophotometer (Shewale and Sadana, 1978).

The activities of CMCase and MCCase were expressed as  $\mu\text{mol}$  glucose released min<sup>-1</sup> under the assay conditions. The activity of xylanase was expressed as  $\mu\text{mol}$  xylose released min<sup>-1</sup> under the assay conditions. The activities of  $\beta$ -glucosidase were expressed as  $\mu\text{mol}$  p-nitrophenol released min<sup>-1</sup> under the assay conditions. One international unit (1 IU) of enzyme activity was defined as the amount of enzyme that released 1  $\mu\text{mol}$  reducing

sugar (glucose or xylose) or 1  $\mu\text{mol}$  p-nitrophenol min<sup>-1</sup>. The protein content of enzyme samples was estimated by the method of Lowry *et al* (1951).

### Statistical Analysis

All the data were analyzed by one-way ANOVA using SPSS version 11 and the difference between the means were compared by Duncan's Multiple range tests. Pearson correlation coefficients among the various parameters were computed and tested for significance to detect bivariate correlation between the various variables.

## 4. RESULTS AND DISCUSSION

*Piromyces* spp. could be isolated from of domestic ruminants and identified based on their morphological and molecular characteristics. These genera of fungus could be isolated from the faeces of zoo ruminants, wild herbivores and pseudoruminants. The dominant fungi isolated from faeces of the zoo and wild herbivores from different locations in India were found to be affiliated to the genera *Piromyces*. Our results are in accordance with those of Ligenstoffer *et al.*, 2010 who found that *Piromyces* spp. were the most abundant fungi. The *Piromyces* isolates from the various sources of animals were capable of utilizing paddy straw as a sole source of fermentable carbon. All the isolates produced an array of enzymes that allowed them to hydrolyze plant cell walls. The enzymatic activity paralleled the growth of the fungi and this is in corroboration with the results obtained by Paul *et al.*, 2006 and Tripathy *et al.*, 2007.

The data on the specific activities of avicelase, filter paper cellulase,  $\beta$  1, 4 endoglucanase, xylanase,  $\beta$  glycosidase and acetyl esterase in axenic cultures of gut fungi belonging to the genus *Piromyces* is given in Table 1.

The activity of the microcrystalline cellulase on avicel (avicelase) and filter paper was found to be significantly higher (P<0.05) in the *Piromyces* strains isolated from nilghai (5.62 and 5.32  $\mu\text{moles/mg}$  protein respectively), the Indian elephant (5.49 and 5.23  $\mu\text{moles/mg}$  protein respectively) and the camel (5.14 and 5.06  $\mu\text{moles/mg}$  protein respectively). Among the *Piromyces* strains isolated from cattle, buffalo, sheep and goats, the activity of the micro crystalline cellulase of the cattle strain BTP1 was found to be significantly lower (P<0.05) as compared to those obtained from buffalo, sheep or goat. In 14 strains of *Piromyces* the activity of this enzyme fell in the range of 4.1-4.9  $\mu\text{moles/mg}$  protein. The endo  $\beta$  1,4 glucanase activity was found to be highest in BTrP1(nilghai; 45.60  $\mu\text{moles/mg}$  protein and the lowest in HAP1(hippopotamus; 24.96  $\mu\text{moles/mg}$  protein). The activity of xylanase was found to be comparable in both the strains from nilghai (BTrP1 and BTrP2), bison (BGP1), African elephant (LCPI1), Indian elephant (EMP1 and EMP2) and camel (CDPI1). It can be observed that these strains are efficient cellulose and xylan degraders. This study demonstrated that

nilgai, camel, elephant, rhinoceros and goats harbor highly efficient strains of anaerobic fungi with comparable ability to degrade paddy straw. It is also evident from the present study that isolates belonging to the same genus differ in their ability to degrade paddy straw and produce fibrolytic enzymes when grown on paddy straw as the substrate. Hence there is greater scope for isolating superior strains of fungi by screening more isolates.

From the results of the present study, it can be inferred that fungal strains from various host animals showed significant *in vitro* fibrolytic activities clearly suggesting that introduction of superior fibrolytic strains into the rumen could possibly improve the nutrient utilization in ruminants. Fibre degrading strains of anaerobic fungi are present in wild and domestic herbivores, but there are considerable differences in the fibre degrading potential among the fungal isolates from domestic ruminants and wild herbivores. The fibrolytic potential of these strains could also be exploited through their administration to domestic ruminants for improved nutrient utilization. However, more *in vitro* as well as *in vivo* studies are needed to verify the possibility of the successful interspecies transfer of these fungal strains and their establishment in the rumen before these fungi can be exploited as a successful additive for domesticated ruminants.

## 5. CONCLUSION

In India, cattle and buffaloes are used for milk production, which is an important protein source for Indians. The common factor limiting ruminant production is the dependence on quality of the feed available. Ruminants depend mainly on crop residues, straws, stovers and native pastures which are high in lignocelluloses. Feeds with a high proportion of lignocellulose are poorly digestible making it difficult for the animals to derive the nutrients they require. The dairy industry in India would benefit from new technologies that would improve the utilization of low quality roughages by treating the low quality roughages with these fungi or by selectively increasing these fungi in the rumen by using specific nutrients.

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Table 1: Fibrolytic enzyme activity of pure cultures of anaerobic fungi from zoo ruminants in Medium 10 with paddy straw as fermentable carbon

S.No	Fungal strain	Activity of the enzyme in $\mu$ moles / mg protein					
		Avicelase	Filter Paper Cellulase	$\beta$ - 1,4 endoglucanase	Xylanase	$\beta$ - Glucosidase	Acetyl esterase
1	BTP 1	3.22 <sup>a</sup> $\pm$ 0.06	2.97 <sup>a</sup> $\pm$ 0.04	26.80 <sup>ab</sup> $\pm$ 0.39	32.08 <sup>de</sup> $\pm$ 0.69	30.27 <sup>f</sup> $\pm$ 0.67	14.59 <sup>abc</sup> $\pm$ 0.34
2	BBP 1	3.58 <sup>b</sup> $\pm$ 0.19	3.23 <sup>c</sup> $\pm$ 0.1	26.55 <sup>ab</sup> $\pm$ 0.74	32.89 <sup>def</sup> $\pm$ 0.56	30.26 <sup>f</sup> $\pm$ 0.82	14.83 <sup>abc</sup> $\pm$ 0.13
3	CHP 1	3.55 <sup>b</sup> $\pm$ 0.08	3.33 <sup>bcd</sup> $\pm$ 0.07	30.19 <sup>bc</sup> $\pm$ 0.24	27.61 <sup>bc</sup> $\pm$ 0.42	33.46 <sup>gh</sup> $\pm$ 0.1	20.77 <sup>g</sup> $\pm$ 0.36
4	OAP 1	3.61 <sup>b</sup> $\pm$ 0.03	3.42 <sup>bcd</sup> $\pm$ 0.07	31.77 <sup>cde</sup> $\pm$ 0.42	26.51 <sup>b</sup> $\pm$ 0.64	32.25 <sup>f</sup> $\pm$ 0.98	19.53 <sup>fg</sup> $\pm$ 0.73
5	EMP 1	5.49 <sup>h</sup> $\pm$ 0.13	5.23 <sup>k</sup> $\pm$ 0.1	42.24 <sup>h</sup> $\pm$ 0.75	35.67 <sup>fg</sup> $\pm$ 1.47	33.92 <sup>gh</sup> $\pm$ 0.46	18.49 <sup>defg</sup> $\pm$ 1.40
6	EMP 2	4.66 <sup>d</sup> $\pm$ 0.15	4.41 <sup>hi</sup> $\pm$ 0.13	38.52 <sup>fg</sup> $\pm$ 0.80	33.90 <sup>efg</sup> $\pm$ 0.40	20.03 <sup>a</sup> $\pm$ 0.18	15.40 <sup>abcd</sup> $\pm$ 0.55
7	HAP 1	4.45 <sup>cd</sup> $\pm$ 0.08	3.97 <sup>f</sup> $\pm$ 0.2	24.98 <sup>a</sup> $\pm$ 0.35	32.16 <sup>de</sup> $\pm$ 0.84	23.81 <sup>de</sup> $\pm$ 0.34	17.49 <sup>cdef</sup> $\pm$ 0.32
8	HAP 2	3.69 <sup>b</sup> $\pm$ 0.15	3.31 <sup>bc</sup> $\pm$ 0.80	31.19 <sup>bcd</sup> $\pm$ 0.21	30.72 <sup>d</sup> $\pm$ 0.24	22.51 <sup>bcd</sup> $\pm$ 0.35	16.78 <sup>cdef</sup> $\pm$ 0.13
9	LCP 1	4.94 <sup>ei</sup> $\pm$ 0.53	4.82 <sup>jk</sup> $\pm$ 0.49	41.38 <sup>gh</sup> $\pm$ 0.34	33.96 <sup>efg</sup> $\pm$ 0.22	23.66 <sup>de</sup> $\pm$ 0.54	17.02 <sup>cdef</sup> $\pm$ 0.57
10	RUP 1	4.33 <sup>c</sup> $\pm$ 0.07	4.14 <sup>gh</sup> $\pm$ 0.07	33.99 <sup>cdef</sup> $\pm$ 0.39	30.12 <sup>cd</sup> $\pm$ 2.39	22.46 <sup>bcd</sup> $\pm$ 0.14	16.48 <sup>bcd</sup> $\pm$ 0.14
11	CDP 1	5.14 <sup>fg</sup> $\pm$ 0.05	5.06 <sup>k</sup> $\pm$ 0.02	41.40 <sup>gh</sup> $\pm$ 0.51	34.36 <sup>efg</sup> $\pm$ 0.76	22.55 <sup>bcd</sup> $\pm$ 0.14	13.10 <sup>a</sup> $\pm$ 0.445
12	ECP 1	4.62 <sup>d</sup> $\pm$ 0.02	3.48 <sup>cd</sup> $\pm$ 0.07	36.30 <sup>ef</sup> $\pm$ 0.15	22.83 <sup>a</sup> $\pm$ 0.69	18.93 <sup>a</sup> $\pm$ 0.19	18.23 <sup>defg</sup> $\pm$ 0.26
13	ZEP 1	3.62 <sup>b</sup> $\pm$ 0.18	3.29 <sup>bc</sup> $\pm$ 0.02	29.19 <sup>abc</sup> $\pm$ 1.60	20.58 <sup>a</sup> $\pm$ 2.14	20.52 <sup>abc</sup> $\pm$ 2.23	13.44 <sup>ab</sup> $\pm$ 3.73
14	GCP 1	4.21 <sup>c</sup> $\pm$ 0.05	3.61 <sup>de</sup> $\pm$ 0.15	35.99 <sup>def</sup> $\pm$ 0.39	26.54 <sup>b</sup> $\pm$ 0.21	20.36 <sup>ab</sup> $\pm$ 0.35	15.39 <sup>abcd</sup> $\pm$ 0.23
15	BTrP 1	5.62 <sup>g</sup> $\pm$ 0.06	5.32 <sup>i</sup> $\pm$ 0.11	45.60 <sup>i</sup> $\pm$ 6.76	36.31 <sup>g</sup> $\pm$ 0.17	34.98 <sup>h</sup> $\pm$ 0.48	18.73 <sup>efg</sup> $\pm$ 0.13
16	BTrP 2	4.89 <sup>d</sup> $\pm$ 0.04	4.65 <sup>jl</sup> $\pm$ 0.07	42.91 <sup>f</sup> $\pm$ 0.31	34.29 <sup>efg</sup> $\pm$ 0.71	24.33 <sup>de</sup> $\pm$ 0.35	14.92 <sup>abc</sup> $\pm$ 0.21
17	ACP 1	4.44 <sup>cd</sup> $\pm$ 0.05	4.23 <sup>gh</sup> $\pm$ 0.05	35.83 <sup>def</sup> $\pm$ 0.38	35.18 <sup>efg</sup> $\pm$ 0.86	25.77 <sup>e</sup> $\pm$ 1.24	17.49 <sup>cdef</sup> $\pm$ 0.31
18	ACP 2	4.27 <sup>c</sup> $\pm$ 0.02	4.07 <sup>fg</sup> $\pm$ 0.02	37.12 <sup>fg</sup> $\pm$ 0.70	35.13 <sup>efg</sup> $\pm$ 0.56	23.52 <sup>d</sup> $\pm$ 0.69	16.75 <sup>cdef</sup> $\pm$ 0.99
19	BGP 1	4.35 <sup>c</sup> $\pm$ 0.03	4.14 <sup>gh</sup> $\pm$ 0.03	35.26 <sup>def</sup> $\pm$ 0.09	35.96 <sup>fg</sup> $\pm$ 0.34	22.98 <sup>d</sup> $\pm$ 0.62	16.05 <sup>abcd</sup> $\pm$ 0.50
20	BGP 2	4.36 <sup>c</sup> $\pm$ 0.05	4.14 <sup>gh</sup> $\pm$ 0.05	36.06 <sup>def</sup> $\pm$ 0.27	34.71 <sup>efg</sup> $\pm$ 0.56	22.43 <sup>bcd</sup> $\pm$ 0.42	17.07 <sup>cdef</sup> $\pm$ 0.25
21	CAP 1	4.30 <sup>c</sup> $\pm$ 0.06	3.81 <sup>ef</sup> $\pm$ 0.07	29.24 <sup>abc</sup> $\pm$ 0.39	23.15 <sup>a</sup> $\pm$ 0.76	22.65 <sup>bcd</sup> $\pm$ 0.37	14.63 <sup>abc</sup> $\pm$ 0.35
22	CAP 2	4.25 <sup>c</sup> $\pm$ 0.05	3.14 <sup>ab</sup> $\pm$ 0.17	35.11 <sup>def</sup> $\pm$ 1.01	20.98 <sup>a</sup> $\pm$ 1.42	23.45 <sup>d</sup> $\pm$ 0.59	15.11 <sup>abc</sup> $\pm$ 0.30
23	CAP 3	4.24 <sup>c</sup> $\pm$ 0.04	3.17 <sup>ab</sup> $\pm$ 0.09	37.07 <sup>fg</sup> $\pm$ 0.71	21.58 <sup>a</sup> $\pm$ 1.19	22.71 <sup>cd</sup> $\pm$ 0.56	16.26 <sup>bcd</sup> $\pm$ 0.46

# Validation and Effectiveness of Modules in Personality Development and Public Relations

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**Abstract-** The study aimed to determine the validity and effectiveness of the developed modules in the subject Social Orientation (Soc. Or.) or Personality Development and Public Relations (PDPR). This study was conducted at the University of Rizal System-Morong Campus during the First Semester of School Year 2009-2010 with 15 PDPR professors and 30 second year students of Bachelor of Technology major in Hotel and Restaurant Management as the respondent-evaluators in the study. Descriptive-experimental method of research using the questionnaire-checklist and test results in gathering data was used in the conduct of the study. The PDPR professors validated the modules based on the following criteria: objectives, subject matter, organization and presentation, language and style and usefulness of the module. Pretest-post test design was used to determine the performance of the control and experimental group in which the students were equated and divided into two groups. Mean, standard deviation and rank distribution were used as statistical tools in treating the data. T-test was utilized to test the significant difference between the mean performance of the control and experimental group as revealed by the post test results. It was found out that the modules in PDPR were very much valid as an instructional material. This is shown in the high performance of the experimental group as revealed in their pretest and post test results. The modules in PDPR were perceived to be very much effective by students and professors.

**Index Terms-** Hotel and Restaurant Management, Instructional Materials, Modules, Personality Development and Public Relations

## I. INTRODUCTION

Social Orientation (Soc. Or.) or Personality Development and Public Relations (PDPR) subject plays a great role for Hotel and Restaurant Management students. Knowledge, skills and values on the physical, intellectual, social, emotional and moral aspects of personality as well as social graces and manners in the business world will be gained by the students before the semester ends. Most of the teachers nowadays teaching the subject PDPR use the available textbooks as their references in teaching and very few support their teaching with other instructional materials in a form of module, work text, workbook and the like. In the usual classroom situation, the teacher tries to teach and evaluate the students in a conventional way by using a book with the same lesson at the same time. On the other hand, with the use of modules, the students learn in a self-paced mode and evaluate his own test results. If he did not pass the test, then, he can go back to the present lesson to study again and then submit himself for

self evaluation until he gained mastery of the lesson. The competing epistemologies which are struggling to shape the formal undergraduate curriculum of the 21<sup>st</sup> century include the deconstruction of the subject, as reflected in, for example, the modularization of the curriculum; the cross-curricular 'key' skills movement; and the learning through experience movement among others [Bridge, 2000]. [1]

Section 3, Chapter 3 of the Education Act of 1982 expressed the following aim which is to develop curricular designs, prepare instructional materials, prepare and evaluate programs to upgrade the quality of teaching [2]. Similarly, Presidential Decree No. 6-A, Section 5 states, "One of the educational objectives is to design, utilize and improve instructional technology and develop or produce textbooks and other instructional materials leading to quality education." [3] A well-developed instructional material will greatly contribute to the performance of the students and would also make learning easier and permanent (Abarro, 2004 [4] Aparejo, 2004 [5] Bautista [6] and Marino, 2004 [7]). The use of work text has a significant effect on the performance of the students and that instructors find it useful if paired with the traditional lecture method (Maranan [8] and Tonido 2005 [9]). Similarly, the developed work text, modules and laboratory manual in Sciences and Mathematics subjects are very useful in enhancing the learning of the students as evaluated by students and instructors (Constantino 2010, [10] Cruz 2006, [11] Jimenez 2008 [12] and Robles 2004 [13]).

The study was anchored on Bruner's Instruction Theory. According to this theory, instruction must have as its object to help the learner to be a self-sufficient problem-solver [14]. The Theory of Bruner is related to the present study because through the use of modules, the students become independent in evaluating their own learning.

## II. OBJECTIVES

The main purpose of this study is to validate and test the effectiveness of the developed modules in the subject Personality Development and Public Relations during the School Year 2009-2010 in the University of Rizal System, Morong, Rizal, Philippines.

Specifically, it aimed to:

1. Determine the validity of the developed modules as evaluated by professors in terms of the following criteria;
  - 1.1 objectives;
  - 1.2 subject matter;
  - 1.3 organization and presentation;
  - 1.4 language and styles;
  - 1.5 usefulness of the module.

2. Determine the performance of the control and experimental group as revealed by the pretest and post test with respect to the following learning areas;
  - 2.1 Aspects of Personality;
  - 2.2 Self-Appraisal, Self Improvement and Philosophy of life;
  - 2.3 The Better You;
  - 2.4 The New You;
  - 2.5 You and Your Clothing;
  - 2.6 Social Graces;
  - 2.7 Emotions, Conflict and Adjustment.
3. Identify the significant difference between the mean performance of the control and experimental group as revealed by the post test results.
4. Identify the significant difference on the effectiveness of the developed modules in Personality Development and Public Relations as revealed by the pretest and post test scores of the experimental group.

evaluated by PDPR professors. Experimental method of research was also used in this study. Experimental method according to Aguinaldo is “the procedure which involves a situation in which a certain phenomena may be controlled... It describes and analyzes variables in carefully controlled conditions as a basis for interfering or concluding. It consists of manipulating an experimental variable under highly controlled condition to determine how and why a particular event occurs [15].”

Pretest-post test group designs were used as instruments in the study. The study made use of a 70 item multiple choice of test in PDPR to find out the accomplishment of the two groups of student respondents. The pretest and the post test scores of the two groups were evaluated and analyzed and were used as the bases to test the effectiveness of the modules in the subject Personality Development and Public Relations (PDPR). The subjects were divided into control and experimental groups using the simple random sampling procedure. Each group has fifteen (15) student-subjects who formed part of the study and were equated based on their grades. A questionnaire –checklist was also used as instrument in the gathering of the data. The questionnaire-checklist was adapted from the questionnaire of Laurice A. Cruz in his study, “The Effectiveness of Environmental Science Teaching Modules on the Performance of College Students” [11]. The criteria included in the questionnaire- checklist are objectives, subject matter, organization and presentation, language and style and usefulness.

### III. METHODOLOGY

The study utilized the descriptive research design using questionnaire checklist which was distributed to the respondents. Descriptive method according to Aguinaldo “is design to gather information about present and existing conditions. It determines and reports the way things are [15].” This design is very appropriate in determining the validity of the modules that were

The instrument used a five- point scale to interpret the gathered data as shown below:

			Verbal Interpretation			
Scale	Range	Objectives	Subject Matter	Organization & Presentation	Language & Style	Usefulness
5	4.20-5.00	Very Strongly Agree	Very Highly Sufficient	Very Much Effective	Very Highly Effective	Very Useful
4	3.40-4.19	Strongly Agree	Highly Sufficient	Much Effective	Highly Effective	Useful
3	2.60-3.39	Agree	Sufficient	Moderately Effective	Effective	Moderately Useful
2	1.80-2.59	Slightly Agree	Slightly Sufficient	Less Effective	Slightly Effective	Slightly Useful
1	1.00-1.79	Disagree	Not Sufficient	Least Effective	Not Effective	Not Useful

Mean and rank were used to determine the validity of the modules as evaluated by professors. Mean and standard deviation were utilized to determine the performance of the control and experimental group as revealed by the pretest and post test, and the significant difference on the effectiveness of the developed modules in PDPR as revealed by the pretest and post test scores of the experimental group. T-test was used to determine the significant difference, between the mean performance of the control and experimental group as revealed by the post test results.

### IV. RESULTS AND DISCUSSIONS

#### Validity of the Modules as Evaluated by Professors in Terms of Objectives, Subject Matter, Organization and Presentation, Language Style and Usefulness .

Table 1 presents the computed weighted mean on the validity of the modules as evaluated by the professors with regards to the objectives.

**Table1. Computed Weighted Mean on the Validity of the Modules with Respect to Objectives**

A. Objectives	Professors		
	Weighted Mean	Rank	Verbal Interpretation
1. The general objectives include the development of logical judgmental behaviors.	4.78	1.5	Very Strongly Agree
2. The specific objectives are clearly stated.	4.78	1.5	Very Strongly Agree
3. The specific objectives are measurable and attainable.	4.59	4	Very Strongly Agree
4. The objectives guide the students to have a full grasp of the concepts to be discussed in each of the module.	4.64	3	Very Strongly Agree
5. The learning objectives are aligned with the mission, vision, goal, and objectives of the University.	4.53	5	Very Strongly Agree
Average Weighted Mean	4.66		Very Strongly Agree

The table shows in terms of objectives as perceived by professor respondents item 1 “The general objectives include the development of logical judgmental behaviors” and item 2 “The specific objectives are clearly stated” both ranked first with 4.78 weighted mean. Last in rank is item 5 “The learning objectives are aligned with the mission, vision, goal, and objectives of the university” with 4.53 weighted mean. All the findings are verbally interpreted as “Very Strongly Agree” with an average weighted mean of 4.66. The findings describe that the respondents very strongly agreed on the “Objectives” of the

developed modules. This implies that the objectives are clearly stated, are of greatest assistance to the students to have a full understanding of the concepts to be discussed, accessible and achievable. As revealed by Cruz (2006) the instructors “very strongly agree” that the objectives include the enhancement of good critical behaviors and are clearly stated [12].

Table 2 presents the computed weighted mean on the validity of the modules as evaluated by the instructors with respect to the subject matter.

**Table 2. Computed Weighted Mean on the Validity of the Modules with Respect to Subject Matter**

B. Subject Matter	Professors		
	Weighted Mean	Rank	Verbal Interpretation
1. The topics in the module are appealing.	4.75	1	Very Highly Sufficient
2. The information provided is relevant and up to-date.	4.57	4.5	Very Highly Sufficient
3. The information is adequate in acquiring the knowledge in each module.	4.6	2.5	Very Highly Sufficient
4. The activities/ exercise are relevant to the concepts being developed in each module.	4.57	4.5	Very Highly Sufficient
5. The activities/ exercise help the students understand better the concepts discussed.	4.6	2.5	Very Highly Sufficient
Average Weighted Mean	4.62		Very Highly Sufficient

The table reveals that the average weighted mean for Subject Matter is 4.62 and is verbally interpreted as “Very Highly Sufficient”. Item 1, “The topics in the module are appealing” got the highest rank with a weighted mean of 4.75. On the other hand, item 2 “The information provided is relevant and up to-date” and item 4, “The activities/ exercises are relevant to the concept being developed in each module” both rank last with a weighted mean of 4.57 all verbally interpreted as “Very Highly Sufficient”. The findings revealed that the respondents perceived the contents of the modules are enough and relevant to the needs

of the end users-the students. This implies that the topics presented are attractive to the interest of the learners, information is adequate and enhance by the activities/ exercises incorporated in each module. As Marino (2004) stressed out, a well-developed instructional material will greatly contribute to the performance of the students. The use of instructional material would also make learning easier and permanent [7].

Table 3 presents the average weighted mean on the validity of the modules as evaluated by the professors with respect to organization and presentation.

**Table 3. Computed Weighted Mean on the Validity of the Modules with Respect to Organization and Presentation**

C. Organization and Presentation	Professors		
	Weighted Mean	Rank	Verbal Interpretation
1. The presentation of topics is sequential.	4.60	2.5	Very Much Effective
2. The discussion of topics is clear and well presented in a logical and orderly sequence.	4.68	1	Very Much Effective
3. The variety of activities is sufficient enough to realize the objectives.	4.53	4	Very Much Effective
4. The illustrations, examples, figures, and exercises are instruments to attain the learning process.	4.28	5	Very Much Effective
5. Instruments for assessment of the targeted objectives are included.	4.60	2.5	Very Much Effective
Average Weighted Mean	4.54		Very Much Effective

The table depicts that the average weighted mean for organization and presentation is 4.54 and is verbally interpreted as “Very Much Effective”. Item 2 “The discussion of topics is clear and well presented in a logical and orderly sequence” is ranked first with a weighted mean of 4.68 while item 4 “The illustrations, examples, figures and exercises are instruments to attain the learning process” is ranked last with a rating of 4.28 and all are verbally interpreted as “Very Much Effective” It could be deduced from the results that the respondents perceived the organization and presentation of the modules to be very

effective as an instructional material. This implies that the topics presented are in order, evaluation instrument is incorporated based on the objectives set as well as provision for illustrations, example, figures and exercises that enhance the learning process. As pointed by Constantino (2010) more exercises focus on the objectives should be added [10].

Table 4 depicts the computed weighted mean on the validity of the modules as evaluated by the professors with respect to the language and style.

**Table 4. Computed Weighted Mean on the Validity of the Modules with Respect to Language and Style**

D. Language and Style	Professors		
	Weighted Mean	Rank	Verbal Interpretation
1. Language used is simple easy to understand in terms of vocabulary and technical terminologies.	4.82	1	Very Effective Highly
2. Language structure avoids misinterpretation and free of grammatical errors.	4.68	3.5	Very Effective Highly
3. There is enough vocabulary to ensure ease of learning.	4.71	2	Very Effective Highly
4. There are sufficient provisions for learning new meaning.	4.68	3.5	Very Effective Highly
5. The language and style are suited to the ability of the students.	4.53	5	Very Effective Highly
Average Weighted Mean	4.64		Very Effective Highly

The table reveals that the average weighted mean for “Language and Style” is very 4.82 and is verbally interpreted as “Very Highly Effective”. Item 1 “Language used is simple, easy to understand in terms of vocabulary and technical terminologies” is ranked first with a rating of 4.82 while item 5 “The language and style are suited to the ability of the students” is ranked last with a rating of 4.53 and all are verbally interpreted as “Very Highly Effective” This means that the professors agreed that the language and style of the developed modules are enough to be understood by the learners, inclusion for learning new

meaning is evident and carefully chosen vocabulary facilitate learning. The findings imply that the modules contain contents that would improve the performance in the subject Personality Development and Public Relations. According to Abarro (2004) the language used should be easily understood by the learners. A well- written module should be clear, simple and orderly in order to make learning easy [4].

Table 5 shows the computed weighted mean or the validity of the modules as evaluated by the professors with regard to the usefulness.

**Table 5. Computed Weighted Mean on the Validity of the Modules with Respect to Usefulness**

E. Usefulness	Professors		
	Weighted Mean	Rank	Verbal Interpretation
1. The modules enable the students to analyze and apply information/theories in real life situations.	4.74	1.5	Very Useful
2. The modules are engaging, beneficial to students learning and supportive of higher level thinking skills.	4.67	4	Very Useful
3. Students can learn, understand and answer the guide questions thoroughly by reviewing examples and illustrations, which are provided per topic.	4.74	1.5	Very Useful
4. The modules can make the students learn and understand the subject matter by reviewing the illustrations and examples at his pace.	4.59	5	Very Useful
5. The modules have well- defined accommodations to support a diversity of learners.	4.70	3	Very Useful
Average Weighted Mean	4.69		Very Useful

The data revealed that the average weighted mean on the “Usefulness” is 4.69 and is verbally interpreted as “Very Useful”. Item 1 “The modules enable the students to analyze and apply information/ theories in real life situations” and item 3 “Students can learn, understand and answer the guide questions thoroughly by reviewing examples and illustrations which are provided per topic” are ranked first with a rating of 4.74 while item 4 “The modules can make the students learn and understand the subject matter by reviewing the illustrations and examples at his pace” is ranked last with a rating of 4.59 and all are verbally interpreted as “Very Useful”. This means that the information/

theories in the modules help the students to actualize it in real life situations and the inclusion of guide questions or study helps are very useful per topic. The findings imply that the respondents considered the modules as very useful instructional material in imparting knowledge to students. As posited by Constantino (2010) the work text is very useful in enhancing the learning of the students [10].

Table 6 reveals the composite table on the validity of the modules as evaluated by the professor- respondents in terms of objectives, subject matter, organization and presentation, language and style and usefulness.

**Table 6. Composite Table on the Average Weighted Mean on the Validity of Modules as Evaluated by Professors with Respect to Objectives, Subject Matter, Organization and Presentation, Language and Style and Usefulness**

Criteria	Average Weighted Mean	Rank	Verbally Interpretation
1. Objectives	4.66	2	Very Strongly Agree
2. Subject Matter	4.62	4	Very Highly Sufficient
3. Organization and Presentations	4.54	5	Very Much Effective
4. Language and Style	4.64	3	Very Highly Effective
5. Usefulness	4.69	1	Very Useful
Grand Mean	4.63		Very Much Valid

Based on the professor’s results of evaluation, generally, they perceived the modules as a “Very Much Valid” instructional material with an average weighted mean of 4.63. This means that generally, the modules are very good support learning materials to instruction as shown in the high results of evaluation of the respondents. The result implies that according to the professor-respondents the modules in Personality Development and Public Relations are very much effective and useful in facilitating the learning abilities of the students. This implication is supported by

Cruz (2006) when he found out that the module in Environmental Science is very useful as evaluated by the instructors [11].

**The Performance of the Control and Experimental Group as Revealed by the Pretest and Posttest**

Table 7 presents the mean performance and standard deviation of the control and experimental group in the pretest and post test of the modules in Personality Development and Public Relations.

**Table7. Mean Performance and Standard Deviation of the Control and Experimental Groups in the different modules in Personality Development and Public Relations as Revealed by the Pretest and Post test Scores**

Module	Test Item Per Module	EXPERIMENTAL						CONTROL					
		Pretest			Post test			Pretest			Posttest		
		Mean	SD	VI	MEAN	SD	VI	Mean	SD	VI	Mean	SD	VI
1	10	8.93	1.27	High	9.80	0.56	High	4.53	1.12	Average	7.13	1.24	High
2	10	8.33	2.38	High	9.46	0.99	High	5.00	0.75	Average	8.13	1.59	High
3	10	7.13	2.97	High	9.13	0.99	High	3.46	1.99	Low	7.53	2.32	High
4	10	8.86	1.55	High	9.60	0.50	High	4.40	1.35	Average	8.20	1.65	High
5	10	7.00	2.8	High	8.33	0.89	High	1.86	1.06	Low	5.33	1.87	Average
6	10	5.33	2.63	Average	7.13	1.84	High	2.13	0.91	Low	4.66	1.83	Average
7	10	4.66	2.63	Average	7.13	2.29	High	2.80	1.65	Low	5.20	2.21	Average

The data shows the number of test items for each developed module. Module1 to 7 have 10 test items. From the table it can also be seen that the post test scores of the control group for each module are 7.13, 8.13, 7.53, 8.20, 5.33, 4.66 and 5.20 with standard deviations of 1.24, 1.59, 2.32, 1.65, 1.87, 1.83 and 2.21 respectively. On the other hand, the post test scores of the experimental group for each module are 9.80, 9.46, 9.13, 9.60, 8.33, 7.13 and 7.13 with standard deviations of .56, .99, .99, .50, .89, 1.84 and 2.29 respectively. The obtained mean and standard deviation of both groups shows that the experimental group performed much better than the control group in all the modules. It may be due to the reason that the experimental group used the modules and was able to internalize additional knowledge from it.

According to Bautista (2004) utilizing modules in teaching the subject produces better performance among students. Furthermore, instructional materials facilitate learning and understanding among students. Additional devices could also add to the capacity of the students to understand and comprehend [6].

**The Significant Difference on the Mean Performance of the Control and Experimental Group as Revealed by the Post test Results**

Table 8 shows the computed t-value the significant difference in the performance of the control and experimental group as revealed by their post test scores.

**Table 8. Computed t-value on the Performance of the Control and Experimental Group as Revealed by their Post test Scores**

Topics	Mean	Standard Deviation	t	D f	P- value	Mean Difference	H O	Verbal Interpretation
Module1 Experimental Control	9.80 7.13	.56 1.24	7.55 9	28	.000	2.66	R	S
Module2 Experimental Control	9.46 8.13	.99 1.59	2.74 7	28	.010	1.33	R	S
Module3 Experimental Control	9.13 7.53	.99 2.32	2.45 1	28	.021	1.66	R	S
Module4 Experimental Control	9.60 8.20	.50 1.65	3.13 0	28	.004	1.40	R	S
Module5 Experimental Control	8.33 5.33	.89 1.87	5.58 2	28	.000	3.00	R	S
Module6 Experimental Control	7.13 4.66	1.84 1.83	3.66 6	28	.001	2.46	R	S
Module7 Experimental Control	7.13 5.20	2.29 2.21	2.35 0	28	.026	1.93	R	S

The data shows mean difference of 2.66 for module 1, 1.33 for module 2, 1.66 for module 3, 1.40 for module 4, 3.00 for module 5, 2.46 for module 6 and 1.93 for module 7. The table also reveals that all the computed t-values for all the modules are higher than the tabular t- values at 0.05 level of significance. Based from the findings, it can be concluded that there is a significant difference between the post test scores of the control and experimental for modules 1 to 7. With regard to the performance of experimental and control groups in the post test, the data reveal that the experimental group performed much better than the control group hence significant. This may be due to the reason that the level of retention tend to be high when the learners able to see the information than merely discussing the lesson the traditional way. The use of instructional materials like modules facilitate the teaching- learning process more

effectively. As stressed out by Cruz (2006) based on his findings, the experimental group performed a little better than the control group. This may be due to the fact that the students tend to remember information better when they are able to see it. Stimulations using instructional materials are very important in making learning permanent [11].

**The Significant Difference on the Effectiveness of the Developed Modules in Personality Development and Public Relations as Revealed by the Pretest and Post Test Scores of the Experimental Group.**

Table 9 presents the computed t-value on the significant difference in the performance of the experimental groups as revealed by its pretest and post test scores.

**Table 9. Computed t-value on the Performance of the Control and Experimental Group as revealed by the Pretest and Post test Scores**

Topics	Mean	SD	t	D f	P-value	HO	VI
Module 1 Pretest Post test	8.93 9.80	1.27 1.56	-2.476	14	.027	R	S
Module 2 Pretest Post test	8.33 9.47	2.38 .99	-2.828	14	.013	R	S
Module 3 Pretest Post test	7.13 9.13	2.97 .99	-2.432	14	.029	R	S
Module 4 Pretest Post test	8.86 9.20	1.55 .50	-2.048	14	.060	A	NS
Module 5 Pretest Post test	7.00 8.33	2.80 .89	-1.958	14	.070	A	NS
Module 6 Pretest Post test	5.33 7.13	2.63 1.84	-2.267	14	.040	R	S
Module 7 Pretest Post test	4.66 7.13	2.63 2.29	-5.069	14	.000	R	S

The table 9 reveals that the computed t-value of the experimental group for module 1 is -2.476, module 2 is -2.828, module 3 is -2.432, module 6 is -2.267 and module 7 is -5.069 with a p-value of .027, .013, .029, .040 and .000 verbally interpreted as significant respectively. The data shows that there is a significant difference on the performance of experimental group as revealed by the pretest and post test scores in the modules stated above. On the other hand, the table also reveals that the computed t-value of the experimental group for module 4 is -2.048 and for module 5 is -1.958 with a p-value of .060 and .070 verbally interpreted as not significant respectively. The data shows that there is no significant difference on the performance of experimental group as revealed by the pretest and post tests scores in modules 4 and 5. It can be gleaned from the majority of the data that the performance of experimental group greatly increases. This may be due to the reason that the modules allowed the students to have a full grasp of information and

concepts included therein. Study helps or supplementary questions included in the discussion served as a challenge for the students to acquire more knowledge and insights. As pointed out by Aparejo (2004), a module should be presented in a manner that is relevant to the concept being developed. The activities should connect old and new learning to ensure the ease of learning. The way a module is presented greatly affects the performance of a student [5].

**V. CONCLUSIONS**

Based from the findings, the following are hereby concluded. As evaluated by the professors, the modules in Personality Development and Public Relations were found to be very much effective. Using the modules as method of teaching, the experimental group learned much in the subject Personality

Development and Public Relations. Majority of the modules in Personality Development and Public Relations were very effective in helping students learn as shown by the pretest and post test scores of the experimental group.

## VI. RECOMMENDATIONS

From the summary of findings and conclusion drawn, the following are hereby recommended. Both the professors and students can use the developed modules in Personality Development and Public Relations to facilitate the teaching-learning process more effectively. Review and enrichment of the modules should be done continuously to match the needs and abilities of the students.

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# A Study of Clinical Features and Management of Pseudocyst of Pancreas

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## Abstract- BACKGROUND AND OBJECTIVES:

Pseudo pancreatic cyst is a common complication of pancreatitis. Accurate diagnosis and timely management is important. This study is to know the various etiological factors, relative frequency of occurrence of pseudo pancreatic cyst in relation to age and sex, establish accurate diagnosis by various investigations and to study various modes of management like conservative, percutaneous drainage and surgery. The different modes of treatment and their efficacy will be dealt in detail. This is necessary to know the better treatment of choice.

## METHODS:

32 patients were selected, who were diagnosed as pseudo pancreatic cyst admitted in Mahatma Gandhi Memorial Hospital during August 2012 to July 2014. All the Patients underwent definitive treatment. Data related to the objectives of the study was collected.

## FINDINGS:

From our study it is observed that

1. Majority of patients belonged to the age group of 31-50 years, which constituted 16(50%) patients in the study. M: F is 4.33:1.
2. Most common etiological factor was alcohol.
3. Most common mode of presentation was pain abdomen followed by abdominal distension / mass per abdomen.
4. Incidence of palpable mass was in 75% of the patients studied, but with the usage of USG and CT scan, pseudocyst was detected in all the patients.
5. Conservative treatment was useful in uncomplicated, acute pseudocysts till they regress or mature when surgery became necessary. The results of internal drainage were excellent, which was done in 56.25% of the patients in our study.
6. The postoperative complications include pain abdomen and wound infection seen in 9 patients of the study.

## INTERPRETATION AND CONCLUSION:

We conclude that, the pseudo pancreatic cyst is the most common complication of pancreatitis. Early diagnosis and timely management with the use of serial USG and internal drainage for mature cyst, external drainage for complicated cyst results in good prognosis.

**Index Terms-** Pseudo pancreatic cyst, internal drainage, External drainage, USG, CT scan.

**FUNDING:** None

## I. INTRODUCTION

Pancreatic pseudocyst is a localized collection of pancreatic secretions surrounded by a wall of fibrous or granulation tissue that arises as a result of acute or chronic pancreatitis, pancreatic trauma, or obstruction of the pancreatic duct by a neoplasm<sup>1</sup>.

Pseudocysts account for about 75% of cystic lesions of the pancreas. They are distinguished from other peripancreatic fluid collections (cystic neoplasms and congenital, parasitic and extra pancreatic cysts) by their lack of an epithelial lining, high concentration of pancreatic enzymes within the pseudopancreatic cyst and formation at least 4 weeks after an episode of pancreatitis or pancreatic trauma<sup>2</sup>. Pseudocyst is formed by the inflammatory response that occurs after extravasated pancreatic secretions are walled off by the surrounding structure.

The capsule of the pseudocyst can be thin fibrous tissue which can progressively thicken as the pseudocyst matures frequently; the liquid contents of the pseudocyst are gradually reabsorbed by the body, and pseudocyst resolves indicating that the communication between the pseudocyst and the pancreatic duct has closed. Persistence of a pseudocyst implies ongoing communication with the pancreatic ductal system regardless of whether the ductal system can be demonstrated radiographically or pathologically<sup>3</sup>.

## NATURAL HISTORY

Pseudocysts are formed by the inflammatory response that occurs after extravasated pancreatic secretions are walled off by the surrounding structures. Their walls are composed of fibrous and granulation tissue derived from peritoneum, retroperitoneal tissue or serosal surface of adjacent viscera. The capsule progressively thickens as the pseudocyst matures, often the liquid contents of the pseudocyst are gradually reabsorbed by the body and the pseudocyst resolves, indicating that the communication between the pseudocyst and the pancreatic duct has closed. The persistence of a pseudocyst implies an ongoing communication with the pancreatic ductal system.

Pseudocyst collections, with an indistinct interface between fluid and adjacent organs, irregular contours with segments of pancreatic wall that are concave are most likely to resolve. Spherical or ovoid collections with sharp margins, especially in association with pancreatic calcifications, are likely to persist. In general, the closer to the onset of acute pancreatitis a fluid collection is detected, the more likely it is to resolve.

Fluid collection may resolve by spontaneous transperitoneal reabsorption, decompression of the collection into the pancreatic duct, or erosion of a cyst into a hollow viscus with subsequent

cyst- enteric fistula formation or rarely, by free rupture into the peritoneal cavity.

Cysts larger than 4-6cms are less likely to resolve by themselves. Smaller cysts and cysts which fail to show a decrease in size or those that shows an increase in size during a 3-4 week period of observation are unlikely to resolve. Patients with multiple pseudocysts are unlikely to resolve. Chronic pseudocyst, especially are unlikely to resolve. Traumatic cysts are less likely to resolve as they tend to be more mature at the time of presentation.

#### PATHOGENESIS

The pathway by which pseudocysts are formed often follows a progression which includes diffuse peripancreatic effusion, pancreatic necrosis, liquefaction, phlegmon, acute pseudocyst and finally encapsulation or maturation. In acute pancreatitis, the duct disruption leads to escape of pancreatic juice into the surrounding tissue, since there is no natural barrier. They may be located anywhere from the mediastinum to the scrotum. They are commonly found in lesser sac or anterior pararenal space.

Cysts arising in the setting of chronic pancreatitis, most often without a determinate antecedent flare of acute pancreatitis are referred to as chronic pseudocyst and generally have a mature wall on presentation. Hence the duct ruptures, owing to inspissated duct. Because the pancreatic parenchyma is firm and fibrotic, chronic pseudocyst commonly are located within the substance of the gland.

#### AETIOLOGY

10-20% of patient with acute pancreatitis.  
20-40% of patient with chronic pancreatitis<sup>4</sup>.  
65% pseudocysts are due to alcohol related pancreatitis.  
15% pseudo cysts are due to gall stones induced pancreatitis.<sup>5,6</sup>  
5 to 10% are due to traumatic pancreatitis.  
45-50% of pseudocysts occur in or around the head of the pancreas and the remainder are evenly distributed along the neck, body and tail of the pancreas.

#### CLINICAL FEATURES

90% of patients present with epigastric pain.  
25-45% with abdominal mass.  
50-70% with early satiety, nausea and vomiting.  
20-50% with weight loss.  
10% with jaundice.  
10% with low grade fever.<sup>7,8</sup>

Abdominal pain is the most common symptom in patients with a pseudocyst. Pseudocysts that follow an episode of acute pancreatitis are often characterized by persistence or recurrence of upper abdominal pain weeks after the initial attacks. The symptoms of early satiety, nausea and vomiting may be secondary to gastroduodenal obstruction caused by a mass effect of the pseudocyst.

More uncommon modes of clinical presentation include

1. Pruritus and jaundice secondary to common bile duct obstruction.
2. Variceal bleeding secondary to either splenic vein or portal vein obstruction.

3. Evidence of sepsis secondary to pseudocyst infection.
4. Evidence of intra-abdominal hemorrhage secondary to bleeding from a pseudo aneurysm in adjacent visceral vessels.

#### COMPLICATIONS

##### A. Infection

Less than 5% of patients with pseudocyst develop a true infection, marked by a clinical presentation of fever, leukocytosis and increased pain<sup>9, 10</sup>. The aspiration of purulent fluid from the pseudocyst confirms the presence of an infection. Open operative drainage allows for the complete evacuation of all infected material and external drain may be placed under direct vision. A pancreatic abscess is one clinical situation in which percutaneous drainage is clearly the treatment of choice. Success rates of up to 85% have been reported in multiple series<sup>11, 12, and 13</sup>.

##### B. Haemorrhage

Arterial hemorrhage may occur in up to 10% of patients with pancreatic pseudocysts.<sup>9, 14, 15</sup> the most common source of pseudocyst associated bleeding is the splenic artery, with the gastro duodenal and pancreatic duodenal arteries, also accounting for a significant number of hemorrhage events.<sup>16</sup> Bleeding may also occur from portal, superior mesenteric, or splenic veins, although this occurs less commonly. This is due to erosion of the vessel wall leading on to pseudo aneurysm formation and eventual rupture. Massive bleeding from the varices of the stomach can occur in cases of chronic pancreatitis complicated by a pseudocyst.<sup>17</sup>

CT scan with intravenous contrast is an appropriate confirmatory test in a stable patient but angiography may be necessary for diagnosis and also provides a mode of treatment. Embolization of the pseudo aneurysm or source vessel is attempted as an initial management in a haemodynamically stable patient. Most of these haemorrhages may be effectively controlled by current embolic techniques.<sup>18, 19, 20, 21</sup> Patients in whom embolic therapy fails, who re-bleed, or who are haemodynamically unstable require emergency surgical exploration.

##### C. Obstruction

Duodenal obstruction is the most common manifestation of mechanical obstruction secondary to pseudocyst formation, obstruction of the stomach, esophagus, jejunum and colon may be identified<sup>22-26</sup>. Obstruction of the mesenteric vessels and portal venous system (particularly the splenic vein) may lead to extra hepatic portal hypertension that causes splenomegaly and gastric varices<sup>27</sup>. Pseudocysts have also been described as obstructing other retroperitoneal structures such as IVC and the ureters.

Congestive heart failure secondary to cardiac compression by a mediastinal pseudocyst has also been reported<sup>28</sup>. Biliary obstruction secondary to pseudocyst formation is also well described, and it leads to complications and cirrhosis. Although biliary obstruction may be caused by direct compression of the bile duct by a pseudocyst, most patients have an associated stricture of the intra-pancreatic portion of the bile duct that does not improve with pseudocyst drainage alone<sup>29</sup>.

##### D. Rupture

Spontaneous rupture, the least common complication of pseudocyst formation, occurs in less than 3% of patients. Pseudocyst that ruptures anteriorly into the peritoneal cavity or posteriorly into the pleural cavity may lead to the development of

pancreatic ascites or pancreatic pleural effusion, respectively<sup>30</sup>. Rupture into the peritoneal cavity may lead to severe acute abdominal pain resulting from chemical peritonitis. Rupture can also occur into adjacent hollow viscus. Silent rupture of a pseudocyst may also occur. Some pseudocysts are presumed to resolve by rupture or fistulization into an adjacent portion of the stomach or of small bowel, similar to operative endoscopic enteric drainage. No further therapy is needed in these circumstances.

## INVESTIGATIONS

Persistent hyper amylasemia following attack of pancreatitis is clue to the presence of pseudocyst formation; it is present only in 50% of patients.

- A. *Ultrasound* : USG is 90% accurate and 98% specific in visualizing pancreas. In 1/3rd of the patients gas obscures the pancreas.
- B. *CT scan*: Contrast enhanced CT scan is the modality of choice for the frontline evaluation of a pseudo pancreatic cyst in the modern era<sup>49</sup>.It provides additional information about retroperitoneal extension of fluid collections and relationship between pseudocyst and adjacent enteric lumen that is not available from USG.
- C. *ERCP*: ERCP demonstrates abnormalities of the pancreatic duct in up to 90% of the patients with pseudocysts. It should not be done routinely. ERCP is indicated in patients with jaundice to differentiate between common bile duct compression by the cyst and a stricture of the intrapancreatic portion of the common duct caused by fibrotic pancreases. In the former case, cyst drainage alone would relieve the jaundice, while in the latter case a biliary bypass procedure is required. As it may introduce infection into a previously sterile cyst, ERCP should be performed only when cyst drainage is to be done within 48 hours.
- D. *Angiography*: Is useful in patient who has had bleeding complications from pseudocyst or those who have portal hypertension. The finding of splenic vein thrombosis with left sided portal hypertension is an indication for splenectomy in patients undergoing operation for drainage of pseudocysts. There is also therapeutic use of angiography to control bleeding from pseudocyst.
- E. *MRI Scan*: The use of MRI has been advocated to predict whether solid debris with in a pseudocyst will prevent adequate percutaneous drainage<sup>32</sup>. Conventional MRI also has the potential advantage of being coupled with MRCP to help to define pancreatic duct anatomy relative to pseudocyst<sup>33</sup>.
- F. *Barium Meal*: Is used in patients when there are features suggestive of compression to adjacent structure by the pseudocyst, mainly the stomach.
- G. *Percutaneous Aspiration*: To differentiate pseudocyst from other cyst of the pancreas, fluid is analyzed for amylase content, cytology and relative viscosity.

## MANAGEMENT OF PANCREATIC PSEUDOCYSTS

- Observation

- Percutaneous Aspiration/Drainage
- Endoscopic Aspiration/Drainage
- Trans papillary Endoscopic Drainage Or Stenting
- Operative Approaches(Open Or Laparoscopic)
- Internal Drainage
- External Drainage
- Pancreatic Resection

Currently, treatment of patients with pancreatic pseudocysts is based on the clinical setting, the presence or absence of symptoms, the age and size of the pseudocyst, and the presence or absence of complications.

## TIMING OF THE DRAINAGE

- A pseudocyst that occurs after an episode of alcohol-related pancreatitis has to be observed for 4 to 6 weeks with regular follow up and ultrasound examinations of the abdomen.
- After 6 weeks, observation should continue if the size of the cyst is less than 6cm and the patient is asymptomatic or if there is decrease in size.
- Therapy is indicated if the patient is symptomatic or if the cyst is more than 6cm, the cyst is increasing in size, the cyst is infected, or there is a suspicion of malignancy.
- Observation is unnecessary and immediate drainage is safe in cysts that have a mature wall or in those arising in chronic pancreatitis.
- Asymptomatic pseudocysts regardless of size and duration can be safely observed, provided that they are carefully monitored and are not increasing in size

## PERCUTANEOUS ASPIRATION

It is aimed at aspirating all pseudocyst fluid at one procedure, without leaving an indwelling drainage catheter. Fewer than 50% of patients undergoing this technique, have complete resolution of their pseudocyst<sup>12</sup>. The remaining patients will require repeat aspiration. Patients with pseudocyst in the tail of the pancreas and volume less than 100ml with low intracystic amylase levels are the best candidates for the percutaneous aspiration<sup>34</sup>.

## PERCUTANEOUS CATHETER DRAINAGE

It involves placement of an indwelling catheter into a pseudocyst by the Seldinger technique using ultrasound or CT guidance. The pseudocyst is normally entered through a flank or transgastric approach and the tract may be dilated to accept a catheter ranging in size from no.7 F to no.14 F. Contraindications to percutaneous drainage includes the presence of significant pancreatic necrosis or solid debris in the pseudocyst, lack of a safe access route, pseudocyst hemorrhage, and complete obstruction of the main pancreatic duct. The common complications of percutaneous catheter drainage are drain tract, persistent or recurrent pseudocyst and pancreatic cutaneous fistula.

## ENDOSCOPIC APPROACH

Flexible upper GI endoscopy is used to localize and drain pseudocysts by creating a fistulous tract between the pseudocyst

and the stomach or duodenum<sup>27</sup>. This communication is made using electrocautery, and an end prosthesis is left in place to stent open the fistula. Endoscopic drainage usually requires for the pseudocyst to be located in the head or body of the pancreas which is apposed to and bulging into the intestinal lumen. Endoscopic ultrasound can be used to visualize the pseudocyst and to choose a site for drainage. The complication of the procedure includes hemorrhage from the gastric or duodenal wall and perforation.

Trans ampullary pancreatic stent-is applicable in pseudocyst which has obvious communication with main pancreatic duct shown by ERCP. If possible, stent is placed through the ampulla, along the pancreatic duct and into the lumen of the pseudocyst; the tip of stent is placed as close as possible crossing any intervening stricture of the pancreatic duct. Complications include post procedure pancreatitis, bleeding and abscess formation secondary to stent obstruction.

#### OPERATIVE APPROACH (OPEN/LAPAROSCOPY)

##### *Internal drainage*

The three standard options include –

- i. Cystojejunostomy to a roux-en-y jejunal limb- advised when a pseudocyst is located at the base of the transverse mesocolon and is not adherent to the posterior gastric wall.
- ii. Cystogastrostomy- faster procedure and is advised when the pseudocyst is adherent to the posterior wall of the stomach.
- iii. Cystoduodenostomy - advised when the pseudocyst is in the pancreatic head or uncinata process that lie within 1cm of the duodenal lumen. Complications include – duodenal leak and subsequent fistula.

Cystojejunostomy and cystogastrostomy have comparable morbidity, mortality and recurrence rates<sup>35,36</sup>.

##### *External drainage*

Is indicated when gross infection is found at the site of operation or an immature thin walled pseudocyst is present which will not allow safe internal drainage. On aspiration if purulent material is found, the content of the pseudocyst cavity is completely evacuated. Then atleast one closed suction drainage catheter is placed into the cavity and is brought out through the abdominal wall. Complications include pancreatic cutaneous fistula, most of which heals spontaneously.

##### *Pancreatic resection*

Distal pancreatectomy is done for pseudocyst located in the body or tail of the gland. After distal pancreatectomy, a roux-en-y pancreatico-jejunostomy to the remnant pancreas may be required to decompress an obstructed abnormal proximal pancreatic duct. Pancreatico-duodenectomy is advised in

symptomatic pseudocyst present in the head of the pancreas associated with an inflammatory mass. In this case pylorus preserving pancreatico-duodenectomy is the procedure of choice.

## II. MATERIALS AND METHODS

#### SOURCE OF DATA:

- Current study was a prospective study conducted at Mahatma Gandhi Memorial Hospital, attached to Kakatiya Medical College, Warangal, Telangana State, India.
- Total 32 patients of pseudo pancreatic cyst, fulfilling the inclusion criteria were included in the study.

**STUDY PERIOD:** Study was conducted from August 2012 to July 2014

The following inclusion and exclusion criteria were used:

#### INCLUSION CRITERIA:

- a) Patients diagnosed as pseudo pancreatic cyst with help of diagnostic procedure like  
USG abdomen, Barium meal, CT scan Abdomen.
- b) Admitted patients of both sex and all age groups.

#### EXCLUSION CRITERIA:

- a) All the true cyst of pancreas.
- b) Neoplastic cystic swelling of pancreas.
- c) Hydatid cyst of pancreas.
- d) Congenital cysts of pancreas.

#### METHODOLOGY:

This study has included both adults and pediatric age group patients. Patients with diagnosis of pancreatitis were monitored. During the course of their illness, if they developed features suggesting of pancreatic pseudocyst, USG of abdomen was done and if it confirmed the presence of pseudocyst these patients were included in our study. Those patients only with or chronic pancreatic or peripancreatic fluid collection without evidence of encapsulation on USG were excluded from the study.

All patients with acute pseudocyst were managed conservatively by withholding oral intake, giving IV fluids, analgesics and antibiotics as long as they had pain abdomen, vomiting or ileus. They were then followed up if the cyst did not regress. Follow up continued till the wall of the cyst matured. All mature cysts were treated surgically. Data like duration of hospital stay, conservative management and its results and surgical procedure done and their results, complications if any, progress of the pseudocyst on follow up were carefully recorded.

## III. OBSERVATIONS AND ANALYSIS

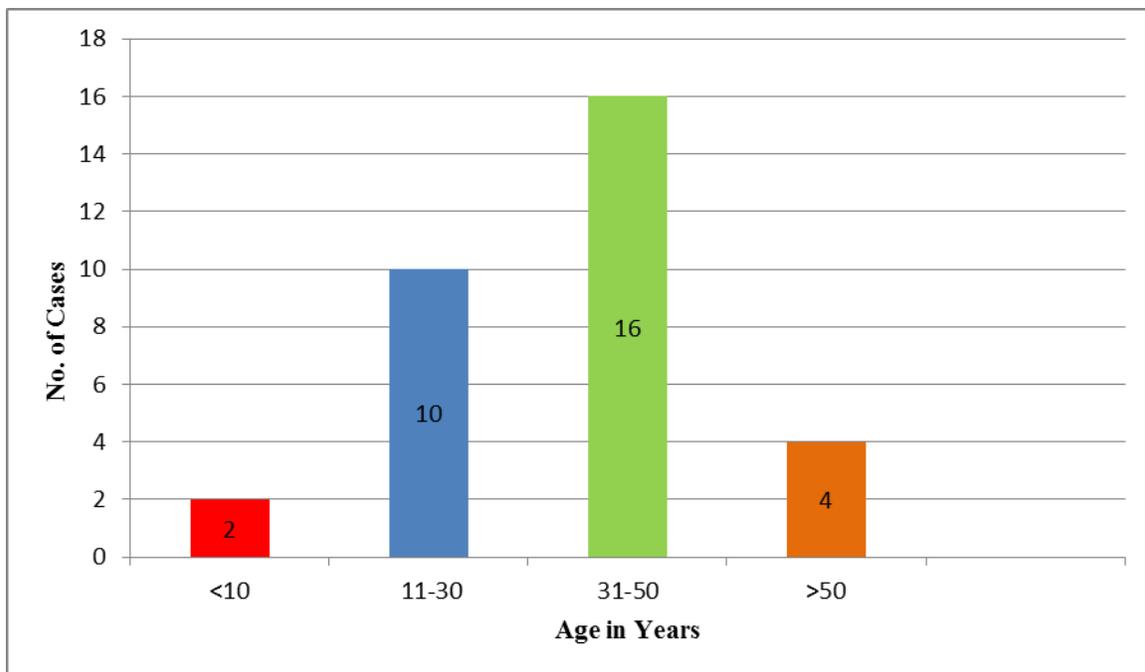
The results obtained were analyzed as follows.

### TABLE – 1: AGE DISTRIBUTION

Age in years	No.of patients	Percentage
≤10	2	6.25
11-30	10	31.25
31-50	16	50
≥51	4	12.5

In our study of 32 patients, the age of patients was from 1 years to 65 years. Pseudo pancreatic cyst was common in age group 31 – 50 (50%) with mean of 40 years. (Figure 1) This was probably due to alcohol use which was common in this age group.

**Figure 1: Showing age distribution of patients**

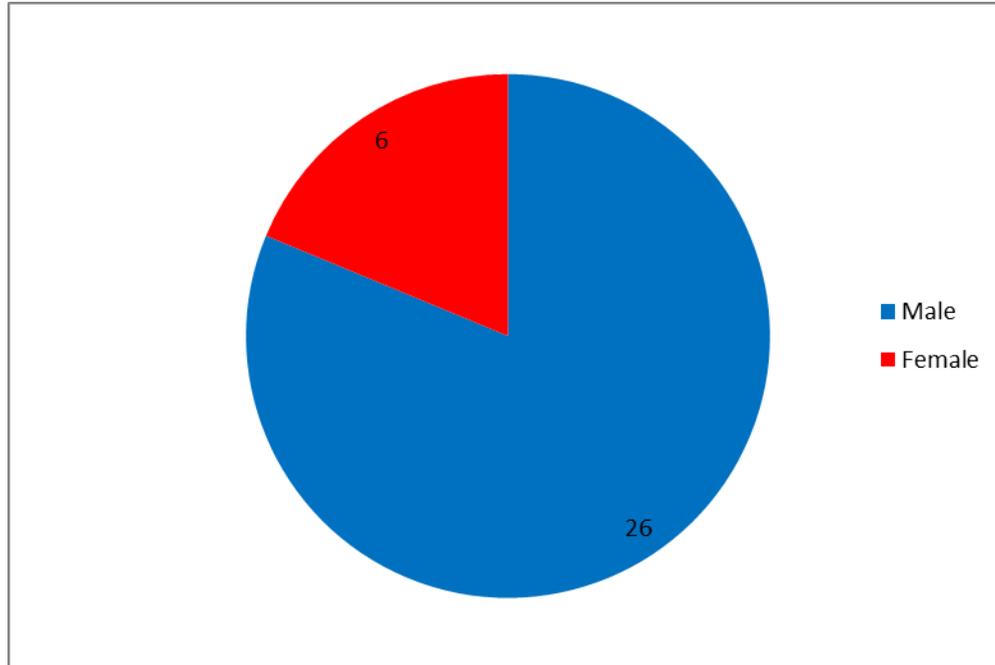


**TABLE – 2: SEX INCIDENCE**

Sex	No.of patients	Percentage
Male	26	81.25
Female	6	18.75

In our study of 32 patients, there were 26(81.25%) male patients and 6(18.75%) female patients indicating that the disease is more common in males with ratio of male to female is 4.33:1. (Figure 2) This again was due to a higher alcohol intake in males.

**Figure 2: Shows sex distribution of patients.**

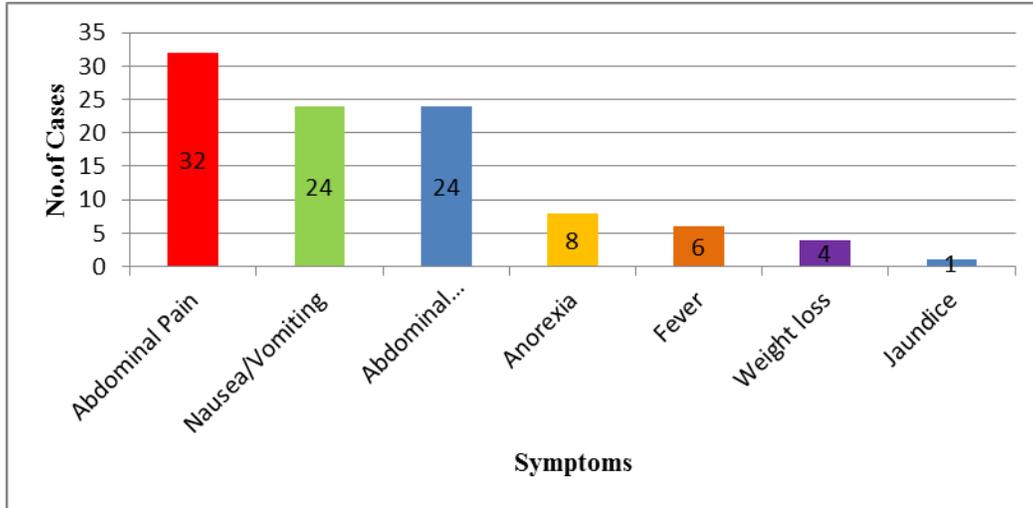


**TABLE – 3: SYMPTOMS**

Symptoms and signs	No.of patients	Percentage
Abdominal Pain	32	100
Nausea/vomiting	24	75
Abdominal distension	24	75
Anorexia	8	33.33
Fever	6	18.75
Weight loss	4	12.5
Jaundice	1	3.12

The commonest symptom was upper abdominal pain which was present in all patients (100%), followed by nausea/vomiting which was present in 75% of the patients and abdominal distension (mass) present in 75% of the patients. (Figure 3)

**Figure 3: Shows number of patients with symptoms.**

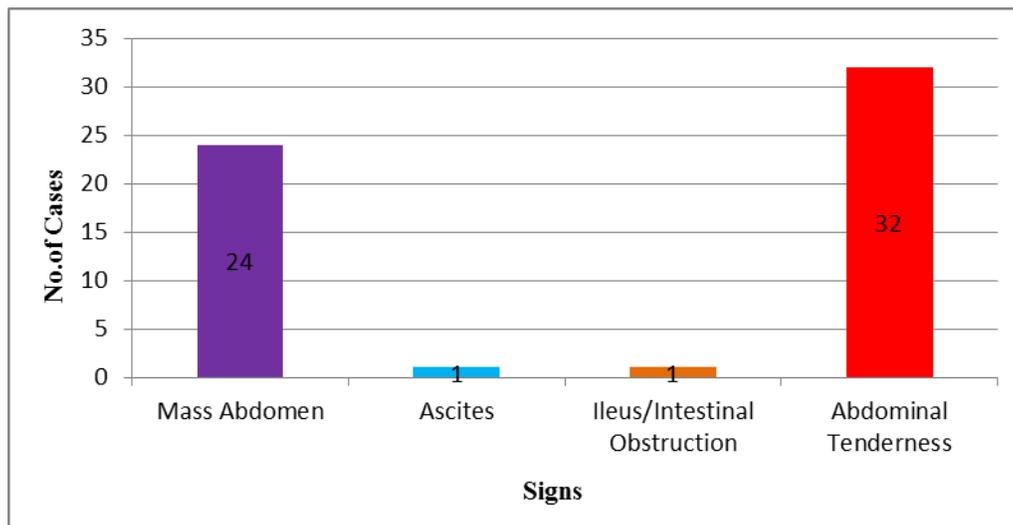


**TABLE – 4: SIGNS**

Signs	No. of cases	Percentage
Mass abdomen	24	75
Ascites	1	3.12
Ileus/intestinal obstruction	1	3.12
Abdominal tenderness	32	100

The commonest sign was upper abdominal tenderness which was present in all the patients (100%), followed by mass per abdomen which was present in 75% of the patients. (Figure 4)

**Figure 4: Shows number of patients with signs.**

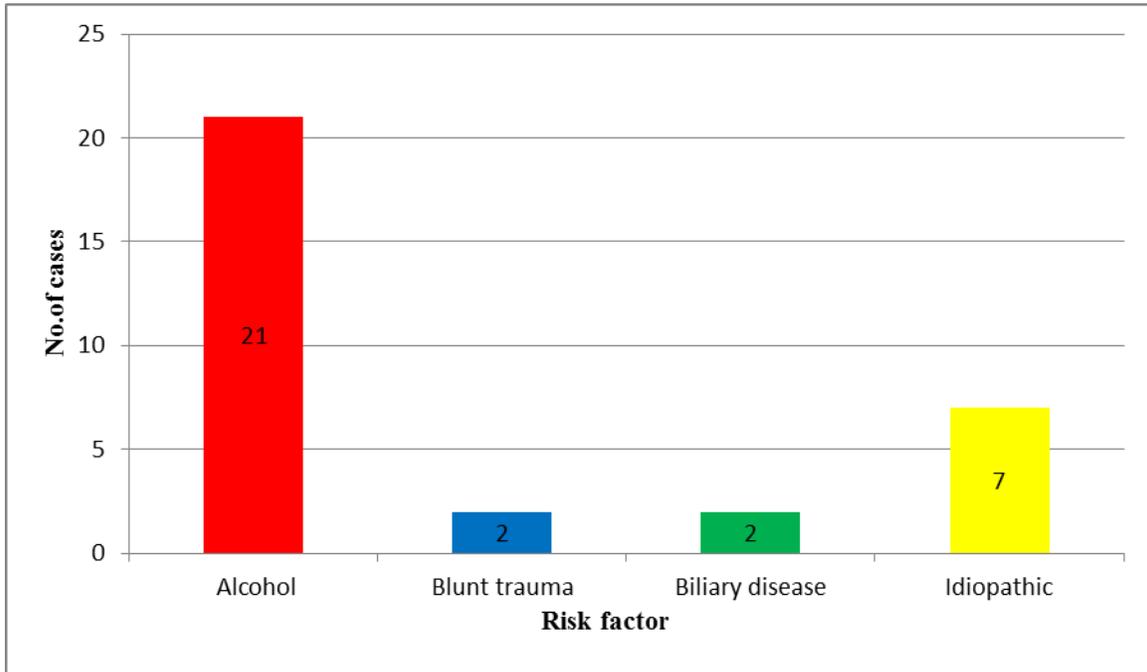


**TABLE: 5 RISK FACTORS**

Risk factors	No. of cases	Percentage
Alcohol	21	65.62
Blunt trauma	2	6.25
Biliary disease	2	6.25
Idiopathic	7	21.87

The commonest risk factor was alcohol consumption which was present in 5.62% of the patients, followed by idiopathic in 21.87%, blunt trauma was present in 6.25% and biliary disease in 6.25% patients.

**Figure 5: Risk factors contribution for Pancreatitis.**

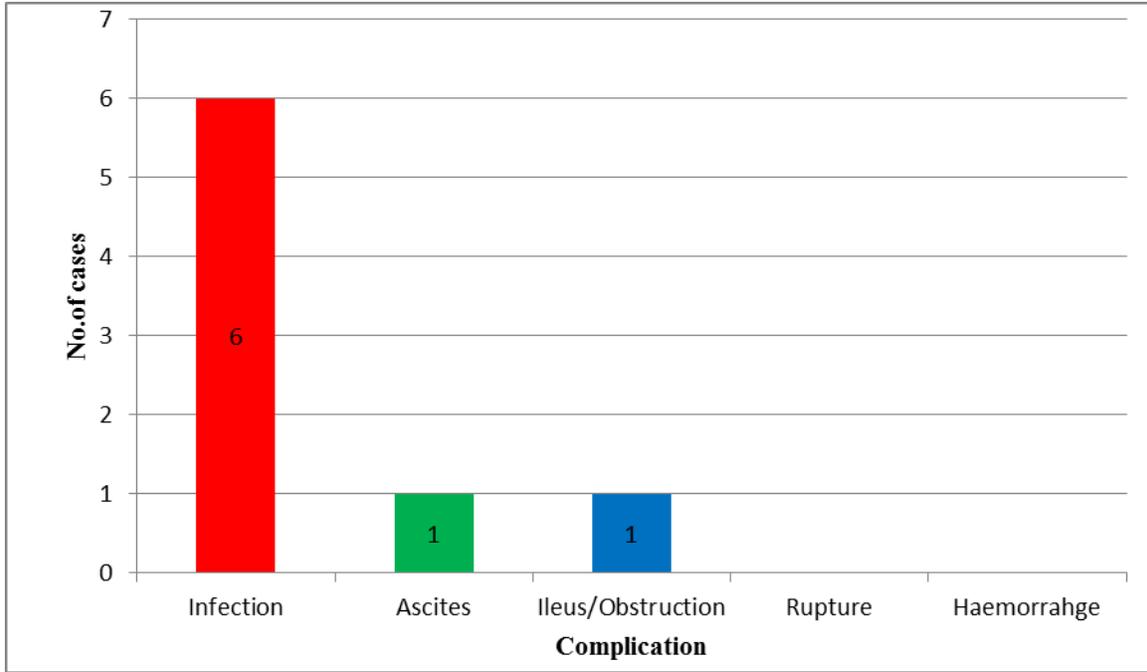


**TABLE: 6 ASSOCIATED COMPLICATIONS**

Complications	No .of cases	Percentage
Infection	6	18.75
Ascites	1	3.12
Obstruction	1	3.12
Rupture	-	-
Hemorrhage	-	-

Infection was the complication found in 18.75% of patients followed by ascites and obstruction, 3.12% in each groups and there were no cases of rupture and hemorrhage.

**Figure 6: Complications in patients**

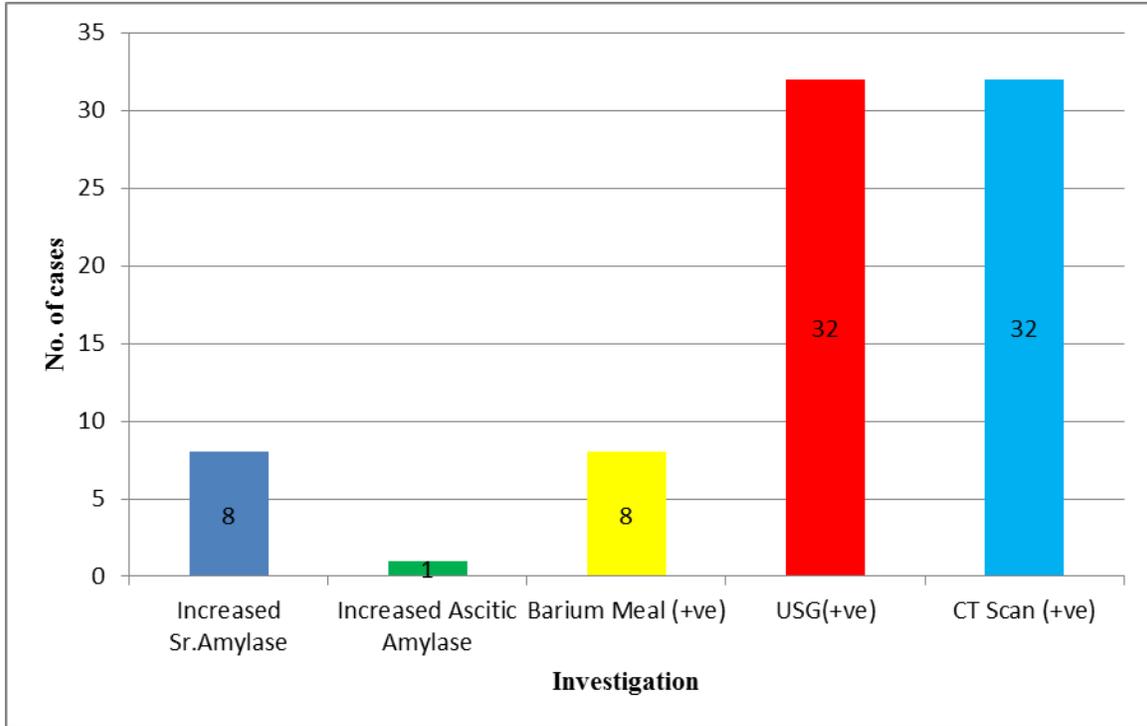


**TABLE: 7 INVESTIGATIONS**

Investigation findings	No .of cases	Percentage
Increased serum amylase	8	25
Increased ascitic amylase	1	3.12
Barium meal(+ve)	8	25
USG(+ve)	32	100
CT scan (+ve)	32	32

Ultrasound was the basic investigation done in all patients (100%). Barium meal was done in 25% of the patients with complaints suggestive of adjacent organ compression mainly stomach. CT-scan was done in all patients to know the extent and complication of the cyst that could not be made out by ultrasound. Serum amylase was done in all the patients and the results were positive in all the patients of acute pancreatitis (8 cases) and ascitic amylase was done in 1(3.12%) of the patients and result was positive.

**Figure 7: Shows investigations done in patients.**

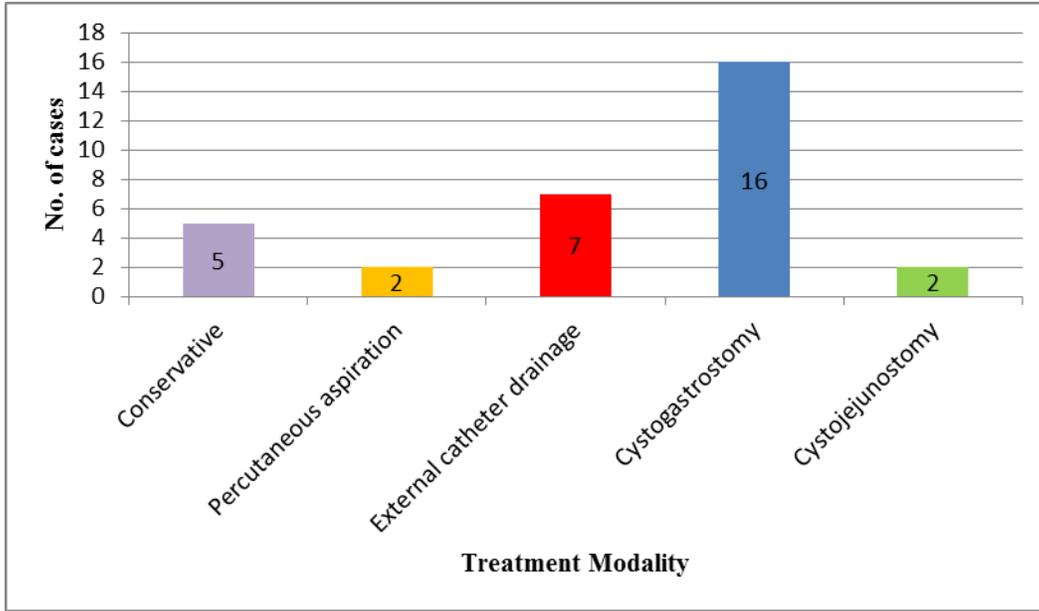


**TABLE: 8 TREATMENT**

Treatment	No. of cases	Percentage
Conservative	6	15.62
Percutaneous aspiration	2	6.25
External catheter drainage	7	21.87
Cystogastrostomy	16	50
Cystojejunostomy	2	6.25
Distal pancreatectomy	-	-

The commonest treatment was cystogastrostomy in 50% of the patients followed by external catheter drainage in 21.87%, conservatively managed in 15.62% and percutaneous aspiration and cystojejunostomy was done in 6.25% of patients in each group.

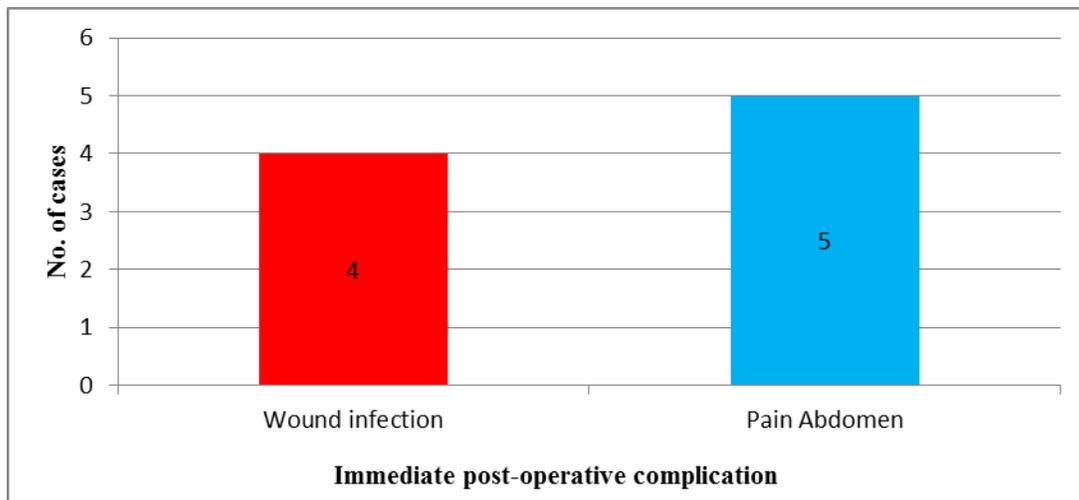
**Figure 8: Shows treatment given for patients.**



**TABLE: 9 IMMEDIATE POSTOPERATIVE COMPLICATIONS**

Complications	No .of cases	Percentage
Wound infection	4	12.5
Pain abdomen	5	15.62

Immediate postoperative persistent pain abdomen was present in 15.62% of patients and wound infection in 12.5% of patients.  
 Figure 9: Patients with immediate post -operative complications



**IV. DISCUSSION**

**Sex incidence:**

Out of 32, 26 patients were male and 6 patients were female. This is compared with the study of V.Ustoff et al (2000)<sup>37</sup> and C.Palanivelu et al (2007)<sup>38</sup>.

Sex	C.Palanivelu et al	V.Ustoff et al	Present study
Male	70.37%	75%	81.25%
Female	29.63%	25%	18.75%

The incidence of pseudo pancreatic cyst is predominated in males; this is due to the fact that alcohol consumption is common in males compared to females.

**Age distribution:**

32 cases of pseudo pancreatic cyst have been studied. Out of 32 cases, 2 were of pediatric age group and 30 were of adult groups.

In our study the common age group was 31-50 years (50%) cases, this is compared with a study group of C.Palanivelu, et al (2007) and V.Usatoff, et al (2000).

Age in years	C.Palanivelu et al	V.Ustoff et al	Present study
Mean age group	44	39	40

This result was probably due to alcohol consumption was more in this age group. There were 2 patients under pediatric age group; the cause was unknown. There were 4 patients over the age of 51 in our study.

**Clinical features:**

The commonest presenting symptoms were pain abdomen and abdominal distension/ mass per abdomen. These were compared with the study group of C.Palanivelu, et al (2007) and V.Usatoff, et al (2000).

Clinical feature	C.Palanivelu et al	V.Ustoff et al	Present study
Pain abdomen	54.63%	100%	100%
Mass per abdomen	9.25%	70%	75%

All patients in our study group presented with pain abdomen and mass per abdomen in 75% of the patients.

**Risk factors:**

The commonest risk factor in our study was alcohol consumption. This is compared with the following study groups.

Risk factor	C.Palanivelu et al	V.Ustoff et al	Present study
Alcohol Consumption	18.52%	71.42%	65.62%

Alcohol consumption was the commonest risk factor.

**Complications:**

The commonest complication was infection followed by ascites. This is compared with V.Ustoff et al (2000).

Complication	V.Ustoff et al	Present study
Infection	8.03%	18.75%
Ascites	1.7%	3.12%

**Treatment:**

Treatment commonly employed in our study was internal drainage; done in 56.25% of patients. This is compared with the following study groups.

Treatment	C.Palanivelu et al	V.Ustoff et al	Present study
Internal drainage	92.6%	3%	56.25%
External drainage	7.4%	40%	18.75%

In a study done by Kim KO, Kim TN (2013)<sup>39</sup>, conservative management was done in 19.42% of patients. In our study conservative management was done in 15.62% of the patients and percutaneous aspiration in 6.25% of patients in our study group.

**Postoperative complications:**

In our study the commonest complication was persistent pain abdomen followed by wound infection in immediate postoperative period. This is compared with the study group of Tuula kiviluoto et al (1989) and V.Usatoff, et al (2000).

Complication	Tuula kiviluoto et al	V.Ustoff et al	Present study
Pain abdomen	29%	10%	15.62%
Wound infection	2%	4%	12.5%

Immediate postoperative complications in our series include, persistent pain abdomen, present in 15.62% of the patients and wound infection in 12.5% of the patients.

In our study most of the patients were followed up to periods varying from 3-6 months. There were no complications except recurrence in 2 patients. 3 of the patients were lost to follow up.

**V. SUMMARY**

Pancreatic pseudocyst represents a common problem in patients with acute and chronic pancreatitis.

- Male patients continue to predominate with incidence of 81.25%.
- Maximum incidence is in the age group of 31-50 years.
- Abdomen pain and tenderness are the most common presenting signs and symptoms seen in 100% of patients.
- Incidence of palpable mass was in 75% but with usage of USG and CT-Scan, pseudocyst was detected in all the patients.
- Uncommon presentations were jaundice, ascites and fever.
- Fever was present in 6 patients, in cases of infected pseudocyst.
- The most common etiological factor was alcohol consumption, which was present in 65.62%. This is followed by idiopathic group which constitutes 21.87%, blunt trauma and biliary disease constitutes 6.25% each.
- USG was the best investigating method for the diagnosis of pseudocyst and was able to detect pseudocyst in all the patients, though extent and complication were clarified by CT-scan. Barium meal was done in 25% of the patients to know the degree of compression on the stomach.
- Infection was a common complication present in 18.75% of patients followed by ascites and obstruction in 3.12% of cases each. The patients with infection and ascites were managed by external catheter drainage.

- Conservative treatment is useful in uncomplicated, acute pseudocysts till they regress or mature when surgery became necessary.

- USG guided aspiration was done in 6.25% of patients who refused surgery and recurrence was seen in all these patients.

- The results of cystogastrostomy and cystojejunostomy was excellent. The choice of procedure was decided upon the location of the pseudocyst, its contents and general condition of the patient. External drainage was done in 21.87% of the patients with infected pseudocyst and in patient with ascites.

**VI. CONCLUSION**

- The disease was most common in the age group 31-50 years and was seen mainly in males.
- Most common cause for the pseudocyst is alcohol induced, followed by idiopathic.
- Most common presentation is pain abdomen with abdominal tenderness.
- Ultrasonography and CT\_Scan were the most useful investigations for diagnosis and follow-up. Barium meal was required in selected cases.
- Acute pseudocysts were treated conservatively, infected cysts required external drainage. Percutaneous aspiration resulted in recurrence in our cases.
- Anastomoses of the cyst to the nearby bowel, either cystogastrostomy or cystojejunostomy was done in the majority of cases with good results.
- Most common post operative complications are persistent pain abdomen and wound infection.
- Total duration of hospital stay ranged from 10 to 15 days.
- Follow up was done for 3 to 6 months, 3 cases lost in follow up. Recurrence is seen in two cases who refused re-admission.

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# Comparative Study of Profile Errors due to Cutting Forces and Tool Geometry of Single Point Cutting Tool

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**Abstract-** The purpose of this study was to determine the Single point cutting tool deflection due to cutting forces which were developed because of different parameters like feed, depth of cut, cutting speed and also because of geometrical parameters of cutting tool like side cutting edge angle and side rake angle and further comparing between side rake angle and side cutting edge angle. Firstly the cutting forces were measured using dynamometer which is taken from reference, then finite element method (FEM) was used to obtain the cutting tool deflection which is finite element analysis (FEA). The FEA results were then validated using cantilever beam model results. The predicted results from FEA were very close to the theoretical study. Though the prediction from FEA and the theoretical results are reasonably accurate.

**Index Terms-** Single point cutting tool, Side Rake Angle, Side Cutting Edge Angle, Deflection, Cutting Forces, Finite element analysis, Cantilever beam model.

## I. INTRODUCTION

The research work in single point cutting tool deflection is important on the basis of accuracy. Cutter deflection consist of different directional deformation such as axial deformation, tangential deformation, radial deformation due to cutting forces exist during cutting. Also other factors like depth of cut, cutting speed, and feed also effects on the accuracy of ideal geometry. However the deflection of tool under the action of cutting forces could be beyond acceptance level especially when the geometric condition of tool is changed. Over the years many researchers focused to compensate many different factors affected by cutting forces and geometrical changes of tool. Flank wear of single point cutting tool due to cutting forces by varying side cutting edge angle can be calculated by using shear area of cutting process [1]. Cutting force varies as there is change in cutting condition such as width of cut, thickness of cut, feed, depth of cut and tool cutting edge angle. So the cutting forces are influenced not only by the cutting condition but also the cutting edge geometry and material of workpiece [2]. Cutting parameters (cutting speed, feed rate and depth of cut) have influence tool temperature, tool wear, cutting forces and surface roughness of carbide coated tools [3]. Using von-Misses theory tool life's increment can be achieved by increasing back rake angle. The resultant von-Misses stress can be calculated using FEA simulation [4]. Deflection of tool affects on their tool life, surface roughness and dimensional correctness. The results can be

calculated using Taguchi's experimental design method and FEM analysis using ABAQUS finite element program [5].

As no one has worked on the deflection of tool under when side rake angle along with side cutting edge angle are changed, this research work shows results of tool deflection under variable side rake angle along with side cutting edge angle using finite element analysis. Analytical solution may not predict the deflection very accurately whereas the more realistic prediction by FEA requires extensive computational time and space. Thus in the present work the tool deflection is predicted by FEA prediction and results are compared and validated with beam model. Cantilever beam model predicts the deflection to very close accuracy similar to finite element. The predicted deflections in axial, radial, tangential directions by FEA are compared with Beam model results at different side cutting edge angle and increasing side rake angle for single point cutting tool for tungsten carbide.

## II. MATERIALS AND METHOD

### 2.1 Finite Element Analysis

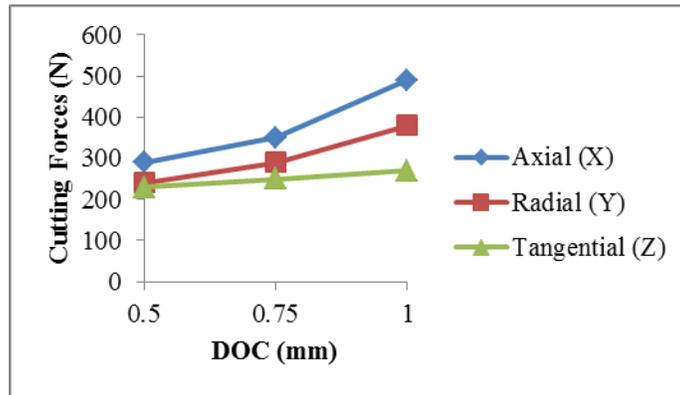
Finite element analysis is carried out to study the cutting tool deflection in three directions e.g., axial, radial and tangential direction due to simultaneous action of all three cutting forces namely axial force ( $F_a$ ), radial force ( $F_r$ ), tangential force ( $F_t$ ). Experimental cutting forces are taken as in reference from Chang and Fuh (1995), which were measured using dynamometer. The workpiece held in the chuck of lathe and the cutter mounted on a dynamometer were used to measure the three-axis component force. The three-axis component forces are Axial cutting force acting in X axis, Radial cutting force acting in Y axis and tangential cutting force acting in Z axis. Below the cutting forces are shown graphically in Fig 1(a), 1(b), 1(c). Nine different tools with geometrical parameters shown in table 1.1 having variable side rake angle according to increasing side cutting edge angle as shown in the following table having tungsten carbide material properties (Yield strength 1404 MPa, Tensile strength 344 MPa, Young's modulus 669 GPa, Poisson's ratio 0.25) is considered for present simulation. Figure 2(a) shows the CAD model of single point cutting tool. Complete cutting tool geometry is meshed with 25554 tetrahedral elements (51793 nodes) with mesh refinement. Figure 2(b) shows meshing of tool. Experimentally measured axial, radial, tangential forces are applied on the edge of nose radius in respective direction [shown in Fig 2(c), 2(d), 2(e)]. Axial, radial, tangential forces at different side rake angle are applied with different DOC ( $d = 0.5, 0.75$  and

1 mm), whereas feed ( $f = 0.3$  mm/min) and cutting speed ( $N = 160$  rpm) is kept constant. The tool deflections are predicted by FEA under the simultaneous changes in side rake angle. Shank of cutting tool (upto the length to which it is hold) is fixed and remaining shank length along with the flank length of tool behaves like cantilever beam. Average measured forces after the stabilization is used to calculate the tool deflection by FEA as well as beam model. After the simulation, the deflection in axial

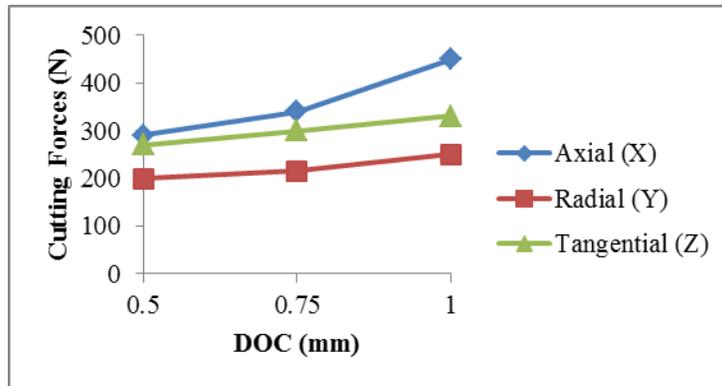
( $\delta_a$ ), radial ( $\delta_r$ ) and tangential ( $\delta_t$ ) direction are extracted and compared with beam model results.

**2.1.1 Cutting Forces**

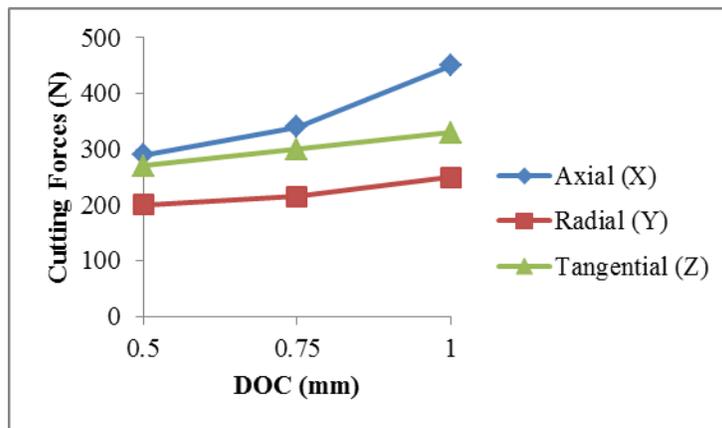
The cutting forces which was recorded during experimental setup shows that there is increase in force as due to depth of cut increasing and as the value of Side Cutting Edge Angle Is increase the force reading decreases from Side Cutting Edge Angle  $20^\circ$  to Side Cutting Edge Angle  $30^\circ$  but the reading for force increase for Side Cutting Edge Angle  $40^\circ$ .



(a) Cutting forces for Side cutting edge angle  $20^\circ$



(b) Cutting forces for Side cutting edge angle  $30^\circ$



(c) Cutting forces for Side cutting edge angle  $40^\circ$

**Figure 1 – Graphical representation of experimental cutting forces due to DOC**

**Table 1.1 Geometrical Parameters of Single Point Cutting Tool**

Total Width	15 mm
Total Height	15 mm
Total Length	70 mm
Flank Length	10 mm
Fixed Shank Length	45 mm
Nose Radius	0.5 mm

**Table 1.2 Angular Parameters of Single Point Cutting Tool for Side Cutting Edge Angle 20°**

Angle	Tool 1	Tool 2	Tool 3
End Relief Angle	10	10	10
Side Rake Angle	10	20	30
Side Relief Angle	10	10	10
Side Cutting Edge Angle	20	20	20
End Cutting Edge Angle	15	15	15
Back Rake Angle	10	10	10

**Table 1.3 Angular Parameters of Single Point Cutting Tool for Side Cutting Edge Angle 30°**

Angle	Tool 1	Tool 2	Tool 3
End Relief Angle	10	10	10
Side Rake Angle	10	20	30
Side Relief Angle	10	10	10
Side Cutting Edge Angle	30	30	30
End Cutting Edge Angle	15	15	15
Back Rake Angle	10	10	10

**Table 1.4 Angular Parameters of Single Point Cutting Tool for Side Cutting Edge Angle 40°**

Angle	Tool 1	Tool 2	Tool 3
End Relief Angle	10	10	10
Side Rake Angle	10	20	30
Side Relief Angle	10	10	10
Side Cutting Edge Angle	40	40	40
End Cutting Edge Angle	15	15	15
Back Rake Angle	10	10	10

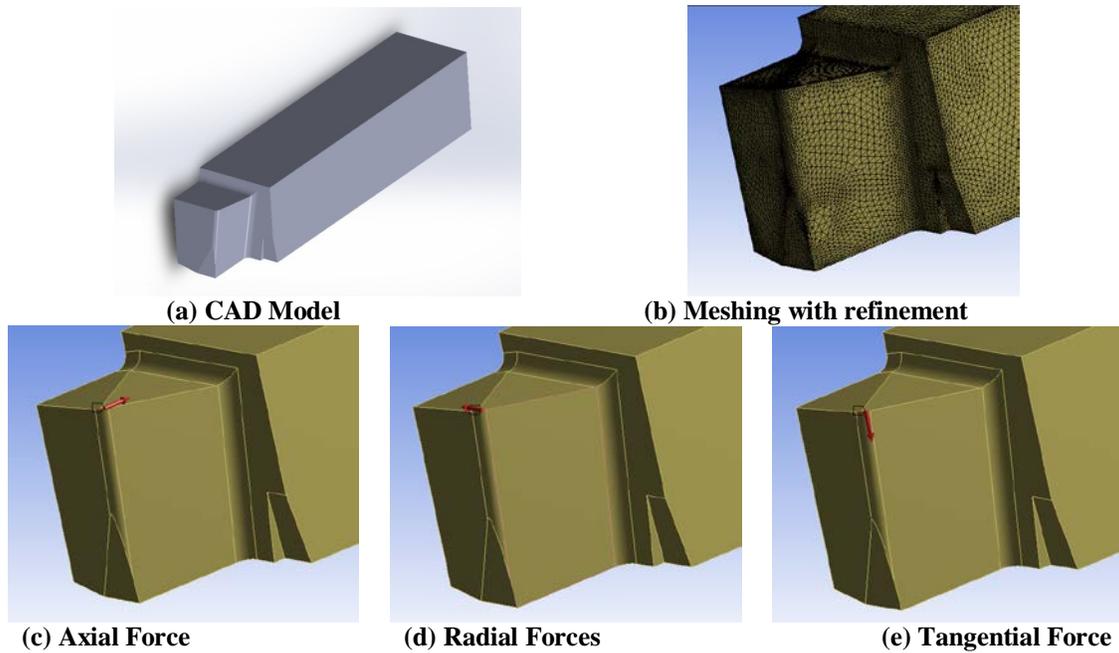


Figure 2 – Single point cutting tool, meshing and boundary condition used for FEA.

### 2.2 Beam Modelling

The forces are measured on the single point cutting tool during machining due depth of cut and used for deflection prediction. The elastic energy due to cutting forces is stored in the tool. The tool deforms due to this elastic energy and this deformation can be found out using Castigliano's theorem.

A force based model for cutter deflection is developed by considering the cutting tool as cantilever beam with forces and moments.

The total strain energy ( $U_a$ ) stored in the tool of length ( $L$ ), cross sectional area ( $A$ ) and young's modulus ( $E$ ) due to axial force ( $F_a$ ) is given by

$$U_a = \int_0^L \frac{F_a^2}{2AE} dx \quad (1)$$

The total shear strain energy ( $U_{r,t}$ ) stored in the tool with modulus of rigidity ( $G$ ) due to radial force ( $F_r$ ) and tangential force ( $F_t$ ) is given by

$$U_m = \int_0^L \frac{F_r, t^2}{2AG} dx \quad (2)$$

The total strain energy ( $U_m$ ) stored in the tool with moment of inertia ( $I$ ) due to bending moment ( $M$ ) is given by

$$U_t = \int_0^L \frac{M^2}{2EI} dx \quad (3)$$

The total strain energy stored ( $U_t$ ) in the tool with polar moment of inertia ( $J$ ) due to Torsion is given by

$$U_t = \int_0^L \frac{T^2}{2GJ} dx \quad (4)$$

Total strain energy is calculated as

$$\begin{aligned}
 U &= \int_0^L \frac{F_a^2}{2AE} dx + \int_0^L \frac{F_r, t^2}{2AG} dx + \int_0^L \frac{M^2}{2EI} dx + \int_0^L \frac{T^2}{2GJ} dx \\
 &= \frac{F_a^2 L}{2AE} + \frac{F_r^2 L}{2AG} + \frac{F_t^2 L}{2AG} + \frac{F_t^2 L^3}{6EI} + \frac{F_t^2 L^3}{6EI} + \frac{F_t^2 L^3}{6GJ}
 \end{aligned} \quad (5)$$

According to Castigliano’s theorem, the displacement corresponding to any force is given by

$$\delta = \frac{\partial U}{\partial F} \tag{6}$$

Therefore, by using Castigliano’s theorem, the deflection in the direction of axial ( $\delta_a$ ), radial ( $\delta_r$ ) and tangential ( $\delta_t$ ) obtained as

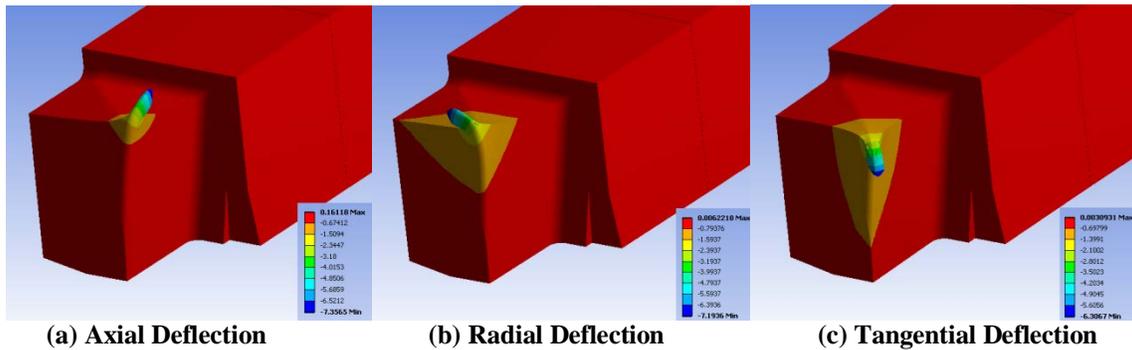
$$\delta_a = \frac{\partial U}{\partial F_a} = \frac{F_a L}{AE} \tag{7}$$

$$\delta_r = \frac{\partial U}{\partial F_r} = \frac{F_r L}{AG} + \frac{F_r L^2}{3EI} \tag{8}$$

$$\delta_t = \frac{\partial U}{\partial F_t} = \frac{F_t L}{AG} + \frac{F_t L^2}{3EI} + \frac{F_t L^3}{3GJ} \tag{9}$$

### III. RESULT AND DISCUSSION

The FEA analysis results show decrease in axial deflection at some extent, continues increase in radial deflection, and varying deflection results for tangential deflection for increasing side rake angle. In Fig 3(a), 3(b), 3(c) FEA predictions for deflection are shown below.



**Figure 3 – Sample force plot and sample FE results of single point cutting tool deflection.**

Figure 4 shows the comparison of deflection in axial, radial, tangential direction between FEA and Beam modelling for side rake angle  $10^\circ$  with side cutting edge angle  $20^\circ$ . The process parameters are given as cutting speed 160rpm, feed 0.3 mm/min and DOC = (0.5, 0.75, and 1). The can be observed that axial deflection and tangential deflection are very closely predicted by FEA and beam modelling with maximum error less than 10%. However, deviation in radial deflection can be observed between FEA and beam modelling.

Figure 5 shows the comparison of deflection in axial, radial, tangential direction between FEA and Beam modelling for side rake angle  $20^\circ$  with side cutting edge angle  $20^\circ$ . The process parameters are given as cutting speed 160rpm, feed 0.3 mm/min and DOC = (0.5, 0.75, and 1). The can be observed that axial deflection and tangential deflection are very closely predicted by FEA and beam modelling with maximum error less than 10%. However, deviation in radial deflection can be observed between FEA and beam modelling.

Figure 6 shows the comparison of deflection in axial, radial, tangential direction between FEA and Beam modelling for side rake angle  $30^\circ$  with side cutting edge angle  $20^\circ$ . The process parameters are given as cutting speed 160rpm, feed 0.3 mm/min and DOC = (0.5, 0.75, and 1). The can be observed that axial deflection and tangential deflection are very closely predicted by FEA and beam modelling with maximum error less than 10%. However, deviation in radial deflection can be observed between FEA and beam modelling.

Figure 7 shows the comparison of deflection in axial, radial, tangential direction between FEA and Beam modelling for side rake angle  $10^\circ$  with side cutting edge angle  $30^\circ$ . The process parameters are given as cutting speed 160rpm, feed 0.3 mm/min and DOC = (0.5, 0.75, and 1). The can be observed that axial deflection and tangential deflection are very closely predicted by FEA and beam modelling with maximum error less than 10%. However, deviation in radial deflection can be observed between FEA and beam modelling.

Figure 8 shows the comparison of deflection in axial, radial, tangential direction between FEA and Beam modelling for side rake angle  $20^\circ$  with side cutting edge angle  $30^\circ$ . The process parameters are given as cutting speed 160rpm, feed 0.3 mm/min and DOC = (0.5, 0.75, and 1). The can be observed that axial deflection and tangential deflection are very closely predicted by FEA and beam

modelling with maximum error less than 10%. However, deviation in radial deflection can be observed between FEA and beam modelling.

Figure 9 shows the comparison of deflection in axial, radial, tangential direction between FEA and Beam modelling for side rake angle  $30^\circ$  with side cutting edge angle  $30^\circ$ . The process parameters are given as cutting speed 160rpm, feed 0.3 mm/min and DOC = (0.5, 0.75, and 1). The can be observed that axial deflection and tangential deflection are very closely predicted by FEA and beam modelling with maximum error less than 10%. However, deviation in radial deflection can be observed between FEA and beam modelling.

Figure 10 shows the comparison of deflection in axial, radial, tangential direction between FEA and Beam modelling for side rake angle  $10^\circ$  with side cutting edge angle  $40^\circ$ . The process parameters are given as cutting speed 160rpm, feed 0.3 mm/min and DOC = (0.5, 0.75, and 1). The can be observed that axial deflection and tangential deflection are very closely predicted by FEA and beam modelling with maximum error less than 10%. However, deviation in radial deflection can be observed between FEA and beam modelling.

Figure 11 shows the comparison of deflection in axial, radial, tangential direction between FEA and Beam modelling for side rake angle  $20^\circ$  with side cutting edge angle  $40^\circ$ . The process parameters are given as cutting speed 160rpm, feed 0.3 mm/min and DOC = (0.5, 0.75, and 1). The can be observed that axial deflection and tangential deflection are very closely predicted by FEA and beam modelling with maximum error less than 10%. However, deviation in radial deflection can be observed between FEA and beam modelling.

Figure 12 shows the comparison of deflection in axial, radial, tangential direction between FEA and Beam modelling for side rake angle  $30^\circ$  with side cutting edge angle  $40^\circ$ . The process parameters are given as cutting speed 160rpm, feed 0.3 mm/min and DOC = (0.5, 0.75, and 1). The can be observed that axial deflection and tangential deflection are very closely predicted by FEA and beam modelling with maximum error less than 10%. However, deviation in radial deflection can be observed between FEA and beam modelling.

Figure 13 show comparison of axial deflection at Depth of Cut 0.5 mm between Side Rake Angle and Side Cutting Edge Angle increment.

Figure 14 show comparison of radial deflection at Depth of Cut 0.5 mm between Side Rake Angle and Side Cutting Edge Angle increment.

Figure 15 show comparison of tangential deflection at Depth of Cut 0.5 mm between Side Rake Angle and Side Cutting Edge Angle increment.

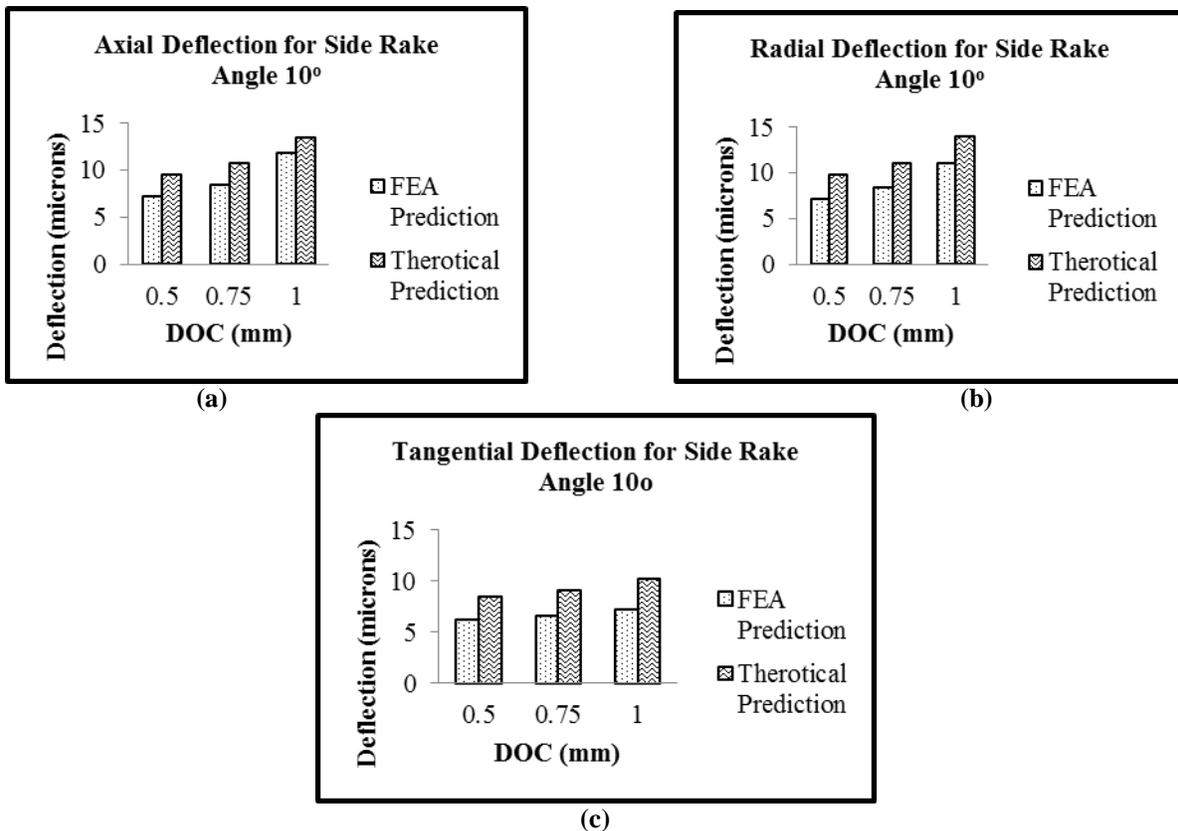


Figure 4 – Comparison of (a) axial (b) radial (c) tangential deflection due to DOC for side cutting edge angle  $20^\circ$

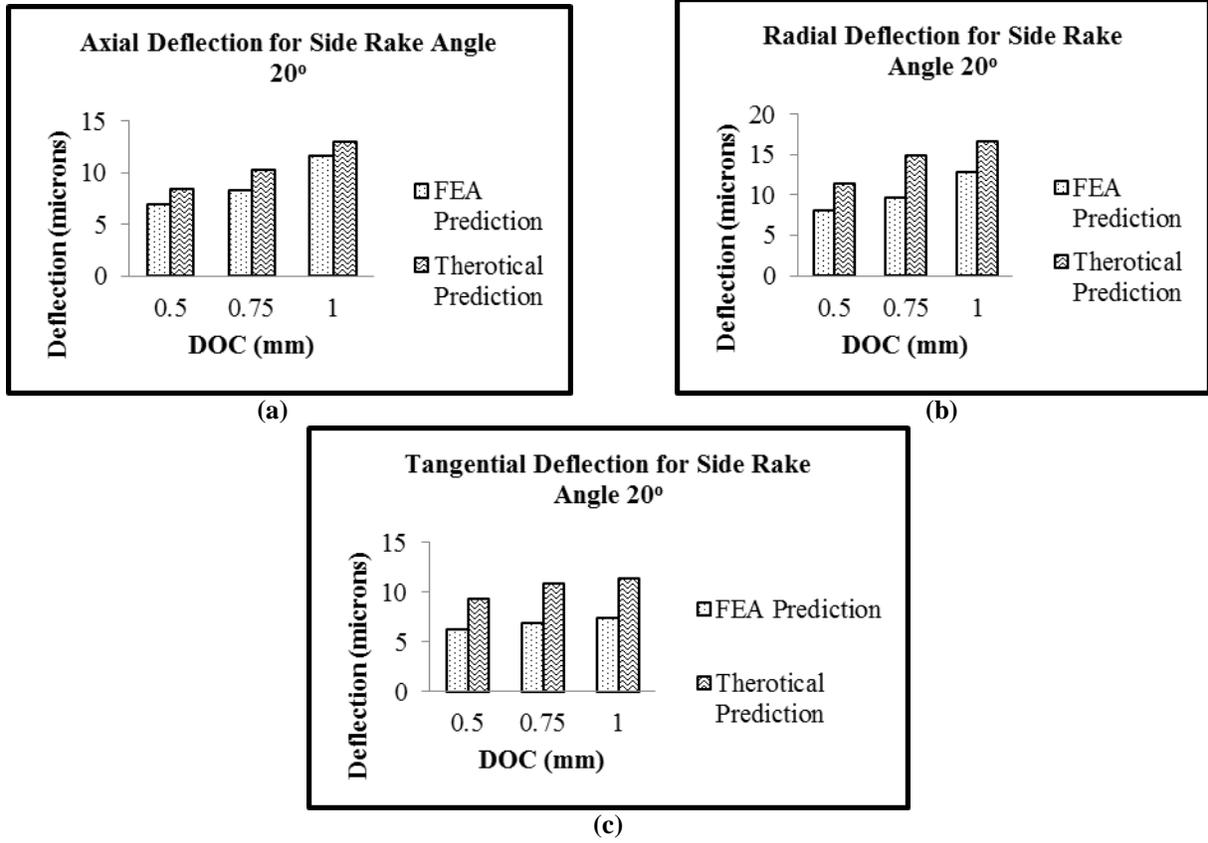


Figure 5 – Comparison of (a) axial (b) radial (c) tangential deflection due to DOC for side cutting edge angle 20°

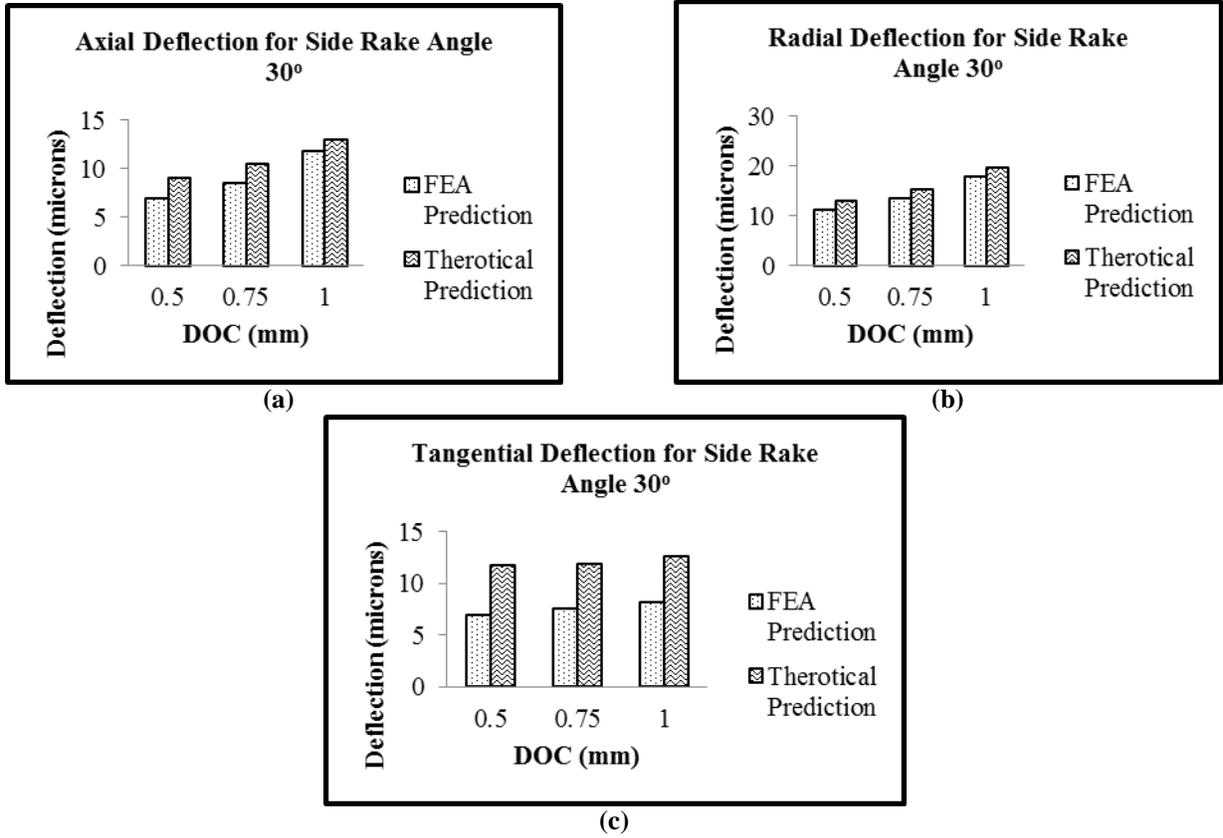


Figure 6 – Comparison of (a) axial (b) radial (c) tangential deflection due to DOC for side cutting edge angle 20°

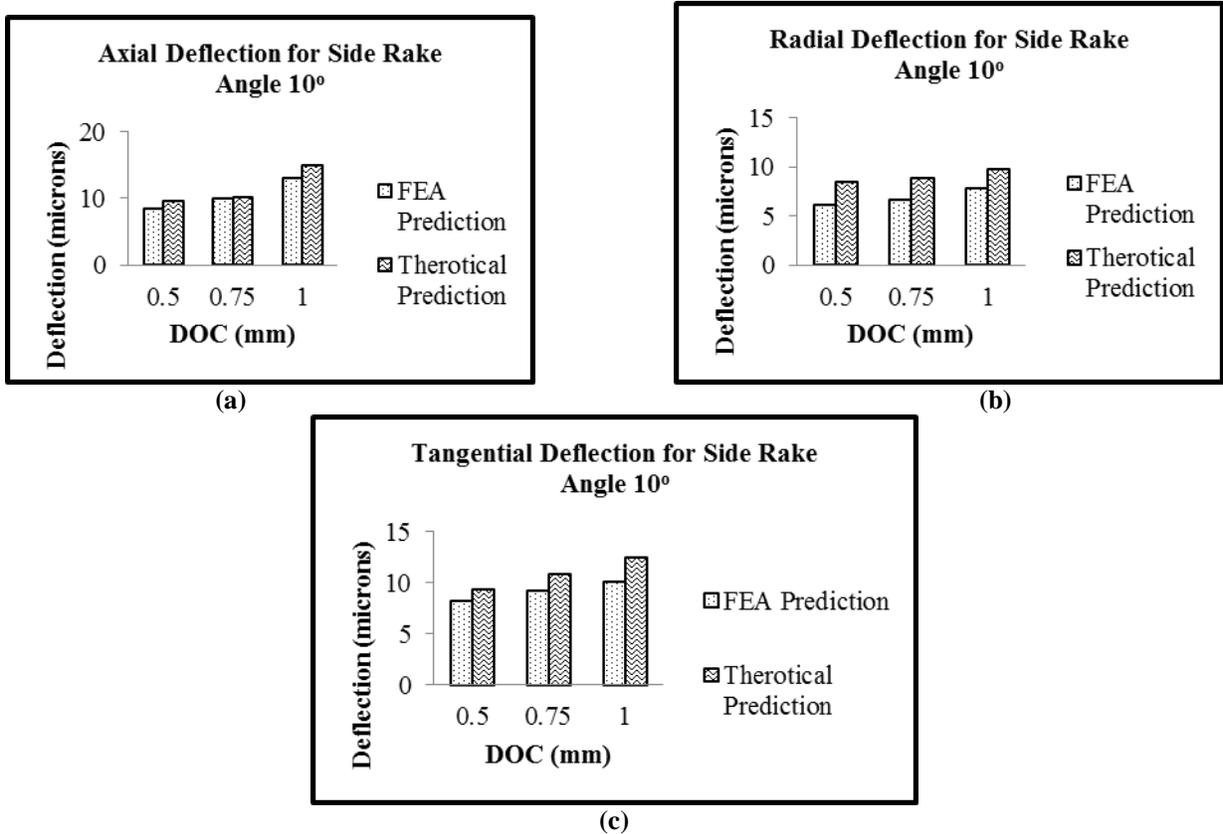


Figure 7 – Comparison of (a) axial (b) radial (c) tangential deflection due to DOC for side cutting edge angle 30°

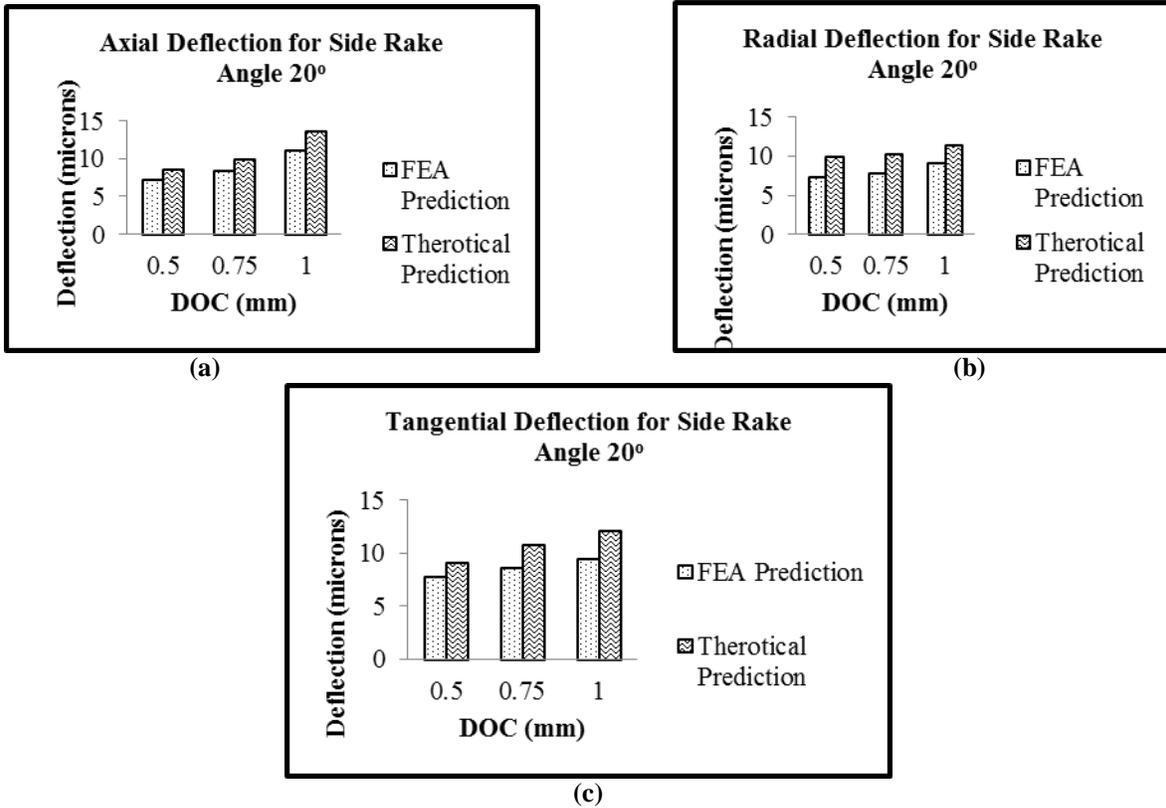


Figure 8 – Comparison of (a) axial (b) radial (c) tangential deflection due to DOC for side cutting edge angle 30°

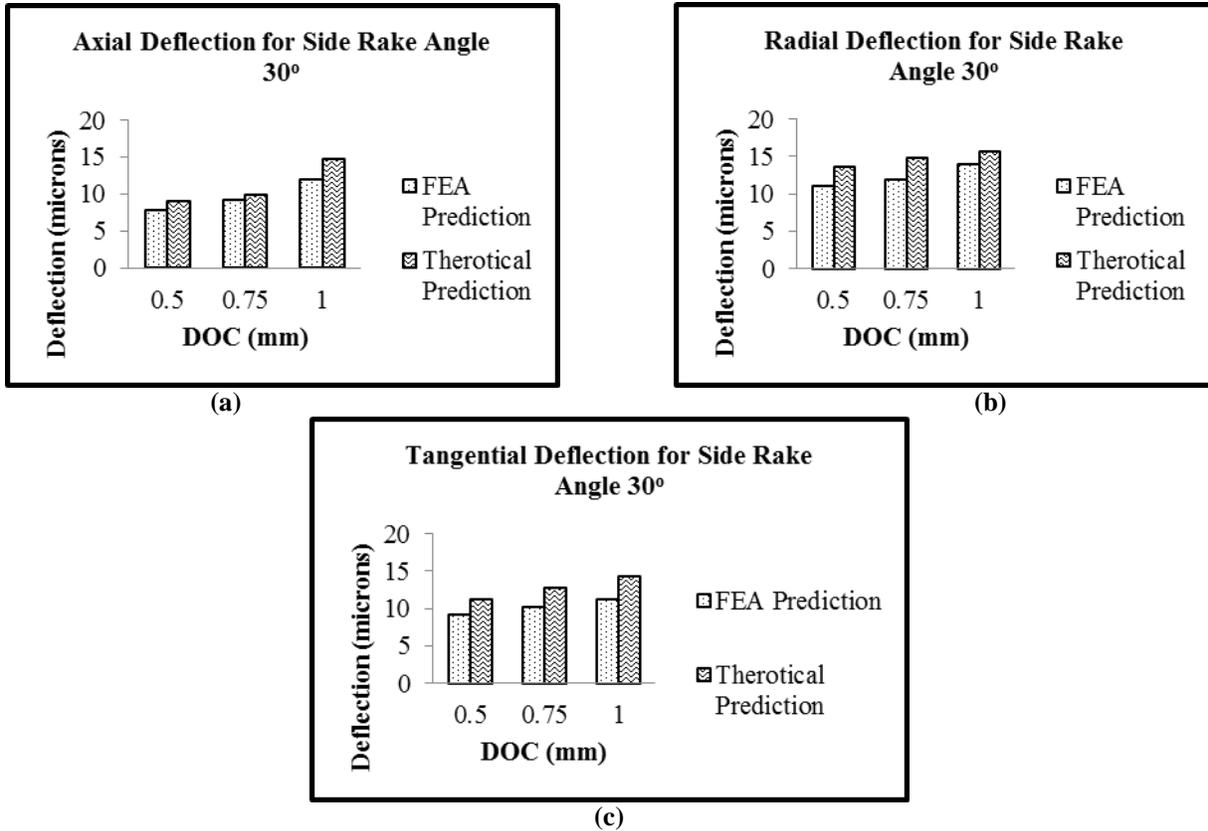


Figure 9 – Comparison of (a) axial (b) radial (c) tangential deflection due to DOC for side cutting edge angle 30°

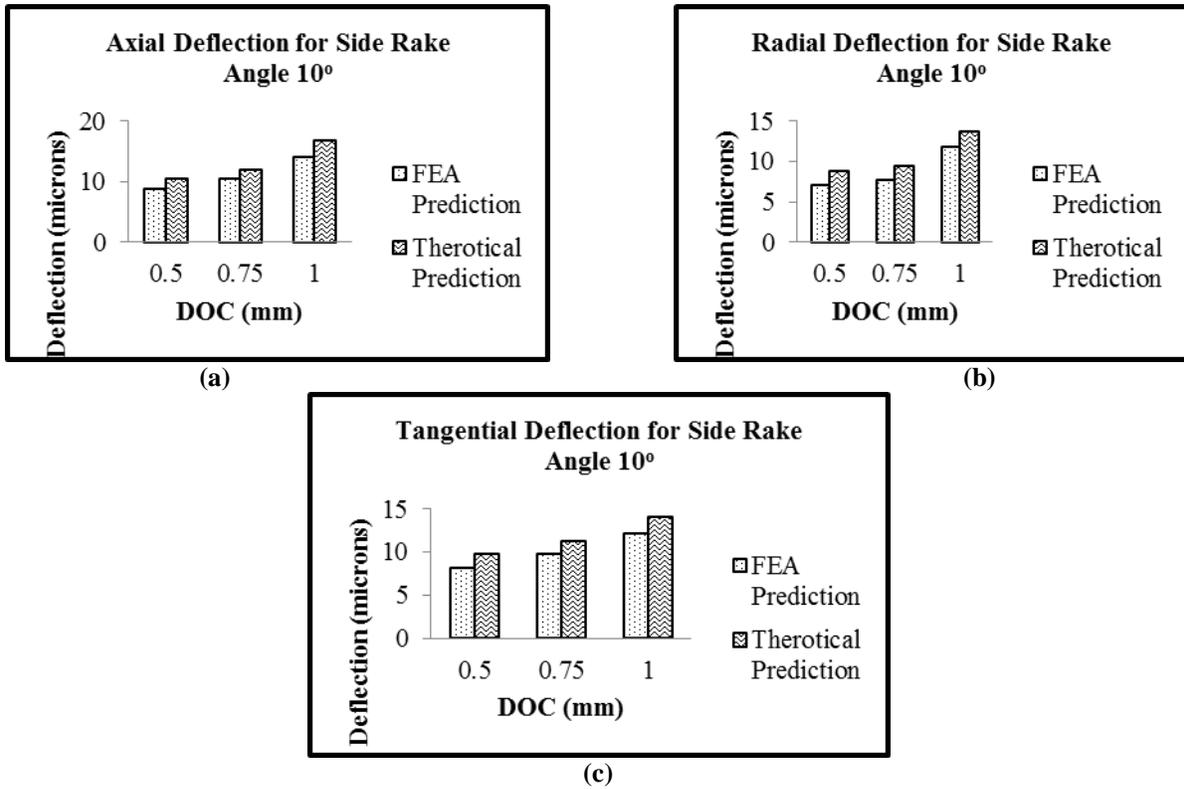


Figure 10 – Comparison of (a) axial (b) radial (c) tangential deflection due to DOC for side cutting edge angle 40°

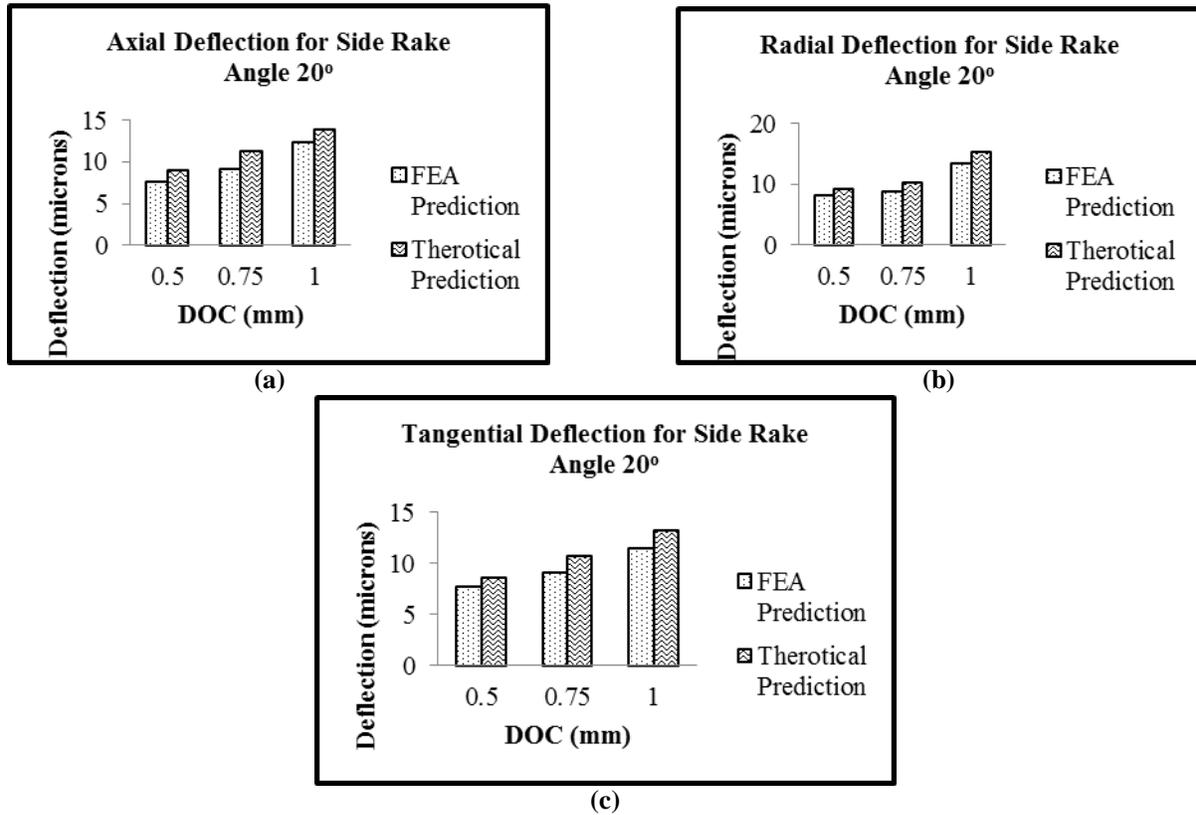


Figure 11 – Comparison of (a) axial (b) radial (c) tangential deflection due to DOC for side cutting edge angle 40°

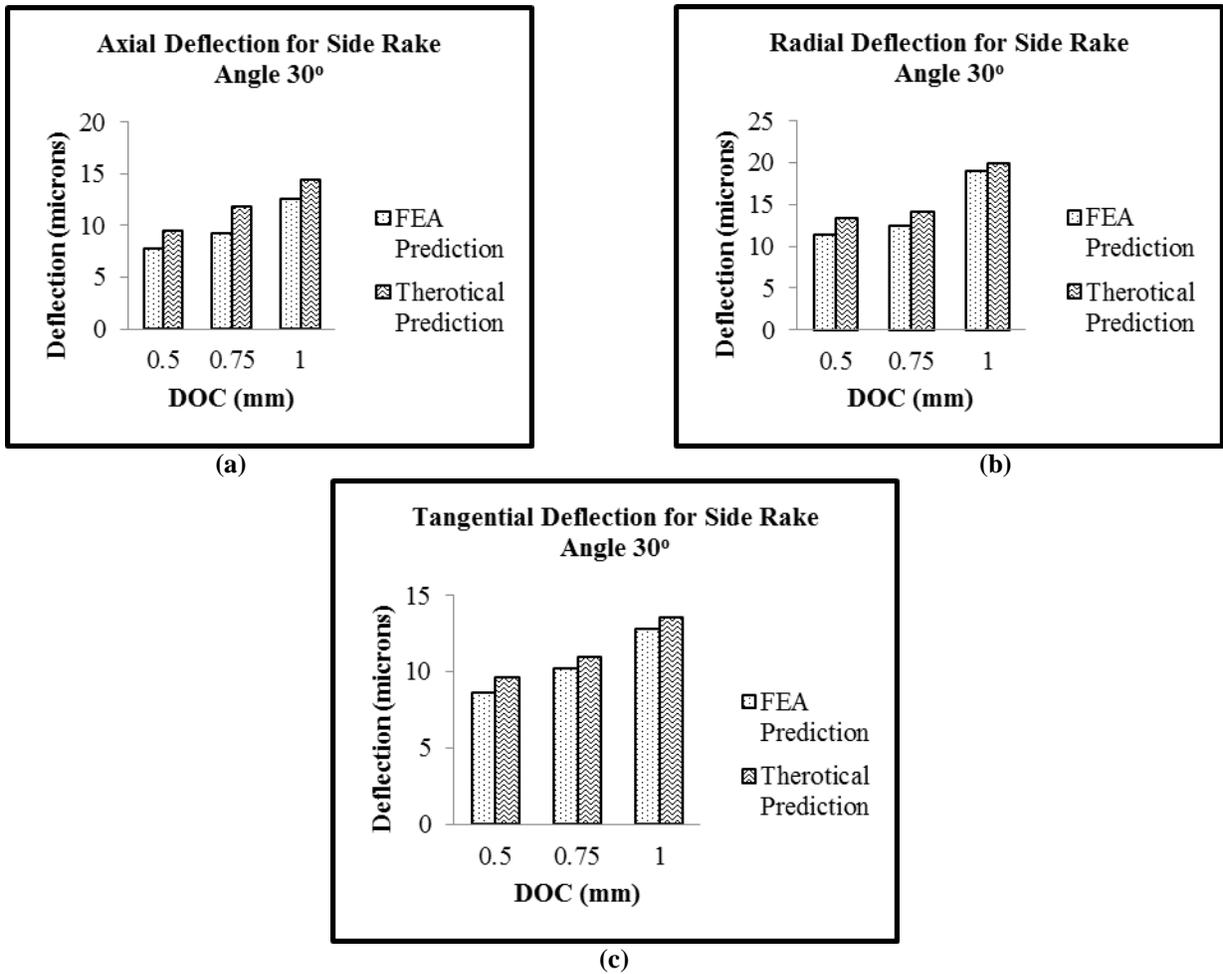


Figure 12 – Comparison of (a) axial (b) radial (c) tangential deflection due to DOC for side cutting edge angle 40°

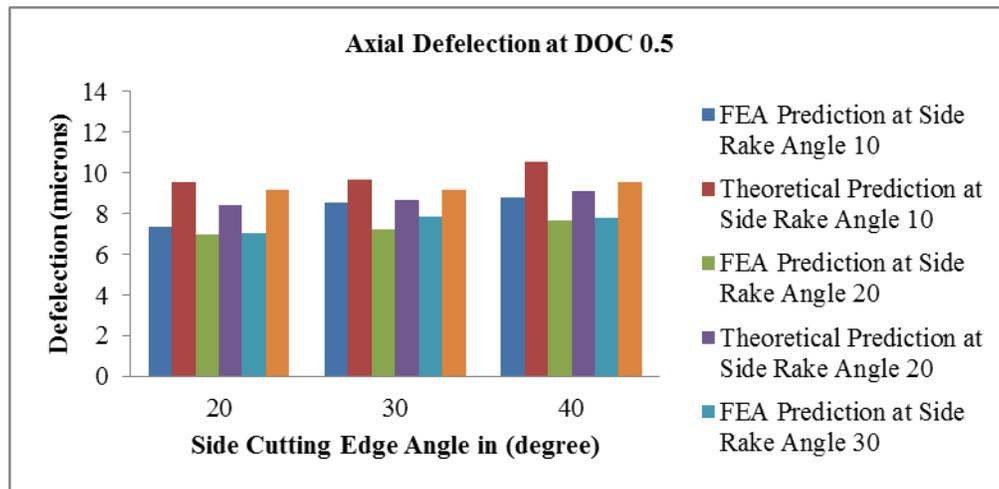


Figure 13 Comparison of Axial Deflection between Side Rake Angle and Side Cutting Edge Angle at DOC 0.5

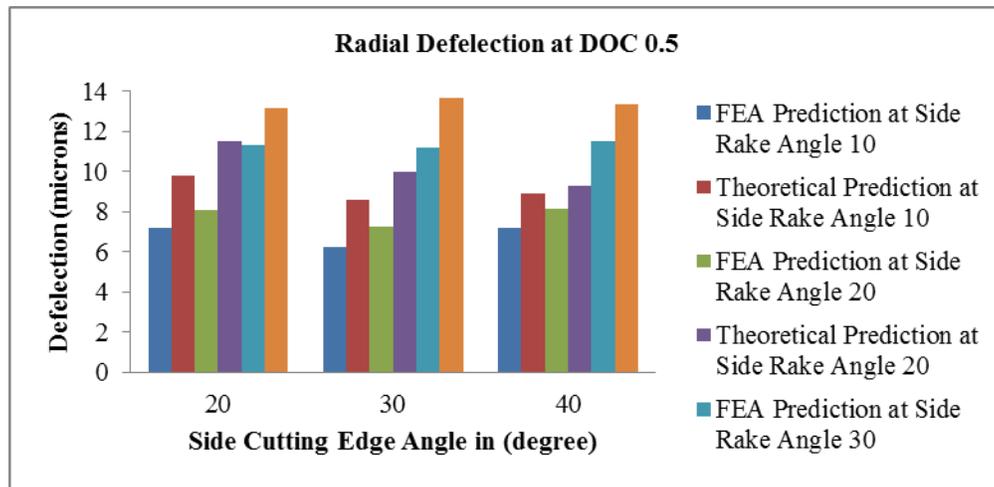


Figure 14 Comparison of Radial Deflection between Side Rake Angle and Side Cutting Edge Angle at DOC 0.5

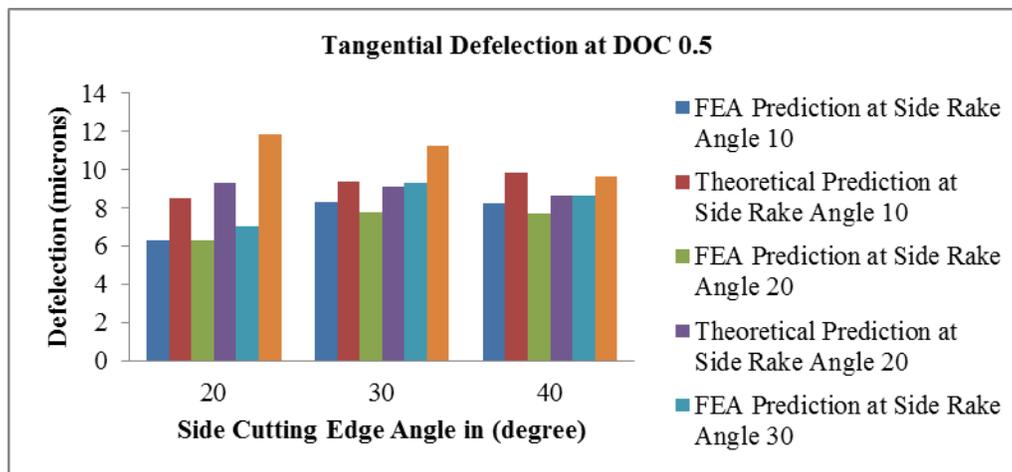


Figure 15 Comparison of Tangential Deflection between Side Rake Angle and Side Cutting Edge Angle at DOC 0.5

#### IV. CONCLUSION

The FEA analysis shows that the tool deflection depends not only on the cutting forces but geometrical parameters, higher the cutting force higher will be the value of tool deflection, but where as for the side rake angle the deflection decreases for some extent and then increases. From the result sit was concluded that a deflection value varies throughout the tool. It is maximum at tool tip and minimum at holding position. The theoretical calculations have been done by varying parameters. The critical analysis of results shows that when side rake angle along with side cutting edge angle is varied by keeping others parameter constant, the deformation values seemed to be more sensitive to it. It means the value of deflection decreases to certain extent with the increase inside rake angle, which decreases the tool deflection. Axial deflection decrease to certain extent for increase in side rake angle, whereas Radial deflection increase in every case. Tangential deflection varies with side cutting edge angle. The results of theoretical deflection are more than FEA results.

Where comparison between Side Rake Angle and Side Cutting Edge Angle show that the axial and radial deflection increases as there is increase in angular value for Side Cutting Edge Angle. But Tangential Deflection decrease with the decrease in Side Cutting Edge Angle.

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# Evaluation of the effect of gamma rays on *Echis Coloratus* snake venom through toxicological, immunological and biological studies.

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**Abstract-** The present study was performed to evaluate the effectiveness of gamma radiation in detoxification of *Echis Coloratus* snake venom without affecting their immunogenic properties. This was carried out by studying the toxicological, immunological and biological properties of the crude venom. Data revealed that the toxicity of venom after (1.5 and 3 KGy) gamma irradiation was reduced 6.4 and 7.2 times, respectively, compared to the native venom. Immunogenicity was evaluated by performing the double immunodiffusion test; same number of visible lines joined smoothly at the corner was observed with the non-irradiated, as well as, the two dose levels gamma irradiated (1.5 and 3 KGy) snake venom; this result indicating that there was no change in antigenic reactivity. The effect of gamma radiation on some venom enzymes was studied; the phospholipase A<sub>2</sub> specific activity of native, 1.5 and 3 KGy gamma irradiated venom was 6.25, 4.8 and 2.7 U/mg; respectively. The proteolytic specific activity of native, 1.5 and 3 KGy gamma irradiated venom was 13, 7.5 and 5.5 U/mg; respectively. This means that proteolytic and phospholipase A<sub>2</sub> activities were inhibited by irradiation. The study confirmed that native *Echis Coloratus* snake venom showed high edema forming activity accompanied by apparent hematoma; peak volume was achieved after 30 min and percent edema reached 41.8 % from the initial diameter of the rat paw. This criteria greatly reduced by radiation as gamma irradiated (1.5 KGy and 3 KGy) venoms induced edema with peak volume achieved after 30 min and percent edema reached 29.7 and 21 % respectively, from the initial diameter of the rat paw. *Echis Coloratus* snake venom showed a high concentration dependant coagulant activity; The clotting time of native, 1.5 and 3 KGy gamma irradiated venom at 200 µg/ml was 4.8, 16.8 and 26.6 seconds. So, gamma irradiation decreased the coagulant activity of the venom. These results indicate that gamma irradiation of venoms offer an effective method for reducing the chronic toxic effect of venom in immunized animals for preparing the best toxoids and vaccines, facilitating antivenin production and extending the lifespan of immunized animals.

**Index Terms-** *Echis Coloratus*, gamma radiation, LD<sub>50</sub>, double immunodiffusion, edema.

## I. INTRODUCTION

Snake bites are a public health problem that deserves attention from health authorities (*De Souza et al., 2012*). Venomous snakes are capable of inject venom, modified saliva, into another creature for the purpose of prey immobilization or self-defense (*Meier and White, 2007*).

*Echis coloratus* belongs to the family *Viperidae*; it is the most familiar family in Egypt (*Mallow et al., 2003*). Its venom induces complex biological alterations and multisystem affection that may result in a death. Vipers' venoms typically contain an abundance of protein-degrading enzymes, called proteases, which produce symptoms such as pain, strong local swelling and necrosis. Another important enzyme in *Echis Coloratus* snake venom is phospholipase A<sub>2</sub>. It is a small enzyme which causes havoc by interfering in the normal physiological processes of the victim and inducing a variety of pharmacological effects (*Kini, 2003*).

Generally, the crude venom of viper *Echis Coloratus* causes swelling, pain, respiratory failure, arrhythmia, hypotension, circulatory collapse which leads to acute renal failure (*Osman and Gumma, 1974; Boviatsis et al., 2003*). Liver is severely affected by *Echis coloratus* envenomation; elevation of serum levels of glucose, hepatocytes glycogen depletion and elevation of AST, ALT and ALP indicates hepatocellular damage (*Al-Jammaz, 2003*). Antivenins are the only effective treatment for snakebites and envenomations by other venomous animals (*Morais and Massaldi, 2009*). In order to improve antivenin production, extend the lifespan of the immunized animals and decreasing the production cost, several trials have been used to detoxify venoms and maintaining its immunogenicity. One method that has been shown to be effective for attenuating venom toxicity and maintaining immunogenicity is gamma radiation (*Shabaan, 2003*).

The present study was performed to evaluate the effectiveness of gamma radiation (1.5 and 3 KGy) in detoxification of *Echis Coloratus* snake venom without affecting their immunogenic properties. This was carried out by studying the toxicological, immunological and biological properties of the crude venom before and after exposure to radiation.

## II. MATERIALS AND METHODS

### Animals

Animals used in the present study included Swiss albino male

mice (20-25 g) and Wistar albino male rats (150-180 g). Animals were obtained from institute of ophthalmology (Giza, Egypt). The animals were acclimatized in the animal facilities of the National Center for Radiation Research and Technology under appropriate conditions of temperature, humidity and light. They were allowed free access to food consisting of standard pellet obtained from El-Nasr chemical company (Cairo, Egypt) and water ad libitum. Study was conducted in accordance with the regulations approved by the ethics committee at Faculty of Pharmacy, Cairo University. Animals were purchased from the National Research Center (Giza, Egypt).

### Venom

The crude venom was obtained from *Echis Coloratus* snakes kept in laboratory unit of Medical Research Centre, Faculty of Medicine, Ain Shams University. The venom was pooled by milking healthy snakes collected from Sinai, Egypt and it was dried and kept in the refrigerator at 4°C until used.

### Antivenin

Egyptian polyvalent antivenin, produced in horses, was obtained from the Holding Company for Biological Products and Vaccines (VACSERA), Agouza, Giza, Egypt. The polyvalent antivenin was kept at 4°C till used.

### Irradiated Facilities

The venom was irradiated with gamma rays in the National Center of Radiation and Research Technology, Cairo, Egypt, using (cobalt-60 gamma cell 220, Atomic Energy of Canada Limited (AECL), Canada). The radiation dose rate was 1.2 Gy per second. In this study, a saline solution of *Echis Coloratus* snake venom was subjected to radiation dose level of 1.5 KGy or 3 KGy.

### Determination of lethal dose fifty (LD<sub>50</sub>) of native and (1.5 KGy and 3 KGy) gamma irradiated venom

Toxicity of *Echis Coloratus* snake venom was studied before and after exposure to 1.5 KGy or 3 KGy gamma radiation. The LD<sub>50</sub> was determined according to the method of Spearman and Karber (Finney, 1964) by intraperitoneal (i.p) injection of the venom in different doses into swiss albino mice. Six mice were used for each dosage. The LD<sub>50</sub> was determined from the formula:

$$M = X_k + \frac{1}{2}d - dr_1/N$$

M = log LD<sub>50</sub>

X<sub>k</sub> = log dose causing 100% mortality.

d = logarithmic interval of doses.

r = Number of dead animal in each group.

r<sub>1</sub> = Sum the number of dead animals at each of the individual dose levels.

N = Number of animals in each group.

### Immunodiffusion technique for native and (1.5 KGy and 3 KGy) gamma irradiated venom

Double immunodiffusion technique of native and (1.5 KGy and 3 KGy) gamma irradiated *Echis Coloratus* snake venom was carried out as described by Ouchterlony (1948). They were carried out using 1.7 Nobel Agar (Difeco. Lab. Detroit. Mich.) in

0.9% NaCl solution, sodium azide was added in a concentration of 0.05%, to retard bacterial growth. The wells were filled with 20 µl volumes. The venom samples in concentration of (20 mg/ml) were added in the peripheral wells, while the antivenin was added in the central well. After developing of the precipitation bands (48 h), the plates were washed for 24 h in saline, dried and stained using 0.5 % Amidoschwartz stain (0.5 % in 5 % acetic acid) for 7 min, washed with methanol acetic acid (9:1) dried in air and photographed.

### Determination of phospholipase A<sub>2</sub> (PLA<sub>2</sub>) activity of native and (1.5 KGy and 3 KGy) gamma irradiated venom

Venom phospholipase A<sub>2</sub> activity of native and (1.5 KGy and 3 KGy) gamma irradiated *Echis Coloratus* snake venom was determined according to the method of Marinetti (1965). A stock of egg yolk suspension was prepared by shaking one egg yolk in 0.9% NaCl to give a final volume of 100 ml suspension, stable for at least 2 weeks when stored at 0 °C. The working suspension of egg yolk was prepared by making 5-fold dilution of this stock suspension in 0.9% NaCl. To 1 ml of the working egg yolk suspension, 4.9 ml of isotonic saline was added. This suspension was mixed, and equilibrated to a temperature of 41°C for 5 minutes. 0.1 ml of the sample in saline was added to this suspension. Then, the contents were rapidly mixed and the absorbance at 925 nm was recorded each 5 min for 10 min. The control was prepared by adding 1 ml of working solution to 5 ml 0.9% NaCl and was adjusted to give an absorbance of 0.7 (at 925 nm). One unit of enzyme is defined as the amount of venom in µg that will cause 50% turbidity reduction per 10 min.

### Determination of proteolytic activity of native and (1.5 KGy and 3 KGy) gamma irradiated venom

Proteolytic activity of native and (1.5 KGy and 3 KGy) gamma irradiated *Echis Coloratus* snake venom was measured using azocasein as substrate according to the method of Lemos et al. (1990). In a test tube, 2.5 % azocasein substrate solution dissolved in distilled water (w/v) was added to reaction mixture containing 0.05M tris Hcl Bufer (PH=8.5) and different concentrations of native venom and (1.5 and 3 KGy irradiated) venom, The mixtures were incubated at 37 °C for 60 minutes. Trichloroacetic acid (15%, 0.5ml) was added to the mixtures. The reaction mixtures were cooled in an ice bath for 10 minutes; the mixtures were clarified by centrifugation. The absorbance of supernatants was determined at 366 nm against blank, using quartz cuvette. One unit of enzyme is defined as the amount of venom in µg which cause a reduction in absorbance by 50% at 366 nm.

### Determinations of the rat's hind paw edema induced by native and (1.5 KGy and 3 KGy) gamma irradiated venom

Inflammatory response caused by *Echis Coloratus* snake venom was investigated by measuring the rat hind paw edema. Rat hind paw edema induced by native and (1.5 KGy and 3 KGy) gamma irradiated *Echis Coloratus* snake venom was determined by the method of Faria et al. (2001). 60 male albino rats weighing (180-200 gm) were selected for the study and divided into 10 groups, 6 rats each. Each sample was injected into sub-plantar region of the right hind paw. The paw diameter was measured using vernier caliper initially and at ½ h. after sample

administration. The percent of induction of edema in the rat hind paw was calculated from the formula:  $(D_f - D_i/D_i) \times 100$

$D_f$  is the final diameter in each time interval

$D_i$  is the initial diameter at 0 h

**Screening of coagulant properties of native and (1.5 KGy and 3 KGy) gamma irradiated venom (Plasma recalcification time)**

Coagulant activity of *Echis Coloratus* snake venom before and after 1.5 & 3 KGy gamma irradiations was determined according to the method of *Biggs and Macfarlane (1962)*. Rabbit blood (4.5 ml) was withdrawn by a sterile plastic syringe from the marginal vein of the ear and immediately transferred to a clean test tube containing 0.5 ml sodium citrate solution (3.8%); the citrated blood was centrifuged for 20 minute at 2000 rpm. The supernatant plasma was pipetted into a clean tube; 0.1 ml aliquots of the normal plasma were pipette into a number of clotting glass tubes incubated at 37°C. Different sample concentration was added to the tubes. Then 0.1 ml of 25mM calcium chloride was added to each tube and the clotting time was immediately recorded with stop watch. The tubes were kept in the water bath and tilted every 10 seconds until a clot was formed.

**Statistical Analysis:**

Values was expressed as mean ± standard error (S.E), Statistical analysis was performed using instant software, version 2 (Graph pad software, Inc., San Diego, USA), One way analysis of variance (ANOVA) followed by Tukey- Kramer multiple comparison test were used for Comparisons between different groups, For all the carried statistical tests, the level of significance was set at  $P \leq 0.05$ . Graphical representation and regression analysis were conducted using Prism computer program.

**III. RESULTS AND DISCUSSION**

**1- LD<sub>50</sub> of native and (1.5 KGy and 3 KGy) gamma irradiated snake venom**

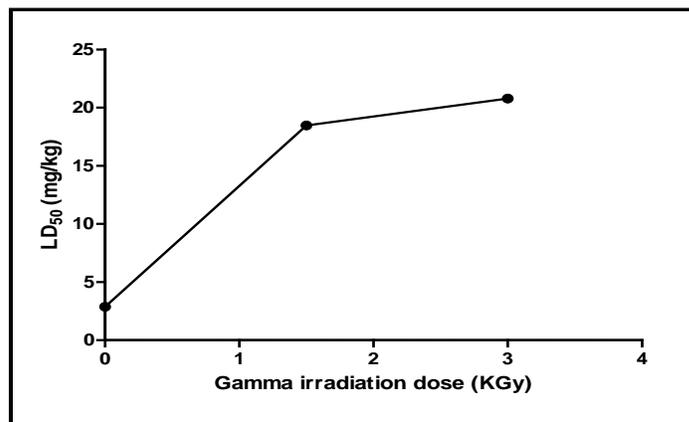
LD<sub>50</sub> for native and gamma irradiated (1.5 and 3 KGy) *Echis Coloratus* venom is 2.88 mg/Kg, 18.47 mg/Kg and 22.42 mg/Kg respectively. There was a dose dependant increase in the LD<sub>50</sub> after gamma irradiation and decrease in toxicity for *Echis Coloratus* venom. The present LD<sub>50</sub> and 95% confidence limits for *Echis Coloratus* venom before and after irradiation by 1.5 and 3KGy are shown in (Table 1 and figure 1).

Envenoming by *Viperidae* family leads to a complex combination of systemic and local symptoms and up to 20% mortality rates without antivenin treatment (*Casewell et al., 2009*).

In the present study, The LD<sub>50</sub> of *Echis Coloratus* venom was 2.88 mg/Kg, whereas the toxicity of *Echis Coloratus* venom after (1.5 and 3 KGy) gamma irradiation was reduced 6.4 and 7.2 times, respectively, compared to the native venom. This dose dependant increase in the LD<sub>50</sub> after gamma irradiation indicates decrease in toxicity of *Echis Coloratus* venom.

**Table (1): LD<sub>50</sub> for Native, 1.5 KGy and 3 KGy Gamma Irradiated *Echis Coloratus* Snake Venom:**

Venom	LD <sub>50</sub> (mg/Kg)	95% Confidence Limits
Native <i>Echis Coloratus</i>	2.88	2.35 – 3.52
Irradiated (1.5 KGy) <i>Echis Coloratus</i>	18.47	16.95 – 20.60
Irradiated (3 KGy) <i>Echis Coloratus</i>	20.77	18.63 – 23.61



**Figure (1): Effect of Gamma Irradiation on Median Lethal Dose (LD<sub>50</sub>) for *Echis Coloratus* Snake Venom**

*Souza et al., (2002)* showed that *Bothrops jararacussu* venom irradiated with a dose of gamma rays (2000 Gy) from a source of Cobalt-60 (<sup>60</sup>Co) reduces the acute toxicity of the venom, preserving the antigenic and immunogenic properties. Also, *Netto et al. (2002)* examined the toxicity of native and 2000 Gy gamma irradiated *Crotalus durissus terrificus* venom from a Cobalt 60 source; the LD<sub>50</sub> values were 0.09 (0.05-0.14) µg/g and 0.40µg/g mouse for native venom and irradiated venom, respectively. So, the LD<sub>50</sub> for irradiated venom was 4.4 times less toxic than native venom. Moreover, *Shaaban, (2003)* showed that the effect of gamma irradiation (15 KGy) on *Naja haje* and *Cerastes cerastes* venoms were 28.1 % and 30.8 % less toxic respectively than the native ones.

Moreover, according to *Bennacef-Heffar and Laraba-Djebari, (2003)* *Vipera lebetina* venom was irradiated with two doses of gamma rays (1 and 2 KGy) from a <sup>60</sup>Co source and Intraperitoneal injection of the irradiated venoms (100-500 µg/ 20 g mouse body mass) were analyzed for the venom's toxic, enzymatic, and structural properties, this revealed that the

toxicity of irradiated venoms with 1 and 2 KGy doses were four and nine times less toxic, respectively, than the native venom. Similarly, *Oussedik-Oumehdi and Laraba-Djebari, (2008)* describes gamma irradiation effects on *Cerastes cerastes* venom after treating with Doses of 1 KGy and 2 KGy gamma radiations. These treated venoms did not have any residual lethal effects until 10 LD<sub>50</sub>.

Loss of function of protein by irradiation is not usually due to breaking peptide bonds, or otherwise, disrupting the primary skeletal structure of the peptide chain. It may result from a change in a critical side chain or from a break in the hydrogen or disulfide bonds which in turn, can result in a disorganization of the internal relationships of side chain groups, or an exposure of amino-acid groups, resulting in a change in biological activity (*Hayes, 2001*).

## 2-Immunodiffusion technique of native and (1.5 KGy and 3 KGy) gamma irradiated venom

The result of double immunodiffusion test of native, 1.5 KGy, 3 KGy gamma irradiated venoms against the commercial polyvalent Egyptian antivenin, showed similar precipitin patterns using venom concentration of 20 mg/ml.

Exposure to 1.5 KGy or 3 KGy gamma radiation did not affect the immunological properties of the crude venom, same number of visible lines joined smoothly at the corner was observed with the non-irradiated, as well as, the two dose levels gamma irradiated (1.5 and 3 KGy) *Echis Coloratus* snake venom (**Figure 1**). These visible lines were identical, continuous and joined smoothly at the corners, indicating that there was no change in antigenic determinants.

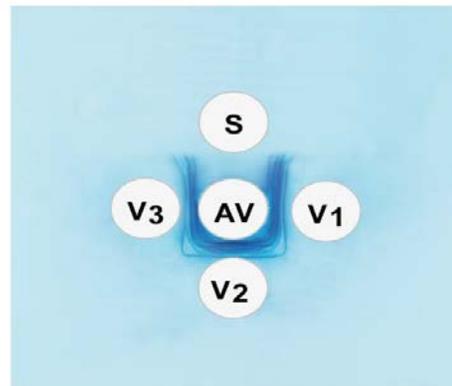
The most efficient treatment known until the present moment for accidents caused by venomous snakes is the antivenin. Venoms employed for immunizations are fairly toxic and some venoms present low immunogenicity. Thus, having modified antigens with lower toxicity and preserved or improved immunogenicity would be useful.

The result of double immunodiffusion test of native, 1.5 KGy and 3 KGy gamma irradiated *Echis Coloratus* venoms against the commercial polyvalent Egyptian antivenin, showed similar reactivity. The visible lines obtained in the immunodiffusion reaction were identical, continuous and joined smoothly at the corners, indicating that there was no change in antigenic determinants, i.e. the antivenin cannot distinguish between the native, 1.5 KGy and 3 KGy gamma irradiated venoms, as they are immunologically identical. So, ionizing radiation has proven to be a powerful tool to attenuate snake venoms toxicity without affecting their immunogenic properties.

*Shaaban (2003)* performed the double immunodiffusion test for non-irradiated and 15 KGy gamma irradiated *Naja haje* and *Cerastes cerastes* venoms against a commercial polyvalent Egyptian antivenin, the tested venoms showed similar patterns; the visible lines obtained in the immunodiffusion reactions were identical and join smoothly at the corners, indicating that there was no change in antigenic determinants. Moreover, *Ferreira Junior et al. (2005)* observed that the optical density values in the ELISA test for the several dilutions of native and 2000 Gy irradiated venoms of *Bothrops jararaca*, *Bothrops jararacussu* and *Bothrops moojeni* did not show statistical difference between the groups studied. Serum titers produced

with native venom were similar to those produced with irradiated venom. This means that these venoms before and after irradiation immunogenically identical.

Also, *Shaaban et al., (2010)* tested using the double immunodiffusion the immunogenic reactivity of the native, 1, 1.5 and 3 kGy  $\gamma$  irradiated *Echis pyramidum* venoms to commercial horse polyvalent Egyptian antivenin and all tested venoms showed similar reactivity



S = Saline  
AV = polyvalent antivenin  
V1 = Native *Echis Coloratus* venom  
V2 = 1.5KGy *Echis Coloratus* venom  
V3 = 3KGy *Echis Coloratus* venom

**Figure (2): Immunodiffusion reaction of horse serum polyvalent Antivenin with Native, 1.5 KGy and 3 KGy Gamma Irradiated *Echis Coloratus* Venoms.**

## 3-Phospholipase A<sub>2</sub> (PLA<sub>2</sub>) activity of native and (1.5 KGy and 3 KGy) gamma irradiated *Echis Coloratus* snake venom

Phospholipase activity of *Echis Coloratus* snake venom decreased after irradiation. The specific phospholipase A<sub>2</sub> activity of native, 1.5 and 3 KGy gamma irradiated venom was 6.25, 4.8 and 2.7 U/mg; respectively (**Table 2 and Figure 3**).

Venom phospholipases A<sub>2</sub> catalyze the hydrolysis of the sn-2-acyl bond of glycerophospholipids in a calcium-dependent fashion to release free fatty acids and lysophospholipids. These reaction products may display direct biological activities or may be transformed into other active compounds with hemostatic, cardiotoxic, convulsant, hemolytic, hypotensive, hepatotoxic, myotoxic and neurotoxic activities (*Dessen, 2000; Kini, 2003; Fuly et al., 2004; França et al., 2009*).

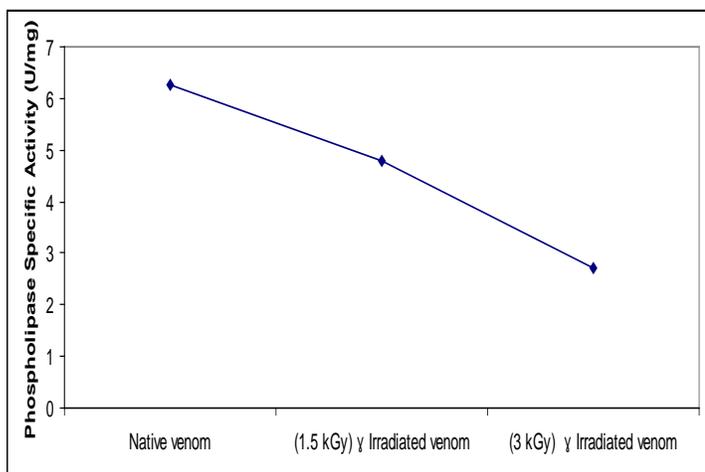
The phospholipase A<sub>2</sub> specific activities of native, 1.5 KGy and 3 KGy gamma irradiated venoms was 13, 7.5 and 5.5 U/mg respectively.

These results are in agreement with results of *Shaaban (2003)* who showed that gamma irradiation of *Naja haje* and *Cerastes cerastes* venoms leads to decrease PLA<sub>2</sub> activity in both venoms. Also, *Bennacef-Heffar and Laraba-Djebari, (2003)* tested the effect of gamma irradiation on *Vipera lebetina* snake venom and they found that the phospholipase A<sub>2</sub> activity was abolished in the irradiated venom with a dose of 2 KGy.

**Table (2): In Vitro Phospholipase specific activity (U/mg) of native, gamma irradiated (1.5 and 3 KGy) venom:**

Group	Specific activity (U/mg)
	Phospholipase A <sub>2</sub> activity
Native venom	6.25
(1.5 KGy) $\gamma$ Irradiated venom	4.8
(3 KGy) $\gamma$ Irradiated venom	2.7

**Figure (3): Effect of native, (1.5 and 3 KGy) gamma irradiated venom on phospholipase A<sub>2</sub> enzyme specific activity of *Echis Coloratus* snake venom.**



**4-Proteolytic activity of native and gamma irradiated (1.5 KGy and 3 KGy) *Echis Coloratus* snake venom**

Proteolytic activity of *Echis Coloratus* snake venom showed a significance decrease after irradiation. The proteolytic specific activity of native, 1.5 and 3KGy gamma irradiated venom was 13, 7.5 and 5.5 U/mg; respectively (Table 3 and Figure 3).

Proteases are abundant in snake venoms, particularly of the *Viperidae* family, and may constitute up to 20% of total venom proteins. Proteolytic enzymes can be divided into two main groups: metalloproteases and serine proteases, which affect the hemostatic system and different steps of the coagulation cascade through different mechanisms (White, 2005).

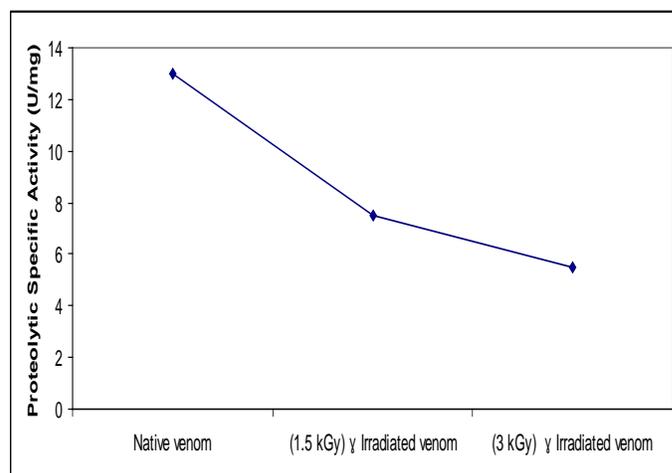
The proteolytic specific activity of native, 1.5 and 3 KGy gamma irradiated venom was 13, 7.5 and 5.5 U/mg; respectively.

This was in agreement with Guarnieri (1992) used 2,000 Gy gamma rays to detoxify *Bothrops jararaca* venom; it was the necessary dose to get the detoxification through attenuation of proteolytic activity with maintenance of immunological properties. Also, Shaaban (2003) reported the inhibition in the proteolytic activity of *Cerastus cerastes* and *Naja haje* venoms by 15 KGy gamma irradiation.

**Table (3): In Vitro Proteolytic specific activity (U/mg) of native, gamma irradiated (1.5 and 3 KGy) venom:**

Group	Specific activity (U/mg)
	Protease activity
Native venom	13
(1.5 KGy) $\gamma$ Irradiated venom	7.5
(3 KGy) $\gamma$ Irradiated venom	5.5

**Figure (4): Effect of native, (1.5 and 3 KGy) gamma irradiated venom on proteolytic specific activity of *Echis Coloratus* snake venom.**



**5- Rat’s hind paw edema induced by native and (1.5 KGy and 3 KGy) gamma irradiated snake venom**

The sub-plantar injection of 0.1 ml of native (1 mg/ml), 1.5 KGy (1 mg/ml) and 3 KGy (1 mg/ml) gamma irradiated snake venom into the right hind paw resulted in marked edema led to an increase in the paw diameters by 41.8, 29.7 and 21 % as compared to the initial paw diameter, after 30 min. The edema formed accompanied by apparent hematoma in case of native and 1.5 KGy gamma irradiated venom (Table 4 and figures 6, 7 and 8).

The sub-plantar injection of 0.1 ml of native (1 mg/ml), 1.5 KGy (1 mg/ml) and 3 KGy (1 mg/ml) gamma irradiated snake venom into the right hind paw resulted in marked edema led to an increase in the paw diameters by 29.1, 23.5 and 9.5 % as compared to the initial paw diameter, after 2 h. (Table 4).

The sub-plantar injection of 0.1 ml of native (1 mg/ml) and 1.5 KGy (1 mg/ml) gamma irradiated snake venom into the right hind paw resulted in marked edema led to an increase in the paw diameters by 4.8 and 2.2 % as compared to the initial paw diameter, after 4 h. But, 3 KGy (1 mg/ml) gamma irradiated snake venom failed to produce any marked edema, after 4 h. (Table 4).

**Table (4): Effect of native, gamma irradiated (1.5 KGy and 3 KGy) *Echis Coloratus* snake venom on the rat hind paw edema after ½, 2 and 4 h**

Parameter Group	% of edema after ½ an hour	% of edema after 2 hour	% of edema after 4 hour
Normal(non- envenomed)	–	–	–
Native venom	41.8±0.21 <sup>a</sup>	29.1±0.45 <sup>a</sup>	4.8±0.08 <sup>a,b</sup>
(1.5KGy) γ Irradiated venom	29.7±0.1 <sup>a,b</sup>	23.5±1.83 <sup>a</sup>	3.2±0.16 <sup>a,b</sup>
(3KGy) γ Irradiated venom	21±1.23 <sup>a,b</sup>	9.5±0.2 <sup>b</sup>	0.4±0.04 <sup>b</sup>

60 male albino rats weighing (180-200 gm) were selected for the study and divided into 10 groups, 6 rats each. Each sample was injected into sub-plantar region of the right hind paw. The paw diameter was measured using vernier caliper initially and at ½, 2 and 4 h. after sample administration. The percent of induction of edema in the rat hind paw was calculated from the formula:  $(D_f - D_i / D_i) \times 100$

Each value represents Mean ± S.E.

Statistical analysis was carried out by one way ANOVA followed by Tukey-karmer Multiple Comparison Test:

<sup>a</sup> Significant difference from normal group ( $P \leq 0.05$ )

<sup>b</sup> Significant difference from native group ( $P \leq 0.05$ )

Edema is a normal response of the body to inflammation or injury (Noma et al., 2014). *Echis Coloratus* as a viper induces edema and alters vascular permeability resulting in local hemorrhage and hematoma. Native *Echis Coloratus* snake venom induced edema after venom injection; peak volume was achieved after 30 min and percent edema reached 41.8 % from the initial diameter of the rat paw, and decreased gradually within 4 h. Gamma irradiated (1.5 KGy and 3 KGy) *Echis Coloratus* snake venom induced edema but less in severity than of the native one; peak volume was achieved after 30 min and percent edema reached 29.7 and 21 % respectively, from the initial diameter of the rat paw, and decreased gradually within 4 h.

Al Asmari (2003) reported that sub- planter injection of *Echis coloratus* snake venom caused intense hemorrhage and marked paw edema compared to saline- injected paws. Abib and Laraba-Djebari (2003) studied the effects of <sup>60</sup>Co gamma radiation on edema-forming activities of *Cerastes cerastes* venom and found that the edematic and hemorrhagic activities were reduced in the detoxified irradiated samples, particularly with the 2 KGy radiation dose.

There are many inflammatory mediators which participate in the production of edema in a variety of inflammatory conditions (Posadas et al., 2000). The expected principal mediators of this inflammatory response produced by *Echis Coloratus* snake were serotonin, histamine, cyclo-oxygenase and prostaglandins (PGs) and cytokines. This was verified by Al-Asmari (2003) who tested the effect of various drugs on edema induced by the *Echis Coloratus* snake. The results showed that (H<sub>1</sub> and H<sub>3</sub>) receptor antagonist (cyproheptadine) and histamine (H<sub>1</sub>) receptor antagonist (chlorpheniramine) produced significant inhibition of edema formation, indicating the role of mast cell and histamine in this inflammatory process. PGs inhibitors (dexamethasone), Cyclo-oxygenase inhibitor (indomethacin) produced significant inhibition of edema formation.



**6- Coagulant properties for native and (1.5 and 3KGy) gamma irradiated venom (Plasma recalcification time)**

The clotting time of native, 1.5 and 3 KGy gamma irradiated venom at 200 µg/ml was 4.8, 16.8 and 26.6 seconds. The clotting time of native, 1.5 and 3 KGy gamma irradiated venom at 1 µg/ml was 49.4, 101.6 and 127.8 seconds (Table 5, Figure 9). The coagulant properties of *Echis Coloratus* snake venom was concentration dependant. As the concentration of the snake venom was increased, the clotting time was reduced indicating that the crude venom has a coagulant effect. The two doses of gamma irradiation (1.5 KGy and 3 KGy) decreased the coagulant activity of the venom.

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*Moav et al. (1963)* reported that *Echis Coloratus* venom contains both coagulant and anti-coagulant components. Also, *Kornlik and Blomback (1975)* reported that *Echis Coloratus* venom is a potent coagulant. *Rogero and Nascimento (1995)* used gamma rays to detoxify *Bothrops jararaca* venom and noticed attenuation of coagulant activities.

This results was in agreement with the results reported with *Al-Saleh et al. (2002)* who investigated the effect of *Echis Coloratus* crude venom on blood coagulation and it showed

a concentration dependant strong coagulant effect, as the concentration of the snake venom was increased, the clotting time was reduced. Moreover, *Al-Sadoon and Fahim (2012)* tested the effect of LD<sub>50</sub> of *Echis Coloratus* venom in male albino rats on blood parameters; platelet count recorded a significant rise compared to the control within one hour.

Also, *Lucas de Oliveira et al. (2007)* examined the anti-coagulant activity of *Bothrops jararaca* venom in vivo, goats were divided into two groups; one group inoculated with 0.5mg/Kg of crude venom and another group inoculated with 0.5mg/Kg of irradiated venom. The native venom was anticoagulant and recorded a clot formation after 55 min after one day of inoculation, while the clotting time was reduced to only 10 min after one day of inoculation by the irradiated venom.

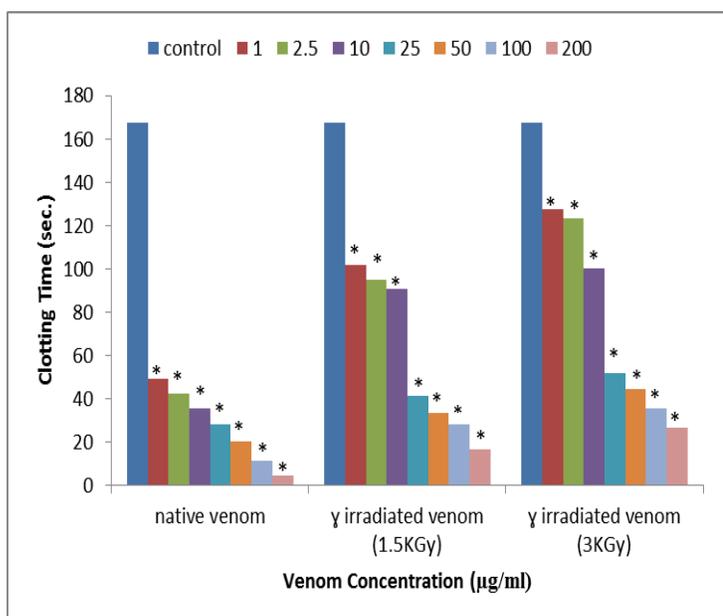
Most vipers have been shown to have strong coagulant activity, this is may be due to indirect effects on blood components through stimulation of epinephrine release and/or direct effects on blood components especially those acting at earlier steps may yield normal thrombin and thus activate platelets (*Bertke and Atkins, 1961*). Since platelets can facilitate coagulation, effects of venoms on platelets may explain in part the ability of the venoms to induce thrombosis and coagulopathies such as disseminated intravascular coagulation (*Mukherjee et al., 2000*). According to (*Tans and Rosing, 2001*) the coagulopathy effect seen by *Echis Coloratus* venom could act through pro-coagulant activation of prothrombin and blood factor X.

**Table (5): Effect of different concentration of native, (1.5 and 3 KGy) gamma irradiated venom on the clotting time of the plasma:**

Venom (µg/ml) Group	Clotting time in seconds						
	200	100	50	25	10	2.5	1
Normal(non- envenomed)	167.8±0.58	167.8±0.58	167.8±0.58	167.8±0.58	167.8±0.58	167.8±0.58	167.8±0.58
Native venom	4.8±0.21*	11.4±0.35*	20.2±0.56*	28.4±0.45*	35.8±0.32*	42.2±0.44*	49.4±0.68*
(1.5KGy) γ Irradiated venom	16.8±0.46*	28.2±0.79*	33.4±0.67*	41.6±0.81*	90.6±0.37*	94.8±0.65*	101.6±0.56*
(3KGy) γ Irradiated venom	26.6±0.33*	35.4±0.46*	44.6±0.46*	52±0.39*	100.4±0.28*	123.2±0.92*	127.8±0.83*

Each value represents Mean ± S.E

\* Significant difference from normal group (P ≤ 0.05).



**Figure (9):** Effect of different concentration of native, 1.5 KGy and 3 KGy gamma irradiated *Echis Coloratus* snake venom on the clotting time of the plasma in seconds.

\* Significant difference from normal group ( $P \leq 0.05$ ).

#### IV. CONCLUSION

This study shows that gamma radiation is a venom detoxification method that keeps the immunological aspects and this help to solve the toxic problems of using native venom in immunizing animals and have the advantage of extend the lifespan of the animals. So, this study confirms that gamma radiation is a powerful tool for having effective, safe and cheaper antivenin using the crude venom.

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# Induction of Flowering in Texas Early Grano Onion Cultivar Using Vernalization and Gibberellic Acid under Gezira State Conditions, Sudan

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**Abstract:** Field experiments were conducted at the research farm of the Faculty of Agricultural Sciences, University of Gezira, Wad Medani, Sudan, during seasons of 2008 to 2010. Treatments consisted of vernalization periods, which ranged from 30 to 180 days, vernalization temperatures of zero to 14° C and gibberellin concentrations ranging from zero to 600 ppm. Results indicated that vernalization temperatures of 4 to 5° C for 90 days or more was the key factor for the induction of flowering in Texas Early Grano cultivar. Application of GA3 alone, without vernalization, at all concentrations tested failed to induce flowering. However, the highest bolting percentage and seed yield were obtained by a combination of vernalization at 4 to 5° C for 180 days and the application of GA3 at the rate of 600 ppm. It is recommended to vernalize bulbs of “Texas Early Grano” cultivar at 4 to 5° C for 180 days with the application of GA3 at the rate of 600 ppm for seed production under Gezira conditions.

**Index Terms:** Onion, bolting, vernalization and gibberellin acid.

## I. INTRODUCTION

olting, or seedstalk development, of onion (*Allium cepa* L.) is important for both bulb and seed production. Plants which bolt do not produce marketable bulbs, but seed yields are directly dependent on flower induction and bolting. Onion requires low temperatures or vernalization for flower induction. In most regions, the mother bulbs of spring-sown cultivars are held in cold storage to fulfill their chilling requirement and then planted in the spring to produce the seed crop. Several workers have reported that optimum duration to fully vernalize onion cultivars at low temperatures (3–11° C) are in the range of 7–90 days [17]; [11]; [14]; [13]; [1]; [12]; [15]). Flowering in bolting resistant cultivars may be particularly difficult and long treatment at low temperature or large bulb size may be required [16]. Although a great deal of work has been reported on the incidence of bolting, no work appears to have been carried out to study the relation between seed yield in onion sets and their chilling requirements.

The introduced cultivar “Texas Early Grano” is widely grown and consumed in the Sudan as a salad crop due to its mild and pleasant taste and low pungency. While seeds of all land races are produced locally, seeds of “Texas Early Grano” have to be imported from western seed companies. Bulbs of “Texas Early Grano” failed to bolt when grown for seed production in the Sudan. The bulbs need to be subjected to low temperatures (vernalization) to initiate seed stalk formation. The vernalization requirements cannot be satisfied due to the mild winter of the Sudan. Therefore, there is an urgent need to look for other methods that can mimic the effect of low temperature for floral induction of “Texas Early Grano”. The present study aims to test the effects of vernalization, Gibberellic acid and their combinations on seed production of “Texas Early Grano” onion cultivar under Gezira State conditions, Sudan.

## II. MATERIALS AND METHODS

Field experiments were conducted during the winter seasons of 2008/09 and 2009/10 in the research farm of the Faculty of Agricultural Sciences, University of Gezira, Wad Medani, Sudan (lat. 14° 25' N, longitude 33° 30' E). The soil is a heavy cracking clay with a pH of 8.3 and low soluble salts (EC = ds/m). The climate is tropical with hot summers (21 – 41°C) and mild winters (14 - 33°C). Day length is about 11 hours during the winter season and vernalization temperature ranged from zero to 14°C. Two experiments were conducted to study the effects of vernalization periods 45, 90, 135 and 180 days, and/or application of different concentrations of gibberellic acid (0, 150, 300, 450 and 600 ppm) on the growth and development of the seed stalk of onion cultivar Texas Early Grano during autumn and winter seasons of 2008/09 and 2009/10.

## III. RESULTS

### Effects of vernalization period and levels of GA3 on bolting of onion during seasons 2008/09 and 2009/10.

The main effects of vernalization period and levels of GA3 on bolting of onion cultivar “Texas Early Grano” during seasons 2008/09 and 2009/10 are shown in tables 1 and 2. Vernalization period manifested highly significant effects on number of days to the

appearance of the seed stalk, number of florets per umbel, number of days to harvest seeds, length of the seed stalk, percentage of bolting and seed yield. Vernalization period also showed significant effects on number of seed stalks per plant and weight of one thousand seeds in both seasons. Our results indicated that the highest values of these parameters in both seasons were obtained with the vernalization period of 180 days followed by 135 days. Vernalization period of 180 days in both seasons markedly resulted in the lowest number of days to the appearance of seed the stalk (40.8 and 34.7 in both seasons, respectively), the lowest number of days to harvest seeds (71.3 and 105.9 in both seasons, respectively) and the longest seed stalks. Moreover, it recorded the highest values of seed stalks per plant, number of florets per umbel, percentage of bolting, weight of one thousand seeds and seed yield per hectare as compared with other vernalization periods (45, 90 and 135 days). [5], [6], [7], [9], [10] and [8] obtained similar results. They showed that onion bulbs stored in temperatures of 2 to 7 °C for 90 to 180 days resulted in earlier flowering, highest number of seed stalks per plant, largest seed stalks, highest number of florets per umbel, highest percentage of bolting and the highest seed yield.

Different levels of GA3 showed highly significant effects on number of days to the appearance of the seed stalks, number of seed stalks per plant, number of florets per umbel, number of days to harvest seeds and percentage of bolting, and showed significant effects on length of seed stalk and one thousand seed weight during season 2008/09. During season 2009/10 it showed significant effects on number of days to the appearance of the seed stalk, number of seed stalks per plant, and showed highly significant effects on number of florets per umbel, number of days to harvest seeds, percentage of bolting and one thousand seed weight, and showed no significant effects on length of seed stalk. The results indicated that the highest responses of these parameters, in both seasons, were obtained with the application of GA3 at the levels of 300, 450 and 600 ppm. Similar results were obtained by [2] who studied the effect of three growth regulators including GA3 at 25, 50 and 75 ppm on seed production of onion. They found that GA3 increased length of flower stalks, number of flowers per plant and seed yield per plant but the highest seed yield was obtained with the application of GA3 at 75 ppm.

**Table 1. The main effects of vernalization period and levels of GA<sub>3</sub> on bolting of onion cultivar “Texas Early Grano” during season 2008/09.**

Means within columns followed by the same letter(s) are not significantly different at P≤0.05 level according to Duncan’s Multiple Range Test.

\*, \*\* and NS indicate significance at P≤0.05, 0.01 and not significant, respectively.

Vernalization period (days)	No of days to the appearance of the seed stalk	No of seed stalks/ plant	No of florets/ umbel	No of days to harvest seeds	Length of seed stalk (cm)	Bolting (%)	Weight of 1000 seeds (g)	Seed yield (kg/ha)
45	0	0	0	0	0	0	0	0
90	58.9 a	1.4 (1.4) b	149.3 c	83.6 a	56.3 c	38.4 c	3.8 b	8.7 c
135	48.6 b	1.7 (1.5) b	153.2 b	71.3 b	62.2 b	82.3 b	3.8 b	39.0 b
180	40.8 c	2.2 (1.6) a	170.0 a	72.1 b	66.0 a	94.8 a	4.1 a	71.4 a
Significant level	**	*	**	**	**	**	*	**
GA <sub>3</sub> level (ppm)								
0	53.0 a	1.7 (1.4) bc	137.2 e	80.7 a	59.9 c	64.4 d	3.8 ab	41.5 b
150	51.1 b	1.4 (1.3) c	164.5 b	77.1 b	60.9 bc	72.3 c	3.7 b	43.4 a
300	48.9 c	2.2 (1.6) a	146.3 d	75.8 c	63.6 a	71.4 c	4.0 a	39.1 c
450	46.7 d	1.7 (1.5) bc	156.3 c	72.0 d	61.4 b	77.1 a	4.1 a	31.6 d
600	47.6 d	1.9 (1.6) ab	183.1 a	72.9 d	61.8 b	74.1 b	3.9 a	42.8 a
Sig. level	**	**	**	**	*	**	*	**
C.V (%)	12.11	20.97	23.91	7.02	11.77	9.99	8.43	11.92

Numbers between two brackets indicate transformed data.

**Table 2. The main effects of vernalization period and levels of GA<sub>3</sub> on bolting of onion cultivar “Texas Early Grano” during season 2009/10.**

Vernalization period (days)	No of days to the appearance of the seed stalk	No of seed stalks/plant	No of florets/umbel	No of days to harvest seeds	Length of seed stalk (cm)	Bolting (%)	Weight of 1000 seeds (g)	Seed yield (kg/ha)
45	0	0	0	0	0	0	0	0
90	58.7 a	1.5 b	117.8 c	148.8 a	55.9 c	42.3 c	3.8 b	9.0 c
135	47.1 b	2.2 a	144.8 b	126.2 b	65.7 b	82.2 b	3.9 b	45.8 b
180	34.7 c	2.6 a	242.9 a	105.9 c	67.8 a	93.8 a	4.3 a	76.0 a
Significant level	**	*	**	**	**	**	*	**
GA <sub>3</sub> level (ppm)								
0	49.6 a	1.8 b	136.3 c	135.6 a	61.6	69.8 c	3.5 c	46.6 b
150	46.3 b	2.0 ab	166.7 b	125.3 b	62.3	69.7 c	3.8 b	47.7 a
300	45.7 b	2.3 a	179.9 a	123.9 c	64.2	74.4 b	4.0 b	43.0 c
450	46.2 b	2.2 a	179.6 a	124.0 c	64.2	74.0 b	4.4 a	34.4 d
600	46.4 b	2.1 ab	180.1 a	126.2 b	63.2	75.8 a	4.4 a	46.6 b
Sig. level	*	*	**	**	NS	**	**	**
C.V (%)	7.44	26.45	22.14	5.31	6.62	14.53	5.50	14.3

Means within columns followed by the same letter(

s) are not significantly different at P≤0.05 level according to Duncan’s Multiple Range Test.

\*, \*\* and NS indicate significance at P≤0.05, 0.01 and not significant, respectively.

**Interaction effects of vernalization period and levels of GA3 on bolting of onion during seasons 2008/09 and 2009/10.**

The interaction effects of vernalization period and levels of GA3 on bolting of onion cultivar “Texas Early Grano” during seasons 2008/09 and 2009/10 are presented in tables 3 and 4, respectively. Results showed significant interaction effects of vernalization period and levels of GA3 on all parameters except number of seed stalks per plant in both seasons. The earliest flowering (35.3.8 and 32.2 days) and seed harvesting (67.8 and 97.3 days), highest values of florets per umbel (203.5 and 268.7), percentage of bolting (98.3% and 98.5%) and seed yield per hectare (86.5 and 92.9 kg) were obtained by the vernalization period of 180 days with the application of GA3 at the level of 150 ppm in both seasons. On the other hand, the longest seed stalks (68.3 and 68.9 cm) were obtained by the vernalization periods of 90 and 180 days with the application of GA3 at the levels of 300 ppm and 450 ppm in both seasons, respectively. The highest weight of one thousand seeds (4.5 and 4.6 g) was obtained by the vernalization periods of 135 and 180 days with the application of GA3 at the levels of 450 and 600 ppm in both seasons, respectively. The variation in the results of seed stalk length during both seasons could be attributed to the effect of the environment, since the genotypes used were identical. [3] and [4] demonstrated that the seed stalk elongation rate was increased by long photoperiods and higher temperatures. Since the photoperiod during the two seasons was the same, the differences in length of the seed stalk could only be attributed to differences in temperature.

**Table 3. Interaction effects of vernalization period and levels of GA<sub>3</sub> on bolting of onion cultivar “Texas Early Grano” during season 2008/09.**

Treatments		No of days to the appearance of the seed stalk	No of seed stalks/plant	No of florets/umbel	No of days to harvest seeds	Length of seed stalk (cm)	Bolting (%)	Weight of 1000 seeds (g)	Seed yield (kg/ha)
Vern. period (days)	GA <sub>3</sub> levels (ppm)								
90	0	60.8 b	1.0 (1.2)	149.3 f	91.3 a	63.6 d	30.3 k	3.4	8.6 j
	150	64.2 a	1.0 (1.2)	153.5 def	89.8 a	65.4 bcd	38.1 j	3.7	8.2 j
	300	59.5 b	1.5 (1.4)	155.0 de	83.0 b	65.6 bcd	43.9 h	4.1	7.7 j
	450	51.3 d	1.8 (1.5)	198.2 ab	76.7 cd	68.3 a	39.2 ij	3.9	9.3 j
	600	58.8 b	1.7 (1.5)	194.0 b	77.3 c	67.2 ab	40.8 i	3.8	9.6 j
135	0	52.0 cd	2.1(1.6)	131.0 h	74.8 d	59.3 e	72.6g	4.0 b	39.6 g
	150	53.8 c	1.9 (1.5)	157.8 d	72.0 e	60.5 e	80.7 e	3.9 b	35.6 h
	300	44.0 g	2.8 (1.8)	126.2 h	72.5 e	66.4 abc	75.7 f	3.9 b	47.0 f
	450	47.8 e	1.7 (1.4)	104.8 i	71.5 e	60.8 e	95.8 b	4.5 a	33.0 i
	600	45.5 fg	2.6 (1.7)	139.7 g	72.3 e	64.1 cd	86.9 d	4.3 ab	40.0 g
180	0	46.3 ef	1.8 (1.5)	131.3 h	75.8 cd	56.9 fg	90.4 c	4.1 ab	76.4 c
	150	35.3 j	1.2 (1.2)	203.5 a	67.8 f	56.7 fg	98.3 a	3.3 c	86.5 a
	300	43.3 g	2.3 (1.6)	200.3 a	75.3 cd	58.7 ef	94.6 b	4.0 b	62.7 d
	450	40.8 h	1.5 (1.4)	166.0 c	69.0 f	55.2 gh	96.3 ab	3.9 b	52.7 e
	600	38.3 i	1.7 (1.5)	151.7 ef	69.0 f	54.1 h	94.6 b	3.9 b	78.9 b

Sig. level	**	NS	**	**	**	**	*	**
C.V (%)	12.11	20.97	23.91	7.02	11.77	9.99	8.43	11.9

Means within columns followed by the same letter(s) are not significantly different at  $P \leq 0.05$  level according to Duncan's Multiple Range Test.

\*, \*\* and NS indicate significance at  $P \leq 0.05$ , 0.01 and not significant, respectively.

Numbers between two brackets indicate transformed data.

**Table 4. Interaction effects of vernalization period and levels of GA<sub>3</sub> on bolting of onion cultivar "Texas Early Grano" during season 2009/10.**

Treatments		No of days to the appearance of the seed stalk	No of seed stalks/plant	No of florets/umbel	No of days to harvest seeds	Length of seed stalk (cm)	Bolting (%)	Weight of 1000 seeds (g)	Seed yield (kg/ha)
Vern. period (days)	GA <sub>3</sub> levels (ppm)								
90	0	61.3 a	1.0	79.2 i	154.7 a	49.3 g	28.4 k	3.1 c	6.8 j
	150	59.0 b	1.3	107.2 h	149.3 b	57.6 f	41.1 j	3.6 bc	8.5 ij
	300	57.7 b	1.8	111.2 h	148.2 bc	57.1 f	44.4 i	3.9 b	9.9 i
	450	57.8 b	1.8	141.3 f	145.8 d	57.0 f	51.7 h	4.2 ab	10.1 i
	600	57.7 b	1.7	150.3 e	146.2 cd	58.3 f	46.0 i	4.1 ab	10.0 i
135	0	48.5 c	1.8	121.7 g	131.0 e	66.9 bcd	86.3 d	3.5 bc	50.8 e
	150	47.8 cd	2.2	124.3 g	129.2 e	63.9 e	74.8 g	3.7 b	41.8 g
	300	46.3 d	2.3	165.2 d	123.8 f	66.5 cd	87.5 d	3.8 b	52.9 e
	450	46.7 d	2.3	161.8 d	123.5 f	67.6 abc	79.3 f	4.1 ab	37.0 h
	600	46.3 d	2.2	150.8 e	123.7 f	63.8 e	83.0 e	4.4 a	46.6 f
180	0	38.8 e	2.5	208.0 c	121.0 g	68.6 ab	94.6 b	3.9 b	82.1 b
	150	32.2 h	2.5	268.7 a	97.3 k	65.4 de	98.5 a	4.6 a	92.9 a
	300	33.2 gh	2.8	263.5 a	99.8 j	68.9 a	91.5 c	4.4 a	66.0 c
	450	34.2 fg	2.5	235.5 b	102.7 i	68.2 abc	91.3 c	4.5 a	56.0 d
	600	35.2 f	2.5	239.0 b	108.7 h	67.8 abc	93.1 bc	4.5 a	83.1 b
Sig. level	**	NS	**	**	**	*	*	**	
C.V (%)	7.44	26.45	22.14	5.31	6.62	14.53	5.50	14.3	

Means within columns followed by the same letter(s) are not significantly different at  $P \leq 0.05$  level according to Duncan's Multiple Range Test.

\*, \*\* and NS indicate significance at  $P \leq 0.05$ , 0.01 and not significant, respectively.

#### IV. CONCLUSIONS

Seeds of onion cultivar “Texas Early Grano” can be successfully produced by vernalization at temperatures of 4 to 5° C for a period of 180 days at Gezira conditions. Application of GA<sub>3</sub> alone, without vernalization, at all concentrations tested failed to induce flowering of onion cultivar “Texas Early Grano” when planted off season but it enhanced the effect of vernalization on bolting and seed production. Future research work is needed to test the ability of GA<sub>3</sub> to induce flowering on non-vernalized bulb of the onion cultivar “Texas Early Grano” at the main season of onion seed production.

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# Undergraduate Chemistry Students' awareness towards Web Based Instruction (WBI) in Chemistry

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**Abstract-** Web-Based Instruction (WBI) brings a number of benefits to individuals requiring a combination of specific learning patterns and program structure. Using Web-based learning to enhance student's marketing education is inevitable nowadays. Technological development provides many opportunities for ethics education to be interesting, stimulating and effective. It is vital that academics make the time and commitment to prepare meaningful course material and accounting departments need to support such initiatives through appropriate resources. Online learning pedagogy may be superior in its overall effect on student performance. Student interest, in online, web-based courses, may also be improved by providing direct video training modules featuring students who have taken online, web-based courses. Web-based instruction is in high demand, from both corporations using it for employee training and educational institutions interested in meeting student needs. There are many different methods utilized to deliver web-based instruction, there are also many different theories and purposes for designing the methods. As a result of the advantages and easy learning process of WBI through technology designed programmes. In web based instruction, students' interests and needs vary greatly when compared with the traditional learning approaches. This paper attempts to find out the undergraduate chemistry students' awareness towards web based instruction (wbi) in chemistry. Survey method was adopted in this study. The sample consists of 74 students; of which 34 were from government college and 40 were from Private college. A tool on questionnaire was used to collect data. The findings of the study served to generate recommendation to help undergraduate students in ariyalur district to optimise WBI method practices and enhance the educational quality and outcomes. Overall this study affirms that WBI has the potential to offer excellent learning and learning ability increases for the physical, organic and inorganic chemistry among undergraduate students.

**Index Terms-** Awareness, web- based instruction, chemistry, underdraduate students.

## I. INTRODUCTION

The World Wide Web has become a widely available platform for educational application. Web based applications can provide an interactive learning environment where students build up their own knowledge. However, web is often limited in guidance, navigation support and application of instructional strategies (Fethi Ahmet Inan & et al.,2004).Nowadays many educational institutions have embraced online education to cater for flexible and student-centered learning. Through online

education, students have an opportunity to gain an education at their own convenience, in terms of time and place (Crystal Chun Yun Lau, 2008).Technology has provided opportunities for online assessment to be more learner-centred to promote self-directed learning, and to increase learner autonomy (Liang Xin & et al., 2004). Initiative is to sustain the evolution from traditional teaching to active learning and to better integrate the increasing number of educational resources available online (Denis Gillet & et al., 2005). The development of Web-based instructional programs, with the final goal being to create programs that can be tailored to the preferences associated with each cognitive style (Sherry Y. Chen & et al., 2004). WBI offers students opportunities for interaction leading to engagement and active learning experiences. These strategies support and improve performance. The access to, availability of, and interaction in WBI encourages students to be more interested in learning (Mohammed Saleh Albalawi, 2007). Improvement among students learning online exceeded that of students learning face to face (John M. Wiecha, 2006). Student-centered online learning nor restructured into modules to create flexibility (Elmarie Engelbrecht, 2005).Web-based instruction are addressed, by identifying teaching and learning strategies that support differential treatment of learners in terms of content and process (Jonathan Foster & et al., 2003). The web-based learning have an approach in helping the learner not just get the right answer but understand the path to that answer through self discovery and the taking advantage of the web's resources (Valentina Terzieva, & et al., 2004). Online interaction can be used to enhance learning, especially for students who tend to be reserved in the classroom setting. In developing online courses, we should realize that some courses may be more challenging to students who persist in the online environment (Anna Ya Ni, 2003). The purpose of this study therefore was to investigate the undergraduate chemistry students' awareness towards web based instruction (wbi) in chemistry in order to proffer useful suggestions.

## Rationale of the study

According to Norman Mathew & et al., (2000) WBI can be used to meet the needs of a more diverse student group. Typical classes consist of students with varying abilities and previous knowledge, and WBI can help a teacher address these differences. WBI also allows students to work on this own pace that is more comfortable - some students work faster than their peers while others may wish to take longer. In addition, the use of WBI provides the opportunity for multiple grade levels to be accommodated in the same classroom at the same time.

Web-based Instruction is in its infancy. There is much research to be done, both in terms of our knowledge of learning and in Web-based Instruction. Using Web-Based instruction

(WBI) is all of these things, but it is also pedagogically sound because it allows teachers to spend more time working with students in small groups and individually. WBI can begin to offer a variety of paths through the curriculum and offers students a self-paced learning environment, thus providing students with a sense of control over their learning. In addition, Web-Based Instruction facilitates multiple levels of instruction in one room with a single teacher. If implemented on the World Wide Web, students can have access to instructional materials at home. Because the instructional materials are stored and distributed electronically, Web-Based Instruction is also environmentally friendly, and there are not the management issues associated with paper-based instruction such as duplicating, revising, filing, and picking up after students. Students who miss school are also able to go to a Web site and find instructional materials they missed during their absence.

The widespread growing ubiquity of media technology has heightened the remarkable changes in higher education over a period of time. Successful technology-mediated teaching-learning has already created new trends and impact on students' learning motivation and on emerging new models of pedagogy. Technology in education has accelerated and promoted students' 21st century literacy skills related to workplace needs (Hussain Ahmed Liton, 2015).

#### Objectives of the study

The following are the objectives of this study

1. To assess the level of undergraduate chemistry students' awareness towards WBI in chemistry.

2. To find out the difference, if any in the awareness on WBI among the tertiary level students with respect to the factors like gender and locality.
3. To find out whether there exists any significant difference between use of WBI method among undergraduate students with respect to their
  - (i) access the computer and
  - (ii) e-mail usage Research Questions

#### Research Questions

- (i) Is there any relationship between the locality and the awareness of WBI among undergraduate students?
- (ii) Is gender plays any role in the awareness of WBI?
- (iii) Do the students who use e-mails for their communication performed better in WBI?
- (iv) Do computer accessibility have any impact on WBI?

## II. METHODS AND MATERIALS

Survey method was adopted in this study in order to find out the awareness of WBI in chemistry. The sample of the study were 74 final year chemistry under graduate students in Ariyalur District, in the Academic Year 2013-2014. In this sample, 34 Chemistry students were from government college, and 40 Chemistry students were from a private college. Questionnaire was developed by the investigator with 20 questions to assess the awareness of WBI.

S.No	ITEMS
1.	Do you use Internet daily?
2.	Do you think web based instruction is effective for learning physical chemistry?
3.	Do you think web based instruction is effective for learning organic chemistry?
4.	Do you think web based instruction is effective for learning inorganic subject?
5.	Do you think web based instruction is effective for learning analytical chemistry?
6.	Do you feel comfortable while browsing in the web?
7.	Are you interacted to learn your subject through the web?
8.	Do you think web based tool enhances your computer skills?
9.	Do you believe web based instruction useful?
10.	Does your college have infrastructure to use web based instruction?
11.	Do your professors to teach through web based in their classroom practice?
12.	Does web based instruction help to improve your learning skills?
13.	Do you like to learn through web?
14.	Are you satisfied with the information provided in the web?
15.	Do you navigate easily through the websites related to chemistry?
16.	Do you think you can get more knowledge through web?
17.	Does web based instruction enhance students motivation in learning chemistry?
18.	Do you think web based instruction provide instructional resource throughout the world?
19.	Do you learn all the contents from the web?
20.	Are you choose different contents based on their web?

#### Research question.1

Is there any relationship between the locality and the awareness of WBI among undergraduate students?

**Table.1 Undergraduate chemistry students’ awareness of WBI by urban and rural area of male and female students**

Urban(34)						Rural(40)					
Male(10)			Female(24)			Male(11)			Female(29)		
Yes	To Some Extent	No	Yes	To Some Extent	No	Yes	To Some Extent	No	Yes	To Some Extent	No
52	40	8	54	40	6	64	30	6	54	32	14

Table no.1 shows that as many as 52% male students and 54% of female students reported yes, 40% of male and 40% of female students to some extent, 8% of male and 6% of female students expressed no in urban area. But 55% of male and 52% of female students said yes in rural area, 36% of male 38% of female students to some extent, 9% of male and 10% of female students expressed no in rural area.

**Research question.2**

Is gender plays any role in the awareness of WBI?

**Table.2 Awareness of WBI by male and female undergraduate chemistry students**

Sample	% of use of WBI by gender					
	Male(21)			Female(53)		
	Yes	To Some Extent	No	Yes	To Some Extent	No
74	58	34	8	52	36	12

Table no.2 shows that as many as 58% of male and 52% of female students said yes, 34% of male and 36% of female students to some extent towards the access of computer. While 8% of male and 12% of female students revealed that they did not have awareness on WBI.

**Research question.3**

Do the students who use e-mails for their communication performed better in WBI?

**Table.3 Use of e-mails by undergraduate chemistry students**

Sample	Use of e-mails in %			
	Male(21)		Female(53)	
	Yes	No	Yes	No
74	100	-	98	2

It can be seen from the table.3 that as many as 100% of male and 98% of female students responded that they use e-mails for their communication .While 2% of female students revealed that they did not use e-mails for communication.

**Research question.4**

Do computer accessibility have any impact on WBI?

**Table.4 Computer access by undergraduate chemistry students**

Sample	Computer accessibility in %			
	Male (21)		Female (53)	
	Home	College	Home	College
74	90	10	85	15

Table no.4 shows that 90% of male and 85% of female students have access to the computer at home. While 10% of male and 15% of female students revealed that they access the computer in college.

### III. MAJOR FINDINGS OF THE STUDY

The following are the major findings of the study,

- Male tertiary level students outperformed the female students in terms of their awareness in WBI in chemistry.
- Female students have less computer access than the male students.
- It is also observed that male tertiary level students performed better than the female students in terms of using e-mails.
- Rural area male and female students were better than urban area male and female students in terms of their awareness of WBI in chemistry.

### IV. DISCUSSION

Vehbi Turel (2013), Margarete Imhof & et al., (2007) studies showed the participants have high computer self-efficacy perceptions, their level in certain programs is good, and they often use computers for a wide range of purposes. The present investigation also access of computer in chemistry learners is high.

Margarete Imhof & et al., (2007) revealed that the male students were better than the female students in the use of e-mails. Present study also go in line with these result.

### V. RECOMMENDATIONS FOR POLICY MAKING

The main focus of the study was to evaluate the level of undergraduate chemistry students' awareness towards WBI in chemistry.

- Workshops should be organized on WBI to create awareness among students..
- Tertiary level teachers should undergo training programme, to update their knowledge on WBI.
- Students also be trained to use the WBI for effective learning.

### VI. CONCLUSION

Due to advancement of technology, usage of websites is inseparable an unavoidable in everyone's life especially for college students. So topic taken create awareness about WBI among UG students, which are helpful for mastery learning and research purpose.

A central issue in chemistry education is the relation between the macroscopic or real world and the molecular or nanoscopic world. New students could better understand chemistry and apply their chemistry understanding to solve problems if they were able to make deeper connections between these worlds. Animations can be used in chemical education so that students get a better knowledge of molecular processes by making better relations between the macroscopic and the nanoscopic world (Han Vermaat & et al., 2003).

Hence this study created awareness on WBI which may helpful for them to update the knowledge, skills and learning ability of undergraduate chemistry students.

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# Effects of Different Substrates on Vermicomposting Using *Eudrilus Eugenia* on the Growth of *Vinca Rosea*

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**Abstract-** Vermicompost are produced by the breakdown of organic waste which results in rich microbial diversity and it has many nutrients that support the plant growth. Vermicomposting is increasingly popular in diverse aspects including recycling of organic waste, efficient nutrient supplier for plant growth. The present study was conducted to investigate the effect of different substrates such as kitchen waste, coir pith and rice straw on the production of vermicompost. These vermicompost were assessed for nutrient values and subjected to studies on the growth of *Vinca rosea*. The temperature of the composting material ranges from 22° C to 35°C, pH was between 5.5 -9 , moisture content of the composting was recorded as 40% - 56%. The nutrient analysis reported that high amount of Total Organic Carbon(TOC) is in coir pith vermicompost i.e about 0.43% -0.63% ,The total phosphorus and available phosphorus are high in rice straw compost about 0.065 and 0.55% on the 75<sup>th</sup> day. The total kjedhal nitrogen was about 1.42% in the kitchen waste obtained on the 45<sup>th</sup> day. The result indicated that vermicompost is a good biofertilizer and showed better growth patterns in *Vinca rosea* cultivated by the vermicompost prepared using coir pith.

## I. INTRODUCTION

Non-conventional sources of amending organic matter status of soil are acquiring much attention because of their easy availability, prompt response and feasibility in using over large area in less time (Hossein Moradi et al, 2014). But incase of inorganic fertilizer leads to an increased risk of burning the plants, leaching, affects the water tables, build up toxic salt concentration in the soil. Excessive use of inorganic fertilizer creates environment related problems and situation can be improved by biofertiliser (Saadatnia and Riahi, 2009). This problem leads the way for using Vermicomposting (organic fertilizer). India has estimated potential of producing about 4.3 million tonnes of compost each year. Organic matter constitutes 35%–40% of the municipal solid waste generated in India. Composting using worms known as Vermicomposting gives a better product than composting due to enzymatic and microbial activity (Bajsa et al, 2003). Vermicompost is homogenous, contains many plant growth hormones and soil enzymes, which enriches microbial populations and tending to hold more nutrients over longer periods without adverse impacts on the environment (Ndegwa et al, 2001). It has tremendous prospects in converting agro-wastes and city garbage into valuable agricultural input. Vermicast also serves as a very good fertilizer and soil conditioner. The type of substrate and species used for Vermicomposting plays a significant role in plant growth and yield. Most commonly used substrates are cowdung, industrial

wastes, agricultural residues etc.. The amount of soil nitrogen increased significantly after incorporating Vermicomposts into soils (Sreenivas, 2000; Kale, 1992; Nethra, 1999) and the amounts of P and K available also increased (Venkatesh, 1998). It has many applications such as increases water holding capacity of soil, improves crop growth and yield, improves physical, chemical and biological properties of soil and production of plant growth regulator. It proves to be the most promising high value biofertilizer, pollution free and cost effective. Earthworms are also multiplied and the excess earthworm can be used as a vermiprotein and used as a feed for poultry, fish etc. Vermiwash can also be used as a spray. In the present study different substrates such as kitchen waste, coir pith, and rice straw were used for preparing the Vermicompost. Their effects were studied as a organic fertilizer in the growth of *Vinca rosea*. Their physiological and nutritive properties of the composted waste was also analysed.

## II. METHODOLOGY

### Sample collection

The substrates for the Vermicomposting such as kitchen waste, Coir pith, Rice straw are collected from Stella Maris Hostel Kitchen, Chennai; Alagar biotech, Vettuvankeni, Uthandi, Chennai; Luz church road, Alwarpet, Chennai respectively.

### Experimental setup

The experimental set up has six plastic trays for Vermicomposting with a size of 30 cm × 11 cm × 5 cm and covered with drapery with micro holes. Kitchen waste, coir waste and rice straw were collected. The trays were setup for Vermicompost as follows:

### SETUP OF VERMICOMPOSTING TRAYS

**Table:1 Setup of Vermicomposting trays**

Layer of gravel	Garden soil	Decomposed material	Cow dung	Kitchen waste
Layer of gravel	Garden soil	Decomposed material	Cow dung	Coir pith
Layer of gravel	Garden soil	Decomposed material	Cow dung	Rice straw
Layer of gravel	Garden soil	Decomposed material	Cow dung	Kitchen waste (control)

Layer of gravel	Garden soil	Decomposed material	Cow dung	Coir pith (control)
Layer of gravel	Garden soil	Decomposed material	Cow dung	Rice straw (control)

The composting was prepared using hand sorting method (Walton 1993). The physico-chemical and biological characters were monitored during Vermicomposting at periodic intervals (15 days).

### PHYSIOLOGICAL PROPERTIES OF VERMICOMPOSTS

The physical properties of the Vermicompost such as pH, temperature, moisture content was evaluated. 5g of soil was weighed which was suspended in 10ml of distilled water, shaken for 30 minutes and pH of the supernatant was measured using pH meter and the temperature was determined using thermometer. The moisture content of the soil was determined by comparing the wet soil with dried soil after 24 hours of incubation. The percentage of moisture content was determined by the formula given below.

$$\% \text{ moisture in soil} = \frac{\text{wet soil} - \text{dry soil}}{\text{dry soil}} \times 100.$$

### NUTRIENT ANALYSIS OF VERMICOMPOSTS

The total organic content in the compost was estimated using Walkley and Black method and it is calculated using the following formula:

$$\% \text{ of oxidizable organic carbon} = (\text{vol. of blank} - \text{Vol of sample} \times 0.3 \times \text{molarity})$$

$$\% \text{ Total Organic Carbon w/w} = 1.334 \times \% \text{ TOC}$$

The nitrogen content was estimated using Kjeldahl method (TKN) and calculated using the following formula:

$$\% \text{ of TKN} = (\text{S-B}) \times 0.02 \times (14 / \text{amount of sample})$$

$$\text{TKN} = (\text{S-B}) \times 0.02 \times (14 / \text{amount of sample})$$

The phosphorus content was estimated using Oleson method and calculated using the following formula:

$$\text{mg P/L} = \frac{\text{mg P (in approximately 58 mL final volume)} \times 1000}{\text{mL sample}}$$

### SEEDLING GROWTH OF *Vinca rosea*

*Vinca rosea* seeds were inoculated into the labeled trays supplemented with Vermicomposted soil and the biometric parameters such as root length, shoot length and number of

leaves were recorded on 10 days intervals. The germination percentage was calculated using the following formula:

$$\text{Germination percentage} = \frac{\text{No of seed germinated}}{\text{No of seed sown}} \times 100$$

Root length was measured from the ground level to the tip of the root (cm) and its shoot length was measured from the ground level to the shoot tip (cm).

### III. RESULT AND DISCUSSION

The present study was conducted to evaluate the efficiency of different substrates for preparing Vermicompost and its vital role in supplying essential nutrients that support the plant growth.

#### Physiological properties of Vermicompost

Earthworms are very sensitive to pH, thus pH of waste is sometimes a factor that limits the distribution, number and species of earthworms. Moisture level and temperature are the significant factor in the setup of a Vermicomposting unit. The different temperatures during composting are illustrated. The maximum temperature was on the 60<sup>th</sup> day of composting was 35° C and the temperature decreases to 28° C at the end of

75<sup>th</sup> day. Ansari (2000) reported that temperature during the process of Vermicomposting was observed to be  $28.26 \pm 2.19$  °C. the study also reported that the pH changes during composting process (60 days). The pH of the Vermicompost was acidic in the earlier stage of decomposing then it becomes neutral and at the end of the 45<sup>th</sup> day it was basic later it again comes to neutral pH at the 75<sup>th</sup> day. The percentage of moisture content increases to 56% on the 45<sup>th</sup> day and then decreases to 45% on the 75<sup>th</sup> day. Figure 1 shows the physical parameters of the Vermicomposted soil every 15 days at regular intervals.

#### Nutrient analysis of Vermicomposted soil

##### Total organic carbon

The highest values of organic carbon of kitchen wastes, coir pith, rice straw were obtained in 45<sup>th</sup> day and lowest values were obtained on the 15<sup>th</sup> day of Vermicomposting. Total organic carbon was very high in coir pith showing (0.63 %) compared to

other substrates (kitchen waste and rice straw). There has been a report which showed increase in organic carbon of kitchen waste Vermicomposted *E.eugeniae* which was 13.5% (Senthil and Chotu et al., 2008). In the study conducted by Elvira et al observed that about 20 to 42% loss of carbon as CO<sub>2</sub> takes place during vermicomposting of paper mill and dairy sludge. Figure 2 illustrates the total organic carbon of different substrates during Vermicomposting.

**Total phosphorus**

The total phosphorus content was very high in kitchen waste compared to other substrates. Available phosphorus of the kitchen waste was obtained in 30<sup>th</sup> day as 0.68% and the lowest values obtained in 15<sup>th</sup> day as 0.15%. Moreover as the time period increases during Vermicomposting, these parameters also increases Garg et al., (1988). The availability of phosphates was enhanced in vermicasts compared to non- ingested soil (Sharpley and Syers, (1978) due to increased solubility of P by high phosphatase activity. Table I illustrates the total phosphorus content of different substrates at 15 days intervals.

**Available phosphorus**

Available phosphorus was very high in kitchen waste compared to other substrates. Table II shows the available phosphorus content present in different substrates.

**Total kjeldhal nitrogen**

The highest values of nitrogen in kitchen was obtained on the 45<sup>th</sup> day (0.36%) and in the control (0.68%). The nitrogen content in the coir pith was noted to be 0.29% on the 45<sup>th</sup> day and in the control was found to be 0.52%. The highest values of total kjeldhal nitrogen of rice straw was noted to be 0.11% on the 45<sup>th</sup> day and in the control was found to be 0.54%.Total kjeldhal nitrogen was very high in kitchen waste compared to other substrates. Increased availability of N in worm casts compared to non- ingested soil has been reported by Tiwari et al., (1989). Bouch et al stated that the worm activity can increase the potential N mineralization rates and it accelerates the transformation of N, after increasing availability

**SEEDLING GROWTH OF *Vinca rosea***

The seedling growth of the *Vinca rosea* plant was measured in the control and in Vermicomposted soils. In control, growth of the plant increased from 2 to 7 cm in length. The plants which were grown in Vermicompost soils showed higher growth than the control.

**Growth of *Vinca rosea* using kitchen waste as substrate**

Height of the root, leaves and stem were measured for the test and control plant seedlings. In test plant, root height increased from 1 to 3.5 cm in length and in the control plant the root height increased from 0.5 to 2.5 cm in length. In test plant, leaves height increased from 0.5 to 3.5 cm and in the control plant the leaves height increased from 0.1 to 2 cm in length. Figure 3 shows the growth of the root of the plant *Vinca rosea* using kitchen waste as substrate in Vermicomposted soil. Figure 4 illustrates the growth of the stem of the plant *Vinca rosea* using kitchen waste Vermicompost. Figure5 shows the growth of the leaves of the plant *Vinca rosea* using kitchen waste Vermicompost.

**Growth of *Vinca rosea* using coir pith as substrate**

The plant seedlings grown using Vermicompost of coir pith substrate the height of the root,stem and length of the leaves were measured.The growth of the root increased from 1.3cm to 4.5 cm in length for the test and in control it is increased from 0.5 cm to 3.5 cm in length. In test plant, length of the leaves increased from 0.5 to 3.5 cm in length and in the control plant the leaf length increased from 0.1 to 2.7 cm in length.It was found that the length of the stem increases from 2 cm to 7cm in test and 1.5 cm to 4.5 cm in control. Figure6 shows the growth of the root of the plant *Vinca rosea* using coir pith substrate as a Vermicompost. Figure7 illustrates the growth of the leaves of the plant *Vinca rosea* using coir pith. Figure8 shows the growth of the stem of the plant *Vinca rosea* using coir pith.

**Growth of *Vinca rosea* using rice straw as substrate**

It resulted that the root increases from 1cm to 4 cm in length for the test and 0.5 cm to 3.5 cm for the control. The leaves length increases from 0.5 cm to 3.5cm in length for the test and 0.1cm to 2.6cm for the control and the stem height increase from 2.5cm to 6.5cm in length for the test and 1.5cm to 3.5cm for the control. Figure 9 shows the growth of the root of the plant *Vinca rosea* using rice straw substrate as a Vermicompost. Figure10 illustrates the growth of the leaves of the plant *Vinca rosea* using rice straw. Figure11 shows the growth of the stem of the plant *Vinca rosea* using rice straw as a substrate.

Growth of the plant *Vinca rosea* on different Vermicomposted substrates showed that height of the root, leaves and stem in kitchen waste found that the maximum growth reaches to 3.5 cm in length. In coir pith were the maximum growth reaches to 7 cm in length compared to rice straw the maximum growth reaches to 6.5 cm in length.

Plants grown by the application of Vermicomposted coir pith in different feed ratios with cow dung by both species of earthworms showed efficient growth than the control Vermicompost with only coir pith as substrate (Dash and Patra 1997). The present work also proved that the coir pith served as a better substrate in increase on the growth of root, height and leaves compared with kitchen waste and rice straw.

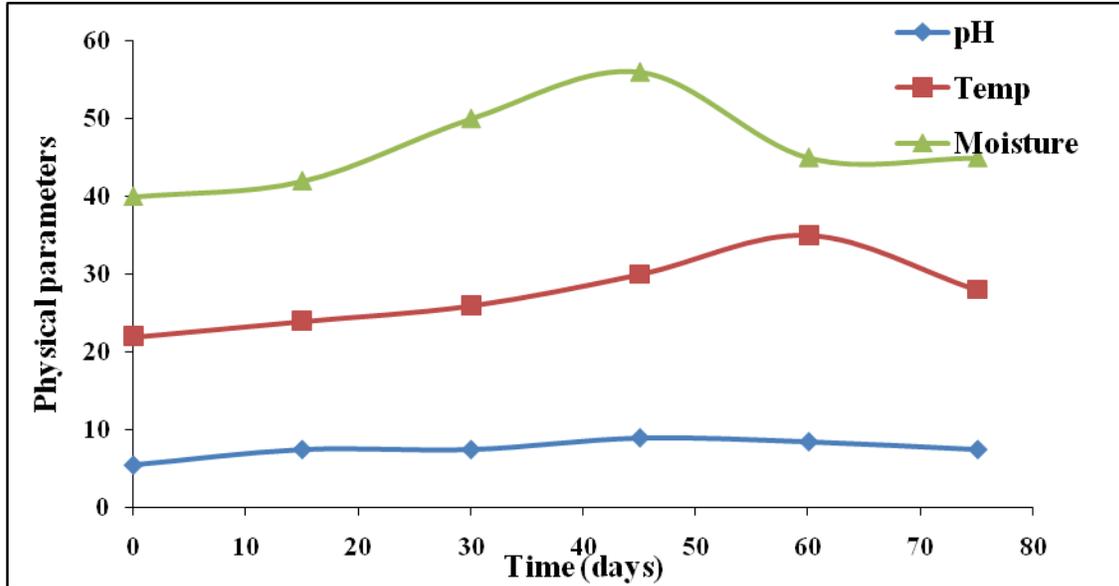
**Table I Total phosphorus content of different substrates at 15 days intervals.**

NO.OF.DAYS	KITCHEN WASTE	COIR PITH	RICE STRAW
0	0.001	0.001	0.001
15	0.020	0.018	0.022
30	0.032	0.026	0.031
45	0.046	0.038	0.043
60	0.058	0.049	0.057
75	0.061	0.057	0.065

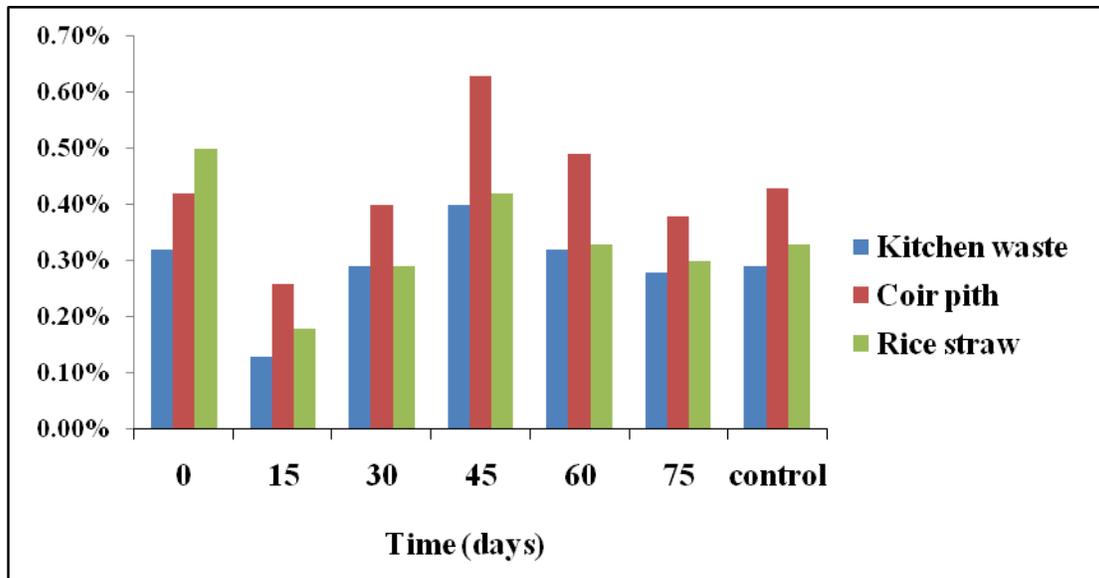
**Table II phosphorus content present in different substrates at 15 days interval. Available**

NO.OF.DAYS	KITCHEN WASTE	COIR PITH	RICE STRAW
0	0.15%	0.10%	0.12%

15	0.24%	0.18%	0.22%
30	0.26%	0.20%	0.27%
45	0.41%	0.26%	0.32%
60	0.58%	0.36%	0.36%



**Figure 1 : Physical parameters of the Vermicomposting soil.**



**Figure 2 : Total Organic Carbon of Vermicompost substrates.**

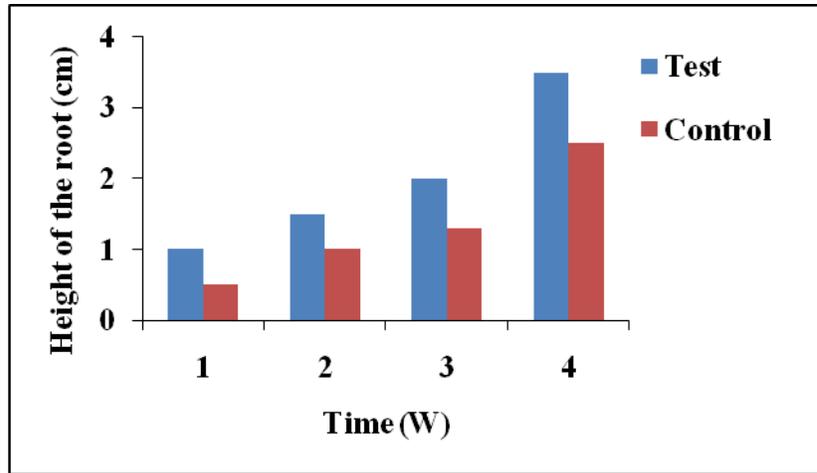


Figure 3 :Growth of the root of the plant *Vinca rosea* using kitchen waste Vermicompost

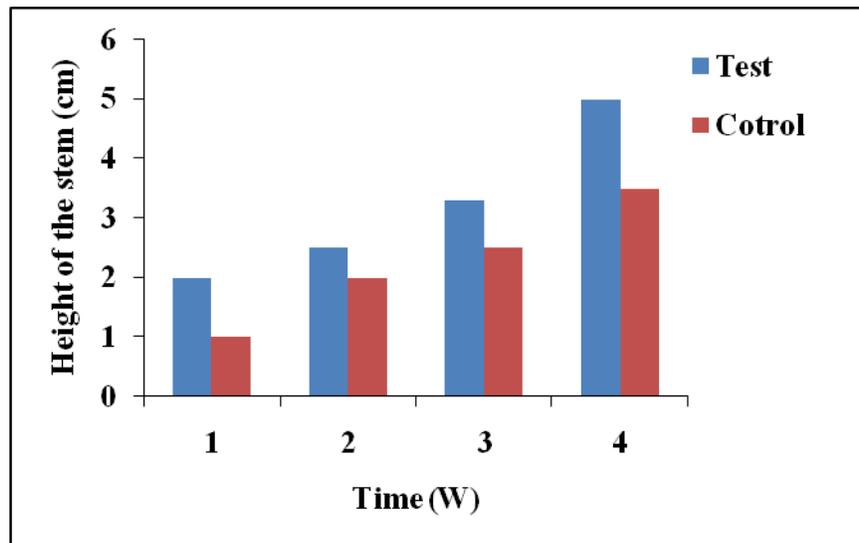


Figure 4 : Growth of the shoot of the plant *Vinca rosea* using kitchen waste

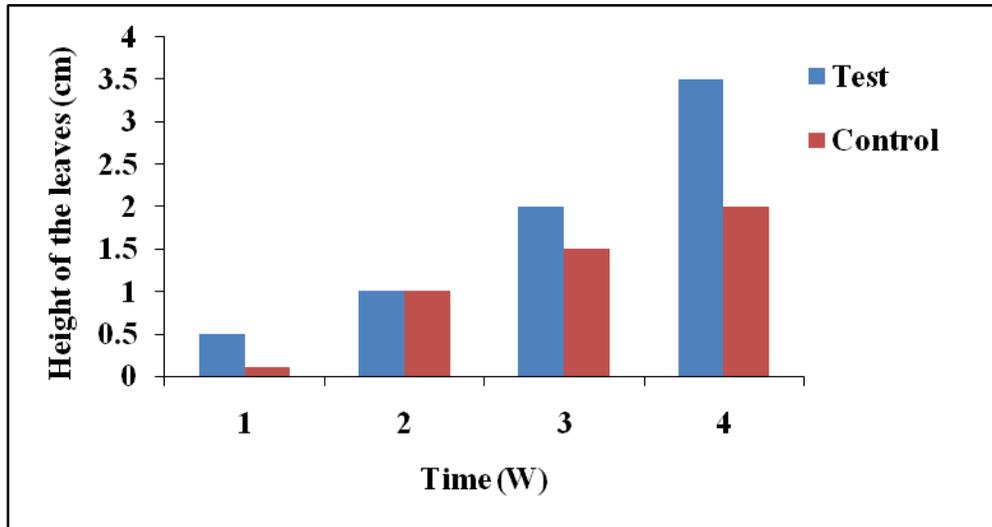


Figure 5 : Growth of the leaves of the plant *Vinca rosea* using kitchen waste as Vermicompost

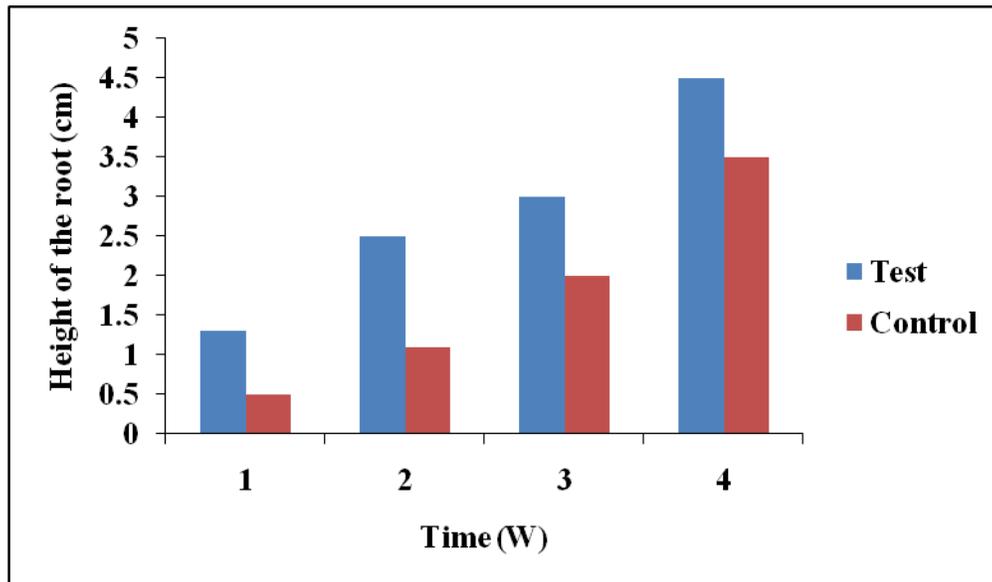


Figure 6 :Growth of root of the plant *Vinca rosea* using coir pith Vermicompost

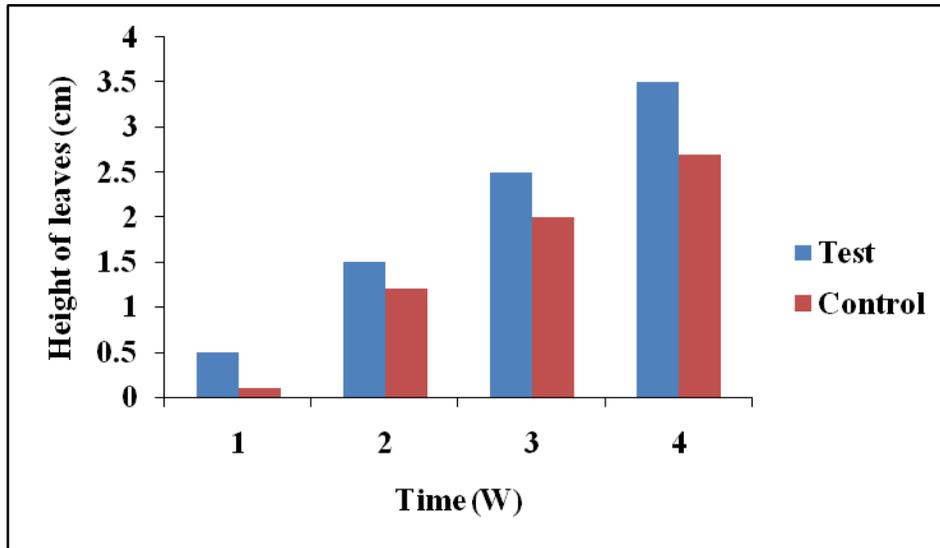


Figure 7 :Growth of the leaves of the plant *Vinca rosea* using coir pith Vermicompost

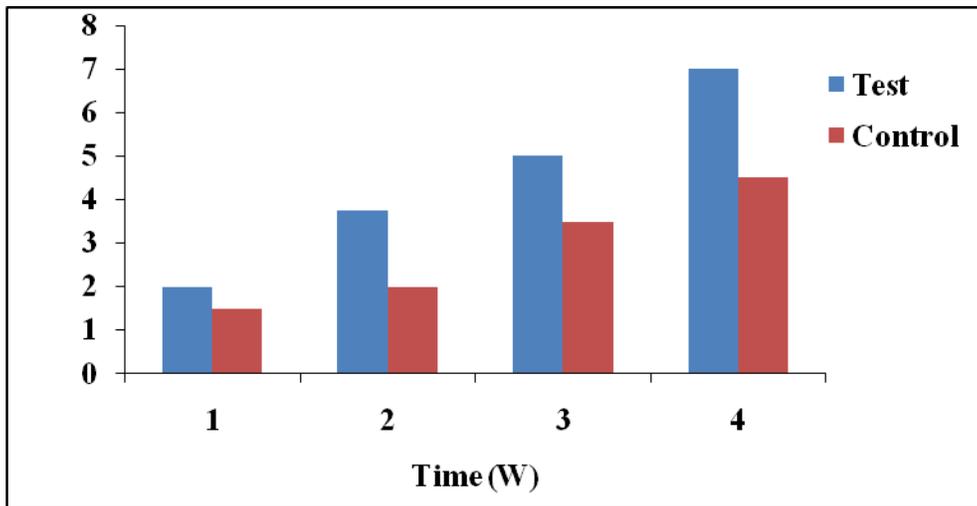


Figure 8 : Growth of the shoot of the plant *Vinca rosea* using coir pith Vermicompost

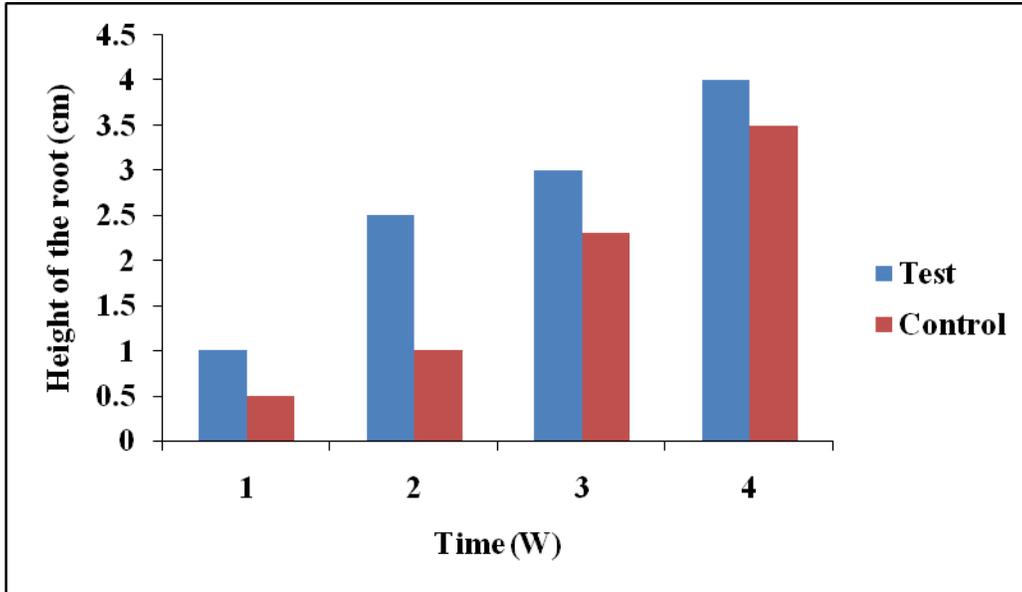


Figure 9 : Growth of the root of the plant *Vinca rosea* using rice straw Vermicompost

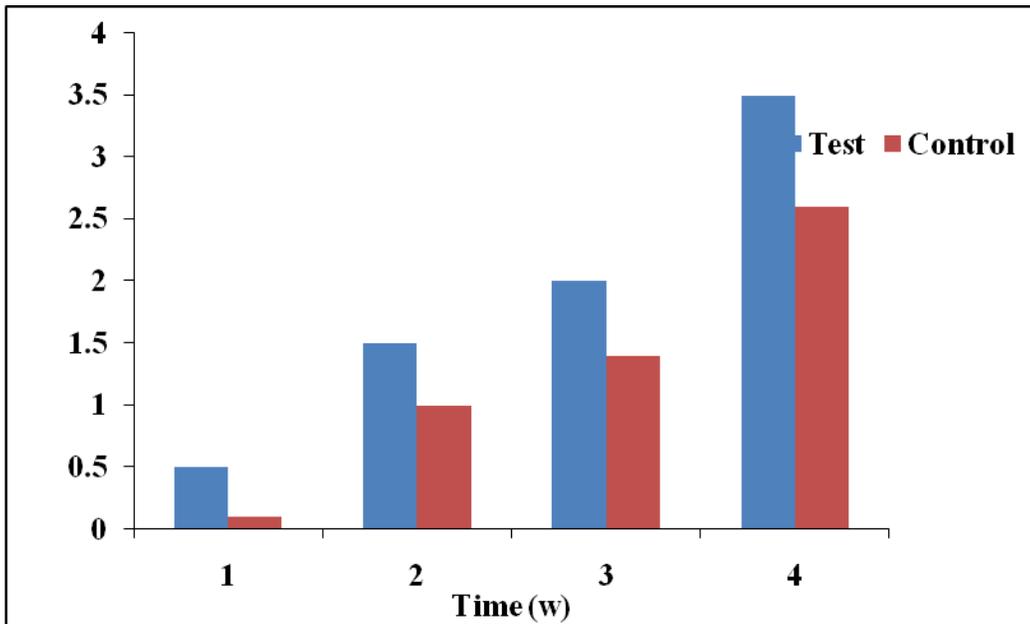
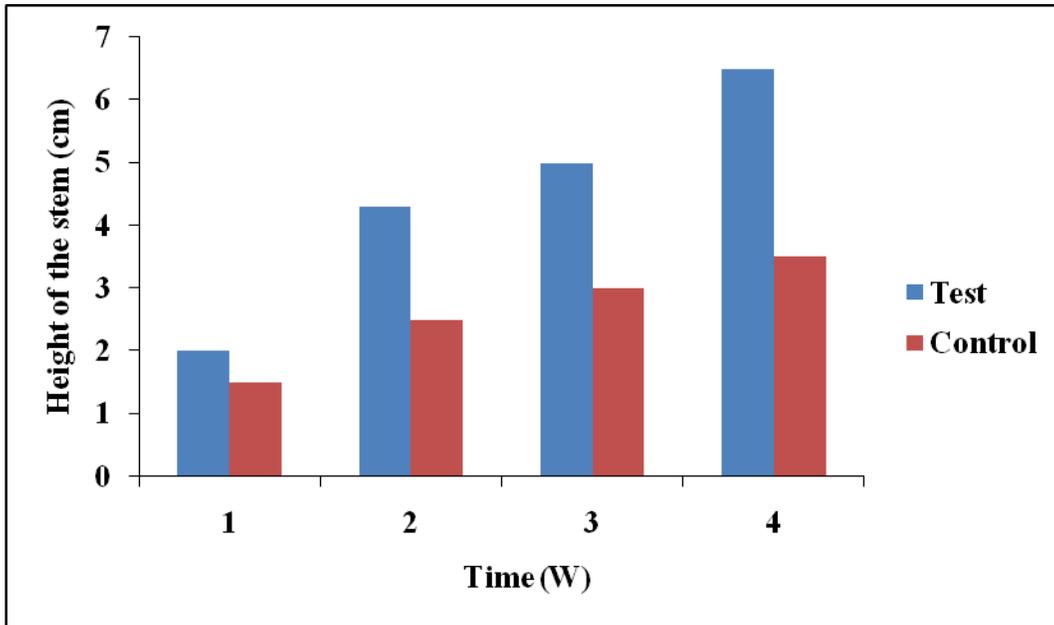
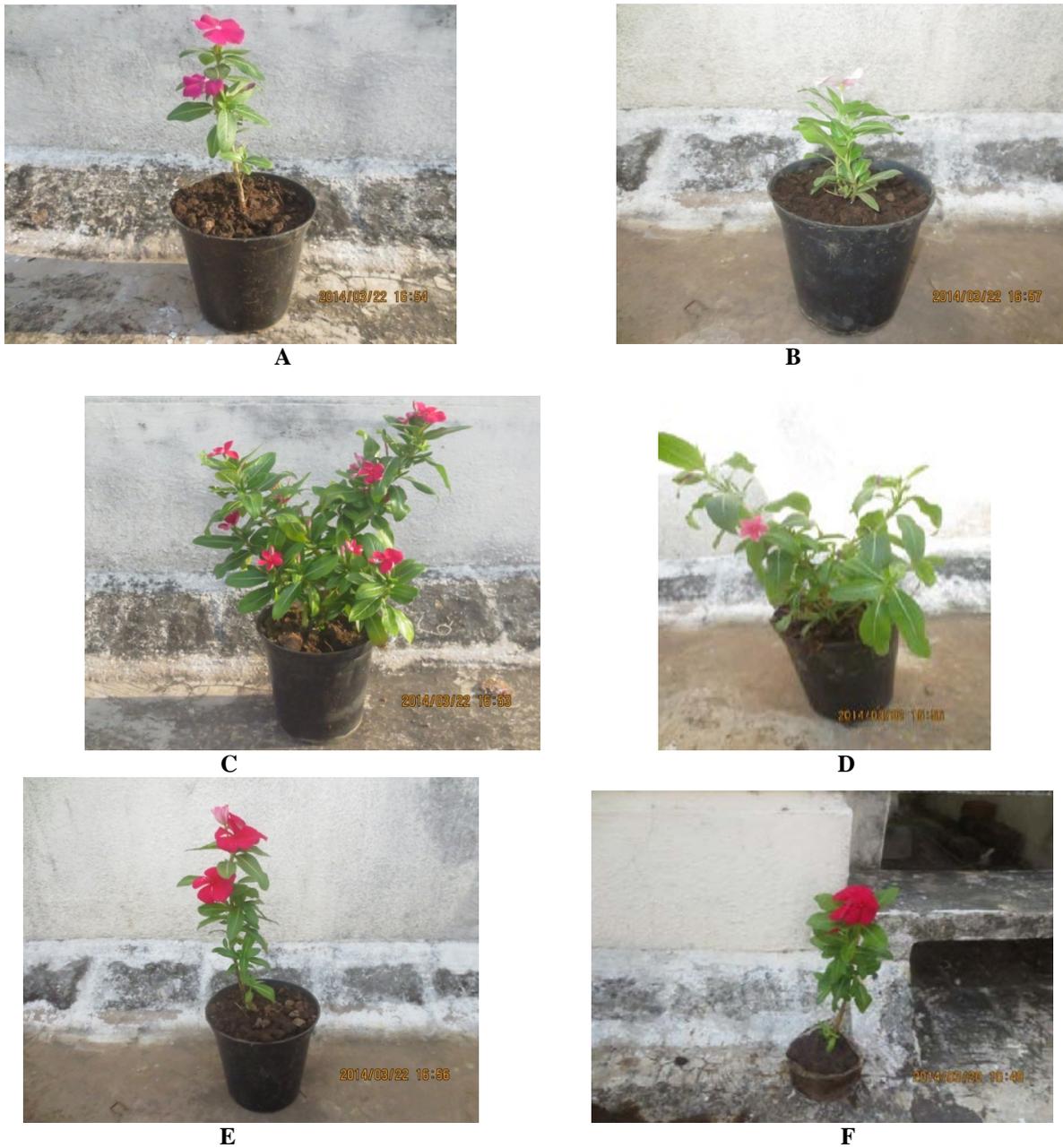


Figure 10 : The growth of plant *Vinca rosea* giving the length of the leaves using rice straw Vermicompost



**Figure 11: The growth of plant *Vinca rosea* giving the height of the shoot using rice straw Vermicompost.**



**Figure 12: Growth of the plant *Vinca rosea* on different Vermicomposted substrates (A)- kitchen waste, (B)- control 1, (C)- coir pith, (D)- control 2, (E)- rice straw, (F)- control3**

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# Awareness on Technology Based Education by the Student Teachers

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**Abstract-** Present education system aims at providing the teacher and the learner to be a literate of Technology and hence technology based education is the need of the hour. Exposure to the use of technology in the teaching and learning process makes the teacher and the student to learn things effectively. In this paper an attempt is made by the researcher to explore the awareness of technology based education by the student teachers. Survey method was adopted in this study. 91 student teachers in the B.Ed College have been selected as sample by simple random sampling technique. Among 91 respondents 68 are female and the remaining 23 are male more exposed to the use of technology. The study found that there is no significant difference in intellectual domain of student teachers based on gender. There is significant difference in emotional domain of student teachers based on gender. With regard to the educational qualification (UG and PG) there is no significant difference among student teachers based on intellectual and emotional domains. As far as the type of family (Nuclear and Joint) there is no significant difference among student teachers based on intellectual and emotional domains.

**Index Terms-** Domains, Internet, Technology, Teacher Education, Professional practice

## I. INTRODUCTION

Education is the core concept that creates an interface between the teacher and the taught. In the process of learning the teacher aims at providing knowledge to the taught through various means and methods. The system is called traditional method of learning but the present education system aims at providing the teacher and the learner to be a literate of technology. Technology improves the quality of education by facilitating learning by doing, real time conversation, delayed time conversation, directed instruction, self-learning, problem solving, information seeking and analysis, and critical thinking, as well as the ability to communicate, collaborate and learn [19]. Possessing the knowledge of technology is really the need of the hour. The need of technology knowledge is very much required for teachers in order to carry out the process of teaching and learning smoothly [16]. Teachers demand special attention because they have special needs and interest that must be addressed with respect and ingenuity in order to make them embrace the new technologies placed in the classroom [9]. In order to improve the pedagogy, teachers need training on technology which motivates the students as well as the teachers [15]. Technology has enhanced teachers' professional

knowledge, skill and capabilities by extending their subject knowledge, enabling planning and preparation for teaching to be more efficient[8]. A change in teachers permeates to all aspect of growth and advances needed in teaching-learning processes and scientific developments. Teachers' knowledge of technology for teaching and learning, problem solving skills, capacity building and other germane issues relating to education cannot be undervalued. For teachers to be able to cope with these functions of electronic technologies there is the need for the right attitude to be cultivated towards technology as a tool for teaching and learning.

## II. OBJECTIVES

- To study the awareness of student teachers on technology based education
- To study the influence of technology on the intellectual aspect of student teachers.
- To study the influence of technology on the emotional domain of student teachers.

## III. HYPOTHESIS

1. There is no significant difference between Male and Female student teachers' in the awareness of technology.
2. There is no significant difference in the intellectual domain of student teachers based on gender
3. There is no significant difference in the emotional domain of student teachers based on gender
4. There is no significant difference between Under Graduates and Post Graduates student teachers' towards the awareness of technology.
5. There is no significant difference in the intellectual domain of student teachers based on Educational qualification
6. There is no significant difference in the emotional domain of student teachers based on Educational qualification
7. There is no significant difference the between the Nuclear and Joint family student teachers' towards the awareness of technology.
8. There is no significant difference in the intellectual domain of student teachers based on the type of family
9. There is no significant difference in the emotional domain of student teachers based on the type of family

IV. MATERIALS AND METHODS

Survey method is adopted by the researcher to examine the level of awareness of the technology based education by student teachers. Data was collected through questionnaire distributed among 91 student teachers in a college of education. Simple random sampling technique was adopted in this study.

The researcher developed a closed ended questionnaire which consists of 48 items with two dimensions namely intellectual and emotional. Out of total 48 items, 11 items were for personal profile, 13 items to assess the awareness of technology, 9 items were for intellectual domain and 15 items regarding emotional domain. The questionnaire has five options such as: Always, Often, Seldom, Never and Undecided.

For establishing face validity and content validity, the tool was given to a panel of experts. Based on their expertise, the tool was fine-tuned with necessary modification. Cronbach's Alpha test was adopted to measure the reliability of tool because Cronbach's alpha test determines, how closely related a set of items are as a group or the internal consistency or average correlation of items in a survey instrument to establish its reliability (Reynaldo & Santos 1999, Bruin, 2006). The reliability coefficient for the tool is 0.512.

**Hypothesis 1** There is no significant difference between Male and Female student teachers' awareness on technology

**Table 1: Shows the awareness of technology based on gender**

Gender	Mean	S.D	Statistical inference
<b>Awareness on technology</b>			
Male (n=23)	41.65	7.352	T=1.360 Df=89
Female (n=68)	39.29	7.130	.177>0.05
			Not Significant

From the above table the p value 0.177>0.05 shows that there is no significant difference between Male and Female student teachers' awareness on technology.

**Hypothesis 2** There is no significant difference in intellectual domain of student teachers based on Gender

**Table 2: Shows the Intellectual domain of student teachers based on gender**

Intellectual domain	Mean	S.D	Statistical inference
Male (n=23)	33.35	4.820	T=.664 Df=89
Female (n=68)	32.54	5.077	.508>0.05
			Not Significant

From the above table the p value 0.508>0.05 shows that there is no significant difference between Male and Female student teachers in intellectual domain.

**Hypothesis 3** There is no significant difference in emotional domain of student teachers based on Gender

**Table 3: Shows the Emotional domain of student teachers based on gender**

Emotional domain	Mean	S.D	Statistical inference
Male (n=23)	53.26	7.563	T=2.474 Df=89
Female (n=68)	47.59	10.061	.015<0.05
			Significant

From the above table the p value 0.015>0.05 shows that there is significant difference between Male and Female student teachers in emotional domain.

**Hypothesis 4** There is no significant difference between UG and PG student teachers' awareness on technology.

**Table 4: Shows the awareness of technology based on Educational qualification**

Degree	Mean	S.D	Statistical inference
<b>Awareness on technology</b>			
UG (n=82)	40.22	7.392	T=1.319 df=89
PG (n=9)	36.89	4.676	.190>0.05
			Not Significant

From the above table the p value 0.190>0.05 shows that there is no significant difference between UG and PG student teachers' awareness on technology.

**Hypothesis 5** There is no significant difference in intellectual domain of student teachers based on Educational qualification

**Table 5: Shows the Intellectual domain of student teachers based on Educational qualification**

Intellectual domain	Mean	S.D	Statistical inference
UG (n=82)	32.84	4.968	T=.541 df=89
PG (n=9)	31.89	5.510	.590>0.05
			Not Significant

From the above table the p value 0.590>0.05 shows that there is no significant difference between UG and PG student teachers in intellectual domain.

**Hypothesis 6** There is no significant difference in emotional domain of student teachers based on Educational qualification

**Table 6: Shows the Emotional domain of student teachers based on Educational qualification**

Emotional domain	Mean	S.D	Statistical inference
UG (n=82)	49.06	9.791	T=.114 df=89
PG (n=9)	48.67	10.173	.909>0.05
			Not Significant

From the above table the p value  $0.909 > 0.05$  shows that there is no significant difference between UG and PG student teachers in emotional domain.

**Hypothesis 7** There is no significant difference between Nuclear and Joint family student teachers' awareness on technology.

**Table 7: Shows the awareness of technology based on type of family**

Type of family	Mean	S.D	Statistical inference
<b>Awareness on technology</b>			
<i>Nuclear (n=53)</i>	40.92	7.656	T=1.629 df=89 .107>0.05 Not Significant
<i>Joint (n=38)</i>	38.45	6.383	

From the above table the p value  $0.107 > 0.05$  shows that there is no significant difference between Nuclear and Joint family student teachers' awareness on technology.

**Hypothesis 8** There is no significant difference in intellectual domain of student teachers based on type of family

**Table 8: Shows the Intellectual domain of student teachers based on type of family**

Intellectual domain	Mean	S.D	Statistical inference
<i>Nuclear (n=53)</i>	33.13	4.682	T= .866 df=89 .389>0.05 Not Significant
<i>Joint (n=38)</i>	32.21	5.428	

From the above table the p value  $0.389 > 0.05$  shows that there is no significant difference between Nuclear and Joint family student teachers intellectual domain

**Hypothesis 9** There is no significant difference in Emotional domain of student teachers based on type of family

**Table 9: Shows the Emotional domain of student teachers based on type of family**

Emotional domain	Mean	S.D	Statistical inference
<i>Nuclear (n=53)</i>	50.57	8.913	T=1.802 df=89 .075>0.05 Not Significant
<i>Joint (n=38)</i>	46.87	10.604	

From the above table the p value  $0.075 > 0.05$  shows that there is no significant difference between Nuclear and Joint family student teachers emotional domain.

## V. RESULTS

The study found that there is no significant difference in Intellectual domain of student teachers based on gender. There is a significant difference in Emotional domain of student teachers

based on gender. With regard to the educational qualification (UG and PG) there is no significant difference among student teachers based on Intellectual and Emotional domains. As far as the type of family (Nuclear and Joint) there is no significant difference among student teachers based on Intellectual and Emotional domains. On the whole low utilization of information resources and lack of awareness in using technology has been witnessed in this study.

## VI. RECOMMENDATIONS

1. Internet connection can be provided to student teachers who can go through many related websites for their teaching learning process.
2. Orientation programme can be conducted to the student teachers to use the technology resources effectively.
3. Workshops can be organized to update the technological knowledge of the student teachers

## VII. CONCLUSION

An attempt is made to study the technological awareness among student teachers. Technologies are electronic devices that have come to reshape the world in all aspects of human endeavor with its stronghold in the provision of education for all. Pivotal to the provision of education for all are teachers who have been trained professionally to educate, improvise and integrate emerging technologies into the paradigm of education. Traditional methods of teaching could never develop plan effective foundation for critical thinking and understanding for the students. They could learn more when learning became personal and it is only possible by using Technology in class room situation. Through it the learners would be able to construct their own concept and find their own solutions to their problems. It will be more possible only when teachers will have adequate knowledge and the awareness regarding technology. The student teachers should be given appropriate training for inculcating skills associated to technology for its awareness. It is expected that if the student teachers are fully aware, they will be able to guide their learners for their bright future.

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# VHDL Simulation of Cusp-like Filter for High Resolution Radiation Spectroscopy

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**Abstract-** One of the main objectives of a radiation spectroscopy is to have good energy resolution so that the results of the nuclear physics experiments can be interpreted faithfully. Electronic noise introduced by the instrumentation systems put a major constraint on the energy resolution. It has been proved theoretically by many researchers/authors that the signal to noise ratio can be maximized to its best value if the electrical pulse obtained from a nuclear detector can be shaped into an infinite cusp form. Practically a cusp-like pulse of finite length can be obtained by processing the detector signals in digital domain. This paper considers VHSIC Hardware Description Language (VHDL) simulation aspect of cusp-like filtering algorithm. Such simulations provide the platform to verify the algorithms for their implementation into a digital hardware such as Field Programmable Gate Array (FPGA) for real time applications. The simulation considers exponentially decaying sequences as the input to the filter. In radiation spectroscopy applications, such signals are obtained by digitizing the slow decaying exponential pulses derived from radiation detectors.

**Index Terms-** Cusp-like Filter, Energy Resolution, Signal to Noise Ratio, Radiation Spectroscopy, VHDL.

## I. INTRODUCTION

In a typical radiation spectroscopy, the ionizing radiation quantum interacts with the sensitive volume of a nuclear detector and releases its energy into the same. This process generates an equivalent charge which is further collected by the preamplifier to form a voltage pulse. Peak of a voltage pulse obtained from preamplifier carries important information as the same is proportional to energy of the radiation quantum. The capability of a spectrometer to distinguish radiation quantum closely separated in energy is characterized by its energy resolution [1]. The energy resolution is a crucial parameter to interpret the findings of a nuclear physics experiment. A poor energy resolution gives rise to widening of spectral lines that may lead to wrong interpretation of the experiment. Energy resolution is usually given by Full width at Half Maximum (FWHM) of the spectral peaks when the detector pulse is approximated by the Gaussian shape [1].

$$FWHM = 2.35\sigma \quad (1)$$

Where  $\sigma$  is the standard deviation of the Gaussian pulse.

In case of spectroscopy the system FWHM is given by the following relation,

$$FWHM_{system}^2 = FWHM_{detector}^2 + FWHM_{electronic}^2 \quad (2)$$

Where  $FWHM_{detector}^2$  mainly depends on statistical fluctuations in charge carrier generation in detector due to discrete nature of radiation quantum.  $FWHM_{electronic}^2$  depends on the noise contribution of preamplifier and other associated instrumentation. The noise introduced by used instrumentation can be termed as electronic noise and it mainly depends on DC baseline fluctuations, pulse pileup effects, electromagnetic and power supply disturbances [2]. Therefore to achieve the best energy resolution the noise must be minimized. Various theories have been established to maximize the signal to noise ratio [1],[3],[4]. The amount of electronic noise is often expressed in terms of the equivalent noise charge (ENC). ENC is the amount of charge when applied to input of the instrumentation system, will result in output voltage equal to RMS (i.e. Root Mean Square) level of output due to noise only [1]. ENC can be decomposed into three terms: one proportional to current (or parallel) noise, another proportional to voltage (or series) noise and the last proportional to  $1/f$  noise. Efficiency of various noise shaping filters are characterized by their ENC value. If an impulse signal is applied to a circuit having only current and voltage noise, the infinite cusp filter offers the best ENC value [5]. The modified versions of infinite cusp filter have extensively been considered in spectroscopy applications to shape the detector pulse in presence of all the three types of noise sources [6],[7]. Due to above mentioned reasons the infinite cusp has been considered as optimum detector pulse shape to achieve the best possible signal to noise ratio and same has become the standard for comparing the performance of other methods of pulse shaping. Figure 1 shows various pulse shapes and their signal to noise ratio relative to an infinite cusp. Practically it is very difficult, rather impossible to obtain the infinite cusp shape using analog circuit techniques [8]. However the

digital signal processing techniques can be exploited to obtain a finite length cusp-like shape. Such shaping will improve the performance of a radiation spectrometer in terms of energy resolution by maximizing the signal to noise ratio. Additionally the same techniques can also minimize the pile up losses. This paper is organized as follows. Section II briefly describes the cusp-like filtering algorithm. It also briefly discusses the used methodology and heart of the developed simulation code. Section III discusses the simulation results. Finally, the concluding remarks are included in Section IV.

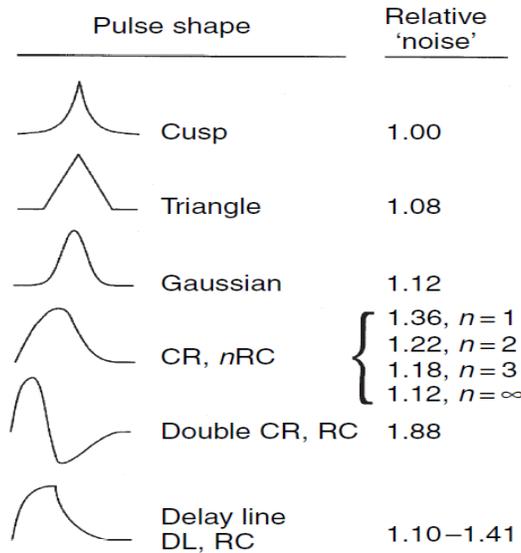


Figure 1: Noise contribution of different pulse shapes relative to infinite cusp (top).

## II. CUSP-LIKE FILTERING ALGORITHM

The finite length cusp-like filtering algorithm can be described in its recursive form [9]. The recursive forms are often faster in execution and same can easily be implemented into digital hardware. The following recursive equations were considered for the VHDL simulation.

$$d\_K[i] = x[i] - x[i - K] \tag{3}$$

$$d\_1[i] = x[i] - x[i - 1] \tag{4}$$

$$b[i] = d\_K[i] - K * d\_1[i - L], \quad i \geq 0 \tag{5}$$

$$c[i] = b[i] + c[i - 1], \quad i \geq 0 \tag{6}$$

$$s[i] = M2 * c[i] + s[i - 1], \quad i \geq 0 \tag{7}$$

$$t[i] = M1 * c[i] + s[i], \quad i \geq 0 \tag{8}$$

$$y[i] = t[i] + y[i - 1], \quad i \geq 0 \tag{9}$$

Where  $X[i]$  is digitized input exponential signal and  $Y[i]$  is output of the filter respectively. The value of  $M$  is given by the equation (10). The value of  $M1$  and  $M2$  can be selected to satisfy the equation (11). The symbol (\*) in the above equations is a multiplication operator.

$$M = \frac{1}{e^{\left(\frac{T_p}{\tau}\right)} - 1} \tag{10}$$

$$M = \frac{M1}{M2} \tag{11}$$

Where  $T_p$  is digitizer's clock frequency and  $\tau$  is time constant of exponential input signal. The duration of the rising (falling) edge of the cusp-like shape is decided by the value of  $L$ , and the value of  $K$  is equal to  $2L+1$ . For high count applications a detector pulse is required to be processed to the short duration [10][11]. The short duration pulse of cusp-like shape can be obtained by appropriately choosing the value of  $L$  to minimize the pile up losses. Figure 2 is block diagram representation of the recursive equations given above. The nature of input signal considered for the simulation was similar as considered in our previous paper [12] and the same has been shown in figure 3. Heart of the simulation code is a 'generate statement' which instantiates the various components required for the filtering operation and the same is given below.

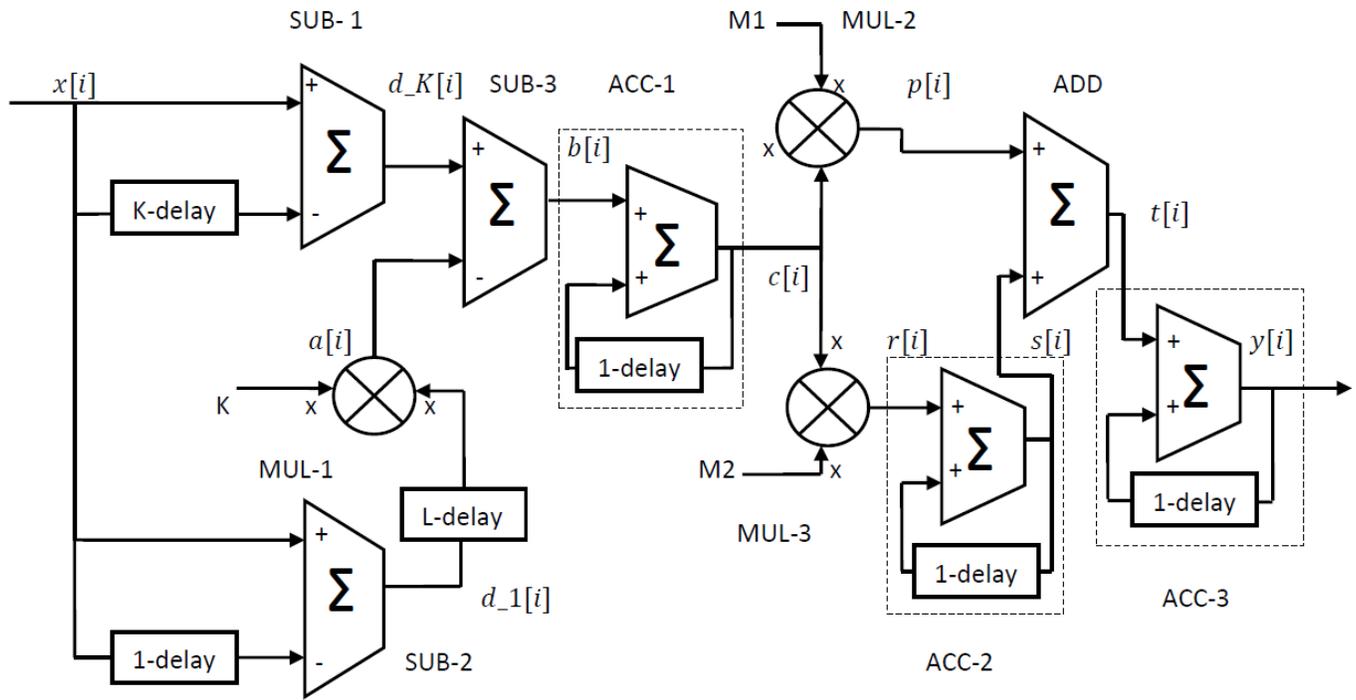


Figure 2: Block diagram of cusp-like filter

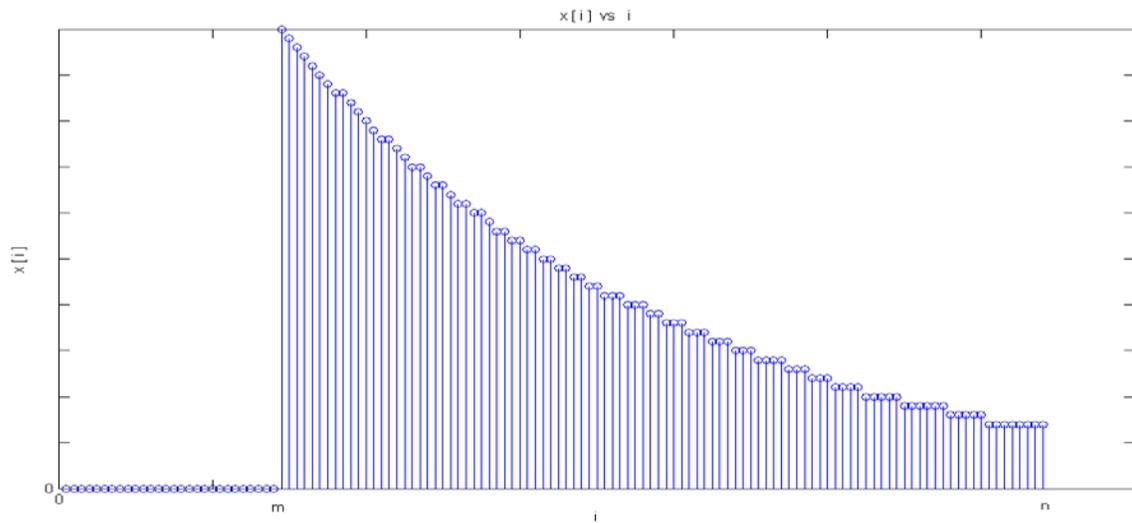


Figure 3: Input sequence to cusp-like filter

```

begin
Cusp-like filter : for i in m to n generate
SUB-1 : subtractor port map (x(i), x(i-K), d_K(i));
SUB-2 : subtractor port map (x(i), x(i-1), d_1(i));
MUL1 : multiplier port map (K, d_1(i-L), a(i));
SUB-3 : subtractor port map (d_K(i), a(i), b(i));
ACC-1 : adder port map (c(i-1), b(i), c(i));
MUL-2 : multiplier port map (M1, c(i), p(i));
MUL-3 : multiplier port map (M2, c(i), r(i));
ACC-2 : adder port map (s(i-1), r(i), s(i));
ACC-3 : adder port map (s(i), s(i-1), t(i));
ADD : adder port map (t(i), d_1(i), y(i));
    
```

```

ADD : adder port map (s(i), p(i), t(i));
ACC-3 : adder port map (y(i-1), t(i), y(i));
end generate Cusp-like filter;
    
```

The filtering scheme comprises of three subtractors, three multipliers, three accumulators and an adder respectively. The subtractors (SUB-1, SUB-2 and SUB-3) and multipliers (MUL-1, MUL-2 and MUL-3) are generated by instantiating the components 'subtractor' and 'multiplier' respectively. Whereas the adder and accumulators are generated by instantiating the component 'adder'. The first two 'signal's in parentheses (after the keyword 'port map') for each component are mapped to input ports while the third 'signal' is mapped to output port respectively. All the 'signal's are one dimensional array of size 'n'.

### III. SIMULATION RESULTS

The simulations were performed for non-piled up input sequences as well as for piled up input sequences by considering different values of shaping parameters (i.e. K and L). Figure 4 shows the simulation result for single input sequence while the figure 5 shows the simulation result for piled up input sequence respectively. Both the figures show plots for  $x[i]$ ,  $c[i]$ ,  $t[i]$  and  $y[i]$  respectively. The value of L, K, M1, M2 and M was selected/calculated as 7, 15, 200, 4 and 50 respectively in both the cases.

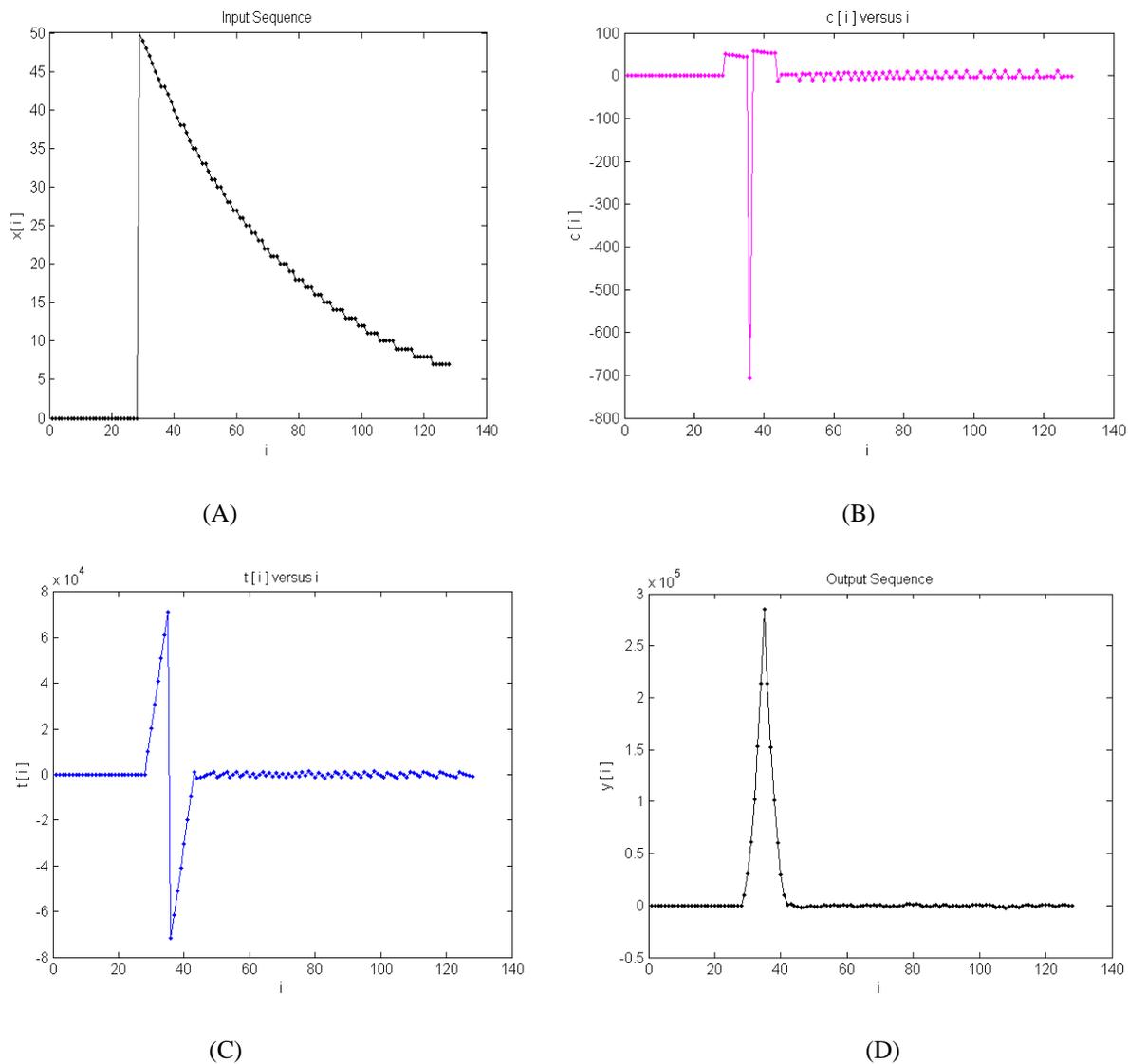


Figure 4: Cusp-like filtering simulation result for non piled up detector signal (A) input sequence- $x[i]$ , (B) sequence- $c[i]$ , (C) sequence- $t[i]$  and (D) output sequence- $y[i]$

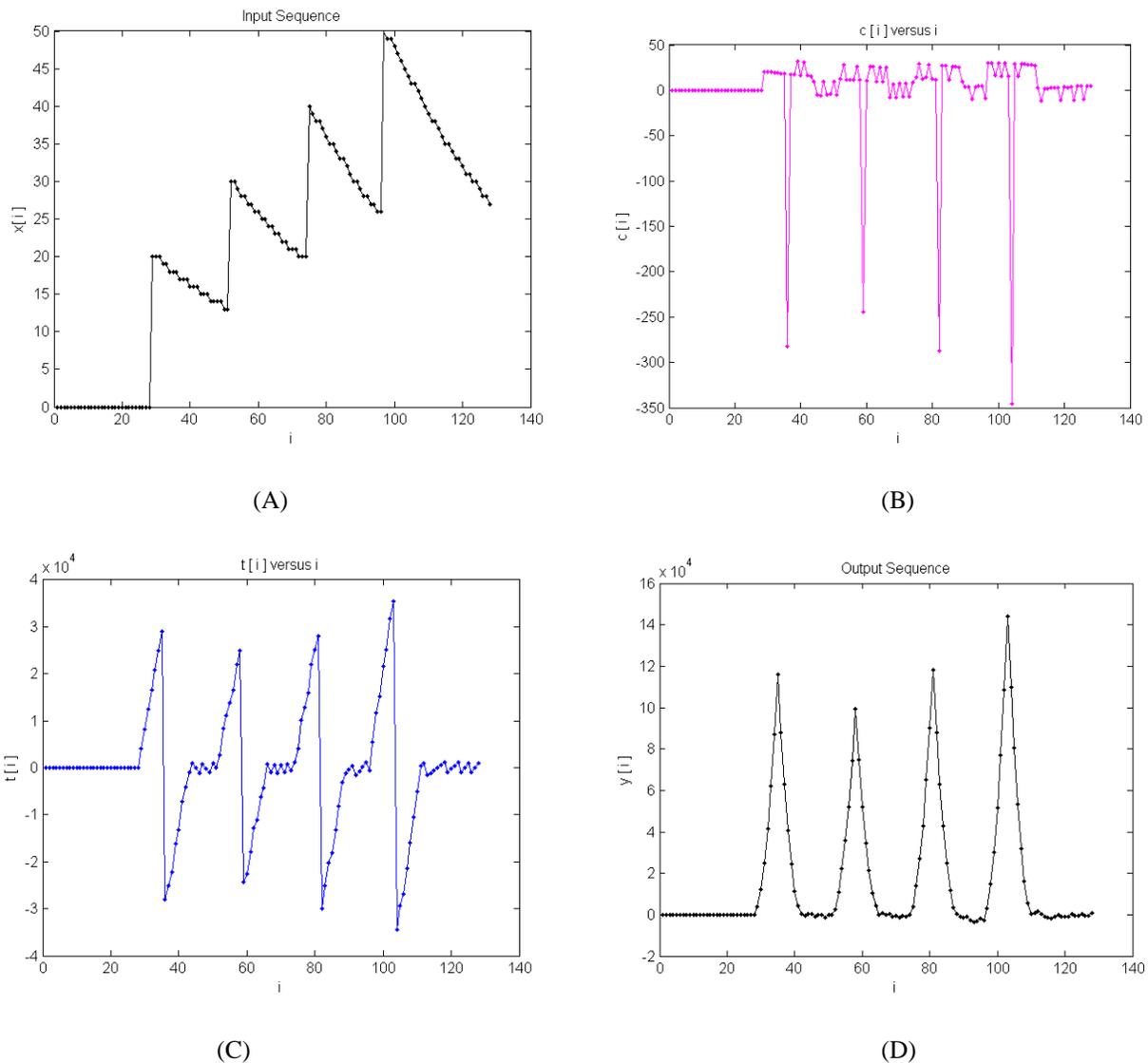


Figure 5: Cusp-like filtering simulation result for piled up detector signal (A) input sequence- $x[i]$ , (B) sequence- $c[i]$ , (C) sequence- $t[i]$  and (D) output sequence- $y[i]$

#### IV. CONCLUSION

The VHDL simulation code for cusp-like filter was developed. The same was verified by observing the desired simulation results. It was also observed that the value of 'L' decides the rise/fall time. This parameter should be chosen carefully to minimize the pile up losses. The algorithm can be implemented into a digital hardware such as Field Programmable Gate Array (FPGA) to carry out the cusp-like filtering in real time applications.

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# AADHAAR – Possibilities with 1 to n authentication

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Syscom Corporation Limited

**Abstract:** When it comes to human trafficking, more than 90% of countries have laws to tackle this but having law only does not prevent, suppress the crime rate. The report published by UNODC<sup>1</sup> mentioned that even when 90% of countries have legislation to criminalize but between 2010 and 2012, some 40 per cent of countries reported less than 10 convictions per year. Some 15 per cent of the 128 countries covered in this report did not record a single conviction.

So let government agencies do their work to reduce trafficking. But today India has a strong system which can be used to track back an individual and possibly rejoin the trafficked child with his/her family. The system is AADHAAR.

Also same system can be used to identify unidentified dead bodies for which biometric data can be collected.

**Index Terms:** AADHAAR, Identity tracking

## I. Introduction

AADHAAR is an initiative of Government of India, where every resident of India will get a 12 digit unique number after obtaining his/her biometric data and verification of demographic data.

Today AADHAAR authentication is preordained for establishing identity, improving efficiency / transparency in service delivery & address / demographic Verification. Following are the different entities involved in AADHAAR authentication:

Following are the key actors in AADHAAR<sup>2</sup> authentication

- **Unique Identification Authority of India (UIDAI):** UIDAI is the overall regulator and overseer of the Aadhaar authentication system. It owns and manages the Central Identities Data Repository (CIDR) that contains the personal identity data (PID) of all Aadhaar-holders.
- **Authentication Service Agency (ASA):** ASAs are entities that have secure leased line connectivity with the CIDR. ASAs transmit authentication requests to CIDR on behalf of one or more AUAs. An ASA enters into a formal contract with UIDAI.
- **Authentication User Agency (AUA):** An AUA is any entity that uses Aadhaar authentication to enable its services and connects to the CIDR through an ASA. An AUA enters into a formal contract with UIDAI.
- **Sub AUA:** An entity desiring to use Aadhaar authentication to enable its services through an existing AUA. Examples: (i) IT Department of a State/UT could become an AUA and other departments could become its Sub AUAs to access Aadhaar authentication services. UIDAI has no direct contractual relationship with Sub AUAs.
- **Authentication Devices:** These are the devices that collect PID (Personal Identity Data) from Aadhaar holders, transmit the authentication packets and receive the authentication results. Examples include PCs, kiosks, handheld devices etc. They are deployed, operated and managed by the AUA/Sub AUA.
- **Aadhaar holders:** These are holders of valid Aadhaar numbers who seek to authenticate their identity towards gaining access to the services offered by the AUA.

<sup>1</sup> [https://www.unodc.org/documents/data-and-analysis/glotip/GLOTIP\\_2014\\_full\\_report.pdf](https://www.unodc.org/documents/data-and-analysis/glotip/GLOTIP_2014_full_report.pdf)

<sup>2</sup> <https://uidai.gov.in/authentication-2/>

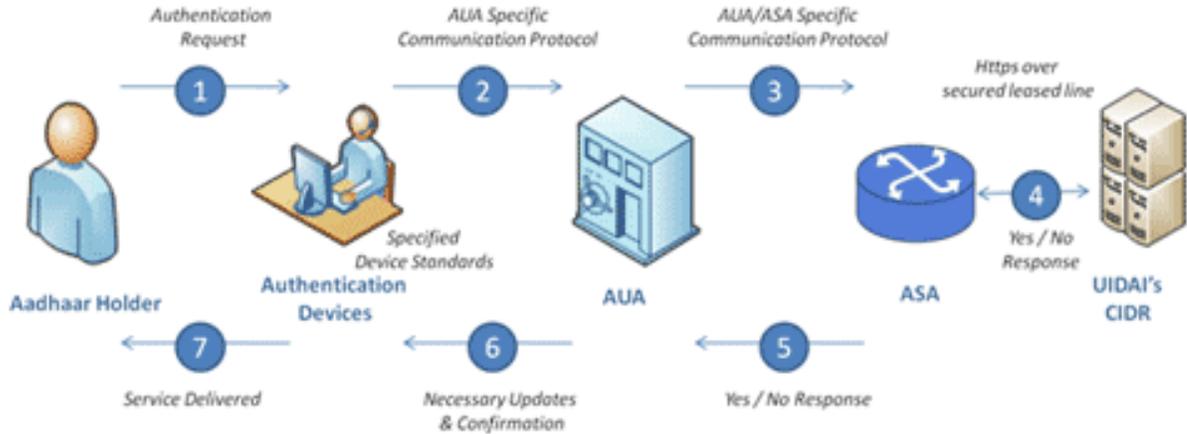


Figure 1: Authentication framework

There are five different modes are defined for authentication.

- Type 1:** Through this offering, service delivery agencies can use Aadhaar Authentication system for matching Aadhaar number and the demographic attributes (name, address, date of birth, etc) of a resident.
- Type 2:** This offering allows service delivery agencies to authenticate residents through One-Time-Password (OTP) delivered to resident's mobile number and/or email address present in CIDR.
- Type 3:** Through this offering, service delivery agencies can authenticate residents using one of the biometric modalities, either iris or fingerprint.
- Type 4:** This is a 2-factor authentication offering with OTP as one factor and biometrics (either iris or fingerprint) as the second factor for authenticating residents.
- Type 5:** This offering allows service delivery agencies to use OTP, fingerprint & iris together for authenticating residents.



Figure 2: Authentication mechanism

In all form of authentication, AADHAAR number has to be provided so that authentication is reduced to a 1:1 match. But it does not mean that the system does not have capability to do 1:n matching. During allotment of AADHAAR number, system performs de-duplication within existing data. But this 1:n facility is not extended beyond this phase.

## II. Proposal

AADHAAR authentication with 1:n facility equips security agencies for identification of suspected individuals and at the same time brings huge hope for families whose loved ones are missing. To make this happen we need to extend the scope of “**Introducer’s Aadhaar No**” or “**Head of Family Aadhaar No**” and authentication facility.

**Role of “Introducer’s Aadhaar No” or “Head of Family Aadhaar No”:** Today this field is used when an individual cannot produce any document as a proof of identify/address. In such case all verification will be based on the Introducer or HOF.

To ensure effective usage of 1:n authentication following would need to be mandated:

- Every kid’s AADHAAR must be linked with introducer / HOF → Parent / Guardian: Ensure that every kid’s biometric identify is associated with their parents/guardian, so that in hour of need it can be used.
- Introducer is also must in case HOF is not alive: There may be situation where an individual may not be able to present AADHAAR related data of his/her parents/guardian. In that case mandate the need of introducer who can be called upon in case of need.
- In all cases Introducer/HOD authentication is must during enrollment process.

Authorized entities need to be listed who can do 1:n verification without presenting AADHAAR number. Security agencies would be the first option but the service should be extended to each individual with some rational charges.

Apart from this a legal framework should be designed so that parents can get information/alert about their children’s 1:n authentication.

### III. Benefits

Security agencies will be able to track back individuals.

Parents of trafficked children can get alert.

In accidental cases Hospitals will be able to process medical claim when the person who is injured and not able to present his/her medical insurance policies.

### IV. Limitation

Children & kids above 1 year of age can apply for AADHAAR card. Kids' biometrics data, such as finger prints, keep changing frequently upto 5 years of age. Therefore no biometric data will be collected for kids below 5 years age. For children below 5 year age, the AADHAAR card will be linked to their guardian / parents.

When the child turns 5 years age, his/her biometric data will be collected and linked to his/her AADHAAR card. When the child turn 15 years age, his/her final biometric data will be taken once again (for the last time) and linked to the AADHAAR card.

### V. Challenges

Trafficking is crime and criminals may go extreme to hide biometric identity of trafficked person. They may try to damage biometric identify of trafficked person.

Tracking individual to its ancestral path may raise concern over privacy.

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# Use of Different Antiepileptic Drugs in Idiopathic Generalized Epilepsy: A Clinical Study

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**Abstract-** We studied 200 patients of idiopathic generalized epilepsy (IGE) diagnosed by EEG criteria in our tertiary care hospital (Sri Guru Ram Rai Institute of Medical & Health Sciences, Dehradun, UK, India) from June, 2012 to May, 2015. 164 (82%) patients were diagnosed IGE. When history and records were checked 30% patients were taking broad spectrum AED, 35% were on specific AED, 51% were on nonspecific AED while 9.5% patients were on combination of AED. 39.21% patients on nonspecific AED were well controlled of seizures and 60.78% were poorly controlled. When we changed the medicine to broad-spectrum AEDs, 50.82% became well controlled.

**Key Words :** AED, Epilepsy, IGE

## I. INTRODUCTION

Idiopathic generalized epilepsy (IGE) is a wide variety of epileptic syndromes. It has a strong genetic basis [1]. IGE is well controlled by broad-spectrum AED. [2]. IGE is usually adult onset IGE and family history of epilepsy is positive in young patients (during childhood or adolescence) [1, 3-5]. IQ of IGE patients is normal, they have no neurological deficit on examination, and magnetic resonance imaging (MRI) scan is normal. IGE is diagnosed by electroencephalogram (EEG). EEG may be normal and, when abnormal, it can be very characteristic of the syndrome, showing generalized spikes and polyspike complexes of 3-4 Hz, or faster frequency, superimposed on a normal EEG background [6-8]. In general, IGEs respond well to treatment, with 70-80% being fully controlled. The use of narrow-spectrum (nonspecific) AEDs, such as carbamazepine (CBZ) and phenytoin (PHT), either in monotherapy or in combination, is a common wrong practice, which could account for the seemingly difficult to control seizures "pseudointractability" in some reported series [1, 9-11].

## II. METHODS

It was retrospective study. We studied EEG reports of all patients seen at our EEG lab in the period from the years 2012-2015. IGE patients with EEG criteria were identified. For those identified patients, we reviewed their charts, demographic data, workup for epilepsy, age of onset, seizure types, seizure frequency, and their history of AED use, prior to their evaluation at a specialized epilepsy clinic. The study was established with the objective of providing a comprehensive evaluation for patients with refractory epilepsy. The management of patient was under guidance of author who is an epileptologist and neurologist along with physician and supportive staff. The seizure response

rate was recorded based on the patients' last 6 months of visits and compared it to a 6-month period following initiation of the "broad-spectrum" AED, if indicated. AED are divided into two types that is broad-spectrum (specific) and narrow-spectrum (nonspecific). It is known fact that certain AEDs are specific than the others for the treatment of IGE, namely, valproate (VPA), lamotrigine (LTG), topiramate (TPM), and levetiracetam (LEV) [10-16]. On the other hand, the group of "nonspecific" AEDs include phenytoin (PHT), carbamazepine (CBZ), oxcarbazepine (OXC), and gabapentin (GBP). International League Against Epilepsy 1989 classification to classify the different epilepsy types is used [17, 18].

The primary objective of our study was to report our experience in Uttarakhand, India to observe wrong diagnosis and wrong treatment of IGE with nonspecific AEDs. The secondary objective was to determine the percentage of patients who become adequately controlled after evaluation at the epilepsy clinic and switched to the "right" choice of AEDs.

## III. RESULTS

200 patients were identified, 120 males and 80 females, mean age of 30 and mean seizure duration of 06 years (Table 1). According to the International League Against Epilepsy classification, 171 patients (85.5%) had idiopathic generalized epilepsy, 17 patients (8.5%) had juvenile myoclonic epilepsy (JME), and 12 patients (6%) had juvenile absence epilepsy (JAE) (Table 2).

When initially seen, 60 patients (30%) were not on any AED, and 70 patients (35%) were using specific AED (Table 3); of those, 48.3% were on VPA, 2.85% were on TPM, 25.71% were on LTG, 14.28% were on LEV, and 4% were on various combinations of specific AEDs (Table 4). On the other hand, 51 patients (25.5%) were taking narrow-spectrum (nonspecific) AEDs (Table 3); of those, 52.94% were on CBZ, 11.76% were on PHT, 11.76% were on PBT, 9.80% were on OXZ, and 13.7% were on various combinations of these nonspecific AEDs (Table 5). The remaining 19 patients (9.5%) were on a combination of both specific and nonspecific AEDs (Table 3).

Of the total 51 patients who were receiving nonspecific AEDs, seizures were adequately controlled in 20 patients (39.21%), while 31 patients (60.78%) had poorly controlled seizures (Table 6). When these patients' AED regimens were changed from nonspecific to a specific AED, 30 patients (58.82%) became fully controlled, 8 patients (11.26%) appeared to be truly intractable to all medication regimens, and 13 patients (25.49%) have missed followup (Table 6).

#### IV. DISCUSSION

It is supposed that IGE patients are difficult to treat. Our study supports that it important to make a correct diagnosis of IGE and use specific AEDs. It is seen in this study that most of uncontrolled IGE are because of use of specific AEDs. According to International League Against Epilepsy, classification of syndromes be “used daily in communication between colleagues” and be the “subject of clinical trials and other investigations.”

Our findings are similar to other series, which show nonspecific AEDs were used in about 30% of IGE patients and 65% of them had poorly controlled seizures. Specific AEDs had good effects and 50% became seizure-free. This shows the importance of thorough and comprehensive evaluation of patients with difficult to control seizures before they are deemed refractory to AEDs. Interestingly, however, 34% of IGE patients treated with “nonspecific” drugs, such as CBZ or PHT, were seizure-free. Of note, all these patients had GTCs as the predominant seizure type, and none of them had associated absence or myoclonic seizures. It is well established that these latter seizure types may worsen with the use of certain AEDs, whereas GTCs may respond well to a narrow-spectrum (nonspecific) AEDs [2, 11, 16].

Clinical importance of our study is as most patients with generalized tonic clonic (GTC) seizures are assumed to have focal seizures with secondary generalization, especially if their seizures start in adult life [19]. Indeed, 22% of our IGE patients had their seizures beginning after the age of 20. We should use an open mind approach, when evaluating these patients, and to consider using broad-spectrum AEDs if in doubt about the underlying syndromic diagnosis.

Our study is retrospective study. It is required to do a large multi-centre study. Moreover, it has a selection bias, as specialty epilepsy clinics tend to evaluate patients that are doing poorly.

#### V. CONCLUSION

Our findings confirm the previous views. A poor choice of AED is main cause of IGEs that are seemingly difficult to control and show the importance of establishing specialized epilepsy clinics to evaluate these patients and make the appropriate changes. Use of inappropriate AEDs for IGE is still not well recognized in a significant proportion and that requires further evaluatios.

#### CONFLICT OF INTERESTS

The authors does not have any conflict of interests.

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**Table 1: Patient demographics.**

Total number	200
Mean age	30
Male	120
Female	80
Duration of seizures (mean)	6 years
EEG (IGE alone)	164 (82%)
EEG (IGE + Focality)	36 (18%)
Family History of seizures, excluding febrile Sz	46 (23%)

**Table 2: Epilepsy/seizure types.**

Epilepsy type	Seizure types	Total patients
Idiopathic generalized epilepsy with generalized tonic clonic seizures	GTCs	171(85.5%)
Juvenile myoclonic epilepsy	Myoclonic	17 (8.5%)
Juvenile absence epilepsy	Absence	12 (6%)

**Table 3: Prior AED use.**

Patients on no prior AED	60 (30%)
Patients on specific AED	70 (35%)
Patients on nonspecific AED	51 (25.5%)
Patients on combination of specific and nonspecific AED	19 (9.5%)

**Table 4: Prior adequate AED use.**

Patients on specific AED	70 patients
(1) Valproate	38 (48.3%)
(2) Topiramate	2 (2.85%)
(3) Lamotrigine	16 (25.71%)

(4) Levetiracetam	10 (14.28%)
(5) Combination	4 (5.71%)

**Table 5: Prior nonspecific AED use.**

<b>Table 5: Prior nonspecific AED use.</b>	
Patients on nonspecific AED	51 patients
(1) Carbamazepine	27 (52.94%)
(2) Phenytoin	6 (11.76%)
(3) Phenobarbital	6 (11.76%)
(4) Oxcarbazepine	5 (9.80%)
(5) Combination	7 (13.7%)

**Table 6: Treatment response in nonspecific AED group.**

51 patients	Prior nonspecific AED	Change adequate AED
Adequately controlled seizures	20 (39.21%)	30 (58.82%)
Poorly controlled seizures	31 (60.78%)	8 (11.26%)
Missed to follow up		13 (25.49%)

# Suspensory Fixation of Grafts in Anterior Cruciate Ligament Fixation using Endobutton and Suture Disc – A Prospective Study of 30 Cases

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**Abstract- INTRODUCTION:** Arthroscopic ACL reconstruction has become the gold standard for ACL insufficiency in active patients. Hamstring tendon is the most favoured graft choice for ACL reconstruction. The aim of this study is to prospectively evaluate the clinical outcome of a series of 30 patients who underwent Arthroscopic ACL reconstruction using hamstring tendons with suspensory method of fixation using Endobutton on femur and titanium suture disc on the tibial end, with a follow-up of 2 years.

**MATERIALS & METHODS:** 30 patients ACL insufficiency were operated upon Arthroscopic ACL reconstruction using hamstring tendon autograft fixed with Endobutton and suture disc between sept 2012 to march 2014 at Sanjay institute of trauma and orthopaedics, Bangalore were included in the study. All the patients were assessed clinically (IKDC) at 6 months, 1 year and 2 years followup in this study.

**RESULT:** At the final follow up, according to IKDC classification 21(70%) patients were in normal group and 7 (23.3%) patients in nearly normal group and 2(6.6%) patients in abnormal group. And grade 1 laxity in grade I laxity seen in 16 patients and grade II in 1 patient at final follow up but none complained of instability. Tunnel widening in 2 cases at tibial side

**CONCLUSION:** Arthroscopic anatomical ACL reconstruction has been the treatment of choice for ACL tear and hamstring tendon is the graft choice for ACL reconstruction. It is necessary to provide sufficient mechanical stability for the graft to obtain good clinical outcome. Endobutton on the femoral side and suture disc on the tibial end is good mechanical and strong suspensory type of fixation device for ACL reconstruction

**Index Terms-** ACL Reconstruction, Hamstring graft, Endobutton , suture disc.

## I. INTRODUCTION

Anterior cruciate ligament rupture is the most common knee ligament injury.

The incidence of ACL tears has increased in the general population with the rise of participation in sports. (1) The development of symptomatic knee instability after ACL injury ranges from 16% to almost 100% (2). There have been significant technical advances during recent decades to treat ACL insufficiency and many studies have documented the successful results of contemporary arthroscopic ACL reconstruction (7). Bone- patellar tendon-bone (BPTB) or hamstring constructs are

most commonly used. All autologous graft has donor site morbidity. Many studies have demonstrated that hamstring grafts have fewer problems with anterior knee pain, quadriceps muscle deficits, loss of extension compared with BPTB autografts. low harvest morbidity and excellent biomechanical graft properties coupled with improved fixation of soft tissue grafts are all reasons for excellent clinical outcomes of ACL reconstruction using hamstring tendons (5,9)

Suspensory methods using endobutton for femur and suture disc for tibia tunnel fixation and aperture methods of fixation have been described, with aperture fixation resulting in increased stiffness of the construction compared with the suspensory method (8)

Our study is designed to analyze the postoperative outcome of arthroscopic ACL reconstruction with quadrupled semitendinosus tendon autograft fixed in femoral tunnel using endobutton and in the tibial side using suture disc.

## Material and methods

This was a prospective study on a continuous series of 30

Patients operated on for ACL rupture, using the same technique, from September 2012 to March 2014.

**The exclusion criteria** were a previously operated knee, ligament reconstruction of the contralateral knee, associated lateral or medial ligament lesions, as well as observed chondral lesions that could modify the postoperative rehabilitation protocol (grade III or IV cartilaginous lesions).

## Pre-operative assessment

The pre-operative assessment included detailed history and physical examination , radiographs and MRI of the involved knee. Lachman test ,Anterior drawer test and Mc Intosh Pivot shift test were used for testing ACL .The results were graded as 0 (negative), 1+,2+ and 3 + positive. Other tests performed routinely included the Varus and Valgus stress tests ,Mc Murray's test , Posterior drawer test and the Reverse Pivot shift test. Radiographs included the standing AP view of both the knees and a Lateral view of the affected. .MRI of the involved knee was done in all the cases (fig 1). In all acute cases of ACL injury, patient were treated with long knee brace for three weeks following which ACL reconstruction was planned after bone oedema subsided

## Operative technique

**Arthroscopic technique:** After induction of anaesthesia, supine position with upper thigh tourniquet. Clinical tests performed under anaesthesia. Initial diagnostic arthroscopy performed via anteromedial and anterolateral ports and meniscal injuries managed. Oblique incision about 3cm antero-medially on proximal tibia starting 3-4cm distal to joint line and 3-4cm medially to tibial tuberosity. Semitendinosus tendon is more horizontal and lies below gracilis. It is pulled with curved clamp or a mixtar and snared with a braided suture, dissection carried proximally up the thigh. The insertion end of the tendon is held with ethibond and the surrounding fibrous extension released ACL graft master used for pretensioning and control of tendon. The overall length of the tendon is measured. The tendon is looped in half to make double strand of equal length. Place a double Krackow-type whipstitch in free end of each tendon with No. 2 Ethibond. The double stranded graft will be looped further to create a total of four strands and graft size measured with the tendon sizer. Femoral tunnel preparation is done through low placed anteromedial port with knee in maximum flexion (>120degree). The guide pin advanced so that it exits the distal femoral cortex the femoral tunnel length to be reamed is measured with a depth gauge and then calculated according to the length of the graft material. Using the appropriate diameter reamer, the femoral tunnel is reamed based on graft size. Tibial guide placed taking ACL footprint, the inner edge of anterior horn of the lateral meniscus, the medial tibial spine, the PCL as reference points. Guide pin passed and cannulated reamer over it as determined by the prepared graft diameter size. Initially No.2 ethibond attached to eye of beath pin passed through anteromedial port to the femoral tunnel exiting lateral aspect of thigh. Using suture retriever through tibial tunnel pull the other end of ethibond out and secure to the pre-tensioned graft with endobutton attached tight rope and is pulled out of the femoral tunnel, so that the thread is out of the thigh. Under arthroscopic visualization in the joint, the threads of the endobutton are pulled using the principle of flipping the endobutton and the femoral fixation is confirmed by toggling of the endobutton. When tension is placed on the grafts, the knee is taken through approximately 15 to 20 cycles of complete flexion and extension. This helps to align the grafts and also tests for impingement between the grafts and bony structures. The tibial side of the graft is fixed with a suture disc which is held over the tibial tunnel by passing the ethibond threads through the suture disc and tightening the knots around the disc. The joint is cleared off the debris by thorough lavage. Graft harvest site is sutured in layers with no 2-0 vicryl. Skin sutured with ethilon / skin staples. Compression bandage dressing done and long knee extension brace applied.

#### Rehabilitation:

Postoperative protocol for rehabilitation was used. A brace was given for a period of three week to protect the ligament. Range of motion of the knee and isometric muscle exercises were started the day after the operation and gradually progressed on the basis of closed kinetic chain exercises. Knee flexion of more than 90° and walking with full weight bearing was allowed one month postoperatively. Indoor cycling and swimming were permitted after four weeks and running after 3 months. High demand sports activities were allowed after approximately 12 months.

## II. RESULTS

This series included 30 patients; the minimum follow-up of the clinical assessment was 2 years with mean follow up of 36 month Highest number of patients fall in age group 31-35yrs (30%), next being 26-30yrs (20%). Mean age of our study is 31.6yrs. Elder patients aged 48yrs and younger ones are 19yrs. Male patients account to 28(93.33%) of the total 30 in study group and rest 02 (06.67%) are females. Male preponderance may be related to their frequent involvement in outdoor work and strenuous activities. 16 out of 30 patients (53.33%) got Right Knee involvement and 14 Left Knee ACL tear (46.67 %). Nature of injury in 11 patients (36.66%) is due to sports (athlete, joggers, jump, physical trainers, kabaddi, cricket, players). RTA being the cause for ACL tears in 10 patients and the rest 9 sustained injuries due to other causes like slip and fall. About occupation majority of our patients 13 (43.33%) of total 30 fall into competitive lifestyle like joggers, military trainers, athletes followed by sedentary 11 patients (36.66), next is farming 06 patients (20%). All the patients were examined with Lachman, anterior drawer and pivot shift tests in OPD and under anaesthesia prior to surgery. In OPD, 28 patients turned positive Lachman rest 2 patients Lachman negative. Under anaesthesia all were Lachman positive. In OPD 27 were anterior drawer positive, when the same done under anaesthesia 29 were positive. Pivot shift test was positive in 16 patients in OPD but the same when done under anaesthesia was positive in 28 out of total 30 patients. Results of associated injuries on initial diagnostic arthroscopy shows ACL with MM tear in 16 patients (53.33%), isolated ACL tear in 9 patients (30%). ACL tear with MM and LM injury noted in 5 patients. complications at the end of 6 months 2 patients complained of mild pain at the graft site. No superficial or deep infection seen. Lachman grade I laxity seen in 16 patients and grade II in 1 patient at the end of final follow up but none complained of instability. 2 patients (who had preoperative restriction of terminal flexion of about 10degrees) had restriction of the terminal 10-15degree flexion at the postoperative 6 month follow-up and 2 patients had 5-10 degree restriction of extension, which improved with physiotherapy. Tunnel widening at the tibial side was seen in 2 cases

Postoperative Outcome x ray was taken,(fig 2) All the patients were examined 3, 6, 12, and 24 months after surgery as well as at the latest follow-up. The clinical assessment was based on, the objective criteria of the International Knee Documentation Committee (IKDC 1999) and LGS In our study, 21 (70%) patients got normal postoperative recovery according to IKDC scoring at final follow-up, while 7(23.3%) near normal and rest 02 were abnormal related to knee stiffness and 21 patients got excellent results according to LGS scoring while 7 patients showed good results.and the score was fair in rest 2 patients at the final follow up

## III. DISCUSSION

Surgical reconstruction of the ACL has become the standard in the treatment of ACL injuries. The primary goal of ACL reconstruction is to restore the stability of the knee .Successful clinical outcomes following anterior cruciate ligament

reconstruction with a hamstring graft has been reported by many authors .(3,4)

The choice of fixation in ACL reconstruction is still evolving and the current fixation device which has been widely used were the Endobutton and the Bio composite interference screws which has helped to render an improved rehabilitation program post operatively.

(11) All patients in our study underwent ACL reconstruction with hamstring graft fixed with Endobutton and suture disc for tibial tunnel.

Vernon J. Cooley et al(10)in their study concluded that ACL reconstruction using quadrupled fold semitendinosus tendon autograft provides excellent clinical outcome, patients maintain preinjury activity without episodes of reinjury. Degeneration of the articular surfaces rarely occurs and the reoperation rates are minimal. About 85% of the patients according to IKDC scoring fall into normal to near normal in their study as compared to more than 70% normal and 23% near normal in our study Although Endobutton is not a direct fixation device into the graft, there is a nylon material present between the graft and the button. This suspensory fixation has been associated with increased anterior joint laxity.(8) In our study we found 16 patients had grade I laxity after 1 year grade II in 1 patient at the end final follow up Due to the indirect fixation of the graft there is a cyclic stretching of the graft under load which leads to the tunnel widening and inhibit the tendon-bone healing.(12) There is an anteroposterior movement occurring inside the widened tunnel described as the “windscreen wiper” effect. Nebeking et al(13) has described that there will be femoral tunnel enlargement when fixing the hamstring tendon with Endobutton in his study. In our study we had 2 cases of tibial tunnel widening

The advantages of Biodegradable interference screw is maintained as we have used titanium suture disc which is also MRI compatible and revision surgery is much easier when compared to metal screws. 23 The disadvantage is breakage of the screw while inserting and the biocompatibility screw is concern (14) which can be overcome with suture disc usage

In a study by Spicer et al (6) areas of sensory change over the front of the knee were identifiable in 50% of the patients and of these 86% demonstrated sensory changes in the distribution of the infragenicular branch of the saphenous nerve. In our study patients complained of numbness over the anterior aspect of leg around 10 % of patients

#### IV. CONCLUSION

This study was conducted on 30 patients suffering from ACL deficiency in the age group of 19-48 years. Instability of knee in the form of giving way is main complaint evaluated by Lachman test and confirmed by arthroscopy. The functional outcome of anterior cruciate ligament reconstruction with quadrupled semitendinosus tendon autograft using endobutton and suture disc will help the graft to facilitate graft tunnel healing and also

maintain its strength until there is a good graft to bone healing occurs completely is excellent to good (93%) with mild laxity

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# Multifetal Pregnancy Reduction: Use of Intra Cardiac Autologous Amniotic Fluid versus Potassium Chloride

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**Abstract- Introduction :** Feticide in multifetal pregnancy is being practised since last two decades for reduction of multifetal pregnancy or selective fetal termination of anomalous twin. Multifetal pregnancy reduction is particularly gaining importance due to rampant use of Assisted Reproductive Technology world over. However, still there are several issues associated with fetal reduction varying from the its actual requirement to different methods of practising it.

**Objective:** To compare the efficacy of intracardiac injection of autologous amniotic fluid versus potassium chloride and evaluate the fetomaternal outcome in high order multiple pregnancies (>2), who underwent multifetal pregnancy reduction (MFPR) to twins.

**Methods:** This was a prospective cohort study conducted in the Department of Maternal and Reproductive Health, Sanjay Gandhi Post Graduate Institute of Medical Sciences. 50 patients were enrolled in the study. Inclusion criteria was High order multiple pregnancy with more than 2 fetuses, Spontaneous conception or conceived via ovulation induction or In-Vitro-fertilization, gestation before 20 weeks. Exclusion criteria was monochorionicity, even in higher order gestations like quadruplets.

All the reductions were done between 11-13 weeks, triplets were done in single session and quadruplets were done in two sittings. There can be various methods with which reduction can be practised. It can be done transabdominally or transvaginally. We did it transabdominally in the patients. Out of total 50 patients, 25 had instillation of amniotic fluid and 25 had KCl.

**Results:** We realize that both amniotic fluid and potassium chloride are equally effective agents for fetal reduction, however it appears that there are few advantages with each. The patients exposed to amniotic fluid did not suffer from spontaneous missed abortion. The pricks required to achieve asystole were similar in both the groups. The dosage and time to achieve asystole was significantly less in KCl group.

**Conclusion:** Multifetal pregnancy has got numerous social, psychological, medical issues. It is a procedure not free of complications. This comparative study demonstrates that, for a multifetal pregnancy reduction, KCl appears to be more effective, less time consuming agent compared from autologous amniotic fluid with similar rates of growth retardation, prematurity and LSCS. Both the groups also had similar mean birth weight and take home baby rates.

**Index Terms-** Multifetal Pregnancy Reduction (MFPR), Potassium Chloride, Amniotic Fluid

## I. INTRODUCTION

Feticide in multifetal pregnancy is being practised since last two decades for reduction of multifetal pregnancy or selective fetal termination of anomalous twin. Multifetal pregnancy reduction is particularly gaining importance due to rampant use of Assisted Reproductive Technology world over. There has been a widespread increase in multifetal pregnancy. Lessons learnt in the past are that higher order pregnancies are associated with an increased risk of maternal complications as well as a high prevalence of prenatal and neonatal morbidity and mortality. However, still there are several issues associated with fetal reduction varying from its actual requirement to different methods of practising it.

The need and efficacy of reduction of high order (more than 2) multifetal pregnancy is proven in the literature. **Van de Mheen et al<sup>1</sup>** compared the time to delivery and perinatal mortality in trichorionic triplet pregnancies electively reduced to twins with ongoing trichorionic triplets and primary dichorionic twins. They concluded that in women with a triplet pregnancy, fetal reduction increases gestational age at birth with 3 weeks as compared with ongoing triplets. The procedure is relatively safe, it has a abortion rate of 4 – 6.5%. It does not lead to any increase in rates of IUGR. **Brown et al<sup>3</sup>** analysed whether the intra-uterine growth performance of a twin pregnancy resulting from MFPR differs from that of an unreduced twin pregnancy. In their retrospective study they found that MFPR does not itself adversely influence intrauterine fetal growth.

Numerous agents exist for the purpose of reduction and there is a constant research to look for which is the preferred one amongst all. Henceforth, this study was planned with the objective to compare the efficacy of intracardiac injection of autologous amniotic fluid versus potassium chloride and evaluate the fetomaternal outcome in high order multiple pregnancies (more than 2), who underwent multifetal pregnancy reduction (MFPR) to twins.

## II. MATERIAL AND METHODS

This was a prospective cohort study conducted in the Department of Maternal and Reproductive Health, Sanjay Gandhi Post Graduate Institute of Medical Sciences. 50 patients

were enrolled in the study. Inclusion criteria were high order multiple pregnancies with more than 2 fetuses, Spontaneous conception or conceived via ovulation induction or In-Vitro-fertilization, gestation before 20 weeks.

Exclusion criteria were monochorionicity, even in higher order gestations like quadruplets. The first step began with the counselling and guiding patients when making decisions regarding multifetal pregnancy reduction which included the various risks associated of multifetal pregnancy, the possible medical benefits of multifetal pregnancy reduction, and the complex ethical issues inherent in decisions regarding the use of multifetal pregnancy reduction.

It was the autonomous decision of the patient who must balance the relative importance of the medical, ethical, religious, and socioeconomic determinants and pursue the best course of action for her situation.

All the reductions were done between 11-13 weeks, triplets were done in single session and quadruplets were done in two sittings.

There can be various methods with which reduction can be practised. It can be done transabdominally or transvaginally. We did it transabdominally in the patients. Out of total 50 patients, 25 had instillation of amniotic fluid and 25 had KCl.

The reduction procedure consisted of intrathoracic KCl or autologous amniotic fluid injection into the area of fetal heart. The fetus with largest NT, smallest CRL, any suspicious morphology or obvious defect and farthest from the internal os was the preferred one to be reduced.

Maternal abdomen was prepped and draped, operator and assistant scrubbed and gowned. Ultrasound transducer placed in a sterile probe cover. Ultrasonographic guidance (voluson S8, GE healthcare) was used to insert a heparinised 20 gauge spinal needle into the thorax of the fetus to be aborted, and 0.5 – 2 ml (2 mEq/ml) of KCl was injected. If cardiac activity persisted after initial 0.5 ml, additional KCl was administered.

In the amniotic fluid group, amniotic fluid was aspirated or drained first to fill the puncture needle until 0.5 mL of amniotic fluid<sup>13</sup> was loaded in a 1-mL syringe. The needle was then advanced into the intrathoracic cavity. We injected 0.1-mL amniotic fluid each time and wait for 2 minutes to repeat until heartbeat ceased immediately.

The dosage of KCl is comparative to other studies<sup>10,11,12</sup> who also used 4 to 8 mEq KCl.

The fetus was monitored by sonography until its heart stopped beating. Total cessation of heartbeat was observed for 5 min to ascertain asystole before removal of needle. Contrary to other studies<sup>11</sup> postoperative oral antibiotics (ampillicin 500mg thrice daily) was given for 5 days. Additionally intramuscular progesterone 500 mg was also given. Ultrasound ere done before discharging the patient the patient from daycare to ensure success of procedure and to evaluate any evidence of sub chorionic bleeding and assessment of viability of remaining foetuses.

Patients returned for follow-up ultrasonography within 1 week of the procedure. The results of the follow-up ultrasound were recorded and pregnancy outcome information was collected in each case.

### III. RESULTS

This was prospective cohort study, a total of 50 patients were enrolled in the study. 25 patients had amniotic fluid instillation and 25 had potassium chloride instillation. Both the groups had similar baseline characteristics. Age of the pregnant women varied between 27-33 years with mean age of patients was 33 years. There were 2 quadruplets in amniotic fluid group and 3 in KCl group. Gestational age at time of procedure ranged between 10 weeks  $\pm$  4 days to 13 weeks  $\pm$  4 days with mean gestational age of 11 weeks 4 days in amniotic fluid group and 11 weeks 6 days in potassium chloride group.

We realize that both amniotic fluid and potassium chloride are equally effective agents for fetal reduction; however it appears that there are few advantages with each. The patients exposed to amniotic fluid did not suffer from spontaneous missed abortion. The number of pricks required to achieve asystole were similar in both the groups (Figure2, table 1)

The dosage and the time required to achieve asystole was significantly lesser in potassium chloride group ( Figure3, 4, table 2). This appeared probably because of tamponade like affect of amniotic fluid which requires higher dosage compared to KCl which acts with its ion like affect on heart causing cardiac arrest.

**Statistical Analysis:** Data was analyzed using Statistical Package for Social Sciences (SPSS) version 15.0. Chi-square test and Independent samples 't'-test was used to analyze the data. A "p" value less than 0.05 indicated a significant association.

Follow up of the patients showed three cases of spotting (which was managed conservatively) and one complete abortion (18wk quadruplet, which also had component of cervical incompetence) and no cases of missed abortion in amniotic fluid group. There were two cases of spotting which was managed conservatively and one case of missed abortion in KCl group both of which was not statistically significant. Two cases showed slight atypical presentation, one had irregular heart rate for 1 hr and finally asystole was achieved with additional 0.1ml and total of 0.3 ml. The other case had repeat procedure as fetal heart reappeared after 15min and 0.2ml was again injected.

There rates of were 2 cases of preterm delivery less than 32 weeks, 1 case of intrauterine death and 3 cases of discordant twins with IUGR in amniotic fluid group which was not significantly different from KCl group.

Mean gestational age at delivery was 35 weeks  $\pm$  7 days in amniotic fluid group and 36 weeks  $\pm$  7 days in potassium chloride group and both the groups had almost similar take home baby rate of 85 %. The mean (+/-SD) birth weight was 1.840+/- 200.44 g in amniotic fluid group and 1.832+/- 230.44 g in potassium chloride group ( Table 3).

### IV. DISCUSSION

Multifetal pregnancy reduction (MFPR) is an effective therapeutic option which reduces the maternal, prenatal, neonatal morbidity and mortality associated with multifetal pregnancies, most important being prematurity.

First trimester transabdominal or transvaginal fetal reduction is a now a recommended and effective alternative for

the management of multifetal pregnancy in assisted reproduction technique. There is constant increment in the literature regarding the methods and agents.

Various agents used are autologous amniotic fluid, potassium chloride, lidocaine and air embolism etc. Furthermore, there are modifications like elimination of use of any agent at all. Embryo aspiration and cardiac puncture have been reported with favorable outcomes, but it may be technically difficult or time-consuming at later gestational ages (4,9). On the contrary, intrathoracic injection of a toxic substance to block fetal blood flow would be less complicated and less time-consuming. Air embolism has been employed in fetal reduction, but the acoustic disturbance makes ultrasound images unclear. In this study, we injected amniotic fluid compared to KCl in efficacy particularly regarding dose and time to achieve asystole.

**Mansour RT et al<sup>9</sup>** modified the technique of multifetal pregnancy reduction and studied the outcome. Cases were 75 patients with high-order multiple pregnancies resulting from assisted reproduction. Controls were 40 nonreduced twin pregnancies and 22 high-order multiple gestations. Transvaginal ultrasonically guided multifetal pregnancy reduction was performed. The first 30 cases were done using KCl as a cardiotoxic agent. The modified technique was used for the last 45 cases at an earlier gestational age (approximately 7 weeks) by eliminating the use of KCl and by aspirating the embryonic parts. Using the modified technique, the miscarriage rate was 8.8% and 41 patients delivered between 32 and 39 weeks of gestation (mean $\pm$ -SD, 36.9 $\pm$ -2.45 weeks). The mean (+/-SD) birth weight was 2,450.51 $\pm$ -235.44 g. The miscarriage rate, fetal wastage rate, mean gestational age, and mean birth weight were similar in reduced and nonreduced twins and were significantly better than in non-reduced triplets and quadruplets. According to them, modified technique of multifetal pregnancy reduction by aspiration of embryonic parts significantly improved outcomes, which were similar to those of non-reduced twins resulting from assisted reproduction and significantly better than those of non-reduced triplets and quadruplets.

Intracardiac puncture without injection of any agent has also been reported by **G Iberico et al<sup>4</sup>**, in which they performed an intracardiac embryo puncture until asystole is verified, without the injection of any substances. Any aspiration of embryo tissues or amniotic fluid was avoided. A total of 149 multifetal pregnancies was reduced to twins ( $n = 134$ ) or singletons ( $n = 15$ ) at early gestational age ( $7.8 \pm 0.8$  weeks). Eleven cases (7.3%) of miscarriage, two cases (1.3%) of chorioamnionitis, and seventeen cases (11.4%) of transient spotting were recorded as postoperative complications. Vanishing of one embryo occurred in four cases (3.0%) of those reduced to twins. The baby take-home rate was 89.5% for twins and 80.0% for singletons. These studies show that early transvaginal intracardiac embryo puncture is an effective and safe technique.

The said disadvantage of reduction at this early gestation is that at a fact that some foetuses might spontaneously die and vanish without any intervention and additionally at around 11- 12 weeks we get an opportunity to see for nuchal thickness and few malformations which could guide us in choosing the fetus most prone to aneuploidy or malformation.

The use of potassium chloride has been reported in literature both intracardiac and intracranial. **Lembet A et al<sup>6</sup>** for the first

time in 2009 reported case series describing the technique of intracranial injection of potassium chloride during MFPR. In certain cases of MFPR, where difficulty is encountered in reaching the thorax due to the fetal position as well as the location of membranes and placenta, an alternative approach may be the insertion of the needle to the fetal cranium. This approach enables a technically easier procedure than the intrathoracic approach.

Recently in 2013, **Li R et al<sup>7</sup>** assess the effectiveness and feasibility of transabdominal intracranial KCl injection as an alternative to intrathoracic KCl injection for multifetal pregnancy reduction (MFPR) in the early second trimester. Amongst 40 cases who underwent fetal reduction between 12 and 18 weeks of gestation, 16 cases had intracranial injection and 24 cases had intrathoracic injection. These groups were compared for clinical procedures and outcomes. Intracranial injection needed significantly fewer punctures for each fetus than intrathoracic did ( $1.1 \pm 0.2$  vs.  $1.4 \pm 0.6$ ), but both groups received similar doses of KCl ( $2.6 \pm 0.8$  ml vs.  $2.6 \pm 1.2$  ml per fetus). All cases succeeded in the first procedure, with no heartbeat recovery. The two groups had similar miscarriage rates and gestational ages at delivery. MFPR by intracranial KCl injection was as effective as, but an easier procedure than intrathoracic KCl injection between 12 and 18 weeks of gestation according to their study.

We performed technique for MFPR by fetal transthoracic intracardiac injection of potassium chloride and autologous amniotic fluid. To our knowledge this kind of comparative study is never reported in the available literature. We found that potassium chloride has significantly lesser dose requirement and shortens time period to achieve asystole compared to amniotic fluid. Other parameters and outcome in both the groups were similar. **Shang-Gwo Horng et al<sup>13</sup>** had reported the only case reports of two triplet pregnancies containing monochorionic twins in which dichorionic twins were successfully preserved after sacrificing one of the monochorionic twins by employing amniotic fluid tamponade. The first case had preterm premature rupture of membranes (PPROM) occurred at 25 weeks of gestation. Both female fetuses failed to survive. In the second case, two healthy babies were delivered by cesarean section at 36 weeks of gestation. The female baby weighed 2100 gm and the male baby 2600 gm, respectively.

Compared to intracardiac amniotic fluid, intracardiac injection of KCl is a modality being practised since long. Long back in 1991, **Donner et al<sup>8</sup>** did multifetal pregnancy reductions during the first trimester of pregnancy in 26 patients. Transabdominal intrathoracic KCl injections were performed in 23 cases, and transcervical aspirations in 3 cases. There were 4 miscarriages (15%) during the second trimester, 18 pregnancies ended in 33 births, 4 pregnancies are going on uneventfully and are beyond 32 weeks. There was no maternal morbidity related to the procedure; fetal morbidity has been mild. Studies have shown an equal efficacy and loss rates between transabdominal versus transvaginal intracardiac KCl injection technique for fetal reduction<sup>11</sup>.

If we look upon the transabdominal methods, **Berkowitz RL et al<sup>10</sup>** presented the outcome of 200 consecutive multifetal pregnancies in whom procedures were performed in the first trimester by the transabdominal injection of potassium chloride. At the time of the procedure 88 women had triplets, 89 had

quadruplets, 16 had quintuplets, and 7 had from 6 to 9 fetuses. These pregnancies were reduced to 189 sets of twins, 5 sets of triplets, and 6 singletons. Reductions to triplets were done at the patient's request, and reductions to singletons were only done for medical indications. There were no cases of chorioamnionitis or other maternal complications attributable to the procedure. A total of 181 women were delivered of one or more live infants after 24 weeks' gestation, and 19 (9.5%) lost all of their fetuses before that time. The mean gestational age for all women delivered after 24 weeks was 35.7 weeks. The mean gestational age at delivery varied inversely with the initial number of fetuses, from 36.1 weeks for women who presented with triplets to 33.8 weeks for those who had 6 or more fetuses. 16 of the 19 complete pregnancy losses occurred more than 4 weeks after the reduction procedure had been performed. The loss rates were 7.9% for those who presented with 3 or 4 fetuses, 12.5% for those with 5, and 42.9% for those with more than 6 and this trend was statistically significant. Two neonates died in the first week of life and one died at 10 months of age as a consequence of the sequel of severe prematurity. Only two surviving infants have shown evidence of chronic morbidity related to early delivery, and all of the others are developing normally. The incidence of intrauterine growth retardation was not increased over that anticipated in a population of twins.

As far as monochorionicity is concerned, it accounts for 30% of multiple pregnancies which occur at a significantly higher rate after ART procedures and could be an important complication after IVF-ICSI treatment. In our study we strictly believed in the fact that agent use to reduce fetus can affect the remaining one in a monochorionic pregnancy owing to the very unique vascular anastomosis seen in majority of monochorionic pregnancies and hence it was considered a contraindication for the procedure. Literature however has case reports for reduction being done in monochorionic pregnancies as well. Li Y et al<sup>5</sup> reported a dichorionic quadramniotic quadruple gestation with monochorionic triamniotic triplets after intracytoplasmic sperm injection (ICSI) treatment and transfer of two embryos. After extensive counseling, selective reduction of two of monochorionic triamniotic triplets was done and a twin pregnancy remained. Reduction of monochorionic fetuses can be safer in higher order multifetal pregnancies where we actually reduce both twins of monochorionic pair. **Carol B. Benson et al**<sup>12</sup> reduced three quadruplet and two quintuplet gestations, each with a monochorionic pair of fetuses. In all the cases, reduction was performed by injecting one of the monochorionic pair with potassium chloride.

## V. CONCLUSION

Multifetal pregnancy has got numerous social, psychological, medical issues. It is a procedure not free of

complications. ACOG has released a new committee statement<sup>2</sup> in February 2013 replacing the previous one in 2007 which clearly states that Fertility treatments have contributed significantly to the increase in multifetal pregnancies. The first approach to the problem of multifetal pregnancies should be prevention, and strategies to limit multifetal pregnancies, especially high-order multifetal pregnancies, should be practiced by all physicians who treat women for infertility.

This comparative study demonstrates that, for a multifetal pregnancy reduction, KCl appears to be more effective, less time consuming agent compared from autologous amniotic fluid with similar rates of growth retardation, prematurity and LSCS. Both the groups also had similar mean birth weight and take home baby rates.

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Pricks	KCl (n=25)		Amniotic Fluid (n=25)	
	No.	%	No.	%
1	16	64.00	13	52.00
2	8	32.00	10	40.00
3	1	4.00	2	8.00

$\chi^2=0.866$  (df=2); p=0.649 (NS)

**Table 1: Comparison of number of pricks required**

	Agent	N	Mean	Std. Deviation	
Dose	KCl	25	.3360	.13503	t=5.162; p<0.001 (S)
	Amniotic fluid	25	.5680	.17963	
Time	KCl	23	3.4130	1.22151	t=4.938; p<0.001
	Amniotic fluid	25	5.6400	1.81728	

**Table 2: Comparison of dosage and timing**

Parameters	Amniotic fluid (n = 25) Delivered N = 18 Aborted / missed/ IUD n = 1	KCL (n = 25) Delivered N = 17 Aborted / missed / IUD n = 1
Mean maternal age at procedure	33.6+/- 3.4	32.6+/- 3.4
Loss of entire pregnancy	1 (4%)	1 (4%)
Inj. Betamethasone coverage	100%	100 %
Gestational age of delivery	< 32wk	2
	32wk1 d -34wk	2
	34wk1d -37wk	11
	>37wk	1
Mode of Delivery	LSCS (10/10)=100%	LSCS (10/10)=100%
Mean Gestational age	35 weeks ± 7 days	35 weeks ± 7 days
<b>20 neonates delivered</b>	Amniotic fluid	Potassium chloride
Neonatal mortality	1 (5%)	1 (5%)
Mean Birth wt.	1.840+/-200.44 g	1.832+/- 230.44 g
Average stay in NICU	6+/-2.5days	7 +/-2.8 days
Requirement of Ventilator	2 (1.1kg bwt.)	2 (1.2 kg)

**Table 3 : Outcome (35 out of 50 patients have delivered 15 ongoing pregnancies)**

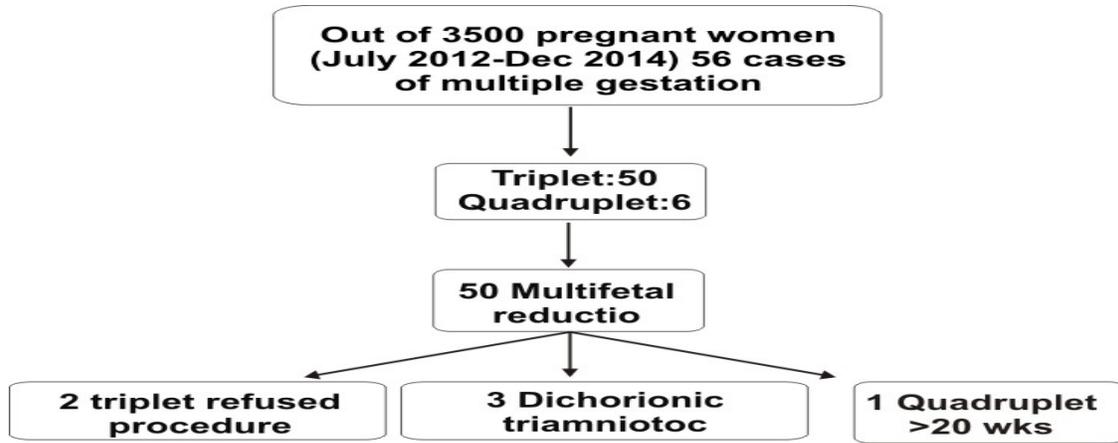


Figure 1. Study Protocol

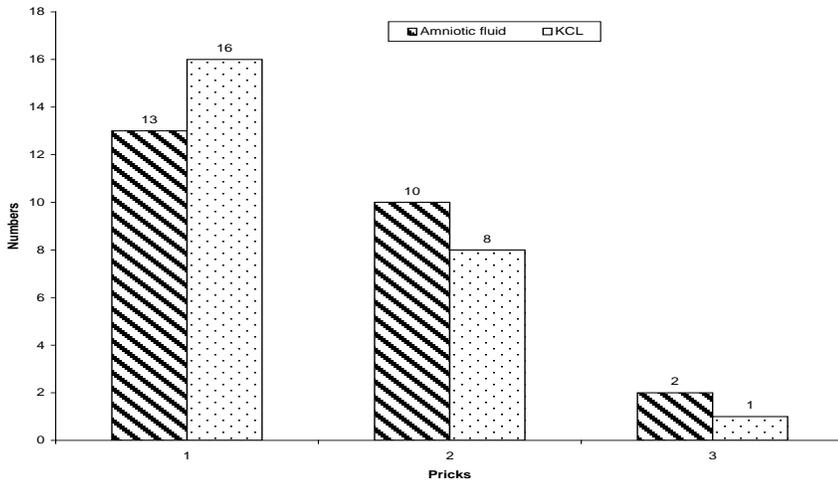


Figure 2: Number of pricks required

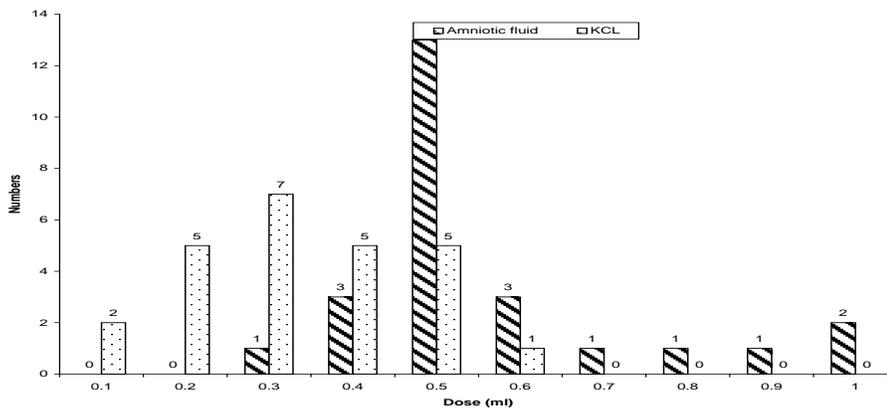
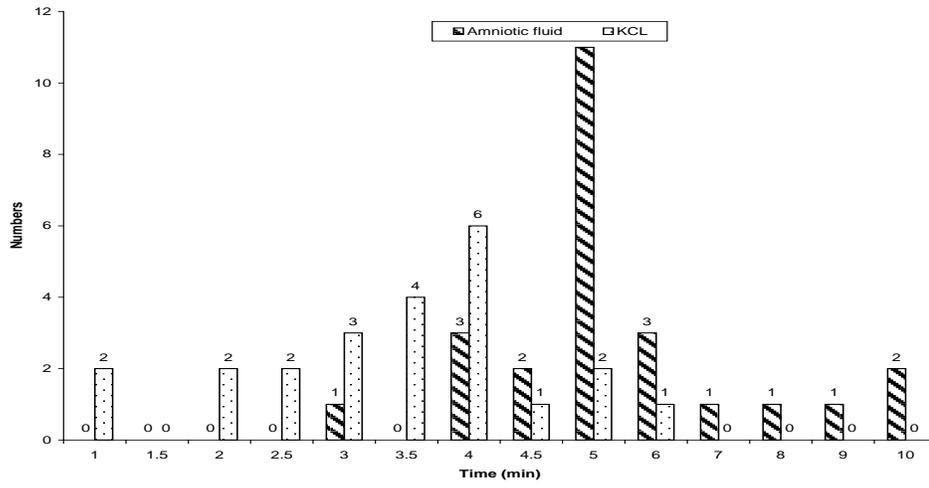


Figure 3. The dosage required to achieve asystole was significantly lesser in potassium chloride group



**Figure 4. Time required to achieve asystole was significantly lesser in potassium chloride group**

# Changes in lipid profile and liver enzymes in HIV infection and AIDS Patients

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**Abstract-** This study was designed to find the correlation between changes in lipid profile and liver marker enzymes in HIV-infected and AIDS patients. The study population consisted of 150 subjects, age and sex-matched and divided into three groups [control subjects (n=50), HIV infected (n=50) and AIDS patients (n=50)]. Serum levels of total cholesterol, high-density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C) were found to be decreased significantly in HIV/AIDS patients when compared with normal counterparts. On the other hand, the levels of triglyceride (TG) and very low-density lipoprotein cholesterol (VLDL-C) were markedly elevated in HIV/AIDS patients compared to normal subjects. The activities of serum aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase (ALP) observed in HIV/AIDS patients were significantly higher than in the control group. Further, the above mentioned biochemical variables were found to be affected more significantly in AIDS patients when compared with HIV infected subjects. Hence, it may be concluded that lipid profile and liver enzymes can be a good index of disease progression in HIV infection and AIDS patients.

**Index Terms-** HIV-AIDS-Lipids-Liver Enzyme

## I. INTRODUCTION

The acquired immunodeficiency syndrome (AIDS), is a fatal illness caused by a retrovirus known as the human immunodeficiency virus that breaks down the body's immune system, progressively leads to AIDS (Rasool et al. 2008). There are 2.47 million persons in India living with HIV; equivalent to approximately 0.36% of the adult population. The revised national estimate reflects the availability of improved data rather than a Substantial decrease in actual HIV prevalence in India. The transmission route is still predominantly sexual (87.4%); other routes of transmission by order of proportion include prenatal (4.7%), unsafe blood and blood products (1.7%), infected needles and syringes (1.8%) and unspecified routes of transmission (4.1%) (UNAIDS 2006).

Men with HIV infection were reported to have hypocholesterolaemia with and without hypertriglyceridaemia (Grunfeld et al. 1991, National AIDS Control Organization - NACO 2003, Anastos et al. 2007). An association between plasma triglyceride and circulating interferon-levels has been observed in persons with AIDS. However, the mechanism for hypocholesterolaemia in HIV and other infections is not known. A pattern of hyperlipidaemia (i.e. elevated levels of total cholesterol, low-density lipoprotein cholesterol, and

triglycerides, and a reduced level of high-density lipoprotein cholesterol) has been observed in patients treated with protease inhibitors (Crook and Mir 1999, Ducobu and Payen 2000, Khiangte et al. 2007). Infection can increase plasma triglyceride levels by decreasing the clearance of circulating lipoproteins, a process considered to be the result of reduced lipoprotein lipase (LPL) or by stimulating hepatic lipid synthesis through increases in either hepatic fatty acid synthesis or re-esterification of fatty acid derived from lipolysis (Grunfeld et al. 1992). Hypertriglyceridaemia was the first dyslipidaemia to be reported in HIV infected patients, but other lipid abnormalities such as hypocholesterolaemia or hypo HDL cholesterolaemia have also been reported. Although immunological dysfunction is common to all AIDS patients, the clinical spectrum of HIV infection is diverse and multiple organ involvement is frequently evident (Dalglish et al. 1984). Liver disease has been linked to HIV infection and may manifest as fever of unknown origin, hepatomegaly or sub-clinical abnormalities in liver function tests (Tietz et al. 1983, Montagnier et al. 1984).

Studies also suggested that the major cause of hepatitis in HIV patients is infection by a secondary virus called the cytomegalo virus. It is also of interest that HIV has been detected in the liver cells of AIDS patients. It may be that those cells targeted for apoptosis are the same cells infected with HIV (Cooper et al. 1984).

In various forms of liver disease, serum levels of numerous cytosolic, mitochondria and membrane-associated enzymes are increased. The degree of elevation varies with the type of disease. Alanine and aspartate aminotransferases and alkaline phosphatase are the enzymes that are most often measured for evaluation of liver disease or diseases affecting the liver or in diseases where the liver is implicated (Tietz et al. 1983). The knowledge of the intracellular location of enzymes can therefore assist in determination of the nature and severity of a pathological process if suitable enzymes are assayed in the blood. The present study was undertaken to find out the relationship between changes in lipid profile and liver marker enzymes in HIV infection and AIDS patients.

## II. MATERIALS AND METHODS

### *Study population*

The population was selected consisting of 150 subjects divided into three groups: HIV infected patients 50 cases (n=50), AIDS patients 50 cases (n=50) and an equal number of age - and sex- matched control subjects (n=50). The study was carried out at the Shri Vasantrao Naik Government Medical College, Yavatmal, Maharashtra, India from January 2012 to January

2014. For diagnosis and confirmation of HIV infection, we followed the National AIDS Control Organization (NACO) recommendations for HIV testing (NACO 2003). All the patients were subjected to detailed history taking and clinical examination. The informed consent of the patients was obtained before testing.

*Biochemical investigation*

Fasting blood glucose, serum total cholesterol, triglyceride, HDL, LDL and serum enzymes (AST, ALT and ALP) were estimated by a fully automated clinical chemistry analyzer (240 Nano Lab Trivitron). VLDL cholesterol was calculated by the Friedewald equation.

*Statistical analysis*

All data were expressed as mean ± SD. The statistical significance was evaluated by student ‘t’ test (two-tailed). A p value of <0.05 was considered statistically significant. Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS Cary, NC, USA) version 10.0.

III. RESULTS

Information about the investigated characteristics is shown in Table 1. The mean age limit was 36 ± 9 in AIDS patients, 32 ± 5 in HIV infected patients and 30 ± 6 in control subjects. The decreased body mass index in AIDS patients (25 ± 5.3 kg/m<sup>2</sup>) compared with HIV infected patients (29 ± 6.2 kg/m<sup>2</sup>) and control subjects (34 ± 6.2 kg/m<sup>2</sup>) were statistically significant. There was an increased number of hypertension sufferers and smokers observed in AIDS patients compared with HIV infection and control subjects. Diabetic participants were defined as those with a fasting blood glucose concentration >120 mg/dl.

The plasma concentrations of lipids (total cholesterol, triglyceride, HDL, LDL and VLDL) and serum enzymes (AST, ALT and ALP) in control and HIV infected and AIDS patients are depicted in Table 2. The levels of total cholesterol, HDL and LDL were significantly decreased, while the level of triglyceride and VLDL were significantly increased in AIDS patients when compared to HIV infected patients and normal subjects, but the levels of VLDL in the HIV infected patients and control subjects did not differ significantly. The activities of serum liver marker enzymes observed in AIDS patients significantly increased in the

HIV infection patients and control subjects, The above biochemical variables were found to be altered more significantly in AIDS patients when compare with HIV infected subjects.

IV. DISCUSSION

The present study showed that the lipid profile was altered in HIV infected and AIDS patients. Alteration in the lipid profile occurred even during the early stages of HIV infection and more so as the disease progressed. Of the total 50 cases, 46 (92%) were classified as having AIDS according to Clinical Case Definition of AIDS. This high number of AIDS cases and the fact that there were no patients in the clinical stage in our study could be due to the fact that patients with HIV infection seek hospital admission only in the late clinical stages when they have opportunistic infections (NACO 2003).

Previous studies have demonstrated that patients with AIDS exhibit highly abnormal total lipid concentrations in plasma (Mullamitha and Pazare 1999). A few authors have determined the levels of plasma triglycerides, total cholesterol and HDL cholesterol in HIV infected individuals by the level of immunological deficiency according to they also came to the same conclusion: with an increase of immunological deficiency and clinical development of HIV infection, lipid profile disorders – indicated by an increase in triglyceride level and decreased concentrations of HDL cholesterol – also intensified (Rogowska-Szadkowska and Borzuchowska 1999, Ducobu and Payen 2000). Consistent with earlier reports, our study also showed similar findings in which the decrease due to disease progression was accompanied by a decrease in total cholesterol, HDL and LDL, and an increase in triglyceride and VLDL levels.

Our findings are also consistent with reports from Ducobu and Payen (2000), who stated that HIV infection induced an early decrease of cholesterol and a late increase of triglyceride with a reduction of HDL. Reported that patients with AIDS had increased levels of LDL cholesterol, which contradicted our findings. Shor Posner et al. (1995)

Reported similar findings in which they showed significantly low levels of total cholesterol, HDL and LDL in HIV infected patients, and about 40% of the HIV-infected subjects were demonstrated hypocholesterolaemic when compared to seronegative controls.

**Table 1. Demographic characteristics of control, HIV infection and AIDS patients**

Characteristic	Control subjects	HIV infection	AIDS patients
Age (years)	30 ± 6	32 ± 5	36 ± 9* <sup>x</sup>
Sex (Male)	50	50	50
Body mass index (kg/ m <sup>2</sup> )	34 ± 6.5	29 ± 6.2 <sup>xx</sup>	25 ± 7.1 <sup>**x</sup>
<i>Number of subjects with</i>			
Smoking	10 (20%)	27 (54%)	29 (58%)

Hypertension	4	(8%)	25 (56%)	43 (86%)
diabetes mellitus	-	-	8 (16%)	12 (24%)

Values are given as mean ± S.D. from 50 patients

\*AIDS patients statistically significant as compared with control subjects <sup>xx</sup> HIV infection statistically significant as compared with control subjects <sup>x</sup> AIDS patients statistically significant as compared with HIV infection

**Table 2. Changes in the level of total cholesterol, triglyceride, HDL, LDL, VLDL and serum enzymes in control, HIV infection and AIDS patients**

Characteristic	Control subjects		HIV infection	AIDS patients	
Total cholesterol (mg/dl)	148	± 23.4	136 ± 25.0 <sup>xx</sup>	120	± 27.6 <sup>*x</sup>
Triglyceride (mg/dl)	115	± 24.6	201 ± 20.0 <sup>xx</sup>	392	± 35.6 <sup>*x</sup>
HDL (mg/dl)	56	± 7.2	43 ± 5.8 <sup>xx</sup>	20	± 9.6 <sup>*x</sup>
LDL (mg/dl)	62 ± 17.2		53 ± 15.3 <sup>xx</sup>	45 ± 21.6 <sup>*x</sup>	
VLDL (mg/dl)	23 ± 17		20 ± 13.0 <sup>NS</sup>	78 ± 15 <sup>*x</sup>	
AST (IU/l)	20	± 9.3	39 ± 10.0 <sup>xx</sup>	80 ± 28.6 <sup>*x</sup>	
ALT (IU/l)	17	± 9.6	73 ± 13.2 <sup>xx</sup>	175	± 22.6 <sup>*x</sup>
ALP (IU/l)	75 ± 22.8		180 ± 20.4 <sup>xx</sup>	216	± 28.6 <sup>*x</sup>

Symbols as in Table 1

This low level of total cholesterol, HDL and LDL was reported to be associated with elevated levels of β-2 microglobulin. Low cholesterol levels are prevalent even during the early stages of HIV and associated with a specific alteration in immune function. Kereveur et al . (1996) stated that hypocholesterolaemia observed in the early and hypertriglyceridaemia in the later stage of the infection are due to cytokine effects on different enzymes of lipid metabolism.

Grinfeld et al. (1991) has reported that HIV/AIDS is characterized by a high prevalence of hypertriglyceridaemia and hypocholesterolaemia, and also an elevated level of cytokines. They observed that decreased cholesterol and cholesterol containing lipoproteins in both AIDS and HIV infection precede the appearance of hypertriglyceridaemia. Increased TG levels in AIDS were primarily due to an increase in VLDL. They also raised the possibility that with the development of AIDS, subsequent increase in IFN may have contributed to an increase in plasma triglyceride levels by decreasing the clearance of TG. The increase of triglyceride catabolism in relation to a reduction of lipoprotein lipase activity was responsible for these lipid changes. Many cytokines such as IFN, IL and TNF probably play a pathogenic role in the dyslipidaemia of HIV (Rogowska-Szadkowska and Borzuchowska 1999). Hence, it may be

suggested that the lipid profile can be a good index of disease progression in HIV infection and AIDS patients.

In this study, we noticed a significant increase in serum liver marker enzymes (ALT, AST and ALP) in HIV/AIDS patients compared with the control group. Our results are also consistent with the earlier findings of Wildup et al. (1993) who recorded a significant increase in the activities of the three aforementioned enzymes investigated. It is of interest to note that HIV has been detected in the liver cells with noticeable pathogenesis of the affected cells in infected individuals and since HIV infection and AIDS patients tend to suffer more chronic, unrelenting forms of many secondary diseases, it is therefore likely that the liver too will be affected and that subsequently changes will occur in the activities of the liver enzymes in HIV infection and AIDS patients. HIV attack host cells and take over the control of the infected cells leading to eventual death of the cells and subsequently the release of cellular contents into the surrounding medium of which enzymes constitute 20%. This may be responsible for the increase in the level of liver enzymes in infected liver cells. Changes in the three mentioned liver enzymes should not be surprising since it is likely that an intact immune response to viral replications is necessary to produce the hepatocellular necrosis and inflammation seen in active hepatitis due to HIV infection and AIDS.

Other causes of increased serum enzymes include: hepatitis due to hepatitis B virus, HCV, drug toxicity, extra-hepatic cholestasis, cirrhosis, hepatobiliary disease, genetic abnormalities with increased production of enzymes, enzyme induction and proliferation of enzyme producing cells, for example, in cancer patients, but these conditions were not exhibited in the patients examined. It is possible nonetheless, that these other conditions could be secondary to HIV infection and thus contribute to an increase in the activities of the liver enzymes examined perhaps to different degrees (Oguntibeju and Banjoko 2003). A detailed analysis, which could include differential enzyme studies, could clarify other sources of ALT, AST and ALP increase in serum. From these findings it therefore becomes necessary to estimate serum levels of ALT, AST and ALP, other liver enzymes and isoenzymes in HIV and AIDS patients to be able to at least monitor prognosis and progressive involvement of the liver cells. This would require continuous monitoring of the patient. In such a case, a sharp increase from the steady state concentrations in a particular patient may be an indication of early or late involvement of the liver cells either mildly or severely in the absence of other known causes. It is likely that the changes in biochemical parameters induced by HIV infection will have biological and possibly pathological importance in the development of AIDS and related complications. It is also recommended that the results obtained in this study be used as baseline in the pre-intervention and subsequent management of HIV infection and AIDS patients.

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# Fertility status of Kannur microwatershed soils in Chamarajanagar, Karnataka

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**Abstract-** The selected microwatershed belongs to Kollegal taluk of Chamarajanagar district. The microwatershed lies 20 km away from Kollegal taluk head quarter. The Micro-watershed is located between 12° 6' 34.5" and 12° 7' 49.6" N latitude, 77° 15' 30.9" and 77° 14' 20.2" E longitude, with an average elevation of 775 m above Mean Sea Level (MSL). It occupies a part of the four villages viz., Kannuru, Anapura, Mangala, and Kamgare. Composite soil surface sample in strategic manner to cover all farming systems of the watershed. Upland soils was slightly acidic to neutral, lowlands soil reaction was neutral to slightly alkaline. The electrical conductivity of all the fertility points was negligible, The organic carbon content vary between low to medium, The cation exchange capacity of the soil varied from low to medium. The available nitrogen, phosphorus and potassium were low, low to medium and medium respectively.

**Index Terms-** Microwatershed, Remote Sensing (RS) tools, Toposheet.

structures like roads, settlements, and lakes were marked on the trace sheet mounted on the imagery.

Soil samples (0-30 cm) at random were collected during 21-25<sup>th</sup> July 2013. The exact sample location was recorded using GPS Collected and analyzed for physical and chemical properties. GPS reading were taken at respective sampling site. Standard analytical methods as described by Richards (1954) and Jackson (1953) were followed for measuring various soils attributes like pH, ECe, soluble cations and anions, CEC and exchangeable cations, organic carbon content.

## I. INTRODUCTION

The ability of the land to produce crops is limited and the limits to produce crops are set by soil, climate and landform conditions. However, the capacity of a soil to produce crops is limited and the limits to production are set by intrinsic characteristics, agro-ecological settings, use and management (FAO, 1993a). Despite the significant growth in production, the sustainability of some cropping systems has been showing signs of fatigue. Therefore, comprehensive account of our land resource and ascertain its potential and problems towards optimizing land use on sustainable basis is necessary. Keeping these considerations in view, an investigation was carried out for Kannur micro watershed in Kollegal taluk of Chamarajanagar.

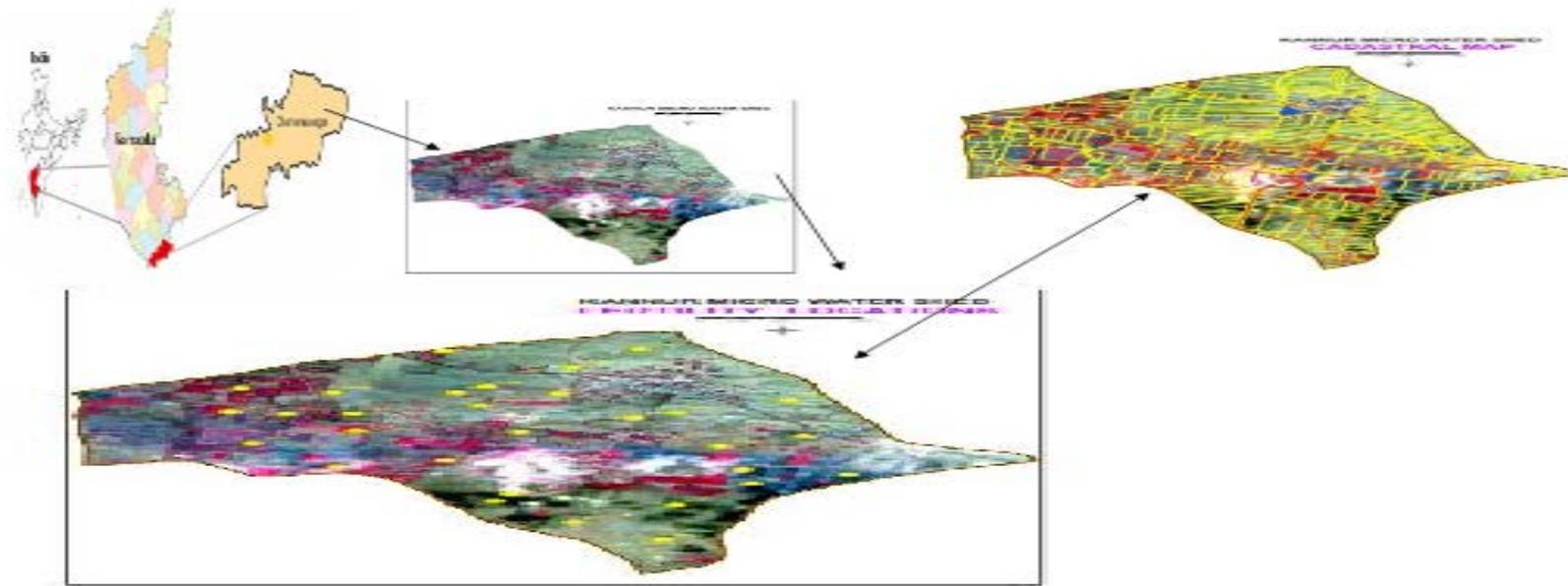
### Objective:

- To assess fertility status of soils of the Kannur micro watershed using RS tools.

## II. MATERIALS AND METHODS

Remotely sensed data from IRS P6 was collected from Karnataka State Remote Sensing application Centre, Bangalore. Sensor used in this satellite is LISS IV MX. The imagery scale is 1:12,500 scales, the imagery collected on 5<sup>th</sup> July 2013. Toposheets used in this study are 57B/4,57C/4,57F/4. The imagery was interpreted in conjunction with the toposheet based on the tonal variations, texture and pattern. Permanent

**Pic:Location of the microwater shed and the gps locations of fertility points**



### III. RESULTS AND DISCUSSION

The pH values in the study area ranged from 5.04 to 8.60 with mean and SD values of 7.08 and 1.16, respectively. Most of the study area was under neutral to moderately alkaline range. The acidic nature of red soils was due to acidic nature of parent material of the study area. The reaction was alkaline neutral to alkaline nature of black soils which was mainly due to high exchangeable bases (Bhadrapur and Sheshagiri Rao 1979). The EC values in watershed area ranged from 0.01 to 1.15  $\text{dS m}^{-1}$ . The black soils which exhibited brown layers were relatively free from salts. The brown layer seems to be controlled salinity and exchangeable

sodium (Dasog and Hadimani 1980 and Anon 1969). The organic carbon content in the study area ranged from 0.04 to 1.0 per cent of soil. Majorly soils of the study area fall under low to medium category. The low organic carbon content of the soils may be attributed to the prevalence of high temperature (Table 1). The organic matter degradation and removal taken place at faster rate coupled with low vegetation cover, thereby leaving less chances of accumulation of organic matter in the soil (Govindarajan and Datta Biswas 1968). The available nitrogen status in study area ranged from 56.5 to 240 kg per ha with mean. All the soils of micro watershed fall under low category.

**Table-1: SURFACE SAMPLES AVAILABLE PRIMARY NUTRIENTS**

Village	Gps reading	Soil type	Crop	pH (1:2.5)	EC (1:2.5) (dS m <sup>-1</sup> )	O.C (%)	Available Macronutrients (kg ha <sup>-1</sup> )		
							N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
1) Kannur	12°6'19.5" N 77°14'32.8" E	Red soil	Ragi	5.56	0.22	0.90	125.0	40.0	94.0
2) Mangala	12°7'0.5" N 77°15'8.6" E	Red soil	Ragi	7.05	0.18	0.42	96.0	31.2	79.1
3) Mangala	12°6'52.8" N 77°15'7.2" E	Red soil	Sugar cane (Harvested)	7.60	0.95	0.13	142.5	33.0	62.9
4) Kannur	12°6'9.6" N 77°14'41.8" E	Red soil	Maize	5.50	0.86	0.15	139.0	11.5	120.0
5) Kannur	12°6'20.5" N 77°15'11.0" E	Black soil	Cotton	8.23	0.34	0.11	106.0	37.3	110.9
6) Kannur	12°6'36.4" N 77°14'59.9" E	Black soil	Bengal gram	8.44	0.54	0.25	140.8	37.9	95.7
7) Kannur	12°6'9.6" N 77°14'41.8" E	Red soil	Maize	5.23	0.04	0.31	135.8	33.4	68.2
8) Kannur	12°6'7.6" N 77°14'49.9" E	Red soil	Maize-sunflower (inter crop)	5.72	0.05	0.38	128.1	72.7	84.4
9) Kannur	12°6'15.7" N 77°14'50.6" E	Red soil	Maize	7.40	0.04	0.16	119.0	7.5	98.8
10)Kannur	12°6'23.8" N 77°14'27.4" E	Red soil	Fallow	7.03	0.29	0.18	168.0	40.0	96.0
11)Kannur	12°6'38.6" N 77°14'10.5" E	Black soil	Sugar cane (Harvested)	8.04	1.05	0.13	125.4	31.2	350.0
12)Kannur	12°6'46.1" N 77°14'8.5" E	Red soil	Bengal gram	8.60	0.32	0.53	136.7	21.5	246.3
13)Mangala	12°6'58.1" N 77°14'7.2" E	Black soil	Fallow	8.25	0.24	0.44	159.0	23.8	264.80
14)Kannur	12°6'52.4" N 77°14'9.0" E	Black soil	Fallow	8.64	0.36	0.25	240.9	29.3	170.5
15)Anapura	12°07'6.0" N 77°14'12.1" E	Red soil	Fallow	6.71	0.10	0.61	116.0	62.9	141.2

16)Anapura	12°6'55.6" N 77°14'36.8" E	Red soil	Maize	8.26	0.23	0.64	146.0	25.2	121.9
17)Anapura	12°6'55.6" N 77°14'36.8" E	Red soil	Maize	8.29	0.29	0.66	94.8	43.4	99.7
18)Mangala	12°7'11.0" N 77°14'26.7" E	Red soil	Maize	6.35	0.13	0.71	79.7	9.1	206.4
19)Mangala	12°7'4.08" N 77°14'52.0" E	Red soil	Ragi-Maize	5.04	0.14	0.82	89.4	18.3	184.5
20)Kamgare	12°7'39.1" N 77°14'17.0" E	Red soil	Maize	7.55	0.12	0.66	69.6	46.6	74.0
21)Anapura	12°7'06.1" N 77°14'12.2" E	Red soil	Fallow	6.13	0.02	0.81	150.8	36.0	117.0
22)Kamgare	12°7'28.5" N 77°14'35.5" E	Red soil	Fallow (maize harvested)	6.12	0.02	0.46	99.5	78.2	130.0
23)Kamgare	12°7'37.8" N 77°14'43.1" E	Red soil	Maize	5.29	0.02	0.45	79.5	39.0	112.6
24)Anapura	12°7'12.0" N 77°15'5.1" E	Red soil	Ragi	6.00	0.01	1.00	84.5	42.3	91.50
25)Ampere	12°7'00.1" N 77°15'00.8" E	Red soil	Fallow	8.47	0.87	0.43	97.8	36.	104.8
26)Ampere	12°7'15.1" N 77°14'3.7" E	Red soil	Maize	6.50	0.02	0.46	77.8	13.6	85.1
27)Anapura	12°7'14.9" N 77°14'3.7" E	Red soil	Coconut plantation	8.11	0.13	0.45	122.0	29.9	105.7
28)Mangala	12°7'18.2" N 77°14'35.2" E	Red soil	Ragi-Maize	7.60	0.1	0.91	98.5	19.1	145.2
29)Anapura	12°6'48.8" N 77°14'52.9" E	Red soil	Ragi	6.20	0.05	0.65	110.5	24.6	85.5
30)Kannur	12°6'41.3" N 77°14'25.5" E	Red soil	Ragi	8.37	0.06	0.62	56.5	20.4	16.0
<b>Mean</b>				<b>7.07</b>	<b>0.25</b>	<b>0.48</b>	<b>119.95</b>	<b>33.60</b>	<b>129.19</b>
<b>S.D</b>				<b>1.16</b>	<b>0.29</b>	<b>0.25</b>	<b>35.19</b>	<b>19.93</b>	<b>21.40</b>

<b>Range (Min- Max)</b>	<b>5.04-8.64</b>	<b>0.01-1.05</b>	<b>0.11-1.00</b>	<b>69.60-240.9</b>	<b>7.5-78.2</b>	<b>21.40-350</b>
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**Table-2: Surface samples available Secondary Nutrients.**

VILLAGE	GPS Reading	SOIL TYPE	CROP	Available secondary nutrients (ppm)		
				Ca	Mg	S
1) Kannur	12°6'19.5" N 77°14'32.8" E	Red soil	Ragi	160.4	64.8	4.1
2) Mangala	12°7'0.5" N 77°15'8.6" E	Red soil	Ragi	133.0	75.8	12.1
3) Mangala	12°6'52.8" N 77°15'7.2" E	Red soil	Sugar cane (Harvested)	112.0	16.0	15.9
4) Kannur	12°6'9.6" N 77°14'41.8" E	Red soil	Maize	148.8	58.4	11.1
5) Kannur	12°6'20.5" N 77°15'11.0" E	Black soil	Cotton	152.2	97.8	0.6
6) Kannur	12°6'36.4" N 77°14'59.9" E	Black soil	Bengal gram	46.0	12.2	11.3
7) Kannur	12°6'9.6" N 77°14'41.8" E	Red soil	Maize	173.8	87.8	8.1
8) Kannur	12°6'7.6" N 77°14'49.9" E	Red soil	Maize-sunflower (Inter crop)	102.2	66.4	12.4
9) Kannur	12°6'15.7" N 77°14'50.6" E	Red soil	Maize	197.6	63.2	11.4
10)Kannur	12°6'23.8" N 77°14'27.4" E	Red soil	Fallow	138.4	35.0	14.9
11)Kannur	12°6'38.6" N 77°14'10.5" E	Black soil	Sugar cane (Harvested)	117.8	60.2	17.0
12)Kannur	12°6'46.1" N 77°14'8.5" E	Red soil	Bengal gram	165.0	69.2	14.9
13)Mangala	12°6'58.1" N 77°14'7.2" E	Black soil	Fallow	150.8	69.0	10.1

14)Kannur	12°6'52.4" N 77°14'9.0" E	Black soil	Fallow	108.4	60.6	15.6
15)Anapura	12°07'6.0" N 77°14'12.1" E	Red soil	Fallow	138.0	35.4	18.0
16)Anapura	12°6'55.6" N 77°14'36.8" E	Red soil	Maize	183.8	45.4	17.0
17)Anapura	12°6'55.6" N 77°14'36.8" E	Red soil	Maize	117.0	36.4	10.4
18)Mangala	12°7'11.0" N 77°14'26.7" E	Red soil	Maize	130.8	26.2	8.3
19)Mangala	12°7'4.08" N 77°14'52.0" E	Red soil	Ragi-Maize	179.2	40.0	17.3
20)Kamgare	12°7'39.1" N 77°14'17.0" E	Red soil	Maize	102.2	48.0	13.8
21)Anapura	12°7'06.1" N 77°14'12.2" E	Red soil	Fallow	160.4	44.8	12.9
22)Kamgare	12°7'28.5" N 77°14'35.5" E	Red soil	Fallow (maize harvested)	127.8	33.0	13.8
23)Kamgare	12°7'37.8" N 77°14'43.1" E	Red soil	Maize	128.2	28.8	8.3
24)Anapura	12°7'12.0" N 77°15'5.1" E	Red soil	Ragi	156.0	21.0	6.2
25)Ampere	12°7'00.1" N 77°15'00.8" E	Red soil	Fallow	165.0	28.8	7.6
26)Ampere	12°7'15.1" N 77°14'3.7" E	Red soil	Maize	134.4	15.0	17.3
27)Anapura	12°7'14.9" N 77°14'3.7" E	Red soil	Coconut plantation	140.0	31.0	10.8
28)Mangala	12°7'18.2" N 77°14'35.2" E	Red soil	Ragi-Maize	107.4	32.2	12.2
29)Anapura	12°6'48.8" N 77°14'52.9" E	Red soil	Ragi	106.0	36.4	6.9
30)Kannur	12°6'41.3" N 77°14'25.5" E	Red soil	Ragi	146.6	39.0	12.0
<b>Mean</b>				<b>137.64</b>	<b>45.92667</b>	<b>11.74333</b>

<b>S.D</b>	<b>30.35867</b>	<b>21.389</b>	<b>4.147022</b>
<b>Range (Min- Max)</b>	<b>30.35-197.6</b>	<b>12.2-97.8</b>	<b>0.60-18</b>

**Table -3: Surface samples available Micro nutrients.**

VILLAGE	GPS Reading	SOIL TYPE	CROP	AVAILABLE MICRO NUTRIENTS (ppm)			
				Cu	Fe	Mn	Zn
1) Kannur	12°6'19.5" N 77°14'32.8" E	Red soil	Ragi	2.34	7.56	11.7	0.04
2) Mangala	12°7'0.5" N 77°15'8.6" E	Red soil	Ragi	2.08	10.22	14.24	0.56
3) Mangala	12°6'52.8" N 77°15'7.2" E	Red soil	Sugar cane (Harvested)	2.56	7.08	9.36	0.62
4) Kannur	12°6'9.6" N 77°14'41.8" E	Red soil	Maize	2.82	6.56	10.4	0.12
5) Kannur	12°6'20.5" N 77°15'11.0" E	Black soil	Cotton	2.00	2.76	5.60	0.04
6) Kannur	12°6'36.4" N 77°14'59.9" E	Black soil	Bengal gram	1.20	5.10	5.16	0.82
7) Kannur	12°6'9.6" N 77°14'41.8" E	Red soil	Maize	2.88	5.82	9.60	0.56
8) Kannur	12°6'7.6" N 77°14'49.9" E	Red soil	Maize-sunflower (inter crop)	2.96	26.18	8.20	0.48
9) Kannur	12°6'15.7" N 77°14'50.6" E	Red soil	Maize	2.70	7.34	8.40	2.14
10)Kannur	12°6'23.8" N 77°14'27.4" E	Red soil	Fallow	2.20	5.02	5.80	0.88
11)Kannur	12°6'38.6" N 77°14'10.5" E	Black soil	Sugar cane (Harvested)	2.44	4.96	7.00	5.08
12)Kannur	12°6'46.1" N 77°14'8.5" E	Red soil	Bengal gram	2.70	7.5	7.20	0.22
13)Mangala	12°6'58.1" N 77°14'7.2" E	Black soil	Fallow	0.42	2.08	6.80	0.10

14)Kannur	12°6'52.4" N 77°14'9.0" E	Black soil	Fallow	3.12	13.08	8.60	0.30
15)Anapura	12°07'6.0" N 77°14'12.1" E	Red soil	Fallow	3.30	14.44	18.20	0.20
16)Anapura	12°6'55.6" N 77°14'36.8" E	Red soil	Maize	3.02	3.10	7.80	0.16
17)Anapura	12°6'55.6" N 77°14'36.8" E	Red soil	Maize	1.52	4.6	8.64	3.80
18)Mangala	12°7'11.0" N 77°14'26.7" E	Red soil	Maize	1.46	5.34	9.00	0.48
19)Mangala	12°7'4.08" N 77°14'52.0" E	Red soil	Ragi-Maize	2.84	5.16	8.60	0.96
20)Kamgare	12°7'39.1" N 77°14'17.0" E	Red soil	Maize	1.64	5.60	10.5	0.30
21)Anapura	12°7'06.1" N 77°14'12.2" E	Red soil	Fallow	3.38	7.08	11.5	0.22
22)Kamgare	12°7'28.5" N 77°14'35.5" E	Red soil	Fallow (maize harvested)	3.02	12.68	9.70	1.32
23)Kamgare	12°7'37.8" N 77°14'43.1" E	Red soil	Maize	2.76	6.08	5.70	0.16
24)Anapura	12°7'12.0" N 77°15'5.1" E	Red soil	Ragi	2.30	4.80	19.04	0.96
25)Ampere	12°7'00.1" N 77°15'00.8" E	Red soil	Fallow	4.32	13.62	5.16	0.88
26)Ampere	12°7'15.1" N 77°14'3.7" E	Red soil	Maize	2.60	3.16	9.50	0.08
27)Anapura	12°7'14.9" N 77°14'3.7" E	Red soil	Coconut plantation	3.68	6.06	9.30	0.12
28)Mangala	12°7'18.2" N 77°14'35.2" E	Red soil	Ragi-Maize	2.14	3.56	9.26	0.14
29)Anapura	12°6'48.8" N 77°14'52.9" E	Red soil	Ragi	2.90	3.56	4.96	0.22
30)Kannur	12°6'41.3" N 77°14'25.5" E	Red soil	Ragi	3.34	7.52	10.44	0.24
<b>Mean</b>				<b>2.55</b>	<b>7.254</b>	<b>9.17</b>	<b>0.74</b>

<b>S.D</b>	<b>0.77</b>	<b>4.74</b>	<b>3.29</b>	<b>1.09</b>
<b>Range (Min- Max)</b>	<b>0.42-4.32</b>	<b>2.08-26.18</b>	<b>4.96-19.04</b>	<b>0.04-5.08</b>

All the study area was low in available nitrogen. Major portion of the nitrogen pool is contributed by organic matter (Table 4.15). Low organic matter content in this area due to low rainfall and low vegetation cover facilitated faster degradation and removal of organic matter leading to nitrogen deficiency. The available phosphorus content in the study area ranged from 7.3 to 63.0 kg per ha. The lowlands were medium in status, whereas uplands and midlands fall under low category. The red soils shown low values of available phosphorus which may be due to low CEC, clay content and soil reaction of <6.5. The available potassium content in the study area ranged from 62.9 to 264.8 kg per ha. Majority of the area falls under low category. The lowland showed relatively high in available potassium than uplands and midlands (Table 1). Black soils shown high values due to predominance of K rich micaceous and feldspars minerals in parent material. The exchangeable Ca and Mg content in micro-watershed ranged from 30.3 to 197.6 ppm and 12.2 to 97.8 ppm. The upland soils are relatively less base saturated than lowlands and midlands. Due to leaching of bases like Ca and Mg (Table 2). The available sulphur content of micro-watershed ranged from 0.6 to 18.0 ppm. The available sulphur content in lowlands was higher (Table 2) than that of uplands and midlands (Balanagoudar, 1989). The available copper content of micro-watershed ranged from 0.42 to 4.32 ppm. The available Iron content of micro-watershed ranged from 2.1 to 26.1 ppm. The available Manganese content of micro-watershed ranged from 2.1 to 26.1 ppm. The available Manganese content in lowlands was higher than that of uplands and midlands, available Manganese was 7.2 and 4.7 ppm, respectively. The available Zinc content of micro-watershed ranged from 2.1 to 26.1 ppm. (Table 3) Soil available micronutrients showed sufficient presence in most of the soils studied (Anil Kumar *et al* 2010).

#### IV. SUMMARY

Soil reaction of upland soils was slightly acidic to neutral which is attributed to the presence of leaching of bases from the soil along with runoff and drainage water due to moderately high rainfall existing in the area. In lowlands, the soil reaction was neutral to slightly alkaline due to deposition of bases from the upland physiographic units. The electrical conductivity of all the samples was negligible, which indicates non-saline nature of soil and good leaching. The organic carbon content in all the samples to vary between low to medium due to low vegetative/cropping cover. The soil erosion and warmer climate leading to low

accumulation of organic carbon in the study area. The cation exchange capacity of the soil varied from low to medium. The upland physiographic units were low in cation exchange capacity values than midlands and lowlands owing to their low clay content, low organic matter and the predominance of 1:1 type of clay minerals, whereas lowlands exhibited moderate CEC values due to higher clay content. The available nitrogen, phosphorus and potassium were low, low to medium and medium respectively. The low nitrogen content is attributed to the low organic carbon due to warmer climate and low vegetative cover coupled with little nitrogen fertilization. Soil available micronutrients showed sufficient presence in most of the soils studied except in case of available zinc confirming the study of Anil Kumar *et al*. (2010). Present Study noticed that study area was adequate in iron, manganese, copper. Study area was low in available zinc status.

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# Effect of Zeolite on the Properties of Natural Rubber Foams

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**Abstract-** In this research work Zeolite has been incorporated as filler with natural rubber latex (NRL) compounds to enhance the odour adsorption property of NRL foam products. Incorporation of Zeolite into NRL has not been reported in the literature. A methodology was developed to prepare stable colloidal dispersion of Zeolite and incorporate it into NRL compound without affecting the stability of the NRL compound and physical properties of final foam product. It was found that stable Zeolite dispersion with 32% Total Solid Content (TSC) can be prepared and 8% (on dry weight) optimum dosage of Zeolite can be incorporated into NRL compound considering the indentation hardness of foam product, sorption and flame retardant properties.

**Index Terms-** Flame retardant, Natural rubber foam, Sorption, Zeolite.

## I. INTRODUCTION

Latex foam rubber is a cellular rubber in which the cells are either all intercommunicating or partially intercommunicating and partly non intercommunicating[1]. The porous microcellular structure of latex foam provides the user in luxurious comfort, but has drawbacks such as it can adsorb dust, unpleasant odours and moisture.

Adsorption is a surface phenomenon that can be defined as the increase in concentration of a particular component on the surface or interface between two phases. Zeolite is a naturally occurring mineral, its porous structure enables to play a major role as an adsorbent and as a fire retardant in various fields.

Jha *et.al.*[2] successfully prepared activated carbon-zeolite composite from coal fly ash, which was proved to be having high capability of uptake of toxic metal ions such as Ni<sup>2+</sup>, Cu<sup>2+</sup>, Cd<sup>2+</sup> and Pb<sup>2+</sup>. Mishra *et.al.*[3] also carried out a similar type of work. It is observed that 13X zeolite which derived from coal fly ash can be used as a better adsorbent for heavy metal sorption from acidic waste water in comparison to that of coal fly ash.

Wanget.*al.*[4] investigated the addition of 0.3 parts per hundred rubber (phr) of 4A zeolite into intumescent flame retardant filled natural rubber (NR) system and found that it could increase the limited oxygen index value and thermal stability. However, mass loss ratio, rate of heat release, carbon monoxide evolution and carbon dioxide (CO<sub>2</sub>) evolution, and improvement of fire retardant properties were decreased.

Demiret.*al.*[5] examined the thermal degradation and flammability of intumescent fire retardant polypropylene matrix consisting of ammonium polyphosphate (APP). APP was used as

an acid source and pentaerythritol (PER) as blowing agent and as a carbonization agent. Natural zeolite was used as a synergistic agent. A synergistic effect in flame retardancy was observed when natural zeolites were used in combination with APP and PER. Wang and Chen[6] observed the addition of microencapsulated intumescent flame retardant agent containing 4A zeolite into dry NR, resulted in an improvement in the physic-mechanical and flame retardant properties.

Activated carbon black has also been added to latex to enhance physical [7] and sorption [8] properties. But, one of the major drawbacks is the black colour. The main objective of this study was to introduce Zeolite as compounding ingredient into NR latex compound to enhance the sorption property of white NR latex foam products. In addition to sorption property, fire retardant property was also investigated.

## II. EXPERIMENTAL

### Preparation and Characterization of Zeolite Dispersion:

Low Ammonia latex (LA-TZ) was supplied by Lalan Group, Sri Lanka, zeolite and all the other standard chemicals were supplied by D. Samson Industries (DSI), Sri Lanka.

Moisture content of zeolite powder was measured using moisture balance (Citizen MB 200x). pH and average particle size of 1% zeolite solution were measured using pH meter and particle size analyzer (Light scattering-Fritsch Analysette 22 compact) respectively.

**Table 1. Formulation of Zeolite dispersion**

Ingredients	parts by weight
Zeolite	24.0
Tamol	0.5
Water (H <sub>2</sub> O)	75.5

Zeolite dispersion, having 36% Total Solid Content (TSC), was prepared by mixing tamol with water first and followed by addition of zeolite. Finally it was mechanically agitated for 10 min.

**Table 2. The formulation of the LA-TZ latex foam compound**

Ingredient	Dry weight%
60 % LA-TZ latex	100.0
20% Potassium oleate	1.4
50 % Antioxidant (Nonax)	1.0
50% Sulphur	2.5

50 % Zinc diethyldithiocarbamate (ZDEC)	1.0
50% Zinc mercaptobenzothiozole (ZMBT)	1.0

Formulation of Zeolite dispersion is given in Table 1. Average particle size, % of particle size less than 10 µm and pH were measured for dispersion. TSC was measured as per ISO 124:1997(E) and viscosity was measured using Dial type Brookfield viscometer in accordance with ISO 1652:1985(E).

**Preparation of Zeolite incorporated natural rubber latex compound:** TSC, Mechanical Stability Time (MST) as per ISO35:1995 (E) and pH of LA-TZ latex were measured. Basic formulation of latex compound used for the study is given in Table 2. Zeolite dispersion was incorporated into latex compound and eleven different latex compounds were prepared by varying the percentage of zeolite on dry basis from 0% to 9%. Foaming ability of zeolite incorporated latex compound was measured using foam height and it was measured at 1 min time intervals up to 5 min and thereafter at 2.5 min intervals for a total time period of 10 min. Final compound height was taken into consideration when calculating the foam height.

**Preparation of Zeolite incorporated latex foam:** A 250 g of zeolite incorporated latex compound was matured for 8 h under room temperature and it was transferred into stainless steel bowl with the open beater. The latex compound was foamed at the highest speed of the beater until the batch volume turns to four times of the initial volume. Once the required volume was reached, the speed was reduced to medium and refined the foam for 2 min. ZnO (0.4phr) and DPG (1.0 phr ) dispersions were added gradually and mixed well at medium speed for 1 to 2 min. SSF (1.5phr) was added and further mixed for 1 min. The foam latex compound was poured into a pre-treated two pieces, 15 cm x10 cm x4.5 cm size mould with pins warmed to 35 °C. The lid was closed tightly and the foam was allowed to gel for 2 to 3 min and 20 min for subsequent curing. The cured latex foam block was stripped from the mould followed by washing and drying at room temperature.

**Physical Testing of Zeolite incorporated latex foam:** Indentation hardness of foam with different zeolite loading was measured as per SLS1334. Flame retardant property of zeolite incorporated foam was tested using the simple comparison method. In this method, foam strips having dimensions of 1 cm x1 cm x10 cm were prepared and mark at 5 cm (measured from one end of the strip) was drawn on each strip. The time to burn the foam strip from one end to the 5 cm mark was measured.

**Sorption Testing of Zeolite incorporated latex foam:** The apparatus for this test was set up according to the schematic diagram shown in Figure 1. Ammonia gas was synthesized by placing 5 ml of 25% ammonia (NH<sub>3</sub>) solution in flask A. It was kept in a water bath and according to the apparatus generated gas transferred into flask B where foam sample was kept. After 1 h

time period, remaining ammonia in the flask was titrated with 1M hydrochloric acid (HCl) in the presence of methyl orange as an indicator. Unabsorbed NH<sub>3</sub> in flask B was measured by adding distilled water and titrated with same titrant and indicator. Above procedure was carried out for a period of 3 h.

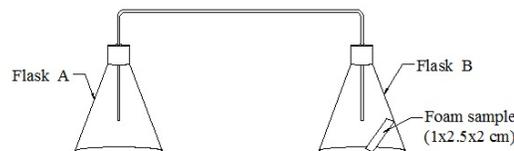


Figure :1 Schematic diagram of sorption test apparatus

The first reading was taken at the end of one hour and others were at 30 min intervals. NH<sub>3</sub> sorption percentage was calculated using the below formula.

$$\frac{B - A}{B} \times 100$$

Where A is remaining NH<sub>3</sub> moles in two flasks, B is the initial NH<sub>3</sub> moles taken.

Carbon dioxide (CO<sub>2</sub>) gas was prepared in flask A by mixing 0.5 g of calcium carbonate with 1M HCl. Let the sample to adsorb CO<sub>2</sub> and measured the sample weight after 1 h for a period of 2 h. The first reading was taken at the end of 1 h and others at 30 min intervals. CO<sub>2</sub> gas adsorption was calculated as follows,

Minimum CO<sub>2</sub> sorption %

$$\frac{(W_2 - W_1) - 0.09}{W_1} \times 100$$

Where W<sub>1</sub> is the initial weight of the sample and W<sub>2</sub> is the final weight of the sample. Since the water is released in synthesizing of CO<sub>2</sub>, the minimum adsorption is considered.

### III. RESULTS AND DISCUSSION

**Behavior of zeolite dispersions:** Moisture content of zeolite powder, pH and average particle size of 1% zeolite solution shown in Table 3. Properties of Zeolite dispersion with 36% TSC is given in Table 4. Its particle size and pH were in the acceptable range [1] as dispersion particle size should be below 5 µm and pH should be either neutral or basic in medium. According to the Table 5 addition of zeolite into latex solution did not disturb the colloidal stability of latex to an acceptable level, as its pH was in the base range

Table 3. Properties of 1% (w/w) zeolite solution

Property	Zeolite powder
Moisture content	3.0

pH	8.35
Average particle size (µm)	2.83

**Table 4. Properties of Zeolite dispersion with 36% TSC**

TSC %	36.1
pH	10.3
Avg. particle size (µ)	2.75
Max. particle size (µ)	5.13
Viscosity (cps)	7.0

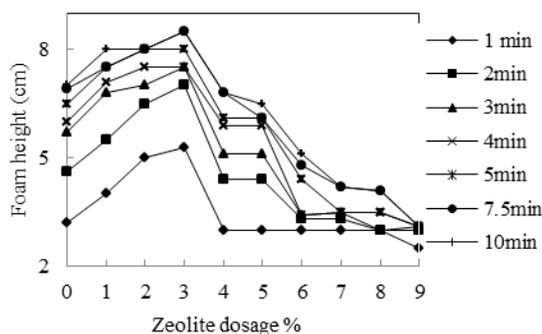
**Table 5: The stability of latex compound with 1% zeolite dispersion (36% TSC)**

Sample	pH of dispersion	pH of compounded latex	Coagulum content (g)
With zeolite	10.3	9.55	0.24
Control	-	9.65	0.00

**Stability of zeolite dispersion on latex foam:** Properties of LA-TZ latex is given in Table 6. Foam heights of latex compounds on partially foamed stage for different dosages of zeolite are given in Fig.2. Foaming ability increased up to 3% of zeolite dosage and it decreased again with increasing zeolite content. It can be seen that the excess of zeolite disturbed the foam structure. As zeolite consists with negatively charged surface, they may act as a foam stabilizer in to some extent and result increase in foam height. However, with the higher dosage of adsorbent, it only act as a foreign particle and disturb the compound foaming by adsorbing latex stabilizers. This can be clearly seen in compound prepared with 9% zeolite. It indicated that the addition of zeolite up to certain extent did not adversely affect the final foam structure of the product.

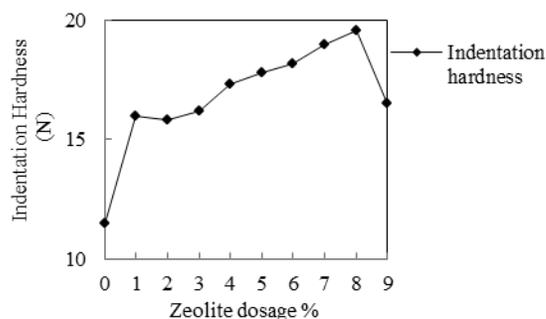
**Table 6: Properties of LA-TZ latex**

Total solid content (%)	Mechanical stability (sec)	pH
60.24	1281	9.85



**Fig.2. Foam heights of latex compounds at partially foamed stage for different dosages of zeolite**

**Physicochemical properties of latex foam compounds with zeolite:** Variation of Indentation hardness of zeolite incorporated latex foam with the zeolite dosage is given in Fig.3. Results showed that indentation hardness, increased up to 8% zeolite dosage in the foam. The hardness of latex foam was influenced by the geometry of the cores, spacing and configuration in relation to each other. It was shown that the indentation hardness, increased with the incorporation of adsorbent due to lack of free space in foam, which decrease the amount of air in the foam structure. However, beyond the above dosage the hardness decreased may be due to the phase separation which leads to a collapse in foam structure.

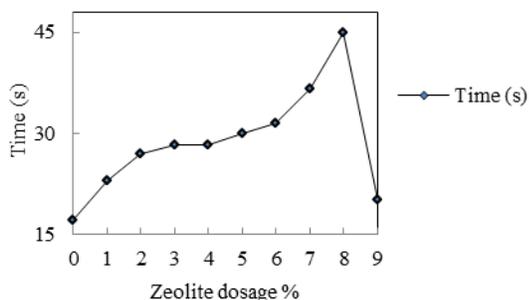


**Fig.3. Indentation hardness of latex compound with zeolite**

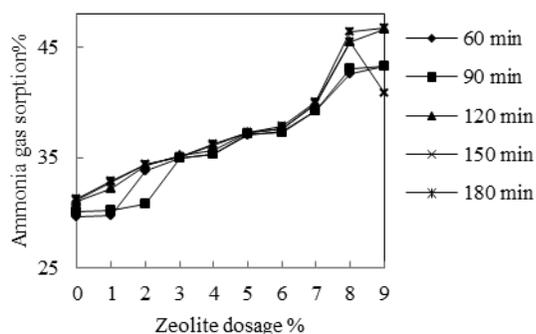
Results in Fig.4 showed that the flame retardant property improved with increased zeolite dosage in foam products. Previous works also proved that zeolite can be acted as a flame retarder [4- 6]. Zeolite is capable of adsorbing water and to make a bound water layer around them. When foam starts to burn these bound water adsorb the energy from the flame and evaporate the water. As a result of this endothermic reaction, it may prevent the flame propagation and protect the foam product, however the sample with 9% zeolite shows drop in flame retardant property. The reason may be due to the decrease of surface area of the Zeolite, due to the phase separation.

Sorption capacities for NH<sub>3</sub> and CO<sub>2</sub> for latex foam product with different zeolite dosages are shown in Fig.5 and 6 respectively. Results showed that zeolite incorporated NR latex foam had a higher sorption power for inorganic gases in comparison to normal NR latex foam. Zeolite pore diameters may suit to ammonia molecular diameter [9] hence ammonia gas molecule can be adsorbed easily and reached equilibrium within 60 min at low dosage level of Zeolite in foam. The shape selective properties of zeolite also facilitate the ammonia gas intake [10]. Ammonia molecules physically adsorbed on to the zeolite surface by weak Vander Waal forces and hydrogen bonds. Since ammonia molecule can donate electrons to Lewis acid sites of zeolite molecule (AlO<sup>+</sup>, Al(OH)<sub>2</sub><sup>+</sup>, AlO(OH), Si<sup>+</sup>) it could be chemisorbed the ammonia molecules [11].

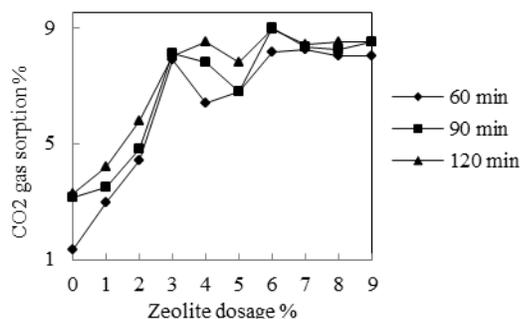
Adsorption of CO<sub>2</sub> into zeolite incorporated latex foam was less than ammonia. This may be due to chemical inert nature of CO<sub>2</sub> and it makes less chemical bonding with zeolite. However physisorption of CO<sub>2</sub> can occur on to zeolite [12].



**Fig.4. Flame retardant property of latex compound with zeolite**



**Fig.5. Ammonia gas sorption % of foam modified with zeolite**



**Fig.6. Carbon dioxide sorption % of foam modified with zeolite**

#### IV. CONCLUSIONS

The work and results reported in this paper suggests that zeolite dispersion can be successfully incorporated into natural rubber latex compound to enhance indentation hardness, fire retardant and sorption properties of latex foam products. Furthermore, the optimum level of Zeolite was identified as 8% considering the stability of latex compound and physiochemical properties of latex foam products.

#### ACKNOWLEDGEMENT

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# The Partnership between the School and Parents

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**Abstract- Introduction:** Parents are one of the key actors in the teaching institution and have a huge impact in school, parents are actors interested in the promotion have teaching because they want an education as perfect for their children and create a partnership between parents and school. It would make the learning level was as high and problems with students were as scarce.

**Purpose:** To study and mutual we highlight the relationship between parents and schools, parental support for the school, the role that he plays in school, parental recognition program curriculum and functioning of the partnership between parents and schools.

**Material and Methods:** Our study is based on the use of a method of quantitative instruments through the body of a structured questionnaire and interview the director and teacher at the school "Ibrahim Rugova", Tirana, Albania.

**Result:** The data collected by random survey prove us that this partnership is not the right level at this school and still have more work to achieve the curriculum standards in Albania.

**Conclusion:** The partnership between the school and parents plays an important role in school decision-making and that parents should have the right to decide the future of the school, then taken into account during decision making and thought of the parents.

**Index Terms-**directory, parents, partnership, schools, students, teachers.

## I. INTRODUCTION

In order for the operation of the educational institution to be as efficient, there must be a more constructive collaboration among the key stakeholders participating in the process, the main actors in this process are the schools, students, parents, community and educational departments because these actors directly and indirectly benefit and have an impact on the school, these stakeholders establish partnerships with each other and sound as these partnerships to be so even more positive results are obtained.

If we observe concentric circles of cooperation would have four main circles coming expanding:

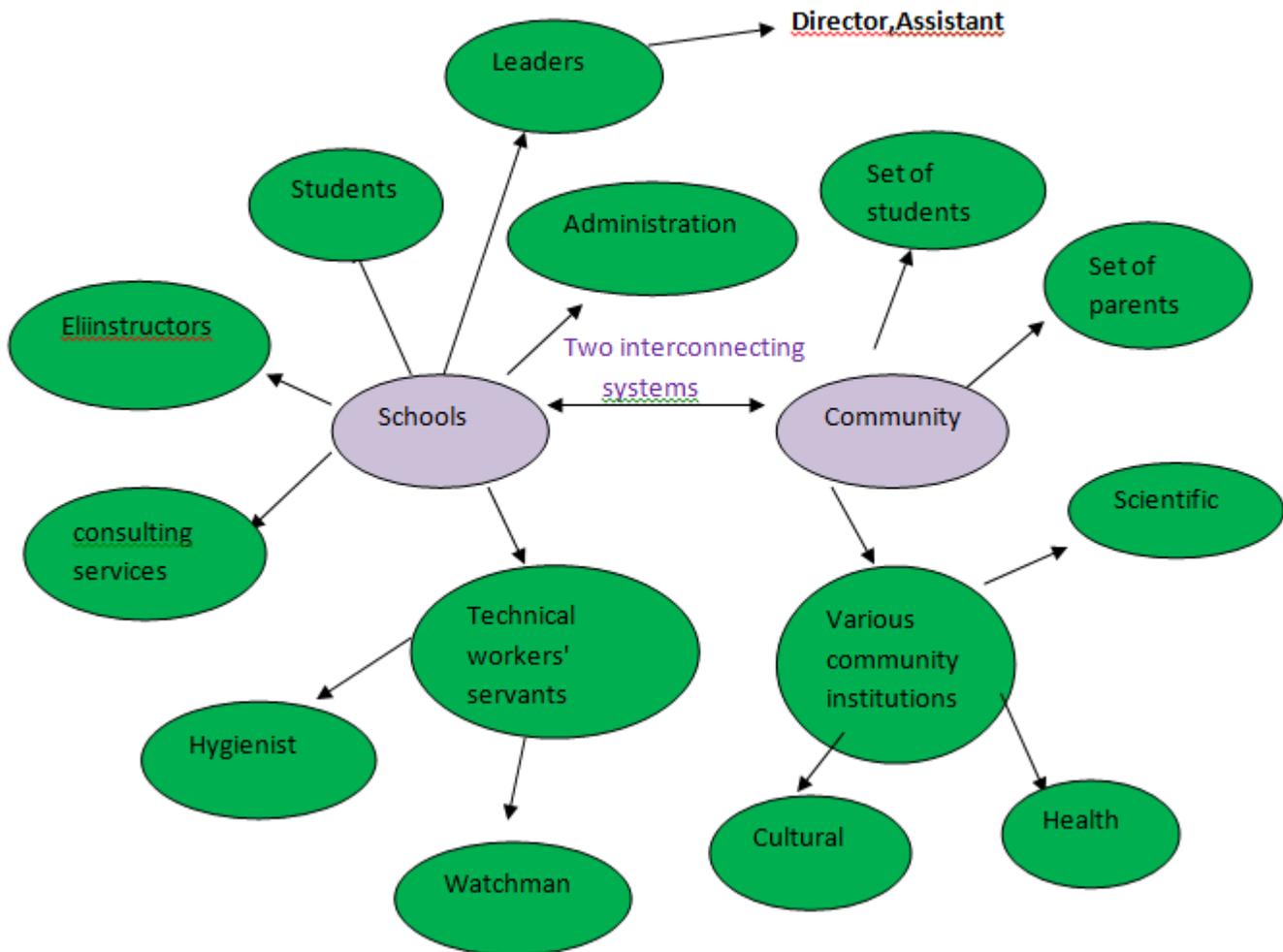
1. Schools, which is also based institution teaching process and close co-operation with the community, family (parent)

2. Establish partnerships with leading institutions which cooperate closely with the school.

3. Partnership with the region (REO and Higher Education Institutions)

4. Partnership at central level (MES) and cooperation with international institutions.

Yes to carefully observe these circles will notice that the first round is the one that cooperates closely with parents, also we notice that schools close partnership with parents and creating with this partnership we'll take the survey to highlight the importance, weight that voice, influence and benefit from this partnership.



**Partnership with Parents**

Parents are one of the key actors in the teaching institution and have a very big impact in school, parents are more interested actors in the promotion of teaching because they want an education and upbringing as perfect for their children and create a partnership between parents and the school would bring the level of learning was much higher and the problems pupils were scarce as. Parents are those who were exercising numerous requests schools and schools according to their eligibility or not. But the creation of a healthy partnership with parents will enable a constructive communication with them, giving their support to the idea and useful advice, also parents can give their support materials to meet the conditions necessary for schools not facing the dot, without forgetting the moral support that give children (pupils) to own .We all studies was noted that the involvement of parents in school contributes to the quality and effectiveness of learning. Insufficient cooperation between parents and the school has negative consequences during the process of teaching and learning. Schools differ efficient and inefficient and efficient or inefficient in cooperation with parents.

The purpose of school education is not only the students but is also their socialization and socialization of children begins from the family (parents), if a child is socialized it will be even

higher in the learning process, if not socialized enough he will be a complex pupils will suffer from stress, paranoia, fear, loneliness and this brings lower results in the learning process .Parent should play its role to increase autonomy and safety to the child itself and to established the first link between social contact that is family and school after school is the basis of education.

Scientific studies over three decades have proven that parental involvement is very important in the learning process of children, in their opinions about the school and their aspirations.

Children are the most successful students at all grade if their parents involved in school and to encourage learning at home, regardless of educational level or their social (Epstein2001)

Also according to scientific research, cooperation and partnership programs school-family-community and practices of teachers in relation to the involvement of parents have positive effects on the ability of parents to help their children to school over the years, we parents for skills assessment of teachers and quality of teaching, on the opinions of teachers possibilities for parents to help their children with school work at home and in the opinion of students to school ... (Becker & Epstein, 1982; Epstein 2001)

The partnership school-family-community-school programs and improves the school climate, provides services and support for families, increases the ability of parents and their leading role, creates a link between parents and the school community and helps teachers in their work such .Partnership created to help young people succeed in school and in life (Epstein 2001) During the years, based on scientific research, has created a system of six major roads to involve parents in school life .They contain activities that may be organized at school, at home and in the community of teachers, students, parents, managers and other stakeholders for improving schools, strengthen families and increase student success. (Epstein 2001) Teachers play a crucial role in the involvement of parents in school. When teachers make parent involvement part of daily teaching practices, interaction with parents raise their children at home, they have more positive feelings about their ability to help their children, the highest appreciations for teachers in general and students improve their attitude and achievements (Epstein 2001).

But that this collaboration with the school to be successful parents should know some of the types of cooperation with parents: Types of cooperation with parent-by Hilton:

1-Work consulting with parents, where the teacher can parents recognize the school program, then what his child learns in school.It may inform the parent of the physical, mental and social development of the child from infancy to adulthood.

2-Communication -that must be continuous.Parents must be kept informed about the progress of his child at school as well as various problems that it can be displayed.

Communication must be mutual, the parent must notify the institution (school) for health and social changes associated with his child.

3 Volunteer work-that include parent participation in school board or council parental giving for teachers their children and for the school in general.

4-Home learning parent-assistance provided in solving the tasks we always house.But assistance must be in proper measure for excess contributions will be shortages for students  
We have cases where the parent of itself solve all tasks only child for the child to come up with good grades, but how realistic are these notes? Does this parent really helps or harms children more?

5-Engagement of parents in decision-parent must be familiar with the school curriculum and school policy and should give its role in decision making and solving different problem, eg: parent as a member of the board may give its support to financial side of the school, in terms of learning in school, in providing additional financial resources to the school, school moral side etc.

6-Cooperation with the wider community-that has to do with the cooperation of parents in the community, either with other parents or community of different institutions.

As one of the closest partners of the parent educational institution has certain duties and rights and we are bringing some of these rights and duties disconnected from the curriculum guidance 2013-2014:

A parent has the right:

1-To be informed by the relevant educational institution for education legislation in force, for the institution and for the curriculum that the institution offers his child.

2-Be informed about terms of safety, health and environment of the institution and their demand performance standards specified in the legislation.

3- Child informed of his activities in the institution and give consent for supplementary and extracurricular activities organized by the school.

4-To be informed about the main directions of activity of the institution and the institution's achievements to similar institutions.

B-The parent is responsible for:

1-Take care that his child regularly follow and teach educational institution regularly.

2-To notify the changes of health and behavior of his child.

3-To take part in meetings on matters relating to his child.

4-To contribute to the progress of the institution.

## II. METHODOLOGY

To understand better this collaboration between parents and schools we have decided to deal with a particular case, with that method of quantitative instruments have made an interview and a questionnaire with the principal and teachers of Secondary School "Ibrahim Rugova" of this school.

Does the known parents with high school curriculum, and how does it work?

Parents these last 2-3 years have been familiar with the high school curriculum by means of questionnaires that were distributed There are parents who have minimal information but there are also those parents who are well informed about the high school curriculum.

What are the main actors in determining the curriculum affect the elections?

Students and schools interact in determining the curriculum of choice with those seeking student and school to what it offers. Realistically our school there were times that students have sought the prosecution of the matter which school is unable to offer.I as director have a duty to these demands of the students to present the curriculum committee for specific curricula ..

Are supporting and what parents give support for the removal of school material?

Parents should be very supportive for the removal of material, and this happens in our school such as; most parents have contributed to the fulfillment of conditions necessary school materials

What is the role of parents in the school board?

Parents at the school board really should have a leading role in the adoption of the plan, the selection of the curriculum to the approval of the teacher and the director.But parents really have no such role in the school board.

A school held workshops for parents? To inform them about the changes to the curriculum?

So far there have been carried out seminars for parents but given that this year our school is a pilot school to school was open to the entire community can be easily studied .Yes paid due importance precisely as high participation of parents in school.

□ The parents participate in the meeting with parents, how active they are in connection with questions about functional curriculum, or ask about curriculum changes? If so who are these changes to the display after parents have discussed with their children.

Usually it involves a high number of parents but only 30% of these are informed about functional curriculum and require additional information about the curriculum and these are parents of students with high academic results.

In the above conversation was born and another question: What about pupils who have parents not active in taking part in the meeting, as you get in school what measures about this situation? Of course it is a worrisome situation because only recently been excluded 37 pupils and it has come from the negligence of parents to be concerned about their children about the problems at the school they represent.

□ How they are aware and react to the parents about the problem when children become familiar with the case when the child guidance has been deprived of the right to participate in an advanced materials due to his notes.

Teachers and the school caretaker supposed to inform parents about behavior and results achieved by them in lessons every month with flyers which are signed by parents to confirm receipt of the notification

We cases of abnormal behavior problem at school pupils, organized special meetings and work ethics council and more problems occur and also because of a case.

Parents along with their children seek to follow a subject for which they do not meet the criteria of the average that requires this course.

Realistically our school this requirement is strictly applied, students have taken the lead by applying this criterion.

### III. RESULTS

Results achieved on the analysis of the case:

During the investigative work of the case study we collected data coming from high school "Ibrahim Rugova" in the city of Kamze honor these data have:

□ Interviews and questionnaires with the director and teachers of the school.

The data collected by random survey prove us that this partnership is not the right level at this school and still have more work to achieve the curriculum standards in Albania.

During the interview with the director of this school was out that parents are part of the functioning of the school, but it's hard work on the part of both parties that parents are an important part of the functioning of the school.

Parents are familiar with functional curriculum at 30%, except the group of parents are informed of this curriculum but also require additional information about it.

In determining the curriculum with no interaction choices and school pupils, pupils with that what you require and schools with what offers, there have been cases where the student has requested materials that schools could not offer but I have a duty as director that these students to submit requests to the commission of curricula for specific curricula

According to our curriculum seminars should be held in the school information but study these seminars take place there

currently, since this is a pilot school is expected that these seminars take place.

From interviews with the director of the school it was observed that the presence of the parents at the meeting was not very high and it differed from the level of the students.

If students have a problem then headteacher and the school made aware of parents for child behavior and their results every month with flyers which are signed by parents to confirm receipt of the notification, while in case of abnormal behavior of students problematic school organized special meetings and work ethics council.

Director conducted a questionnaire for activities that parents should do in school, the director replies have come to these conclusions that parents should participate in extracurricular activities such as sports events, the ceremony for outstanding students also parents should be encouraged to be voluntary.

Parents should control the students homework and make frequent visits to the school to understand the progress and what their children do in school.

Parents should attend school board meetings should also seek out schedule meetings when they think that it is necessary .When asked that the main task of parents in school is to make sponsorships then he replied categorically not.

### IV. RECOMMENDATIONS

The partnership between the school and parents is a process that always has room for improvement .We school that we took in the study partnership between the school and parents were not at the right level, in many ways had many shortcomings.

We recommend that parents are familiar with the curriculum, and how is it done? This can be done several ways:

1) Organizing numerous workshops where parents could be informed on the curriculum and for the latest updates on laws about education

2) Distributed leaflets, curriculum material about parents

3) To inform the students and then they inform their parents

4) In any local radio or television station made presentations and explanations of the curriculum that the entire community be informed.

We recommend that parents be very supportive to school to meet pupils' material basis, to finance the improvement of school infrastructure by investing in monetary value to do to meet the school as a material and create a positive atmosphere as class, it also causes the students to care more for the material basis of school knowing that for this they have invested their parents.

We recommend that parents to participate in school board and play a decision-making attaches great significance to the school and they have the right to decide on the future of the school, and the school must always invite parents and for any issues important never ruled alone, but during the decision to consider the opinion of parents and tutors elementary school board meetings to be more open to parents, community and other stakeholders to be secondary to the comprehensive decision making.

Parents should have a higher participation in the meeting with the parents, to understand how the learning process continues in school and to be updated as the problems of school

and educational progress of their children, in meeting with the parents, the parents may child learn their problems and to take lessons from the problems of other children shall also it gets even a summary of all teachers to progress their child is learning, there will be discussed also for ideas and methods that parents can use urging home for their children to learn more.

We recommend that in the case when students exhibit problems as disrespect of the rules at school, then the respective parents are required to participate in an urgent meeting to discuss issues surrounding their child, but also recommended that other parents who also participate they be updated with the problems of the students, to prevent such behavior from their child, why not give his ideas for solving this problem.

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# Assessment of Air Quality (Bioaerosols) of the Municipal Waste Dumpsite in Uyo Urban, Akwa Ibom State, Nigeria

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**Abstract-** Microbial load in air over municipal waste dumpsite and its environ was assessed using sedimentation or settle plate method. The numbers of viable microbial cells extracted from the dumpsite project site atmosphere ranged between 64 cfu/15minutes and 16 cfu/15minutes for bacteria, 39 cfu/15minutes and 1 cfu/15minutes for coliforms and; between 77 cfu/15minutes and 13 cfu/15minutes for fungi. The values remarkably higher than results reported for other human-impacted projects in the tropics. *Bacillus* sp was 100% prevalence followed by *E. coli* with 80% prevalence. The fungal genera such as *Absidia*, *Mucor*, *Penicillium*, *Aspergillus restrictus* and *Cladosporium* showed 60% prevalence in the study area. The predominant fungi characterized from the old stadium project atmosphere were *Absidia*, *Mucor*, *Penicillium*, *Aspergillus restrictus*, *Candida pseudotropicalis* and *Cladosporium*; while *Micrococcus*, *Bacillus* and *Staphylococcus* species were the predominant bacteria species found in the project environment. *Escherichia coli* (faecal coliform) and *S. aureus* as microorganisms do not survive well in aerosols, the two isolates were predominantly detected at the dumpsite and its immediate environment, an indication that the project site and its environ are heavily impacted by humans and animals feces and wastes or that fecal wastes are also wrongly discharged at the open dumpsite.

**Index Terms-** Bio-aerosol, Municipal waste, Dumpsite, Coliform, Colony Forming Unit, sedimentation

## I. INTRODUCTION

Air pollutants are added in the atmosphere from variety of sources that change the composition of atmosphere and affect the biotic environment. The concentration of air pollutants depend not only on the quantities that are emitted from air pollution sources but also on the ability of the atmosphere to either absorb or disperse these emissions. The air pollution concentration vary spatially and temporarily causing the air pollution pattern to change with different locations and time due to changes in meteorological and topographical condition (Atash, 2007).

Bio-aerosols are defined as airborne particles consisting of living organisms such as microorganisms or originating from living organisms, such as metabolites, toxins or fragments of microorganisms (ACGIH, 1999; Lee, 2011; USEPA, 2004; Ambrose *et al.*, 2014). Sources of bio-aerosols include large

quantities of manure, animals, and feed; increase in the microbial load within the production environment; livestock harbor a variety of zoonotic pathogens; many pathogens are excreted with feces; unregulated waste dumps; sewage treatment plant, etc (Herman, 2007, Madl, 2003). Municipal waste dumps are the main sources of microorganisms' emission to the air. Availability of the large amounts of organic matter in the waste is the source of nutrition for microorganisms. Long-term holding of the unstable waste biomass inhabited by the microorganisms and the necessity of pushing them creates the bio-aerosols with high microorganisms' concentration in one air unit (Frączek and Ropek, 2011). Nielsen et al showed that people at the nearby municipal waste dumps are most exposed to the bio-aerosols in summer during the collection, transport and gathering of the waste and it depends on the type of waste, way of collection and weather conditions. These microorganisms and their byproducts are naturally occurring and are considered to be ubiquitous. Under certain environmental conditions, many bio-aerosols can cause varying symptoms, disorders, and diseases in humans, and they can survive for extended periods (Sherertz, 1993). Airborne microorganisms play a pivotal role in public health, national security, economic, and agricultural matters, yet our understanding of their identity, distribution and abundance is limited (Rodríguez de Evgrafov, 2009). Review papers and reports support a relationship between bio-aerosols and the occurrence of human diseases. Fungal bio-aerosols are known to cause allergies and they are of particular concern to immunocompromised patients in health-care facilities (Lee, 2011). The endotoxin of bacterial bio-aerosols has been recognized as an important factor in the aetiology of occupational lung diseases including (non-allergic) asthma (Douwes *et al.*, 1997). Thousands of Americans were suddenly exposed to airborne *Bacillus anthracis* spores, which raised international concerns about the seriousness of the intentional release of pathogenic bio-aerosols. The pandemic outbreak of flu due to the influenza A H1N1 virus also raised awareness of bio-aerosols in 2009 (Lee, 2011). Herr *et al* (2003) reported that when evaluating health effects of bio-aerosols, their composition, concentration, and measurement methods applied must be considered. Individual susceptibility, for example, atopy, allergic sensitization, or immunodeficiency, also plays an important role in the risk assessment. It is, however, known that infectious allergic, or toxic disturbances triggered by bio-aerosols originate mostly in moulds, thermophilic actinomycetes, Gram negative bacteria, and viruses (Lacey and Crook, 1988; Richerson, 1990). This





### Bio-aerosol Analysis

The microbiological air quality at the dumpsite project environment was investigated using settle plate culture technique, also known as sedimentation technique. This is based on deposition of viable particles (bio-aerosols) on the surface of a solid medium per a given exposure time, as proposed by APHA (1992). The numbers of aerobic count (mesophilic aerobic bacteria) and fungi (yeast and molds) was determined using Nutrient Agar (NA) and Sabouraud dextrose agar (SDA) respectively, according to methods proposed by APHA (1992). The media was fortified with 50 $\mu$ g/ml of streptomycin and 100  $\mu$ g/ml cycloheximide-50  $\mu$ g/ml benomyl respectively for the selective enumeration and isolation of fungi and bacteria. Also determined were the densities of coliforms in the atmosphere using MacConkey's Agar (MCA) as the analytical medium.

For the settling technique, open 9 cm diameter Petri dishes containing 20 ml of appropriate culture media (NA, SDA or MCA) were distributed at each sample station using 4ft high wooden platforms and exposed for 15 minutes. The experiment was conducted with a threefold repetition for each

microbiological attribute, and samples were obtained from 6 sampling stations.

At the end of exposure, the Petri dishes were closed, transported to the laboratory and then incubated at 37°C/ 2days for aerobic bacteria and coliforms, and at 28  $\pm$  2 °C (room temperature)/ 4 days for fungi (yeasts and molds). After incubation the organisms were counted with the aid of a Quebec colony counter and recorded as cfu/15 minutes. Pure bacterial isolates obtained were characterized to generic level according to the taxonomic schemes of Cowan (1985) while the yeasts and moulds were identified based on the recommendation of Domsch *et al.* (1980), Samson *et al* (1984), and Barnett and Hunter (1987).

### IV. RESULTS AND DISCUSSION

Figure 1 shows the number of viable cells of bacteria, coliforms and fungi that constitutes the bio-aerosol of the project atmosphere. For all the sampling stations analyzed the values of mesophilic aerobic bacteria obtained by the sedimentation technique were higher than the APHA's recommended standard (30 cfu/15 mins) for outdoor environment using settling technique except for station ST- 4 (Uyo village Road Stream) which had 23 cfu/15 mins of bacteria. This may be ascribed to the ongoing soil excavation work witnessed at the dumpsite during the sampling periods. Similarly, the fungal loads recorded for stations 1, 2, 3 and 5 were also above the recommended standard.

The predominant fungi characterized from the atmosphere of the project environment were *Absidia*, *Penicillium*, *Aspergillus restrictus*, *Mucor* sp, *Rhizopus* sp, *Candida pseudotropicalis* and *Cladosporium*; while *Escherichia coli*, *Staphylococcus aureus*, *Micrococcus* and *Bacillus* species were the predominant bacterial species found in the dumpsite project environment (Table 1). Although *Escherichia coli* (faecal coliform) and *S. aureus* as microorganisms do not survive well in aerosols (Sullivan, 1979), the isolates were frequently detected in the project environment, an indication that the site is being impacted by indiscriminate defecation by construction workers and residents of the project environment or fecal wastes are also wrongly discharged at the open dumpsite. Figures 2 and 3 show percentage prevalence of microbial load in the project site atmosphere, *Bacillus* was 100% widely spread, while *A. clavatus*, *Candida albicans*, *Geotrichum* and *phoma* were not distributed over a considerable extent.

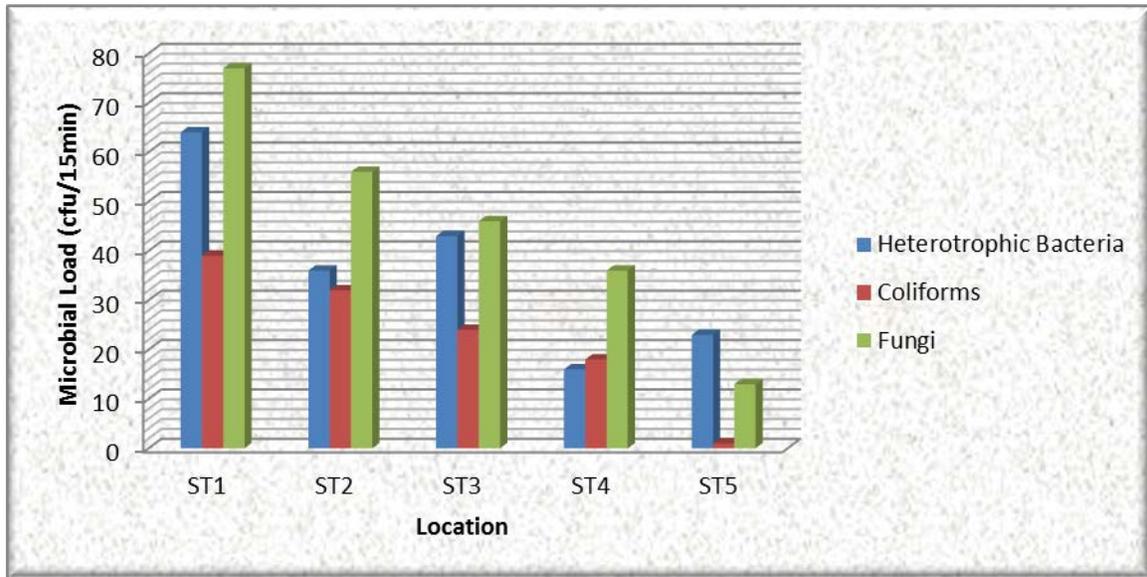


Figure 1: Microbial Loads (cfu/15 minutes) of the Atmosphere within the Dumpsite Project Environment

Table 1: Diverse species of microorganisms extracted from the Dumpsite project atmosphere

Isolate	Sample Station					% Prevalence
	ST-1	ST-2	ST-3	ST-4	ST-5	
<b>Bacteria:</b>						
<i>Bacillus</i>	+	+	+	+	+	100
<i>Escherichia coli</i>	+	+	+	+	-	80
<i>Micrococcus</i>	+	+	-	-	-	40
<i>Pseudomonas</i>	+	+	+	-	+	80
<i>Staphylococcus aureus</i>	+	+	+	-	-	60
<b>Fungi:</b>						
<i>Absidia</i>	-	-	+	+	+	60
<i>Alternaria</i>	+	+	-	-	-	40
<i>Aspergillus restrictus</i>	+	-	+	+	-	60
<i>A. glaucus</i>	+	-	+	-	-	40
<i>A. fumigates</i>	+	-	-	+	-	40
<i>A. clavatus</i>	-	-	-	+	-	20
<i>Candida albicans</i>	-	-	-	-	+	20
<i>Cladosporium</i>	+	+	-	+	-	60
<i>Fusarium</i>	+	-	-	+	-	40
<i>Geotrichum</i>	-	-	+	-	-	20
<i>Mucor</i>	+	+	+	-	-	60
<i>Penicillium</i>	+	-	-	+	+	60
<i>Phoma</i>	-	-	-	-	+	20
<i>Rhizopus</i>	+	+	+	+	-	80

+ = isolated; - = not isolated

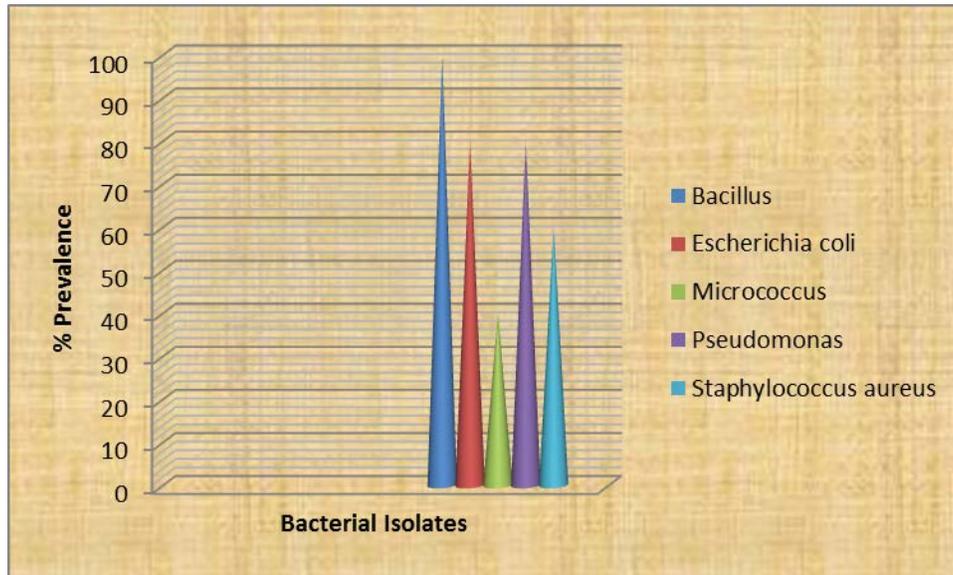


Figure 2: Bacterial percentage prevalence in the project area

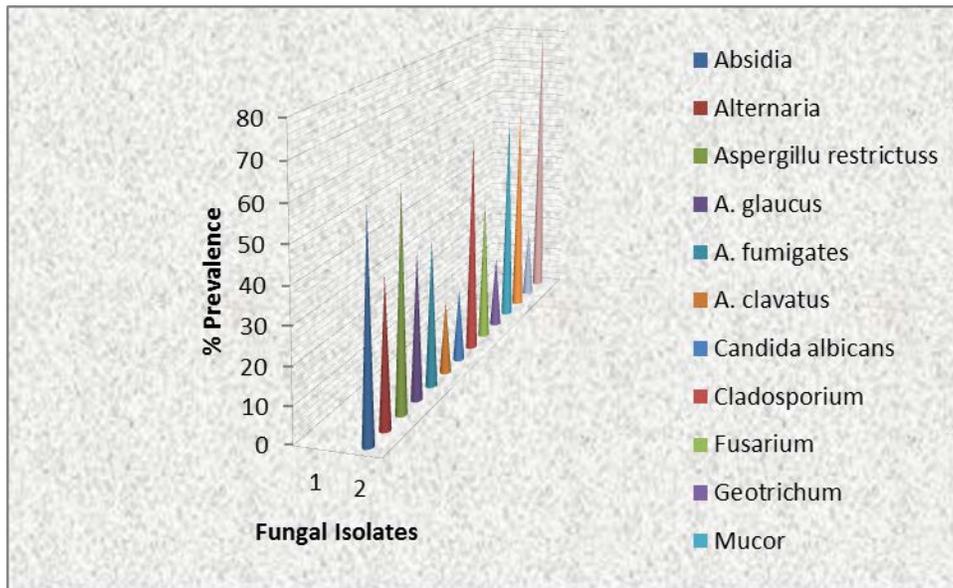


Figure 3: Fungal percentage prevalence in the project area

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# Know How – Internet of Things

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**Abstract-** The next revolution in IT industry after World Wide Web that we can realize is the introduction of Internet of Things (IoT). Internet of Things is also sometimes referred to as Internet of Everything. In simple terms, we can understand Internet of Things (IoT) as a concept where all day to day objects are connected to the Internet and to one another. The IoT is a concept that can improve our lives to make it easier and smarter.

The concept of IoT is very simple but is very dominant. It is nothing great but simply a concept where the network devices sense data and collect it from all around us and finally share it over the Internet for further processing and utilization as desired by the end user.

The day is not far when Internet of Things will create a bridge between the real life and virtual world.

**Index Terms-** IoT, Internet of Technology and IoT vs M2M.

## I. INTRODUCTION

Internet of Things can be referred as ANY THING Connection, ANY TIME Connection and ANY PLACE connection. Though the evolution of Internet has existed for several decades but the explosive growth of smart mobile devices and introduction of wireless technology has given this technology a new boost. Not only this, the declining cost of smart devices and widespread and omnipresent connectivity will lead to easy and smooth deployment of IoT solutions. The physical world will become an informative world as the Internet of Things comes into existence through sensor enabled devices.

Internet of Things is an extended expression of M2M technology, which requires some new in-network features to connect to objects in the physical world similar in a way computers do now.

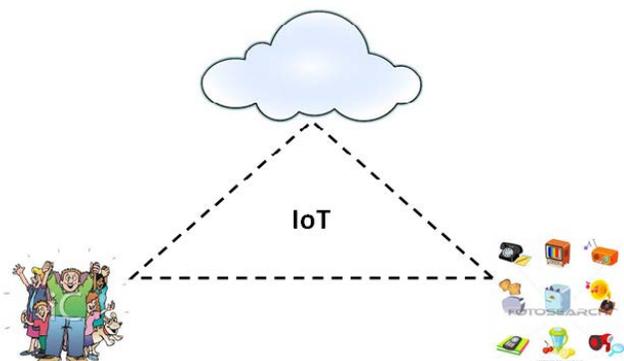


Figure 1: IoT at a Glance

## II. IoT OVER M2M

It is difficult to distinguish between IoT and M2M because both the technologies are connected through automated devices with their end points communicating to devices, such as sensors or sensor holding devices. M2M with a combination of some transport protocols can be treated as a subset of Internet of Things. M2M is actually a communication between machines with the remote computer. In M2M technology, first machine connects the device to the cloud, next it manages the device and finally it collects the machine data. It is actually connecting and communicating with anything, such as machine, device or sensor where as IoT is an extension of M2M, setting up a communication between things with people, system and things.

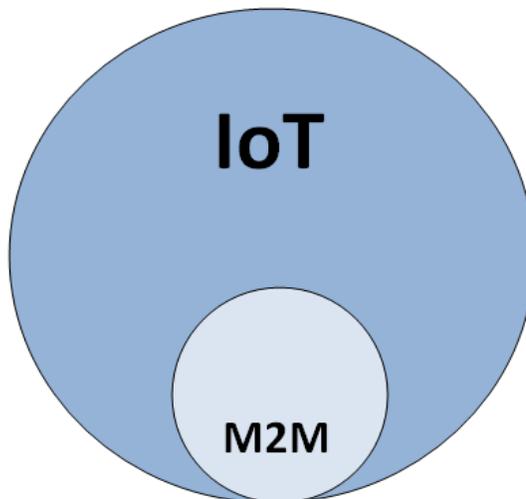


Figure 2: IoT vs M2M

## III. APPLICATION

As we are moving towards connected things through the evolving IoT technology, the sensors will be embedded in a normal device to turn it into a smart device. Let us now learn that how Internet of Things enables different sectors in offering new services.

1. **Healthcare:** Data driven decision making is the biggest gift to healthcare sector by introduction of IoT technology. The patient will wear IoT enabled wearable and facilitate the doctor in capturing the health related data. Moreover, a person with troubling health problem can get detected by the physician before the problem gets converted into more chronic health issue.

The introduction of IoT in healthcare will reduce cost of care and at the same time will improve quality of life of patients and real time disease management.

**2. Transportation:** The introduction of safety enabled sensors in automobiles will be a boon to transport industry in reducing road accidents every year. As majority of accidents on roads are because of human error, hence through IoT automobile industry is committed in removing human decision making intervention while driving.

The biggest advantage by introducing IoT in this sector would be reduction of carbon emission to the environment.

**3. Retail:** It is very important to track assets in real time to keep the business going smoothly. The introduction of IoT in retail sector will help the organizations to identify any bottlenecks or challenges in the supply chain.

The introduction of IoT in retail sector will help in bringing retailers closer to the end user.

**4. Energy:** Today the energy sector is facing tough challenge in finding ways to reduce cost and save energy waste by consumers. The introduction of IoT will convert the energy sector into an efficient energy sector.

IoT in energy sector will help the energy sector to collect real time usage data thereby predicting the demand supply ratio and accordingly ensure energy load balancing. Hence, this will help the energy sector as well as the customer to save significant cost and resource saving.

There are many other sectors, such as Finance, Manufacturing, Real State, Aerospace, Marine etc where the IoT can play a significant role.

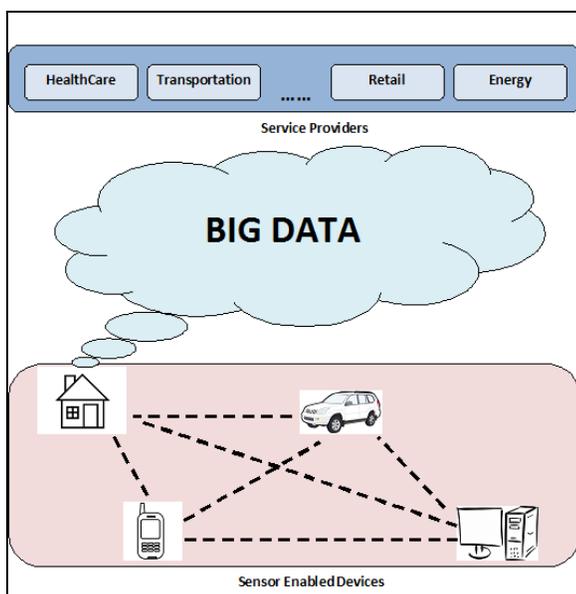


Figure 3: IoT Application in varied Sectors

#### IV. CHALLENGES

The foundation of IoT technology is sensor based devices, but the control and management of sensor enabled devices over large geographical area will be a real challenge. In addition, also the supply of continual energy to sensors fitted in billions of devices across the globe will not be less than a challenge for IoT technology.

As IoT technology relies on big data gathering from various sources, the management of this big data will become a real time problem as the user base and devices increase over a period of time.

Above all the challenges, the biggest threat is security of the personalized data that is continuously getting collected through numerous sensor fitted devices. Hence, protection of personalized data from unauthorized access and utilizing it only for the specific purpose for which it is intended to is a big challenge of IoT technology.

#### V. CONCLUSION

History repeats itself; the evolution of the Internet now in terms of Internet of Technology is now knocking again at our door step. For IoT to gain acceptance among common people, it is necessary that everyone has to come together and play their part of significant role in making it a success.

The white paper is intended only for knowledge purpose. Unless stated to the contrary, any opinions or comments are personal to the writer and do not represent the official view of the company / organization.

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# The Semantic- syntactic Scopes of Negation in English language

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**Abstract-** This study attempts to present a clear picture about negation scoops in semantic and syntactic features in the English language. It aims to describe the various aspects of sentential negation by showing how negation operates with different negative particles, and to illustrate the different positions of negations in English language. It also attempts to shed light on the classification of the negative particles in English language according to their occurrences in sentences, i.e., verbal and non verbal sentences and according to their semantic and syntactic positions in these sentences.

dialectological point of view. These four Arabic dialects are: Egyptian Arabic (EA), Moroccan Arabic (MA), Syrian Arabic (SA), and Kuwaiti Arabic (KA). She states that the four dialects have three strategies of negation: verbal negation, predicate negation, and categorical negation. She has also defined categorical negation in these dialects as that kind of negation which is not restricted to a single entity or two of the category but includes the whole category which, according to her, does not mirror the mood of the speaker but has a normative aspect that is arrived after witnessing the negation of a certain relationship, incident, member of a group, etc.

## I. INTRODUCTION

Negation is a subject of variation across languages. Every language has its own syntactic, semantic and morphological devices expressing negation. A great deal of research has been conducted by English and Arab Linguists on the similarities and differences of negation in the two Language. Not only does this study tackle negation in its wide sense, but also it focuses on a special aspect that is the semantic and syntactic scope of negation in the English language.

The goal of linguistic study is to discover the natures and facts of language, how it is acquired and how it functions? In recent years, much attention has been given to the question of how best to represent the structure of negative phrases and the nature of structures that negate themselves. Negation data in various languages give many significant inferences about the underlying structural principles of negation (Gleason, 2001).

Negation is a universal linguistic notion. Indeed, it is one of the most basic elements in human mind that makes it an indispensable part of natural languages which are the tools for human thoughts. Every language has negative particles or expressions; statements that involve negative particles are called negative statements. As it is known, negation is the opposite of affirmation; (positive and negative) one sentence or statement can be the negation or denial of another. Thus, negation is the process of making a sentence negative usually by adding negative particles within the structure. All languages have their own rules to change the statement from affirmative to negative. According to Gleason (2001), this allows us to discuss what is not happening, or what we do not want. Bloom (1970) suggests that when children are learning a language, it is likely that they learn to produce and distinguish between two basic types of sentences: the affirmative and the negative.

Negation is a fundamental linguistic phenomenon for the whole language system. It appears at different semantic and syntactic levels and has different purposes or meanings. Brustad (2000) investigated negation in four Arabic dialects from a

## II. OBSERVATIONS

In this section, all types of negation in English are to be previewed.

### 2.1 Types of Negation in English and Arabic

#### 2.1.1 Auxiliary Negation

There is a negation rule in English: If we want to state that something is not true, we can form a negative sentence by adding the word "not" after the first auxiliary verb in the affirmative sentence. If there is no auxiliary verb in the affirmative sentence, as in the Present Simple and Past Simple tenses, we will add one with the word "not" after it. When an auxiliary verb is added like that, the main verb must be in the infinitive form (no '-s' or '-ed' ending).

Nowadays, when looking at a negative sentence, we usually see the auxiliary verbs with 'not' in contracted forms, not in full forms. Full forms are used in very formal cases or when we want to emphasize. Contractions of negated auxiliary verbs in English are formed by reducing the negative particle 'not' to n't, a clitic or suffix which is fused to the root verb form.

Examples include isn't, aren't, wasn't, weren't (from be), hasn't, haven't, hadn't (from have), won't, wouldn't (from will), shan't, shouldn't (from shall), can't, couldn't (from can), mayn't, mightn't, and mustn't (from may). And we should remember that there is no standard contraction for 'am not'. This is known in Linguistics as the "amn't gap". All conjugations of 'be' are subject to contraction even when used in a non-auxiliary sense.

Ex: "He isn't my teacher." ('be' here isn't an auxiliary). In some dialects, 'have' as a main verb is subject to contraction, in other dialects the negation is realized by the insertion of auxiliary 'don't'. Ex: "I haven't a pen." (We rarely see this form.)

"I don't have a pen." (More popular). Here is a review of auxiliary negations including examples. In this table, we can see both contracted forms used in informal writing and speaking and full forms. Table 1:

Tense	Negative element + contracted forms	Examples
Present simple	Do+not = don't Does+not = doesn't	I do not study. She doesn't study.
Past simple	Did+not= didn't	I didn't study.
Present progressive	Am+not (no amn't) Is+not = isn't Are+not = aren't	I am not studying. He is not studying. We aren't studying.
Past progressive	Was+not = wasn't Were+not = weren't	I wasn't studying. They were not studying.
Present perfect	Have+not = haven't Has+not = hasn't	You haven't studied. She has not studied.
Present perfect progressive	Have+not+been = haven't been Has+not+been = hasn't been	I have not been studying. She hasn't been studying.
Past perfect	Had+not = hadn't	You hadn't studied.
Past perfect progressive	Had+not+been = hadn't been	She hadn't been studying.
Future simple	Will+not = won't	I won't study.
Future perfect	Will+not+have = won't have	He will not have studied.
Conditional	Would+not = wouldn't	She wouldn't study.
Conditional perfect	Would+not+have = wouldn't have	She wouldn't have studied.
Modals	can + not = can't or cannot (formal) should+not = shouldn't	I can't study. I cannot study. We shouldn't study.

### 2.1.2 Noun Phrase Negation

Another way of changing an affirmative sentence into a negative sentence is to place a negative determiner or a restrictive quantifier before a noun, which is called noun phrase negation.

Determiner 'not'. In English, there are several instances where 'not' can grammatically negate the subject of a sentence. Ex: "Not everyone can do this task."

"Not one thing was left untouched by the wrath of the tornado."

However, it doesn't mean that all noun phrases can be negated by 'not'. For example, we can't say, "Not Lan went to school yesterday."

Based on various analyses of quantifiers (Barwise & Cooper, 1981; Keenan & Stavi, 1986; Tottie, 1991) and negation (Horn, 1989, and those cited in Horn), negation by 'not' is only allowed when the denotation of the negated noun phrase has a readily definable interpretation; more specifically, the set of

possible sizes for the set denoted by the negated noun phrase must be a continuous range of values. We can see more clearly with examples in the following table: Table 2: Example sentences demonstrating when it is grammatical (or interpretable) to negate a noun phrase with 'not'.

Grammatical	Ungrammatical
1. Not <b>every</b> company expects to report increased earnings.	10. *Not <b>each</b> citizen files a tax return.
2. Not <b>all</b> of NASA's space-science work will be so auspicious.	
3. Not <b>a</b> peso is offered.	11. *Not <b>some</b> pesos are offered.
4. Not <b>one</b> thing in the house is where it is supposed to be.	
5. Not <b>many</b> people came to the meeting last week.	12. *Not <b>several</b> people came to the meeting last week.
6. Not <b>any</b> person can just walk right in there and get what they want.	
7. Not <b>more than half of</b> the team showed up last Friday.	13. *Not <b>most</b> of the team showed up last Friday.
8. Not <b>more than 200</b> people attended the opening gala celebration.	14. *Not <b>few</b> people came to the meeting. 15. *Not <b>no</b> man left.
9. Not <b>less than one million</b> people enjoy listening to ABBA Gold every day.	16. *Not <b>the</b> man walked into the store. 17. *Not <b>John</b> came on time

From the above table, we can find out the rule of negation by 'not':

- All vs. Every, More than x, Less than x, Few; Many vs. Several; More than half vs. Most.
- 'All' and 'every' can be negated with 'not' and they seem to have the same meaning.
- Ex: "Not all students have to join that activity." = "Not every student has to join that activity."
- 'More than' and 'less than' are grammatical when negated while 'few' is ungrammatical.
- According to Barwise & Cooper's (1981) analysis 'not few' could mean both 'no' and 'many', which is very confusing. Therefore, it cannot be negated by 'not'.
- 'Many' and 'several' have a difference in the grammaticality of their corresponding negating quantifiers.
- Reconsider sentences number 5 and number 12:
- Not many people came to the meeting last week.
- \*Not several people came to the meeting last week.

In these sentences, there are two possible values for the size of the set denoted by 'not several': less than the value for several

given by the discourse, or greater than that value. This is very similar to the case of 'few'.

- Not several people came.... = few / no people came....
- Not several people came .... = everybody / (many people) came....

The range of sizes for the set denoted by 'not several' is not a continuous set of values (the size is either less than or greater than the value of several ), and so 'several' cannot be negated. On the other hand, the size of the set denoted by 'not many' cannot be more than many, since it is possible that 'many' indicated the size of the entire set (many may possibly equal all, so not many  $\neq$  all ). Hence, 'not many' can only denote a set of size less than the value given for 'many' by the discourse. This set is a continuous set of values, and so 'many' can be grammatically negated.

- 'More than half' and 'most'

Since 'more than half' denotes a set of size anywhere from >50% to 100% of the set (i.e., there are no 'two sides' to more than half ), the possible values for the size of the negated quantifier is a closed, continuous set of values (from 0% to 50%), and so the negation is grammatical.

However, 'most' means anywhere from greater than 50% of the set to some value less than 100% of the set, depending on the given situation. So, when we try to negate 'most', it is possible that 'not most' could mean more than 'most' or less than 'most'. Again, we find that the negation of a quantifier is ungrammatical exactly when the set that contains the possible values for the size of the set denoted by the negated quantifier is not a continuous set of positive integral. So, 'most' cannot be negated.

- 'Any' and 'both'

Tottie (1991) notes that, "In present-day-English it is only normal to use not-negation at the beginning of a sentence if the meaning is 'not just any'" (p.102). We can extend this statement to assert that a speaker uses the phrase 'not any x' to indicate that they have a specific set of individuals in mind who in fact can have the property mentioned in the sentence. To make this clear, consider example: "Not anybody is allowed to shake hands with the Queen." [from Tottie, 1991, p.102].

In this example, the speaker means to indicate that nobody, except a very specific group of people (possibly only foreign diplomats) is allowed to shake hands with the Queen. With each use of 'not any x', the negated quantified noun phrase denotes a specific, closed set. The size of the negated set is closed and continuous. Thus, 'not any x' is grammatical. Unlike 'any', however, the speaker who uses 'not both' either intentionally or unintentionally ambiguates the subject of the sentence. Consider the following example: -

- "Not both David and Amy came to my party."

The addressee is to infer that one person, and not the other, did in fact come to the party. The identity of the person who came to her party is ambiguous, however this is unimportant in terms of the ability of 'both' to be negated. The set of possible

values for the size of the negated set is closed and continuous, so the negation of 'both x' is grammatical.

- Cardinals Vs A, One

All cardinal determiners that do not equal zero should be ungrammatical when negated.

Ex: \* "Not two/twenty/300 hundred people came to the movie debut." However, if the determiner denotes a set of size one, the negation is grammatical because it indicates none, or a set of size zero. Ex: "Not one/a person came to the movie debut."

- EACH

With 'not each', it is unclear whether the negation negates the universal quantification portion of each or the manner or 'individuating' portion of each. Ex: "Not each company is expected to pay taxes." only a few are required to pay them this quarter. "Not each company is expected to pay taxes." the companies are all expected to pay the tax as a group. The ambiguity of the negation of each leads to its ungrammaticality. So, 'each' cannot be negated.

- "Determiner 'no'

'No' is another negative determiner which we can place before a noun to bring a negative meaning into a sentence.

"He sold no house last month." = "He did not sell any house last month."

"They will make no cakes for her." = "They won't make any cake for her".

After the determiner 'no', we can use both singular and plural nouns, it mainly depends on the context. Ex: "No new message" is correct if we are dealing with only one message; "No news messages" is correct if we are dealing with more than one message. Restrictive quantifiers 'little' and 'few'. Like 'no', 'little' and 'few' also bring negative meanings to sentences.

However, we should pay attention to the use:

- Little is used with uncountable nouns:

Ex: "There is little water left."

- "I have little reason to think they will help."

- Few is used with plural nouns:

Ex: "There are few men who are capable of doing it. "

"I know few places that I could recommend to you."

Determiner 'none' and 'neither'

If we use determiner 'no' to refer a singular item, we should use 'none' and 'neither' to refer to an item of a group mentioned afterwards. We use 'neither' to refer to 2 items and 'none' to a group of more than 2.

Ex: "No one knew the answer."

"None of them/the boys/the students knew the answer."

"Neither of them/the boys/the students (just as long as there are only two of them) knew the answer."

Noun phrase negation has a very powerful role in emphasizing. For example, when we say "They will make no cakes for her.", the hearer will pay more attention to the result "no cake" than when we say "They won't make cakes for her."

The second seems a normal action while with the first, we will think “they” as unkind people.

### 2.1.3 Adverb Negation

In English, there are some negative adverbs which create negative sentences, without adding no/not/any negative expression. So, when using negative adverb, we don't need the 'no' part of a negative sentence.

For example, if we want to say 'I almost don't know him', when using negative adverb it will be 'I barely know him'. As we can see, the negative expression (don't) is erased from the sentence. That's the reason why many people make mistakes when using this negative adverb. It is already negative, so there is no use of negative expression (no/ not/ neither/ nor/ etc). Therefore, we have a new formation for a negation:

**Subject + negative adverb + positive verb**  
**Subject + to be + negative adverb.**

Ex: “She never apologizes for her wrong behaviour.”  
“John is rarely late for school.”

### 2.1.4 Morphological Negation

This type of negation is also called affixal negation and is marked by the presence of negative affixes: a-, non-, dis-, un-, in- (including the variants im-, il-, ir-), the suffix -less and the suffix -out.

Ex: atypical = not typical;  
non-stop = without any stop;  
dislike = not like;  
unnecessary = not necessary;  
ineffective = not effective;  
impossible = not possible;  
illogical = not sensible;  
irresponsible = not responsible;  
useless = not fulfilling the intended purpose  
without = not having

Note: Items that are apparently formed by negative prefixes but that are not clearly negative in meaning are not considered (example: disgruntled).

#### • Describing Negation

A describing negation is used to inform, describe the absence of a thing, a person or an event. We often use this type to answer a question with a negative meaning.

Ex: A: Is Nga good at Math?

B: No, she isn't.

#### • Rejecting Negation

A rejecting negation is used to claim that some idea or judgment is wrong. It means that we use this type when we want to raise against an idea.

Ex: A: Nga is good at Math.

B: Nga isn't good at Math at all.

In conclusion, based on these manners and the characteristics of negative sentence in English, we can figure out

some similarities and differences of negative sentence in English and Arabic.

The second observation: ambiguous sentences versus unambiguous ones:

Regarding ambiguity or non-ambiguity of English sentences, it should be noted that this study is related to the semantic and syntactic interpretation of ambiguous sentences including negation with certain grammatical aspects. Interestingly, Smith (1975, argues that unambiguous sentences become ambiguous when they are negated. Such as. The following examples:

1. a. john ran until dark.
1. b. john didn't run until dark.

As we have seen in the above mentioned examples : Sentence 1.a is unambiguous whereas sentence 1.b is ambiguous. Sentence 1.b is not the opposite of 1.a because it might mean "john, stopped running before it became dark" or "john didn't run until it became dark".

Modality is one of the most widely related aspects that have unexpected behavior under negation. Radden (2007: 224) argues that “The behavior of modal verbs is erratic when they occur with negation”. The ambiguity arises not only because the same modal might have more than one meaning but also because the negated modals might negate either the modality or the proposition. In other words, it is not always necessary that the negated modal verbs affect the modality but in certain cases the proposition of the sentence might be negated. These two terms related to the semantic scope on both languages. There are other aspects of grammar that have ambiguity under negation such quantifiers, adverbials, subordinate clauses and others.

The relation between intonation and negation is a necessary one because it plays a crucial role in defining the extension of the scope of negation especially the falling and fall-rise tones. Based on Halliday assumption, this proposal treats intonation as a grammatical, semantic and syntactic aspect.

Actually, the semantic and syntactic scope of negation has been extensively studied in English by linguists around the world and many studies have set out to investigate this domain. Arab linguists have largely neglected this area especially the relation between negation and intonation and such studies on the relation of modality and negation are also very rare in the Arab World. Therefore, in this study I will try to fulfill this gap.

There are certain syntactic aspects that have unexpected behavior under negation in that the unambiguous sentences become ambiguous when they are negated. One of the most widely related aspects which has ambiguity under negation is the negation of modality in that it isn't always necessary that the negative modals affect the modality but in certain cases the proposition of the negative sentences might be negated. So the scope of modal negation is difficult to define in the negative sentences in that either the proposition or the modality might be negated. Consider the following examples:

1. You can't stay here.
2. He mustn't be at school.

Sentence 1 negates the modality. It means that "you are not allowed/permitted to stay here". While sentence 2 negates the proposition in that it means "it is necessary that he isn't at home". There are other syntactic aspects that have scope ambiguity under negation such as quantifiers, adverbials, subordinate clauses, prepositional phrases and others.

### III. CONCLUSION AND RECOMMENDATIONS

This article has been an overview of negation where approximately all negation types were tackled. For further research, there are different dimensions which could be explored given the wealth of data available at the Lab School for instance. Researchers could study students with different first languages to see what their inter-language relative to negation looks like. There are many areas that could be explored. And as teachers use second language acquisition research to inform their teaching, the classroom is a logical setting for more research. Finally, researchers could conduct a comparative study between Arabic and English Language.

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# Study on the variations of Soil Edaphic and Chemical Factors of different forest types of Achencovil Range during Post Monsoon Season

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**Abstract-** Comparison between the three forest types namely moist deciduous, semi evergreen and evergreen of Achencovil forest in the post monsoon season on the basis of soil edaphic factors like gravel,  $p^H$ , Organic carbon content (OC), Exchangeable Acid (EA), Exchangeable Base (EB), sand, silt, clay and soil chemical factors like Nitrogen, Phosphorous, Potassium, Calcium and Magnesium contents. 20 sites from moist deciduous, semi evergreen and Evergreen were randomly selected. Soil samples of  $5 \times 5 \text{ cm}^2$  area from a depth of 5 cm were collected from these three habitats. Mean with standard deviation were taken. Habitat wise variation was analyzed by using two way ANOVA. The study shows that the evergreen soil has high nitrogen content (3779.8 ppm). Phosphorous content (5.98 ppm), potassium content (242.45 ppm) and calcium content high in moist deciduous and magnesium (74.75ppm) content high in semi evergreen. The Evergreen soil has high organic carbon content (4.72 %).

**Index Terms-** Achencovil Forest, Moist deciduous, Semi evergreen, Evergreen, Soil edaphic factors, Post Monsoon

## I. INTRODUCTION

Soil is a major component of earth's ecosystem. Soil must be considered as a complex of living and nonliving components which are present in different combinations, with identifiable gross characteristics. As cited by Kuhnelt (1961), 'the soil is the uppermost weathering layer of the solid earth Crust; it consists of broken up and chemically changed parent rock and the remains of the plants and animals. A thin layer of soil covers most of the earth's land surface. This layer is varying from a few centimeters to 2 or 3 meters in thickness. It is in this layer of soil that the plant and animal kingdom meet the mineral world and establishes a dynamic relationship. Early chemist considers soil as a store house of plant nutrients. One gram of soil supports a population of millions or even billions of bacteria and other microorganism. In addition to living components soil also contains nonliving components like rocks, minerals, soil water, soil air etc. Soil is made up of substances existing in solid liquid and gaseous states with colloidal particles of organic and inorganic origin.

Soil contains sand, clay and silt in definite proportions. Besides soil particles, the soil contains mineral nutrients which are important for plant metabolism and growth. These elements are essential for maintaining the osmotic balance and absorbing ions from soil solution. It include macro elements or

macronutrients like Carbon, Hydrogen, Oxygen, Calcium, Nitrogen, Phosphorus, Sulphur and Magnesium and microelements or micronutrients like Potassium, Iron, Manganese, Zinc, Boron and molybdenum. The soil also contains organic matter and humus. These organic substances increase soil fertility and acts as a food substrate for microorganism and soil animals. Humus is the dark amorphous portion of the organic matter which has lost its structure through decomposition. The amount of organic carbon in the soil depends on various factors like soil texture, climate, vegetation and land use.

The present study was undertaken for the comparison of soil edaphic and soil chemical factors between the three habitats of the Achencovil forest namely moist deciduous, semi evergreen and evergreen as a part of Western Ghats.

## II. METHODOLOGY

The study was conducted in Achencovil forest area of Kollam district lies between latitude  $9^{\circ} 00' N$  and  $9^{\circ} 08' N$  and longitude  $77^{\circ} 00' E$  and  $77^{\circ} 015' E$ . This forest area comprises different types of forest ecosystems, including tropical evergreen, semi evergreen and deciduous forests. Hence the study sites were selected evenly based on a primary observation on the forest and soil types in which they belong.

### A. Collection and transportation of sample

Three forest types, moist deciduous, semi evergreen and evergreen of Achencovil forest range were selected. From each type, 20 sampling sites were identified. Soil samples of  $5 \times 5 \text{ cm}^2$  areas from a depth of 5 cm were randomly collected using soil auger during the monsoon period of 2014 (September, October and November). Collected samples were taken to the laboratory in polythene covers.

### B. Soil edaphic factor analysis

From the sample collected, the soil edaphic factors like gravel content,  $P^H$ , organic carbon, Exchangeable acids, Exchangeable base and soil morphology (sand, silt and clay content) were detected using standard procedure. The soil gravel content was measured using standard procedures. The soil  $P^H$  was measured using  $P^H$  meter. Exchangeable acid and exchangeable bases were measured using the procedure of Trivedy and Goel (1987). Soil organic carbon content was measured by using the procedure of Walkley and Black (1934).

Soil sand, silt and clay content were measured by standard procedure.

**C. Soil chemical factor analysis**

Soil samples are air dried and sieved. From the sample chemical factors like Nitrogen, Phosphorus, Potassium, Calcium and Magnesium content were analyzed. Nitrogen content was analyzed by Kjeldhal distillation method, the Phosphorus content was analyzed by Molybdate stannous chloride method, Potassium content was analyzed by Flame photometry method

**III. RESULT**

**A. Soil edaphic factors**

In the three forest type of Achencovil (moist deciduous, semi evergreen and evergreen), the soil edaphic factors like gravel, P<sup>H</sup>, organic carbon, Exchangeable acids, Exchangeable bases, sand, silt and clay content in the post monsoon season were detected.

Gravel content was an average of 30.03 in the moist deciduous, 14.99 in semi evergreen and 23.11 in the Evergreen (Table 1). Two way ANOVA showed no significant variation between the sites (P>0.05) of the same habitats and significant variation between the habitats (P<0.05). The average P<sup>H</sup> of the moist Deciduous was found to be 4.615, in the semi evergreen 4.54 and in the evergreen is 4.74 (Table 1). The two way ANOVA showed no significant variation between the sites (P>0.05) and showed significant variation between the habitats (P<0.05) (Table 2). All the three habitats show an acidic P<sup>H</sup>.

The organic carbon content in the moist deciduous forest was an average of 3.42%, in the semi evergreen of 4.33% and in the Evergreen of 4.72%. The exchangeable acids in the moist

(APHA 2012). Calcium and Magnesium content of the soil were analyzed by the methods of Jackson (1958).

**D. Statistical analysis**

Descriptive statistical analyses were done by using Microsoft Excel Software. Two way Analysis of variance (ANOVA) was conducted to determine the significant differences in the value of each parameters between the sites and the forest habitat using SPSS package 14.00.

deciduous forest was an average of 2.61%, in the semi evergreen of 2.54% and in the Evergreen of 1.45%. The exchangeable base in the moist deciduous forest was in an average of 5.41%, in the semi evergreen of 12.06% and in the Evergreen of 3.34 % (Table 1). The two way ANOVA showed no significant variation in the level of organic carbon, exchangeable acids and Exchangeable bases between the sites (P>0.05) and showed significant variation the level of organic carbon, exchangeable acids and Exchangeable bases between the habitats (P<0.05) (Table 2).

The Sand content in the moist deciduous forest was an average of 83.3%, in the semi evergreen of 75% and in the Evergreen of 75.45%. The silt content in the moist deciduous forest was an average of 6.7%, in the semi evergreen of 12.4% and in the Evergreen of 14%. The clay content in the moist deciduous forest was an average of 10.25%, in the semi evergreen of 13.35% and in the Evergreen of 11.25 % (Table 1). The two way ANOVA showed no significant variation in the level of sand, silt and clay content between the sites of the same habitat (P>0.05) and showed significant variation the percentage of sand, silt and clay content between the habitats (P<0.05) (Table 2).

**Table 1: Soil Edaphic Factors of Achencovil forest in post monsoon season**

Forest Type	Gravel	P <sup>H</sup>	Organic Carbon%	EA%	EB%	Sand%	Silt%	Clay%
Moist Deciduous	30.03±1.15	4.61±0.08	3.42±0.09	2.61±0.15	5.41±0.15	83.3±1.03	6.7±0.97	10.25±0.71
Semi Evergreen	14.99±0.33	4.54±0.08	4.33±0.009	2.54±0.12	12.06±0.46	75±0.72	12.4±1.72	13.35±1.34
Evergreen	23.11±0.14	4.74±0.12	4.72±0.05	1.45±0.06	3.34±0.06	75.45±2.79	14±1.58	11.5±0.71

**Table 2: Two way ANOVA for soil Edaphic Factors of Achencovil forest in post monsoon season**

Parameter analyzed	Comparison aspect	F- value	F- Critical Value	P value
Gravel	Within the Habitat	1.023918	1.867332	0.458822
	Between the Habitat	2341.566	3.244818	1.62X10 <sup>-40</sup>
P <sup>H</sup>	Within the Habitat	1.100467	1.898622	0.390108
	Between the Habitat	2301.818	3.259446	1.04x10 <sup>-38</sup>
Organic Carbon	Within the Habitat	0.545426	1.867332	0.920619
	Between the Habitat	1.849569	3.244818	1.37x10 <sup>-38</sup>
Exchangeable Acids	Within the Habitat	2.790126	1.867332	0.00348
	Between the Habitat	953.2968	3.244818	3.37x10 <sup>-33</sup>
Exchangeable Base	Within the Habitat	1.223812	1.867332	0.290031
	Between the Habitat	5520.67	3.244818	1.48x10 <sup>-47</sup>
Sand	Within the Habitat	1.562811	1.867332	0.118711
	Between the Habitat	164.6394	3.244818	1.91x10 <sup>-19</sup>
Silt	Within the Habitat	0.662338	1.867332	0.830732
	Between the Habitat	121.101	3.244818	3.27x10 <sup>-17</sup>

Clay	Within the Habitat	1.130309	1.867332	0.362489
	Between the Habitat	55.09266	3.240818	$5.9 \times 10^{-12}$

**B. Soil chemical factors**

The nitrogen content in the moist deciduous forest was an average of 2253.45ppm, 3260.6ppm in the semi evergreen and 3779.8ppm in the evergreen. The phosphorus content in the moist deciduous forest was an average of 5.92ppm, in the semi evergreen is 4.80ppm and in the Evergreen is 4.70ppm (Table 3). The two way ANOVA showed there is no significant variation in the level of nitrogen and phosphorus content between the sites of the same habitat ( $P > 0.05$ ) and showed significant variation in the level of nitrogen and phosphorus content between the habitats ( $P < 0.05$ ) (Table 4) during the post monsoon season.

The potassium content in the moist deciduous forest was an average of 242.45ppm, 164.4ppm in the semi evergreen and 152.05ppm in the evergreen. The calcium content in the moist deciduous forest was an average of 371.2ppm, in the semi evergreen is 346.95ppm and in the Evergreen is 141.35ppm. The magnesium content in the moist deciduous forest was an average of 28.30ppm, 74.75ppm in the semi evergreen and 48.19ppm in the evergreen (Table 3). The two way ANOVA showed there is no significant variation in the level of potassium, calcium and magnesium content between the sites of the same habitat ( $P > 0.05$ ) and showed significant variation in the level of potassium, calcium and magnesium content between the habitats ( $P < 0.05$ ) (Table 4) during the post monsoon season.

**Table 3: Soil Chemical Factors of Achencovil forest in post monsoon season**

Forest type	Nitrogen ppm	Phosphorus ppm	Potassium ppm	Calcium ppm	Magnesium ppm
Moist Deciduous	2253±22.21	5.92±0.03	242.45±0.99	371.2±15.00	28.30±3.19
Semi Evergreen	3260.6±11.77	4.80±0.03	164.4±3.03	346.95±3.60	74.75±2.26
Evergreen	3779±10.53	4.70±0.04	152.05±1.23	141.35±1.08	48.19±0.73

**Table 4: Two way ANOVA showing soil chemical Factors of Achencovil forest in post monsoon season**

Parameter analyzed	Comparison aspect	F- value	F- Critical Value	P value
Nitrogen	Within the Habitat	1.191899	1.867332	0.313439
	Between the Habitat	51739.9	3.244818	$5.38 \times 10^{-66}$
Phosphorus	Within the Habitat	1.535661	1.867332	0.127962
	Between the Habitat	7462.404	3.244818	$4.91 \times 10^{-50}$
potassium	Within the Habitat	1.048597	1.867332	0.435252
	Between the Habitat	12498.89	3.244818	$2.77 \times 10^{-54}$
calcium	Within the Habitat	1.2061	1.867332	0.302848
	Between the Habitat	4275.361	3.244818	$1.87 \times 10^{-45}$
Magnesium	Within the Habitat	1.843237	1.867332	0.053598
	Between the Habitat	2624.608	3.244818	$1.88 \times 10^{-41}$

has high nitrogen, potassium and calcium content but low potassium and magnesium content.

**IV. DISCUSSION**

From the three habitat of Achencovil forest, moist deciduous, semi evergreen and evergreen soil edaphic factors like gravel content,  $P^H$ , organic carbon, Exchangeable acid, Exchangeable base, sand, silt and clay content were detected. The soil gravel content is high in moist deciduous forest and low in the semi evergreen. The entire three habitats showed an acidic  $P^H$  and evergreen habitat found more acidic.

In the moist deciduous forest the soil is sandy, loam and moderately acidic. Organic carbon content is high. Exchangeable acid was generally low but Exchangeable base is high. The soil

In the semi evergreen type, the soil is moderately acidic with high amount of organic carbon, Exchangeable acid was generally low but Exchangeable base is high. The soil is sandy with slightly higher level of clay. The level of Nitrogen, potassium and calcium was high but the level of phosphorus and magnesium was found to be low.

In the evergreen forest the gravel content showed a medium range, moderately acidic, with high carbon content, with low value of Exchangeable acid and a moderate value of Exchangeable base. The soil has high nitrogen, potassium and calcium content but low level of phosphorus and magnesium content.

The present study showed that nitrogen content is high in evergreen habitat and low in moist deciduous habitat. Phosphorus content is high in moist deciduous and low in evergreen. Potassium and calcium content is high in moist deciduous and low in evergreen habitat. Magnesium content is high in semi evergreen and low in moist deciduous.

## V. SUMMARY AND CONCLUSION

Compared the three habitat of Achencovil forest; moist deciduous, semi evergreen and Evergreen based on the soil edaphic factors like soil temperature, pH, exchangeable acid, exchangeable base, organic carbon content, moisture content, sand silt, and clay content, soil chemical factors like nitrogen, phosphorus, potassium, calcium and magnesium content. In each habitat, 20 sites were selected for the soil study. Soil samples were taken during the post monsoon season. Mean with standard deviation were taken for each parameter value. Two way ANOVA was conducted to test whether the samples have variation in values between sites and habitats. From this study found that the Evergreen habitat was more fertile than Moist deciduous and semi evergreen.

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# Assessment of Water Supply Situation in Owo, Ondo State, Nigeria: Implications for the Attainment of the Millennium Development Goals.

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**Abstract-** Water is one of the most important factor in the development of a nation and until recently, this essential element of urban liveability-domestic water supply have not received the much needed attention it deserved in promoting good urban living. This paper therefore, examines water supply situation in Owo, Ondo State, Nigeria. Data were obtained from both primary and secondary sources through physical survey, observation, interview and questionnaires administered to targeted residents of the different quarters of the ancient town. The study reveals among others shortage of portable water as well as lack of attention to maintenance and sustainability. Moreover, majority of the respondents get their water supplies from unprotected source thereby making them vulnerable to water borne diseases. The study therefore recommends among others the conduct of awareness campaign to sensitize the local people, provision of good and safe drinking water as well as the repair/maintenance of the existing water facilities in order to achieve the target of the MDG.

**Index Terms-** Millennium Development Goals, Sanitation, Safe Drinking Water, Urban liveability

## I. INTRODUCTION

Social services are of critical importance to the well-being of the people and the enhancement of socio-economic development of their various communities. One key critical social service is water. Right from the advent of human civilization, water spawned life of this planet and has since sustained it. Water possesses the powers of life and death, controlling the fate of everything from micro-organisms to man. This explains why the United Nations in November 1980 inaugurated its International Drinking Water Supply and Sanitation decade. This ambitious programme is premised on the fact that water resource development is integral to national economic and social development and that access to safe drinking water and facilities are basic human rights (Buell, 1984).

Water is the most common substance on earth and it contributes in several ways to the economic and social development of any society. The use of water in any place includes drinking, cooking, washing and general sanitation. Others include industrial usage, growing of crops in terms of irrigation and livestock keeping. It covers more than 70 percent of the earth surface. It fills the oceans, rivers, and lakes, and is in

the ground and in the air we breathe. Water is everywhere regardless of language, culture or ethnicity, all human shares this basic need that is essential for survival.

Water is therefore one of the most important factor in development and until recently, the multiple benefits of this essential element of urban liveability- domestic water supply have not received the much needed attention it deserved in promoting good urban living.

It is generally acknowledged that Africa has the lowest total water supply coverage of any region in the world. The minimum water requirement per head for houses with modern conveniences according to WHO (Adaramola 1990) is about 115 litres. According to Kabbaj, (2004), total coverage of water supply in Africa is around 62 percent and sanitation coverage around 60 percent. It is estimated that currently about 300 million people in Africa do not have access to safe water supply. This situation is a major cause of diseases, as a high proportion of Africans suffers from one of six major water-related diseases. Particularly affected are women and children who travel long distances to fetch water and spend inordinate amounts of time and energy at the expense of family activities, education and other productive work.

The UNCH Habitat (1998) identified urban problems throughout the less developed countries to include environmental degradation, inadequate shelter, infrastructure, water supply, sewerage and employment. Estimates from the WHO indicates that 25 percent of all urban dwellers in developing world do not have access to safe water supplies and 50 per cent do not have an adequate sanitation. In addition, the UNDP World Bank water and sanitation programme indicate that by the year 2000 more than 600m million urban people will lack adequate sanitation and 450 million will lack safe drinking water (Urban Age, 1992).

In much of the world polluted water, improper waste disposal and poor water management cause serious public health problems. Some water related diseases such as malaria, cholera, typhoid and schistosomiasis harm or kill millions of people every year. According to Water org (2010) 443 million school days are lost each year to water-related illness. A child dies every eight seconds from contaminated water with total deaths record of over 5million people every year (Ushman, 2003). Overuse and pollution of water supplies are also taking a heavy toll on the natural environment and pose increasing risk for many species of life (Ifabiyi, 2000). Shortage of portable water supply for domestic use has become a perennial problem in many Nigerian towns and cities. In November 2001, it was reported that

polluted water supplies led to an outbreak of cholera in Kano, causing more than 600 deaths (African Discovery B.B.C., 2001). It was based on the above and other factors that world leaders made the following declaration during the Millennium Summit in 2000: "We must spare no effort to free all humanity and above all our children and grand children, from the threat of living on a planet spoilt by human activities and whose resources would no longer be sufficient for the need" (Ajayi, 2005). The Millennium Development Goals (MDGs) were formulated from the above declaration.

This paper therefore examines water supply situation in Owo, Ondo State, Nigeria and make recommendations in order to achieve the target of MDGs.

## II. THE MILLENNIUM DEVELOPMENT GOALS

The World Water Council in 2005 declared that 1.1 billion people lack access to safe drinking water. 2.6 billion people lack adequate sanitation. 1.8 million people die every year from diarrhoea diseases, including 90% of children under 5, this situation is no longer bearable. Based on the above, the United Nations formulated the Millennium Development Goals, dedicated to reduce poverty and ensure sustainable development, the goals range from halving global poverty and hunger to protecting the environment, improving health and sanitation and tackling illiteracy and discrimination against women. The millennium Development Goals (MDGs) is therefore the end product of numerous United Nations Development conferences from the 1960s to 1990s.

In September 2000, the United Nations General Assembly representing 189 countries, unanimously adopted the Millennium Declaration. At the United National General Assembly request, the Secretary General and various UN agencies, as well as representatives of the World Bank, International Monetary Fund (IMF) and Organization for Economic Cooperation and Development (OECD), devised a plan for achieving the Millennium Declaration's objectives – resulting in 8 goals, 18 targets and 48 indicators known as the Millennium Development goals (MDGs).

The MDGs therefore are a set of time-bound and measurable goals and targets ranging from halving extreme poverty, increase access to safe drinking water, halting the spread of preventable diseases, environmental devastation and discrimination against women to providing access to basic education, all by the year 2015

In all there are 8 goals and 18 targets but of interest is goal number 7, target 10 of the Millennium Development Goal which is targeted toward: "***Halve, by 2015, the proportion of people without sustainable access to safe water and basic sanitation***". The year of reference for this goal is 1990. In order to meet the water supply and sanitation target, an additional 260,000 people per day up to 2015 should gain access to improved water sources and an additional 370,000 people should gain access to improved sanitation (WHO 2004).

## III. NIGERIA GOVERNMENT AND THE MDGS

The Nigerian Government as part of the signatory of the declaration, set up the office of the special assistant on Millennium Development Goals in the presidency, and also included the objectives of the MDGs in the NEEDS (National Economic Empowered and Development Strategy) document, which essentially is the road map of the Federal Government socio-economic development of the Country.

As a foregoing to the above, the State Governments in Nigeria has also set up their own adapted document/policies as SEEDS (State Economic Empowerment and Development strategy) and the Local Government as expected to set up the LEEDS (Local Economic Empowerment and Development Strategy). Direct implication of the above policy thrust is that a lot of government investments will be channelled towards the implementation of the Millennium Development Goals through the NEEDS, SEEDS and LEEDS.

Despite various policies and blue prints as well as huge resources committed to water service delivery by government at all levels, potable water at all levels is still very scarce, there is now a palpable fear that the country may not meet the MDG goals for water. Different studies have established this inherent fear if the current trend of poor water supply is not improved upon. The 2006 WHO/UNICEF Joint Monitoring Programme report submitted that Nigeria like several other African countries may not meet the MGD goals for water and sanitation (WHO/UNICEF, 2006). This was also collaborated by the study conducted by the United Nations Development Programme (UNDP) report of 2006 which rated Nigeria as being off track towards achieving the MDG goal on water. The report also stated that Nigeria has a low human development water, sanitation and nutritional status and that with the current trend, the MDG goal on water target may not be reached, not in 2015 but in 2040 (UNDP, 2006).

## IV. WATER SUPPLY SITUATION IN NIGERIA

Nigeria has a total surface area of 923.768km<sup>2</sup>, with a land area of 910.770km<sup>2</sup> and a water area of 13,000km<sup>2</sup> (Ince et al, 2010). Nigeria is endowed with about 267 billion cubic metres of surface water and about 52 billion cubic metres of ground water annually (Ince et al, 2010). In the southern part of the country, rainfall is high, surface water and springs are often the most appropriate source of water while in the north, rainfall is low and aquifers are shallow. It is obvious from the above that the country is generously blessed with abundant surface and ground water. In spite of this level of endowment, national sector data indicates poor access of Nigerian to water and basic sanitation.

Nigeria has an estimated Total Actual Renewable Water Resources (TARWR) of 286.2km<sup>3</sup>/year amounting to 1893m<sup>3</sup>/year per capital (AQUASTAT FAO, 2010). According to the National Urban Water Sector Reform Project (NUWSRP) report of January 2004, it is estimated that about 50% of the urban and 20% of the semi-urban population have access to reliable water supply of drinking water from non traditional sources (Monday, 2004). The same report submits that the overall effective urban water supply coverage may be as low as

30% of the population due to poor maintenance and unreliability of supplies, with rural coverage being estimated at 35%.

The rapid population growth of urban centres in Nigeria has brought about disproportionate increases in urban water demand. Due to the present economic recession in the country, government agencies responsible for water supply are not able to meet this increased demand for water in most urban areas. This shortfall in water supplied by these agencies results in pipe borne water shortages. It is a common fact that water is the resources that define the limits of sustainable development and it has no substitute.

The Water Supply sector in Nigeria has come under increasing focus since independence, but particularly during the last 20 years when the country participated in the global efforts and initiatives aimed at addressing the problem of low access to

safe water. Many entities are involved in water supply, including: Federal Ministry of Water Resources, State Water Agencies, River Basins Development Agencies, Local Governments, and external support agencies including UNICEF, UNDP, World Bank, DFID, Global 2000, WaterAid, Concern Universal, and ZONTA International. These institutions employ their own implementation strategies and involve individual communities and LGAs to varying degrees. Because of the inadequacy of the approach to maintenance adopted by these, about half of the pumps in the country are out of service at any one time.

The water situation for six cities in the country is shown on Table 1. From the Table it is obvious that despite the abundance of both underground and surface water in Nigeria, access to safe water is highly limited to urban dwellers.

**Table 1: Main Sources of Drinking Water in selected cities in Nigeria: 2009**

Urban Centre	Main sM Sources of Water							Total
	Borehole	Well	Stream	Public tap	In-house tap connection	Water vendor	Others	
Onitsha	87.8	5.6	0.0	0.5	1.0	5.1	0.0	100.0
Maiduguri	23.6	4.0	0.5	20.6	12.1	39.2	0.0	100.0
Katsina	10.1	26.5	4.8	30.2	7.9	20.6	0.0	100.0
Lokoja	26.8	30.6	6.0	1.6	8.2	25.7	1.1	100.0
Lagos	26.1	22.6	0.5	8.0	6.0	36.7	0.0	100.0
Port Harcourt	44.0	0.5	2.0	13.5	40.0	0.0	0.0	100.0
All cities	36.6	14.7	2.2	12.4	12.7	21.2	0.2	100.0

Sources: NISER, 2010

This is no doubt a great resource which should be harnessed to produce maximum benefit to the nation. In an attempt to maximize this potential, a number of agencies have been put in place for the management of water resources and provision of water services infrastructure in the country. At the Federal level, there is the Federal Ministry of Water Resources (FMWR) with mandate for development of overall policy and regulatory mechanism for water development and utilization. In the country, water supply is a state responsibility. Towards this end, state governments have created State Water Agencies (SWAs) – Water Boards and water Corporations – They have the responsibility of providing urban, semi-urban and in some cases, rural water supply; they develop and manage water supply facilities within respective states in accordance with established financial objectives. Each SWA is responsible to the State Government generally through the State Ministry of Water Resources (SMWR). The Nigerian Water Policy indicates that water should be regarded as an economic good as well as social services and encourages the autonomy of SWAs.

Paradoxically, irrespective of the abundant natural water resources, proliferation of water works in the country coupled with a robust policy that spells out strategies and attainable targets, the water situation in Nigeria could be best described as precarious. Over the years, improvement in domestic water supply has not been impressive. For instance, in 1990, 47% of Nigerians have access to improved water. This percentage improved slightly to 53% in 1990. Displaying similar growth

rate, only 58% access was recorded in 2008 (WHO/UNICEF JMP, 2010). In rural areas, where the majority of Nigerians live, only 58% had access in 2008 (WHO/UNICEF JMP, 2010). In literature, piped water is often equated to safe water since improved sources could still contain some harmful substances (Sullivan *et al*, 2003). Therefore, access to piped water is regarded as a measure of access to safe water. It is pathetic to observe that access to piped water among Nigerians has decreased extensively from 14% in 1990 to 6% in 2008 (WHO/UNICEF JMP, 2010)

## V. MATERIALS AND METHODOLOGY

### 5.1 Study Area

Owo, the headquarters of Owo Local Government area is situated 38 kilometres east of Akure, the capital city of Ondo State, 400 kilometres North East of Lagos, the commercial nerve centre of Nigeria and 480 kilometres South East of Abuja the Federal Capital Territory. Owo lies on latitude 7°15' north of the Equator and longitude 5°35' east of the Greenwich Meridian. It is about 150 metres above mean sea level. The core area covers an area of about 1,341 hectares (Adebisi, 1996) with six main traditional quarters bounded by defense moat. The town has however grown far beyond the traditional moat and has incorporated many major landmarks in the process of its spatial expansion.

The town falls within the sub equatorial region characterized by a monsoon climate. The temperature is relatively high throughout the year with an average daily temperature of about 27°C, with marked seasonal changes in rainfall and relative humidity. Owo (situated in the south western part of Nigeria), like other tropical areas of Nigeria enjoys abundant rainfall of over 1,500 millimetres yearly (Aribigbola and Omosulu, 2002). Available records show that Owo had a population of 30,662 during the 1952/53 census year. The 1963 population census recorded population of 80,413 for the city. By the year 1991, the population of the town rose to 155,006 and her population was estimated to be 176, 955 in 1996 and in 2003, the population also rose to 203,381. The 2006 population census however put the population of the ancient town at 218,886 and using a growth rate of 2.5% the present population (2013) is estimated at 260,187.

### 5.2 Data Sources

The basic data set utilized for this paper was collected using a structured questionnaire administered on selected residents (household heads) of Owo to obtain information on their socio-economic status, sources of water supply, distance travelled in sourcing water, water treatment methods as well as the problem associated with getting water for their daily needs. Systematic random sampling technique was used to select buildings and residents at interval of every tenth building in the six main traditional quarters which the town was stratified. A total of 300 questionnaires were administered. Moreover, officials of water supply agency responsible for water administration and management in the study area were interviewed. Other relevant materials and data were sourced from published sources such as textbooks, journal articles, newspaper and internet among others.

## VI. EXISTING SITUATION OF WATER SUPPLY AND SANITATION IN OWO

There is no city in Nigeria even in the world that can boast of efficient and effective water supply system. The various water supply schemes in Nigeria are not consistent and sometimes when it is available it is often not in sufficient quantity which leaves the majority of the people having to look for other supplementary and substandard sources of water. The above situation defines the state of water supply and sanitation in Owo. Public water supply for Owo is supplied by the Ondo State Water Corporation through the Ose water scheme which was designed to supply about 2,000m<sup>2</sup> of water/day to the town on a daily basis. An analysis of water situation in 1984 in Owo carried out by DHV consult shows that out of an estimated 1100ha of the built up area, only 500ha was laid with water mains (DHV, 1986). This shows that less than 50% of the built environment residents enjoy safe water supply (Aribigbola and Omosulu, 2002).

Field investigation revealed that out of the 300 respondents sampled, only 27, representing 9% of the entire population derive and enjoy their water supply from the public pipe borne water. This show a sharp decline from the situation in 1984, when the Ose water scheme had the capacity of serving 26,000 people (DHV, 1986), the situation has deteriorated further. The main

reason behind this is the fact that the Ose water scheme that supply water to Owo town which was expected to pump about 130,000 gallons of water to Owo urban per day is operating below capacity, the quantity of water supplied to the town on a daily basis is grossly inadequate, this oftentimes constitute a serious burden on the part of every household who has to travel long distances from their various houses in search of safe drinking water for their domestic needs. The reasons behind this include shortage of manpower, lack of capital/finance, erratic power supply, people's attitude towards public utilities and obsolete/lack of maintenance of their equipments.

Table 2 reveals other sources of water supply in Owo to include stream/river which accounted for 6.7% of the populace, borehole accounted for 25.7%, well 56.3% and others which include those that depend on rain water and those that buy water from water vendors accounted for 2.3% of the sampled population. The implication of the above analysis is that majority of the population depend solely on unhygienic/untreated source of water. Some of the respondents interviewed attested to this that they get water for their daily use from pond, stream and rivers, which are unclean, so many of them especially children contact diarrhea and cholera. In view of the inadequate pipe borne water supply situation in the study area, majority of the respondents travel more than one kilometre in search of water for their daily need especially during the dry season.

**Table 2: Sources of Water Supply in Owo Urban**

Source of Water	Frequency	Percentage (%)	Cumulative Percentage
Pipe Borne	27	9.0	9.0
Stream/River	20	6.7	15.7
Borehole	77	25.7	41.4
Well	169	56.3	97.7
Others	7	2.3	100.0
<b>Total</b>	<b>300</b>	<b>100</b>	

Source: Field Survey, July, 2008

From Table 3, it is evident that majority of the population travelled more than 1 kilometre in sourcing water for their daily needs. 69.3% of the sampled population travelled more than 1 kilometre, 18.7% travelled less than 1 kilometre, while the remaining 11.7% of the population were of the opinion that they have their water source within their compound. Majority of the residents of the study area do carry drums, kegs and jerry cans to places like the Federal Medical Centre, Rufus Giwa Polytechnic, the Ose Water Scheme and other locations within the town where there are boreholes in search of potable water. The implication of the above analysis is that the water might have been contaminated in the course of travelling mostly along the road because most of the water containers are not covered, and on getting home neither will the water be treated before consumption, thereby, exposing themselves to water borne diseases such as cholera and diarrhea.

**Table 3: Distance covered in sourcing Water**

Distance	No of Household	Percentage (%)	Cumulative Percentage
Less than 1 Km.	56	18.7	18.7
1-2 Kilometre	109	36.3	55.0
3-4 Kilometre	76	25.3	80.3
4-5 Kilometre	24	8.0	88.3
Others	35	11.7	100.0
<b>Total</b>	<b>300</b>	<b>100.0</b>	

Source: Field Survey, July, 2008

A large percentage of the population (70.3%) of the respondents used their water raw without any treatment. This might account for the incidences of water related disease such as diarrhea in the area. Few respondents (14.7%) used water guard (water treatment) or alum (11.7%), while 3.3% of the respondents boiled their water before drinking as presented in table 4.

**Table 4: Water Treatment Methods.**

Methods	No of Household	Percentage (%)	Cumulative Percentage
No Treatment	211	70.3	70.3
Addition of alum	35	11.7	82.0
Addition of Water guard	44	14.7	96.7
Boiling	10	3.3	100.0
<b>Total</b>	<b>300</b>	<b>100</b>	

Source: Field Survey, July, 2008

**6.1 Problems of Water Supply and Sanitation in Owo**

In the course of the study, a number of problems were identified. They include: Lack of attention to maintenance and sustainability, it is a common thing to come across damaged water pipes in the areas where we have them within Owo urban with water flowing continuously for days unattended to. This constitutes waste of resources which economically translate to waste of public funds. Erosion has also exposed many pipes to the risk of being damaged by men, vehicles and construction activities. Other related problems include inadequate supply and irregular supply which made consumers to supplement their water consumption with other sources of water such as well, boreholes and stream water, the dependence of the populace on these poor water sources comes with diverse consequences; inadequate coverage of pipe borne water distribution network, poor quality and increased time cost in the process of getting water for their daily needs. Some of the people go as far as buying water from jerry cans, whose original source they are not sure of. This unhealthy source of water accounts for the causes of severe cases of sickness and diseases such as typhoid, cholera and the rest, which kill thousands of people on a daily basis.

Inadequate funding on the part of the government is another problem facing water supply in Owo. Both the local and state government has not done enough for the people of the study area

as regards water supply of piped water to Owo. DHV (1986) recognized that investment in capital projects is being financed through capital grants from Ondo State Government. The size of these grants has been progressively reduced over the last few years, from 8.4 million in 1979 to 2million in 1984 (DHV, 1986).

It takes a strong will for government to embark on, and sustain projects that affect the welfare of the people. It is unfortunate to note that the State Government has not really funded the Ose Water scheme for it to maintain its equipments and equally get the materials needed for the treatment, production and distribution of water in other to meet the water demand of the people of the study area. Other findings include the shortage of manpower, people’s attitude towards public property, low revenue collection from consumers, as well as the increase in population/area of the study area.

**VII. RECOMMENDATIONS**

In order to meet the Goal 7 Target 10 of the millennium Development Goal before the target year, 2015, the following policy recommendations should be adhere to. Since safe drinking water and basic sanitation is of crucial importance to the preservation of human health, especially among children, there is the need for proper funding of the Ose water works. The Ondo State Water Corporation should endeavour to repair or replace obsolete and outdated pumps at Ose water works, repair/change damaged pipes and laying of new water pipelines to the entire length and breadth of Owo township to ensure availability of safe drinking water in every part of the city so as to reduce the distance travelled in getting safe drinking water, and the resuscitation of the reservoir at Rowntree in order to store water for distribution to Owo urban.

In the alternative, while construction of new dams and rehabilitation of old one may be so huge investments, boreholes and wells may be constructed and equipped with submersible pumping machines. Water from the boreholes and wells could be pumped to overhead tanks which will be connected to pipeline networks that will distribute water to points of consumptions-homes, schools, hospitals, industries, farms, recreation centres, hotels etc. it is essential that planning take into cognizance the fast growing population and the extent of the built-up areas, and of course, the consequent expansion of such schemes.

There should be great involvement of private sector in water supply and distribution through innovative approaches like public-private partnership (PPP). The involvement of private ownership and franchise in water provision will improve efficiency and reduces government financial risks.

Moreover, there is an urgent need for the Government of the day to embark on awareness campaign, organization of workshops, use of the print media as well as radio and television jingles to sensitize the people on the need to boil their water before drinking and treat by adding alum to remove the sediments. Equally to ensure sustainability of water by ensuring proper payment of revenue as well as maintaining and reporting damage water pipes promptly and also to ensure genuine public participation in water supply planning and effective sanitary environment.

Since municipal water supply facilities are built and designed to serve a targeted population, there is the need to

construct new water schemes with increased facilities in order to meet the ever increasing population of the study area.

### VIII. CONCLUSION

Recognizing the fact that population growth is at an alarming rate and the demand for safe drinking water can not be met by the present level of supply, Sustainability of water supply in the study area therefore will be a mirage except fundamental issues raised above as affecting water supply are addressed. However, in achieving the MGD goal 7 targets 10 therefore changes in behaviour and attitudes on the part of the government and the inhabitants of the study area is a prerequisite.

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# Designing, development and implementation of Text to Speech algorithm for Gujarati text using concatenative methodology

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**Abstract-** Speech is the most natural and major form of communication between humans. Since last three decades humans are trying to create computer that can understand and talk like human. Compared to English and other European languages like French, Spanish etc., much research is not done in Indian languages. There is less work done particularly in Gujarati. This paper describes Designing, development and implementation of a concatenate based Text to Speech algorithm for Speech Synthesis in Gujarati language. When the researcher tries to develop certain recognition system, they require certain previously stored data i.e. database for respective recognition system. Concatenative Synthesis described in this paper uses database of prerecorded Gujarati phonemes and concatenates them to produce sound. It also describes concatenative method which boosts up data matching and speech generation process.

**Index Terms-** Text to speech, Concatenative Synthesis, Gujarati consonants and vowels, TTS IDE.

## I. INTRODUCTION

Text-to-speech (TTS) systems are software that convert natural language text into synthesized speech [1]. Text-To-Speech (TTS) synthesis system has a wide range of applications in every day life like public speaking, Listening aid, Screen reader etc.. In order to make the computer systems more interactive and helpful to the users, especially physically and visibly impaired and illiterate masses, the TTS synthesis systems are in great demand for the Indian languages. In this paper concatenate approach is used to generate TTS engine. It uses phoneme corpus database [2] containing all basic symbols, numbers and 'Barakhadi' characters made using combination of Gujarati Consonants and vowels. The concatenative approach is based on the small pieces of recorded speech. In this approach, to prepare "speech database", the small pieces are either cut from the recordings or recorded directly and then stored. Then, as per shown in figure 1, at the synthesis phase, units selected from the speech database are concatenated and, the resulting speech signal is synthesized as output.

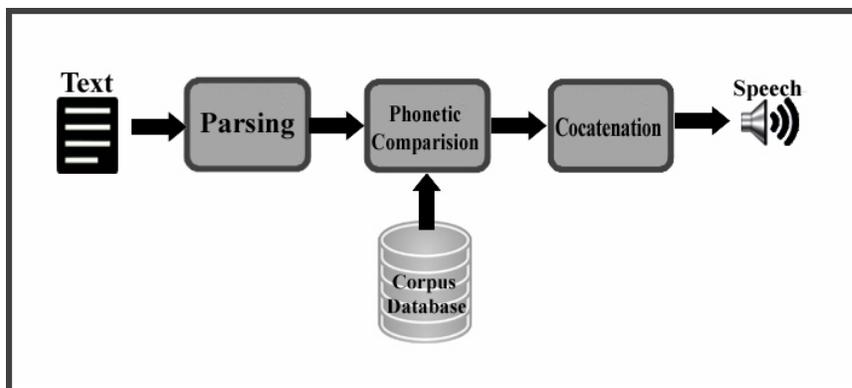


Figure 1: Concatenative TTS Synthesis System Design

## II. CURRENT RESEARCH IN GUJARATI TTS SYNTHESIS

*dhvani* is a text to speech system designed for Indian Languages. The aim of this project is to ensure that literacy and knowledge of English are not essential for using a Computer[3]. Currently *dhvani* is capable of generating intelligible speech for

the following Indian Languages . Bengali, Gujarati, Hindi, Kannada, Malayalam, Marathi, Oriya, Panjabi, Tamil, Telugu, Pashto (experimental). Dhvani works in GNU/Linux platforms as of now.

Tanvina B.Patel and their team from DAICT have developed TTS. For their project, TTS voice in Gujarati is built using festival frame work and HTS frame work[4].

SAFA (Screen Access For All) Reader is a program developed by National Association For The Blind, New Delhi [5]. It is a screen reader. SAFA can detect the text language on the fly and calls the relevant TTS for speaking it. The latest version of SAFA is supporting following languages: Hindi, English, Sanskrit, Tamil, Marathi, Bengali, Nepali, Gujarati, Kannada and Telugu.

eSpeak is a compact, multi-language, open source text-to-speech synthesizer. This version is a SAPI5 compatible Windows speech engine which should work with screen readers such as Jaws, NVDA, and Window-Eyes. There is also a version of eSpeak which can be run as a command-line program.

### III. GUJARATI CHARACTERS FEATURE

Gujarati (U]HZFTL) is an Indo-Aryan language spoken by the people of Gujarat. It is a derived from Old Western Rajasthani which is the ancestor of modern Gujarati and

Rajasthani. Gujarati is one of the 22 official languages and 14 regional languages of India. It is officially recognized in the state of Gujarat, India [6]. It is spoken by over 46 million people all over the world.

Gujarati Script is based on abugida system rather than the alphabet system commonly used for European languages [7]. A character in Indian language scripts is close to a syllable and can be typically of the form: C\*V\*N, where C is a consonant, V is a vowel and N is anusvAra, visarha, jivhAmUllya etc. There is fairly good correspondence between what is written and what is spoken [8].

### IV. GUJARATI CONSONANTS / VOWELS

Gujarati language is phonetic in nature. The grapheme to phoneme mapping is linear. Gujarati language has its own set of Vowels and Consonants. The Vowels and Consonants of Gujarati are listed in Table 1 and 2.

**Table 1: Consonants in Gujarati Language.**

S	B	U	3	R	K	H	Ü	8	9	0	-
6	T	Y	N	n	G	5	O	A	E	D	I
Z	,	J	;	X	Ø	C	/	Ü	7		

**Table 2: Vowels and Diacritic with S in Gujarati Language**

V	VF	>	.	p	é	V[	V{	VM	VÁ	V\	Vo
S	SF	IS	SL	S]	S}	S[	S{	SM	SÁ	S\	So

### V. TTS MODULE

A TTS process can be dividing into two modules: Natural Language Processing (NLP) and Digital Signal Processing (DSP). The NLP module takes Text as an input and gives a normalized phonetic sentence. These phonetic sentences are the input for DSP module [9] which is responsible for generating the corresponding possible natural speech.

Concatenative TTS (CTTS) synthesis approach is used here for solving the text-to-speech (TTS) paradigm. Recorded speech

feature segments, which may be words, phonemes, or even sub-phonemes, are used in this method. In this approach, speech is generated by concatenating the best compatible segments according to certain concatenation rules [10]. Speech generated by this approach inherently possesses natural quality. However, its quality depends on the size of the recorded database, as high-quality CTTS needs an extensive database.

Researchers have developed text to speech model which is shown in figure 2. It includes entire process containing master database creation, Phoneme recording and TTS Engine creation.

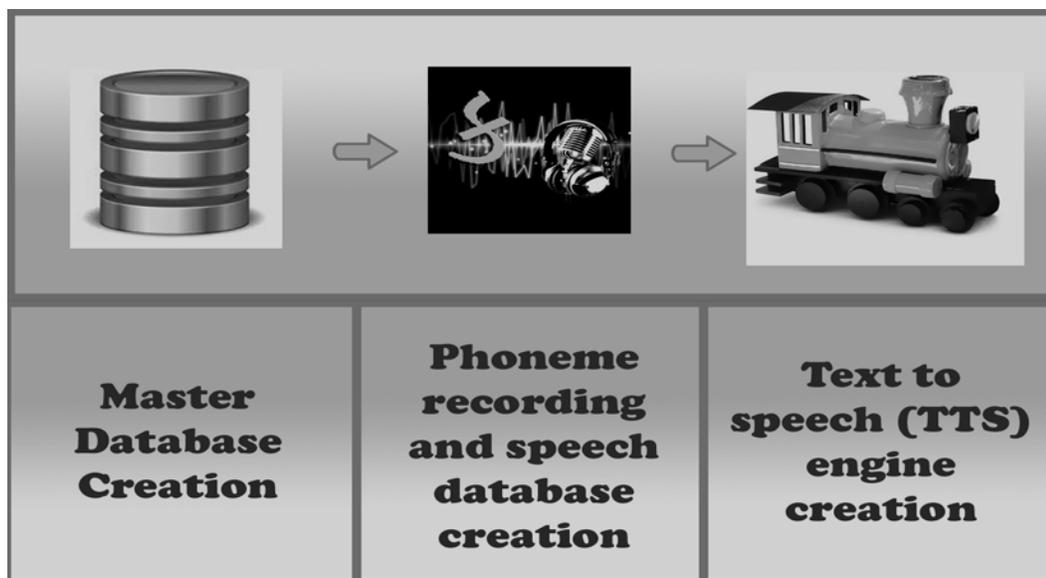


Figure 2: Text to speech model

A. Master Database Creation

This project focuses primarily on the process of creating a voice for a concatenative Text-To-Speech system own standard output voice to sound more like the target voice. In this methodology, text entered by user is compared with master database. Master database is created using base tables shown in table 3. Each base tables (base table 1 to base table 5) contains syllabus with its ASCII code.

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Table 3: The structure of Gujarati syllables and required speech records

Base table	Syllabus Structure	syllables	Required	Total
1	Half Consonant	É b u r ß ^ t y w g % a e d i < j : x Q ? 1 ` à	24	24
2	Barakhadi	S SF IS SL S] S} S[ S{ SM SÁ S\ So Likewise Barakhadi for B U 3 R K H h 8 9 0 - 6 T Y N W G 5 O A E D I Z , J ; X Ø C / Û 7	34X12	408
3	Digits	_ ! ¼ # \$ %F & * ( )	10	10
4	Sp. Single Characters	k ~ ç ® ± ½ È Đ Ò Ó Ú Ô Þ ª æ ç è ê ë ô õ ü lü\ ý	24	24
5	Special Characters Barakhadi	V + Ç È Ì Ý à â ã ä	10X12	120

B. Phoneme Recording

Entire system is developed in Microsoft Visual studio 10 in .NET environment. C# and SQL are used as Front End and Back End tools respectively. 586 phonemes of entire master table described in table 3 are recorded in following format by native Gujarati speaker.

- File format: Wav
- Recording Device: Microphone
- Sample rate : 44100
- Channels: 16 bit Stereo

The recorded sound files are then named and stored by using the phoneme name itself. For example the sound file of /ka/ (S) is named ka.wav. All the sound files recorded are named and stored in the similar way.

C. Text to Speech Engine Creation

TTS methodology is explained here in conceptual part presenting algorithm and Implementation part as TTS IDE (Integrated Development Environment).

Following is the Algorithm describing entire text to speech conversion process:

- Step 1: Enter text say message
- Step 2: Find length of message say N
- Step 3: I=1 as character to be extracted from message
- Step 4: j=1 as new character position during next phoneme finding process
- Step 5: k=1 as position to put next phoneme to phoneme array say myphones
- Step 6: Initialize next phone as blank string
- Step 7: Extract I th character from message and add it to phone

Step 8: Find match of phone from phoneme database  
 Step 9: If found then add 1 to I,  
 Step 10: If I <= N then go to step 8  
 Step 11: Remove last character from phone.  
 Step 12: Add phone as k th element of myphoneme array.  
 Step 13: make phone to blank string  
 Step 14: If I > N then go to step 17  
 Step 15: Go to step 8  
 Step 16: Initialize I as 1  
 Step 17: Take I th element of myphones array.  
 Step 18: Copy corresponding .wav file to SpeakIt .wav file  
 Step 19: Repeat step 20 to 22 till last element in myphoneme array. Then move to step 23  
 Step 20: Add 1 to i  
 Step 21: Take I th element of myphones array.  
 Step 22: Concatenate it at end of SpeakIt .wav file.

Step 23: Play speakIt .wav file  
 Step 24: End of process.

A TTS IDE is developed for entering text and retrieves it in sound form. It is shown in figure 3 which contains different components as per described below.

IDE contains two parts:

[a] Text area: this is the area where user enters Gujarati text which is to be converted into speech. 'mansit.ttf' font is used for text entry. This font is developed by Dr. CK Kumbharana for his research work regarding speech synthesis [11].

[b] Button panel: This area contains different buttons helping text to speech conversion. Function of each buttons is explained below by taking assumption that Gujarati word "ZFHF" is entered in text area.

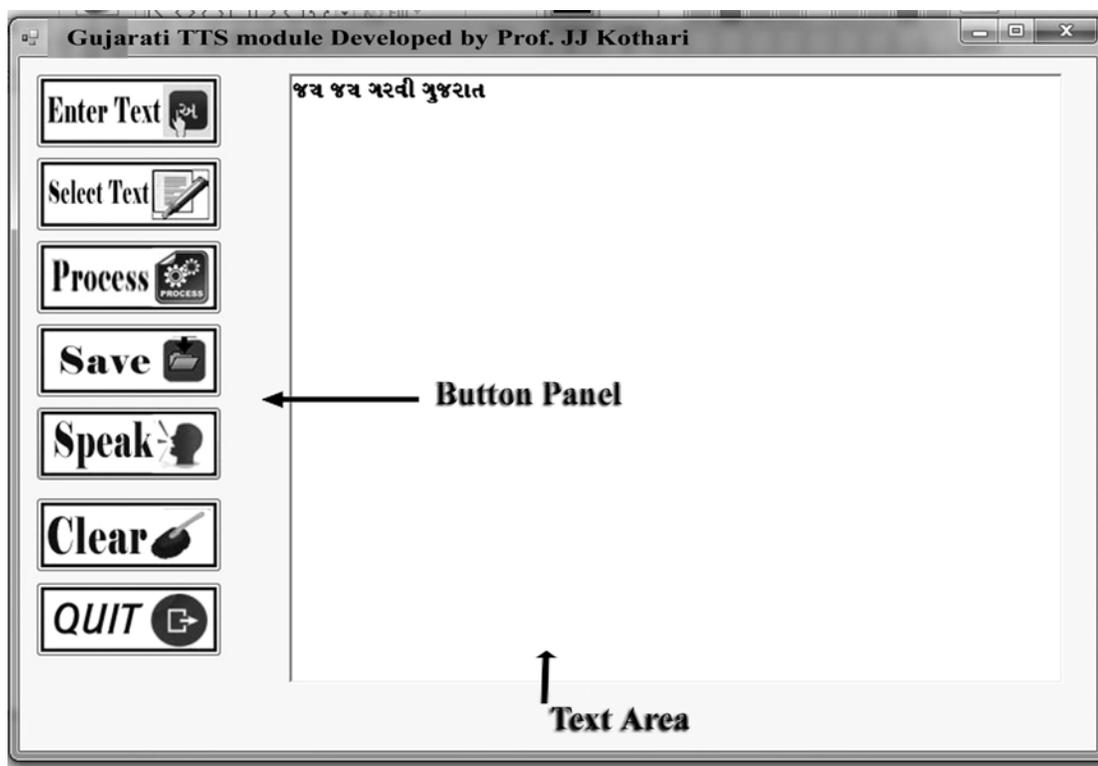


Figure 3: IDE of TTS Module

**Enter Text:** Work area becomes enabled to enter Gujarati text.

**Select Text:** This option allows to select portion of entered text.

**Process:** First it makes text area disable. Now text cannot be modified or selected. It executes 3 steps as follow:

Step 1: Converts each character in ASCII form.  
 i.e. ZFHF → Z F H F → 090 046 072 046  
 Step 2: Matches and finds corresponding phonemes from master database.

i.e. 090 046 072 046 → 090046 072046 → ra ja  
 → ra.wav ja.wav

Representation of extracted wav files ra.wav and ja.wav are shown in figure 4a and 4b.

Step 3 Stores each wav files in an array.

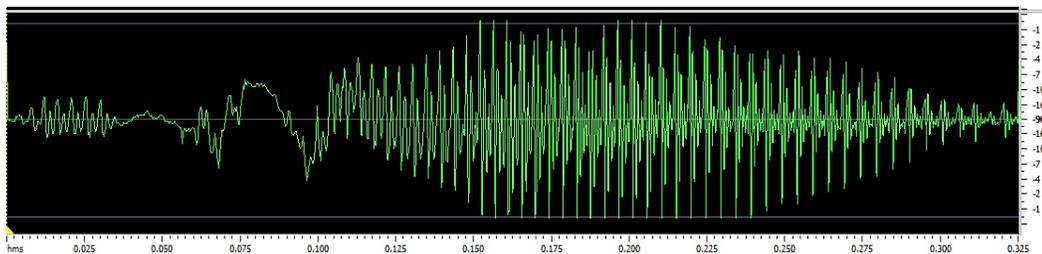
**Save:** Concatenates wav files stored in array and puts resulting wav file in a folder. i.e. 1.wav

Here 1.wav is resulting wav file after concatenating ra.wav and ja.wav. Its wav representation is shown in figure 4c.

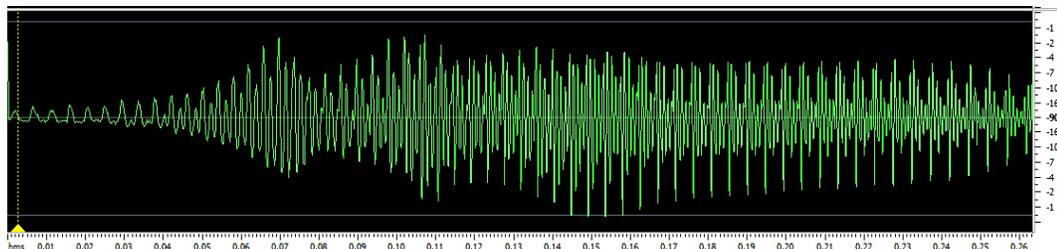
**Speak:** Plays resulting wav file. It will produce vocal form of entered text.

**Clear:** Clears text entered in text area.

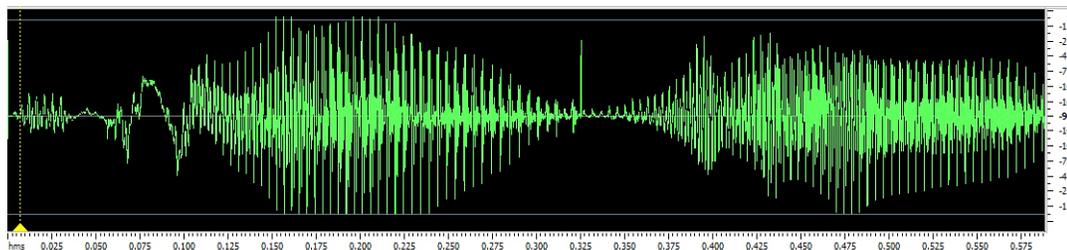
**Quit:** To exit from TTS Module.



**Figure 4a: wave diagram showing the phoneme 'ZF'**



**Figure 4b: wave diagram showing the phoneme 'HF'**



**Figure 4c: Wav diagram showing how the word 'ZFHF' (King) was concatenated**

Based on concatenation in figure 4c (stringing together) of segments of recorded syllables in figure 4a and 4b, stringing of syllables occurred when the text being supplied was linked to its corresponding syllables in the sound database. The pronunciation of the word 'ZFHF' (king) was achieved by concatenated the two syllables involved (ZF and HF) with the correct tone on each syllable, the sound of each syllable were fetched from the sound database and then stringed them together which then produced distinct sound.

## VI. CONCLUSION

Algorithm and implementation of Gujarati TTS system using phoneme concatenative methodology is developed by researchers. This project focuses primarily on the process of creating a voice for a concatenative Text-To-Speech system, or altering the TTS systems own standard output voice to sound more like the target voice. The synthesized speech produced through this model is reasonably natural. About 80% of basic Phonemes are covered in database corpus which makes mismatch ratio very less. Phoneme matching is based on ASCII code combination. Researcher have observed the efficiency of this approach for Gujarati language and found that the performance of this approach is better. The generated speech shows distortion at the concatenation point of two syllables. If this distortion is significant then it would loose the naturalness. Future work will

mainly focus on improving the naturalness [12] of the synthesizer.

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# Privacy Protection in Personalized Web Search using Homomorphic Encryption

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**Abstract-** Personalized web search (PWS) has showed its effectiveness in improving the quality of search services on the Internet. However, evidences show that users' fear to disclose their private information during search has become a major barrier for the wide proliferation of PWS. Here we are introducing the concept of Homomorphic encryption to encrypt the server such a way that an eavesdropper nor an untrusty admin could access the search words and the profile. It is less complex and more efficient than the UPS framework.

**Index Terms-** Privacy protection, personalized web search, utility, risk, profile.

## I. INTRODUCTION

The web search engine has long turn into the most vital source for individuals searching for helpful data on the web. However, clients may encounter disappointment when web search return unimportant or unwanted results that don't meet their requirements. Such immateriality is generally because of enormous variety of users' contexts and backgrounds, and additionally the equivocalness of writings. Personalized Web Search (PWS) is a general class of pursuit procedures going for giving better indexed lists, which are custom-made for individual client needs. As the cost, client data must be gathered and broke down to make sense of the client expectation behind the issued inquiry.

The PWS can be divided into two types, to be specific click-log-based systems and profile-based systems. The click-log-based strategies are clear they basically force inclination to clicked pages in the client's search history. Despite the fact that this system has been exhibited to perform reliably and extensively well[2], it can just chip away at new domain inquiries from the same client, which is an in blow to the keeping of its appropriateness. Interestingly, profile-based routines enhance the inquiry involvement with convoluted client interest models created from client profiling strategies. Profile-based systems can be possibly successful for a wide range of questions, however are accounted for to be temperamental under some circumstances[2].

Although there are advantages and disadvantages for both types of PWS techniques, the profile-based PWS has proved more effective in improving the quality of web search recently, with increasing usage of personal and behavior information to profile its users, which is usually gathered from query history [3], [4], [5], browsing history[6],[7], click-through data[8],[9], bookmarks[10] , user documents[3],[11] , and so forth.

Unfortunately, such certainly collected personal data can easily reveal a matters of interest of user's private life.

Privacy issues rising from the lack of protection for such data, for instance the AOL query logs scandal, not only raise panic among individual users, but also hinders the enthusiasm of client in using personalized search service. In fact, privacy concerns have become the major barrier for wide success of PWS services. The major concern being that of an eavesdropper and that of an untrusting admin at the server. From fig 1 shows the attack model where an eavesdropper can eavesdrop both the search query and client profile in transit, and that of an untrusting admin at search engine server. The admin as well as the eave can have full access to data send from client.

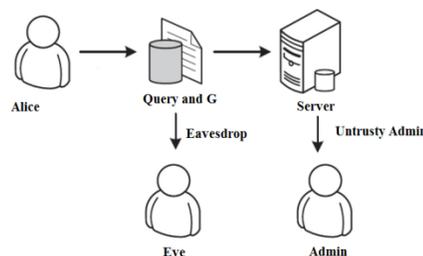


Fig 1: Attack Model of PWS

### A. Motivations

To ensure client's security in personalized web search the analysts need to consider two variables amid the pursuit process. The primary component being the thought for expanding the proficiency of customized web search. Also, the second variable being the need of security of the client profile to place protection chance under control. By incorporating the concept of Homomorphic Encryption into the existing system can improve privacy. Thus, user privacy can be protected without compromising the personalized search quality. The problems with the existing methods are explained in the following observations:

- 1) At the client level user needs to repeatedly select the word or terms that need to be hidden from the eavesdropper
- 2) The system is complex and takes much time for computation.
- 3) The system is away from PWS.

## II. THE EXISTING SYSTEM

L. Shou et al. proposed "Supporting Privacy Protection in Personalized Web Search" to protect user privacy in profile-based PWS, specialists need to consider two repudiating impacts

that affects the search process. From one perspective, they endeavor to enhance the inquiry quality with the personalization utility of the client profile. Then again, they have to conceal the security substance existing in the client profile to put the protection hazard under control. The existing system known as UPS has following components :

A. User Profile

Consistent with numerous past works in personalized web search, each user profile in UPS adopts a hierarchical structure. A diagram of a sample user profile is illustrated in Fig. 2(a), which is constructed based on the sample taxonomy repository in Fig. 2(b). As the owner of this profile is mainly interested in Computer Science and Dance, because the major portion of this profile is made up of fragments from taxonomies of these two topics in the sample repository. Some other taxonomy also serves in comprising the profile, for example, Sports and gender.

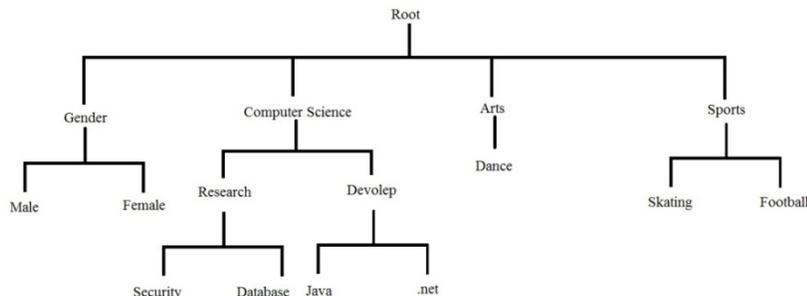


Fig 2(a): Sample User Profile

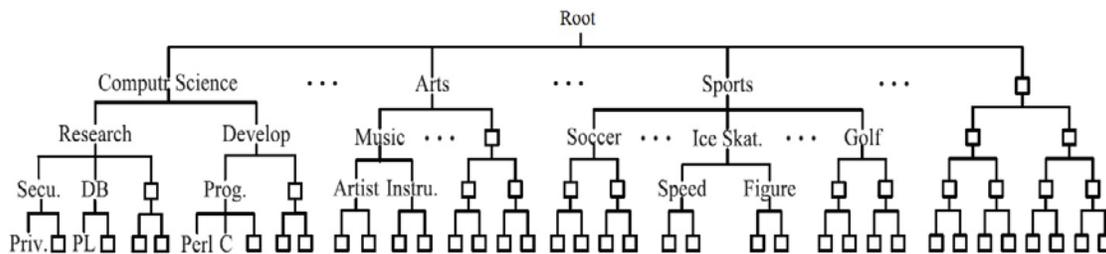


Fig 2 (b) Sample Taxonomy Repository

B. Customized Privacy Requirements

Customized privacy requirements can be specified with a number of sensitive-nodes (topics) in the user profile, whose disclosure (to the server) introduces compromising the privacy of the user. In the sample profile shown in Fig. 3.1 a, the sensitive nodes  $S = \{Adults; Security; Skating\}$ ; are shaded in gray color in H. It must be noted that user's privacy concern may differ from one sensitive topic to another. In the above example, the user may hesitate to share her personal interests only to avoid various advertisements. Thus, the user might still tolerate the exposure of such interests to trade for better personalization utility. However, the user may never allow another interest in topic gender to be disclosed.

As the sensitivity values expressly show the client's security concerns, the most clear protection saving strategy is to uproot sub-trees established at all delicate hubs whose sensitivity value are more prominent than a limit. Such system is alluded to as forbidding. In any case, forbidding is a long way from enough against a more refined foe.

C. Generalizing User Profile

To address the problem with forbidding, the existing system proposed a technique, which detects and removes a set of nodes X, that are sensitive, from H, such that the privacy risk

introduced by exposing G is always under control. For clarity of description, it is assumed that all the sub-trees of H rooted at the nodes in X do not overlap each other. This process is called generalization, and the output G is a generalized profile.

The generalization technique can seemingly be conducted during offline processing without involving user queries. However, it is impractical to perform offline generalization due to two reasons:

1. The output from offline generalization may contain many topic branches, which are irrelevant to a query. A more flexible solution requires online generalization, which depends on the queries. Online generalization not only avoids unnecessary privacy disclosure, but also removes noisy topics that are irrelevant to the current query.
2. It is important to monitor the personalization utility during the generalization. However, overgeneralization may cause ambiguity in the personalization, and eventually lead to poor search results. Monitoring the utility would be possible only if generalization is done at runtime.

III. THE HOMOMORPHIC ENCRYPTION SCHEME

**Parameters:** The construction below has many parameters to control the number of integers in the public key and the bit-length of the various integers. As basic, we use the following four parameters for the algorithm :

$\gamma$  is the bit-length of the integers in the public key,  
 $\eta$  is the bit-length of the secret key ,  
 $\rho$  is the bit-length of the noise, and  
 $\tau$  is the number of integers in the public key.

These parameters are set under the following constraints:

- $\rho = \omega(\log \lambda)$ , to protect against brute-force attacks on the noise;
- $\eta \geq \rho \cdot \Theta(\lambda \log^2 \lambda)$ , in order to support homomorphism for deep enough circuits to evaluate the “squashed decryption circuit”;
- $\gamma = \omega(\eta^2 \log \lambda)$ , to thwart various lattice-based attacks on the underlying approximate-gcd problem;
- $\tau \geq \gamma + \omega(\log \lambda)$ , in order to use the left over hash lemma in the reduction to approximate gcd.

We also use a secondary noise parameter  $\rho' = \rho + \omega(\log \lambda)$ . A convenient parameter set to keep in mind is  $\rho = \lambda$ ,  $\rho' = 2\lambda$ ,  $\eta = \tilde{O}(\lambda^2)$ ,  $\gamma = \tilde{O}(\lambda^5)$  and  $\tau = \gamma + \lambda$ . (This setting results in a scheme with complexity  $\tilde{O}(\lambda^{10})$ .) For a specific ( $\eta$ -bit) odd positive integer  $p$ , we use the following distribution over  $\gamma$ -bit integers:  $D_{\gamma, \rho}(p) = \{ \text{choose } q \xrightarrow{\$} \mathbb{Z} \cap [0, 2^\gamma/p), r \xrightarrow{\$} \mathbb{Z} \cap (-2\rho, 2\rho) : \text{output } x = pq + r \}$ .

A. The Construction

KeyGen ( $\lambda$ ).

The secret key is an odd  $\eta$ -bit integer:  $p \leftarrow (2\mathbb{Z} + 1) \cap [2^\eta - 1, 2^\eta)$ .

For the public key, sample  $x_i \leftarrow D_{\gamma, \rho}(p)$  for  $i = 0, \dots, \tau$ . Relabel so that  $x_0$  is the largest. Restart unless  $x_0$  is odd and  $\text{rp}(x_0)$  is even. The public key is  $\text{pk} = \langle x_0, x_1, \dots, x_\tau \rangle$ .

Encrypt ( $\text{pk}, m \in \{0, 1\}$ ):

Choose a random subset  $S \subseteq \{1, 2, \dots, \tau\}$  and a random integer  $r$  in  $(-2^{\rho'}, 2^{\rho'})$ , and output  $c \leftarrow [m + 2r + 2\sum_{i \in S} x_i]_{x_0}$ .

Evaluate ( $\text{pk}, C, c_1, \dots, c_t$ ):

Given the (binary) circuit  $C_\epsilon$  with  $t$  inputs, and  $t$  ciphertexts  $c_i$ , apply the (integer) addition and multiplication gates of  $C_\epsilon$  to the ciphertexts, performing all the operations over the integers, and return the resulting integer

Decrypt ( $\text{sk}, c$ ):

Output  $m' \leftarrow (c \bmod p) \bmod 2$ .

IV. THE PROPOSED SYSTEM

The new scheme called “Privacy Protection in Personalized Web Search using Homomorphic Encryption” is proposed here to support privacy preservation in personalized web search using an index server which is encrypted using Homomorphic encryption. It provides privacy for personalized web searches at server.

In the system proposed attains personalized web search using click-log based technique. Our main consideration is for privacy of searched terms at server and that of an eavesdropper. For that we send all the data’s ,i.e. search terms, using index number for the search word which will be encrypted homomorphically before sending it to the server. We assume of an index matrix as shown below, it consists of 3 components word, url and rank which denotes words to be searched for, unique resource locator of sites and rank for a word with respect to the url it can vary from 0 to n, respectively.

	url 1	url 2	url 3	url 4	.....	url i	url i+1
Word 1	1	7	2	7	.....	8	0
Word 2	0	7	0	4	.....	7	4
.....	.....	.....	.....	.....	.....	.....	.....
Word i	5	0	0	7	.....	8	9
Word i+1	3	4	7	0	.....	0	1
.....	.....	.....	.....	.....	.....	.....	.....

Fig 3: Index Matrix

We have a similar index table in our index server but with a difference that the index matrix is homomorphically encrypted in the proposed system and instead of words we store index for each word as shown below where  $E()$  shows the Homomorphic encryption function.

The index for each word is created or determined as an continues process at web crawler and is simultaneously updated at each client. This index will send from client to server rather than words as such, moreover this index will also be homomorphically encrypted.

	E(url 1)	.....	E(urli)	E(urli+1)	.....
E(word 1)					
.....					
E(word i)					
E(word i+ 1)					
.....					

**Fig 4: Homomorphic encrypted index matrix**

Word	Index
E(Word1)	E(1)
.....	.....
E(Word1)	E(i)
E(Word1)	E(i+1)
.....	.....

**Fig 5: Word Indexer**

When user searches for a word, a matrix called query matrix is send to the index server form of query matrix is as shown below, it consists of two columns word index and rank. It is an n\*2 matrix where n stands for each n search words. Each word index is homomorphically encrypted and has a value attached to it which is the rank of word for the client. The figure 4.4 below shows query matrix for 4 search words say word 1, word 2, word 3 and word 4.

Word index	PWS rank
E(index (word1))	E(Rank( word 1))
E(index(word 2))	E(Rank(word 2))
E(index(word 3))	E(Rank(word 3))
E(index(word 4))	E(Rank(word 4))

**Fig 6: Query matrix**

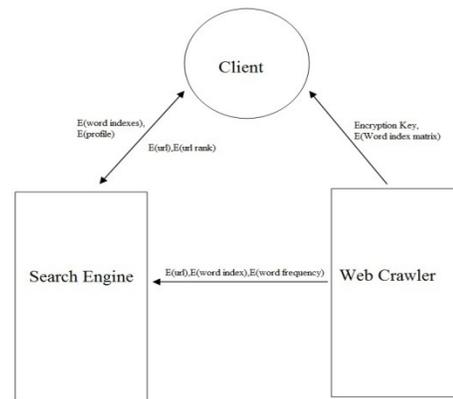
This value column is multiplied with corresponding column in the index matrix and sum of each column is taken. What will be send back to the server will be the list of urls with corresponding obtained ranks and key for decryption of data send by index server.

url	rank
E(url 1)	E(0)
E(url 2)	E(1)
.....	
E(url j)	E(0)
E(url i+1)	E(0)

**Fig 7: Results**

On receiving the url matrix it will be decrypted using the decryption key send from the index server. Then according to the rank value attached url's will arranged in order with url with highest rank displayed first and so on

The whole functioning of the system can be summarized as show below at client side user gives up the word for search, then corresponding word index, rank and profile is send to the server, remember all data send to and from server are homomorphically encrypted. The server then processes the received data to process result for the corresponding search indexes. The server then sends the results matrix ,which includes url and rank of each url, back to the client. The web crawler continuously builds the search engine and the word index matrix at client and send to the client along with encryption key.



**Fig 8: The Proposed System.**

**V. CONCLUSION**

This paper presented a client-side privacy protection framework based on Homomorphic encryption for personalized web search. The system could potentially be adopted by any PWS that can in-co-operate an homomorphically encrypted server. The framework allowed users to have full privacy over the PWS. Our experimental results revealed that the system could achieve quality search results without affecting the privacy of client/end user. The results also confirmed the effectiveness and efficiency of our solution.

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# Documentation of Traditional Ethnomedicinal Plants Used by Tribals from Painganga Forest Range in Umarkhed Region of Yavatmal District of Maharashtra State

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**Abstract-** Painganga forest is a rich store house of medicinal plants. Tribals in Painganga forest have great faith in effectiveness of medicinal plants. The present study was carried out to explore traditional medicinal knowledge of plants of Painganga forest in Yavatmal district. This information were based on exhaustive survey, interviews during the year 2014 -15 in the tribal inhabited area. The present study was carried out to explore traditional medicinal knowledge of plants of Painganga forest of Umarkhed taluka. It was found that 20 different plants belonging to 15 families are used to treat various diseases.

**Index Terms-** Traditional knowledge, Medicinal plants, Painganga forest.

## I. INTRODUCTION

Man has depended on plants from time immemorial. Our knowledge of the intimate relationship between early man and plants has come to us mainly through surviving traditions. This relationship between not forms the core of the multifaceted science "Ethnobotany". Ethnobotanical studies have attracted much attention, not only due to its great academic or historical importance, but also due to many economic applications. India is one of the 17 mega biodiversity countries in the world. It has 45000 plant species, out of which 15000- 20000 plants have medicinal values. In India, plants have used for medicinal purpose since ancient time, as mentioned in Ayurveda. Medicinal plants have served as the main source of medicine in India. Medicinal plants are used for preventive, primitive and curative purposes. Medicinal plants have been preliminary selected on the basic local traditional knowledge. The traditional knowledge of herbs is famous among the indigenous and local people. The traditional healers are the main source of information of medicinal importance of plants. The rural people have traditional indigenous knowledge about the use of medicinal plants to cure various diseases. Traditional indigenous knowledge comprises practices based on observations.

During the last few decades, there has been an increasing interest in the study of medicinal plants and there indigenous uses of different parts of world. Medicinal plants have been used for research in both systematic and advanced field of plant sciences. Documentation of such indigenous knowledge is essential for conservation and utilization of biological resources. Painganga forest is located in eastern (vidarbha) region of the

Maharashtra. It is located between 19° 36' to 19° 7' North latitudes and 77° 42' to 77° 7' East longitudes. The total forest area in Umarkhed tehsil is 487 sq/km. which is 39-33% of the geographical area of the tehsil. This region is rich in diverse flora and suitable for ethnobotanical exploration. Keeping in mind, the medicinal importance of plants among local people, the present study was undertaken to study Ethnobotany of Painganga forest, district Yavatmal.

## II. MATERIALS AND METHODS

The study area, Painganga forest is situated in the taluka Umarkhed, Yavatmal district, Maharashtra. Ethnomedicinal data was collected according to the methodology suggested by Jain (1996, 2001). Ethnobotanical survey was conducted during the period of 2014-15. Local healers called vaid, gunias, native people, old persons, using medicinal plants for curing various diseases were interviewed for documenting the information in their local area. The collected specimens were identified taxonomically with the help of floras by taxonomy experts in department of botany, B.P. Science College, Digras, District Yavatmal, Maharashtra. Data was tabulated with plant name, family, local name, part used and folk use (Bhogaokar and Kadam, 2006; Kanthale and Biradar, 2010).

## III. RESULT AND DISCUSSION

In the present study 20 plants species belonging to 15 families were reported after undertaking the survey and having conversation with elder persons of various age groups. It was found that dominated medicinal plants of this region are main source of primary health cure. Majority of the elder persons have sound knowledge of medicinal plants and use in their daily life. These plants are used in the forms of juice, decoction, powder, paste and whole plant extract. The medicinal plants are mainly used for the treatment of mouth ulcer, body pain, cough, bronchitis, piles, asthma, dysentery, constipation, headache, stomach, leucoderma, gum problem, wound healing, ring worm, vomiting, muscular pain, tooth ache, snake bite, urinary burning, nose bleeding.

#### IV. CONCLUSION

The present study shows that Painganga forest region is rich with valuable medicinal flora & people are enriched with folk traditional knowledge about these plants. Though this knowledge is passing orally from one generation to another but it has not been documented yet. So documentation of this

knowledge is necessary for safeguarding this valuable information for the well being of future generation the present study will provide new incentive to the traditional system of healthcare and also will be helpful for researcher and pharmaceutical industries to find out the other use of plants which would be helpful to modern healthcare system.

**Table 1: Systematic enumeration of plants used as ethnomedicine by tribals of Painganga region of Umardhed, Yavatmal district**

S.N.	Botanical Name	Vernacular Name	Family	Plant Part of Use
1	<i>Annona squamosa</i> (L)	Sitaphal	Annonaceae	Leaf and seed
2	<i>Capparis grandis</i> (L)	Pachunda	Capparaceae	Leaf, fruit
3	<i>Casearia tomentosa</i> (Roxb)	Chila	Flacourtiaceae	Root bark
4	<i>Bombax ceiba</i> (L)	Katesawar	Bombacaceae	Root
5	<i>Ceiba pentandra</i> (L)	Pandhari sewar	Bombacaceae	Root bark, flower
6	<i>Alanthus excelsa</i> (Roxb)	Maharuk	Simaroubaceae	Whole plant
7	<i>Schleichera oleosa</i> (Lour)	Lac tree	Sapindaceae	Bark
8	<i>Buchnanian lanzan</i> (Spreng)	Char	Anacardiaceae	Whole plant
9	<i>Butea monosperma</i> (Lamk)	Palas	Fabaceae	Root bark, flower
10	<i>Ougenia oojenensis</i> (Roxb)	Tiwas	Fabaceae	Bark
11	<i>Bauhinia racemosa</i> (Lam)	Apta	Caesalpiniaceae	Root, bark
12	<i>Albizia lebbek</i> (L)	Siris	Mimosaceae	Whole plant
13	<i>Pithecellobium dulce</i> (Roxb)	Firangi chinch	Mimosaceae	Bark, leaf, fruit
14	<i>Terminalia elliptica</i> (Roxb)	Ain	Combretaceae	Bark
15	<i>Gardenia resinifera</i> (Roth)	Dikamali	Rubiaceae	Gum from stem
16	<i>Ixora parviflora</i> (Vahl)	Lonkhand	Rubiaceae	Bark, root, fruit, wood
17	<i>Diospyros melanocylon</i> (Roxb)	Tembhurne	Ebenaceae	Bark, fruit, flower
18	<i>Carissa carandus</i> (L)	Karvanda	Apocynaceae	Root, leaves, fruit
19	<i>Cordia ghataf</i> (Forsk) Lamk	Gondani	Ehretiaceae	Leaf
20	<i>Gmelina arborea</i> (L)	Chiman sag	Verbenaceae	Seeds

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# Automatic SMS Scheduling via SIM Card

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**Abstract-** There are instances when we want to wish someone on his or her birthday at exact 12:00 am in midnight but due to certain reasons, we forget to do so. Scheduling an Automatic SMS [Short Message Service] can prove handy in such cases.

In this fast moving life, it is the use of such Technology which can ease up our efforts of manually remembering important notifications, whether it's our friend's birthday or an official message to be delivered to one of our colleagues.

This paper details the facility of scheduling the user SMS, for a particular time and date, without having the feature prebuilt on our mobile equipments.

**Index Terms-** SMS, ME, SIM, STK, PLI, EF, GSM, 3GPP

## I. INTRODUCTION

**T**he ME [Mobile Equipment] have the facility to schedule a user originated SMS, to be send at particular date and time.

Usually this service is provided in high end MEs with use of either some internal applications or using third party software applications. This paper contains the method for providing the service via SIM [Subscriber Identity Module] based Application.

The application will reside on SIM and will perform all the relevant tasks related to the functionality of Automatic SMS Scheduling.

### **Roles:**

- 1) **User-** The user of application will get a menu in STK [SIM Toolkit Menu refer [2] like "Create new SMS".  
When user selects this menu, he/she will be asked to enter the text of SMS, receiver's number, date and time of scheduled SMS.  
User will also enter the frequency of SMS i.e. Once, Daily, Weekly, Monthly or Yearly.
- 2) **Application-** The application will run in background while the ME remains switched ON.

## II. DESCRIPTION

The solution is achieved by the use of an application, which performs tasks in background after taking initial inputs from the user. The user of the application is only required to provide the necessary details for scheduling such as desired recipient to whom the message needs to be sent and exact time and date on which the message is to be triggered.

The solution is provided using the following set of mechanisms:

- 1) **Status Command:** It is send by ME to SIM card at specified intervals.
- 2) **Poll Interval Command:** It is send by SIM to ME, to set the duration of intervals between receiving Status commands.
- 3) **PLI or Provide Local Information Command:** It is send by SIM to ME, to request the ME for ME specific information i.e. Date, Time & Time Zone.

The application will be using the above commands and their responses with the additional calculations, to find the approximate time of target SMS triggering.

### III. PROCEDURE

The method for calculating the time and date is defined below:

- 1) SIM card will send 2 commands to ME, whenever the ME is switched ON. These are:
  - a. Poll Interval Command: It will be send with default value, as defined in [2] i.e. 30 seconds.
  - b. PLI command with qualifier value 03 for requesting Date, Time and Time Zone values from ME.
- 2) On the basis of response from above commands, the Application will calculate 2 things:
  - a. The remaining time of reaching 12:00 AM of next day.
  - b. Checking and extracting the information of Scheduled SMS that has to be sent before next day's Midnight (12 AM).
- 3) After the above steps, Application will perform some calculations, for extracting the number of Status commands, which are to be received from ME, for:
  - a. Reaching midnight time
  - b. Reaching the scheduled time of any scheduled SMS
- 4) After reaching the scheduled SMS time by receiving required number of Status commands from ME, application will prepare and send the Scheduled SMS to required recipient automatically and also will also set the next occurrence of the Scheduled SMS, as per the frequency selected by User at the time of scheduling the SMS.
- 5) After reaching the midnight time by receiving required number of Status commands from ME, as explained above, the application will send the PLI command with qualifier value 03, extracting the values for calculations, as defined in STEP 2.
- 6) The application will use a proprietary EF [Elementary File], which will store the SMS data and other required information for scheduling the SMS.

### IV. CONCLUSION

The mentioned Application will have following benefits:

- 1) Messages that are scheduled are not ME dependent. User can switch phones with all its Scheduled SMS through SIM card which means user just have to switch the SIM card to new or other handset.
- 2) The application will be working in background and will not affect the other functionalities of normal GSM [Global System for Mobile Communications] operations.
- 3) The application is fully compliant with 3GPP [3<sup>rd</sup> Generation Partnership Project] norms.
- 4) The application requires normal working procedure which means it does not requires enhanced proactive commands and envelops which vary from ME to ME.

### V. LIMITATIONS

As the application will reside and work at SIM card's end, so there are certain limitations which are:

- 1) Exact time value cannot be received from ME, as it will require the duration of time interval as permitted by [1]. So there can be delay of + or - 30 seconds in sending SMS.
- 2) As the application works on receiving the Status commands and their duration, any other application, modifying the time interval of Status command, will have affect on the Application.
- 3) It is on the discretion of ME to receive, reject or negotiate the requested time duration in Poll Interval command.
- 4) If the mobile is found switched off during any time on which Scheduled SMS was to be triggered, the message will not be delivered later on when the mobile is switched ON.

#### ACKNOWLEDGMENT

I would like to acknowledge my family and co-workers for supporting and encouraging me throughout the course work.

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# Evangalizing the need for Secure Web Development

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**Abstract-** As web attacks and security threats are increasing; security teams are now working together with web application development team to mitigate the causes of attacks at its initial stage of development. The paper describes the most critical web based threats that had defaced huge number of websites and also talks about various methodologies that can be followed by developers to build a secure web application. The paper describes certain practices that aids in tackling of web application security through secure web application development.

**Index Terms-**Cross Site Scripting Attack, Insecure codes, Malicious code, Secure Web Development, Security Breach, Web Attacks, Web Security Threats.

## I. INTRODUCTION

When it comes to security, the developers had perception of considering it as a job not for them. Web applications get compromised due to insufficient security assessment at developer's end. This is because the team is chasing deadlines or had implemented a new feature or even due to insufficient skills<sup>[2]</sup>. The security team usually report similar set of issues to the development team. Many development teams aren't aware of what they do may hamper security and create loopholes. Increasing security attacks had forced the organizations to address application development to be secure application development.

It is important to understand that measures taken after the development process cannot be the solution to the web attacks. Attackers have understood that almost any web application can be exploited because of the mistakes made by developers when building them. Therefore it turns out to be developer's responsibility to focus on 'secure' web development. This article discusses about some of the biggest security threats that had shaken the organizations globally and guides developers about how they can possibly surpass these attacks at the early stages of development process.

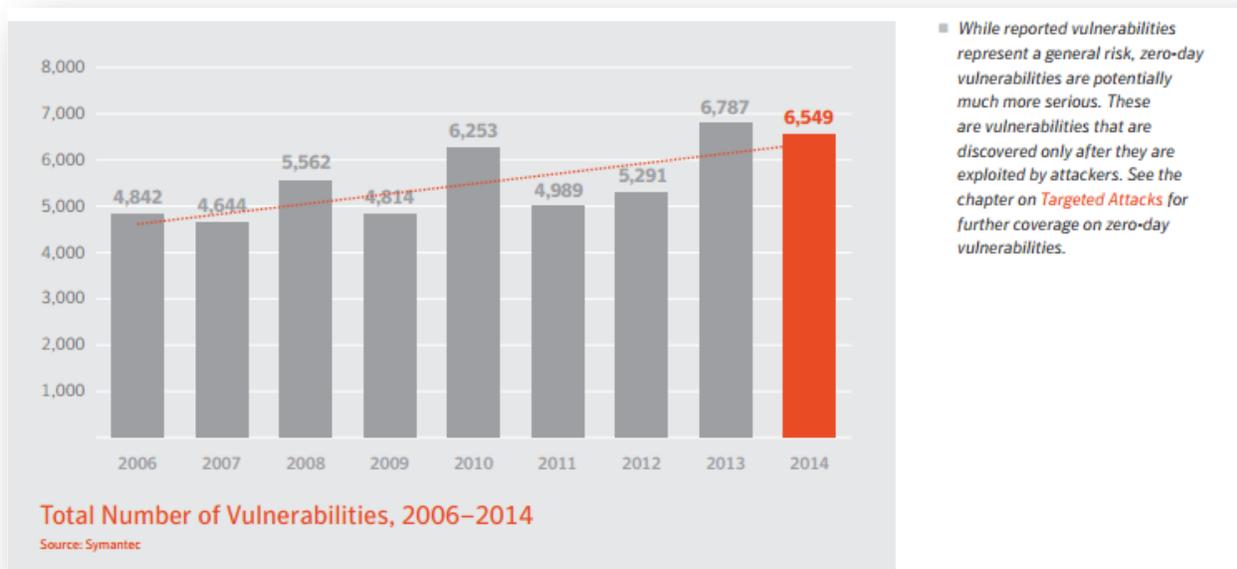


Figure 1: Symantec Internet Security Threat 2015 Report of total number of vulnerabilities from 2006-2014<sup>[4]</sup>

## WEB THREATS AND ITS HANDLING

Web application provides data to be accessed by the legitimate users. The attackers either steal or corrupt those data. The Open Web Application Security Project (OWASP) had reported some of the security threats to be the most powerful web application security threats used by the attackers.<sup>[1]</sup> These are categorized as follows-

Attackers use this flaw to access backend data. Cross Site Scripting, Buffer Overflow and SQL injections are among the biggest threats that lie under this category. Attackers manipulate with the input and create malicious code to attack through end user’s browser and perform illegal activities like hidden field data hack, session hack, database hack, query string hack etc. Certain measures can be taken by the developer while building the application to avoid these attacks from occurrence. Firstly, a rigorous input data validation should be done. Client side validation could be bypassed by the attacker so, server side validation must be included too. If possible a strict data format check should be included for inputs. Sometimes this cannot be done where inputs cannot be summarized for example in search section of web. Here a negative input validation can be done where data can be filtered from evil inputs that may do harm to the system thereby preventing insertion of scripts from producing executable form at client’s machine.

Validation criteria for developers <sup>[3]</sup>

- i. Allowed character checks
- ii. Data type checks
- iii. Regex checks
- iv. Length check (Minimum and Maximum)
- v. Range check (Minimum and Maximum)
- vi. Null allowed check
- vii. Data Annotation check
- viii. Converting <, >, (,), # and & characters to HTML encoding to avoid running client side scripts.

## 2. Attacking sessions for authentication and unauthorized access

Sessions have always been the prime targets for hackers. Hacking the sessions, accessing the credentials of legitimate users to get authenticated and traverse unauthorized access to the web application by session hi-jacking, the attacker can even modify or delete the content from the web. The browser cannot identify whether the malicious script is coming from a trusted source or not. Therefore, developer should take high precautions by encrypting the session elements. XSS attack is also used for session hacking to impersonate as an authenticated user. The developer can follow the principle of least privilege so that even if the impersonator gets authenticated, not much of the system gets effected.

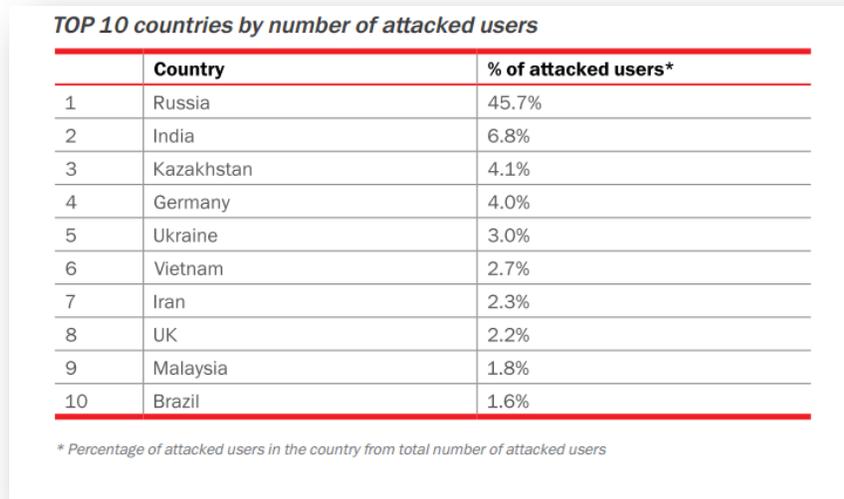


Figure 2: Kaspersky Security Bulletin report 2014 representing top 10 most cyber attacked countries <sup>[5]</sup>

## 3. Tracing via exceptions and unsafe access control

In 2014, the researchers mentioned that 99.3% of malicious files re-used known URLs for Command & Control (CnC) <sup>[6]</sup>. Usually in web application, an authenticated user is not restricted on what not to do with the data (internal/external). Attackers use this as a privilege to access sensitive data with probably read/write and download permission. Moreover if there is an exception thrown by the application, the error traces the log which the attacker can use to gain system understanding like stack trace, database dumps, error

SSRN 2250375) cause security mechanism to fail or worse. These log messages gives implementation details which should never be exposed to attackers. Attackers can replicate these errors and may loop it on server thereby consuming a huge amount of resources end up in DoS attack.

The developer should disable path traversal of end users especially in case of external data source. The file permissions must be limited so that it only serves its purpose. The attacker may look into the source code for any external link available on the web page. In this case either block the source code display or put the external calls in API libraries. For database access, provide only those permission that are needed for performing the operation. Stored procedure is recommended instead of SQL commands for including validation at backend level too. The errors on the page should be handled in a way such that end users get a meaningful message and site maintainers receive the log information about the error. Thus the attacker cannot fetch any purposeful information from the errors. By default all the permissions should be denied and should be available on needful basis.

#### 4. Configuration Security flaw

In 2014, HeartBleed made the headlines as a vulnerability found in the Open SSL library. In October 2014, Google discovered another vulnerability known as Poodle that let the attackers exploit servers compatible with older version of SSL i.e. SSL 3.0<sup>[4]</sup>. Many web applications uses OS features like system date and time, browser cookie and cache management, memory management etc. Attacker may access these resources and consume it heavily thereby leading to DoS attack. The developers cannot assure these flaws while developing the software but can use certain tools to monitor it. Load testing tools such as JMeter creates virtual scenarios to monitor the site's performance on heavy traffic. It's always recommended to limit the resource allocation to any user by establishing quotas. For unauthenticated users, try avoiding unnecessary database request or other external resources by caching it.

#### CONCLUSION

The paper describes various web security threats and how these threats are hampering through the web vulnerabilities. It also tells about certain approaches for developers which if practiced can mitigate the exposure of security flaws to a minimal level. Securing HTTP request has always been a tedious task. While security team works on protecting the web application against various types of attacks, development team can also play a vital role in parallel. Practicing these methods and following security principles will end up with a greater user experience with web.

#### ACKNOWLEDGMENT

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- [6] Websense 2015 Threat Report

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# Client Side Binding of Dynamic Drop Downs

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**Abstract-** This paper talks about

- **How to bind dynamic content in a webpage?**
- **What are the challenges to fetch dynamic content from the server?**
- **What can be the other approach to bind dynamic content?**

**Index Terms-** Client Side Binding of Dynamic Drop Downs, jQuery, How to write jQuery Code to bind Dynamic Content

*Performance!!! This is what everyone expects from others and himself too in every aspect of life. Whether you are playing, studying or doing any activity performance always matters. When it comes to websites, performance is the major factor which decides the efficiency of that website. In this paper, I demonstrate a technique which increases the page performance of any website. A section in performance enhancement has been implemented using jQuery which demonstrates that how the page performance can be increased by reducing the response time for the page.*

## I. INTRODUCTION

It is very often that we have to bind dynamic dropdowns in our website or application. For implementing the same, various approaches are used. There are two basic approaches for doing this:

- 1: By Re-Loading Complete Page from the Server (Full Postback).
- 2: By Re-Loading Only Required Element of a Page (Partial Postback using AJAX).

I would like to introduce a different approach for binding the dynamic dropdowns in any web application. By using this approach, the load time of dependent dropdowns (or it may be any other control as per your need) is reduced and as a result the total response time of the application also decreases.

## II. PURPOSE

The purpose for introducing this technique is mainly to reduce the response time of web pages that contains the dynamic dropdowns. Also, it reduces the round trips to the server for fetching the data of dynamic dropdowns. Usually in a web application, when the dynamic dropdown data needs to be populated, it is fetched from the server, this takes a lot of time thus response time of a web page increases. This problem is solved using my approach and ultimately the performance of a page is increased.

## III. CLARIFY THE PROBLEM

For binding the dynamic content in page either people uses full postback approach or partial postback by using AJAX. Let's talk about the first one, in full postback when the dynamic content is required, the whole page gets loaded again. Whereas in partial postback, instead of loading the whole page, only the dropdown content is fetched from the server. Although in partial postback response time is much decreased but in both the cases, a call has to be made to the server for just fetching the values of the dropdowns or it may be some other small dynamic value. This reduces the performance of the page as round trips to the server are made each time the data is required for dynamic dropdowns.

## IV. HOW THE SITUATION OCCURRED

Suppose there is an application that is hosted in a different region and it is being accessed at various other regions. In such cases, it takes a long time in binding dynamic dropdowns for the pages which results in a bad user experience. Reason being, the latency is very high because of the distance between the client and the server.

Moving further, suppose we have three dropdowns named as Region, Country and State. Data is dynamically binding to these dropdowns. Now, if we choose a region from the region dropdown, the data dynamically gets fetched for the country dropdown and same for the State dropdown. This whole process takes a lot of time as round trips are made to the server. Even if I am using partial postback approach then it takes 4-5 seconds to load the country dropdown. This is a major problem faced and I don't think using postback approach is suitable for such a small problem.

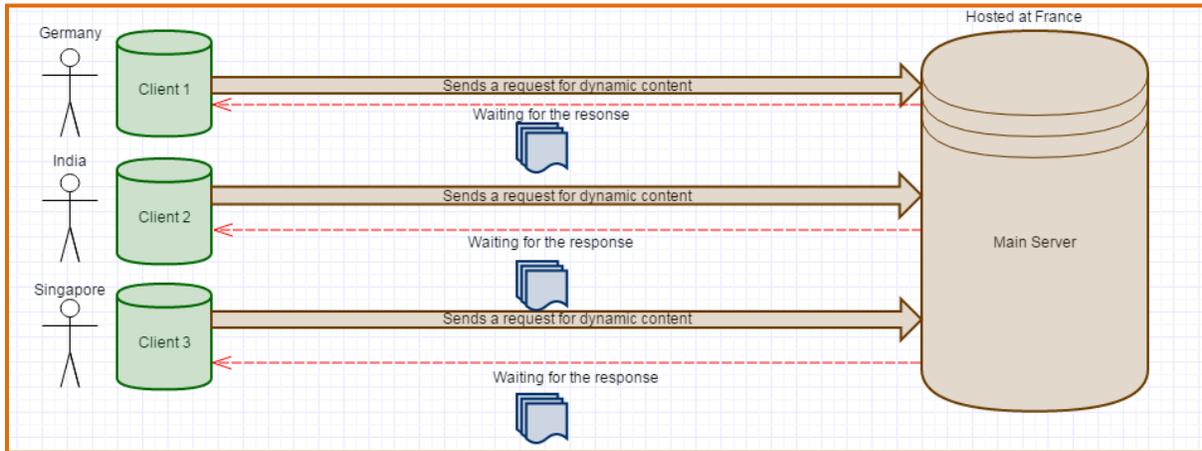


Figure 1: Clients are waiting for the Dynamic Content

### V. SOLUTION

Here I have come up with a solution by using the jQuery. This solution loads all the data from the server to the local machine of the client at the time of page loading. As all the content is present in the local machine and server round trip needs not to be done for fetching the dynamic content this increases the response time of a page. Also, the approach is language independent (means one can use Java, C# or any other language at server side) making it flexible enough to be implemented using any language. Through this, let's see how I am achieving the same:

#### PREREQUISITES:

As I have already mentioned that we have 3 dependent dropdowns in my page Region, Country and State. In which Region dropdown is a parent dropdown, Country dropdown is a parent-child dropdown and State is a child dropdown. So the value of child and parent-child dropdowns must contain some logical data that will link it with its parent dropdown. Before using this approach we have to ensure that at client end the data of the drop down should be bind in following format:

```
<select id="Region">
    <option>--Select--</option>
    <option value="1">Africa</option>
    <option value="2">Asia</option>
    <option value="3">Europe</option>
    <option value="4">Oceania</option>
    <option value="5">North America</option>
    <option value="6">South America</option>
</select>
```

Figure 2: HTML of Region Dropdown List Rendered at Client Machine

```
<select id="Country">
    <option>--Select--</option>
    <option value="5,2">Afghanistan</option>
    <option value="6,2">Bangladesh</option>
    <option value="7,2">Bhutan</option>
    <option value="8,2">China</option>
    <option value="9,2">Egypt</option>
    <option value="10,2">Georgia</option>
    <option value="11,2">India</option>
    .....
</select>
```

Figure 3: HTML of Country Dropdown List Rendered at Client Machine

Purpose to show this html code is to notice the highlighted value field. Here value attribute contains comma separated string in which first part indicates the ID of the Country and the second part indicates ID of the Region.

```
<select id="State">
    <option>--Select--</option>
    <option value="5,11">Andhra Pradesh</option>
    <option value="6,11">Arunachal Pradesh</option>
    <option value="7,11">Assam</option>
    <option value="8,11">Bihar</option>
    <option value="9,11">Chhattisgarh</option>
    <option value="10,11">Goa</option>
    <option value="11,11">Gujarat</option>
    <option value="12,11">Haryana</option>
    .....
</select>
```

Figure 4: HTML of State Dropdown List Rendered at Client Machine

In the above code first part of value field indicates the ID of the state and the other part indicates ID of the corresponding country.

**PROCEDURE**

As I have mentioned above that Region drop down is parent drop down and Country drop down is a child drop down of Region as its value depends on selected Region. A child drop down must contain all its values with corresponding Parent value. Now I will explain by quoting an example so that it will be clearer. What I am doing, loading the complete data of all dynamic dropdown when the page loaded first time and assigning the whole data of Country drop down into an array at client side by using jQuery. This array will contain Country Name, Country ID and Region ID. When a Region is selected then I am clearing all data from Country dropdown and re-assigning the data to Country dropdown from the array based on selected Region ID. Now you can see data to Country dropdown is populated without any postback.

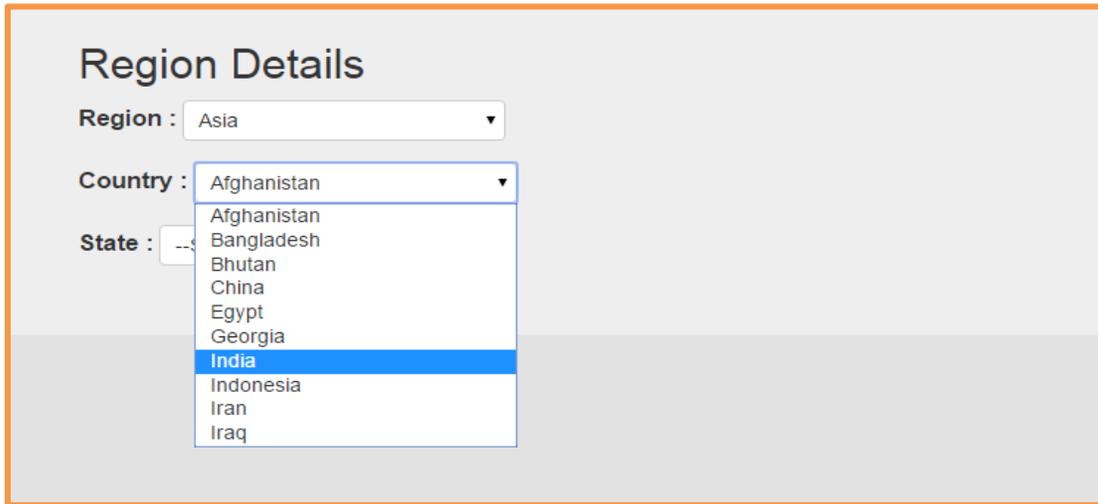


Figure 5: Dropdown at Client Machine

Following are the steps to implement the client side binding of dynamic dropdowns by using jQuery:

**NOTE: Here I am displaying the code to bind Country on the basis of selected Region as my purpose is to give an idea only.**

*STEP 1:*

Declare an array to hold all the items of the Country dropdown.

```
var arrCountry[];
```

*STEP 2:*

Iterate over Country DropDown and insert items on array arrCountry[].

```
$("#Country option").each(function (index) {  
    var val = $(this).val();  
    var CombinedID = val.split(",");  
  
    var item = {}  
    item["RegionID"] = CombinedID[1];  
    item["CountryID"] = CombinedID[0];  
  
    item["CountryName"] = $(this).text();  
  
    arrCountry.push(item);  
});
```

*STEP 3:*

Declare a variable myJsonString.

```
var myJsonString;
```

*STEP 4:*

Declare a variable myJsonString.

```
var myJsonString;
```

*STEP 5:*

Convert arrCountry[] into JSON text and store it in a string.

```
myJsonString = JSON.stringify(arrCountry);
```

*STEP 6:*

Store JSON string into a hidden field or in hidden text area.

```
$("#data").val(myJsonString);
```

*STEP 7:*

Create a function to Handle the Change Event of Primary Dropdown.

- a. Declare a variable RegionID that will contain the selected RegionID from dropdown.

```
var selectedRegionID = $(this).val();
```

- b. Parse the data into JSON contained in hidden field and assign this data into a new variable CountryData.

```
var CountryData = jQuery.parseJSON($("#data").val());
```

- c. Remove all the options from Country Dropdown.

```
$("#Country").find("option").remove();
```

- d. Iterate over CountryData and assign data to country dropdown.

```
jQuery.each(CountryData, function (i, jArray) {  
    if (selectedRegionID == jArray["RegionID"]) {  
        $('#Country').append($('', {  
            value: jArray["CountryID"],  
            text: jArray["CountryName"]  
        }));  
    }  
});
```

## VI. CONCLUSION

Although and is widely used but in my opinion there are some scenarios where latency is very high, it is not preferable. For such scenarios I prefer the jQuery approach for binding the dynamic content at client side.

## ACKNOWLEDGEMENT

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<http://www.w3schools.com/jquery/>  
<https://jquery.com/>

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# “The Epidemiological Study and Role of Socio-Technical and Personal Characteristics on Work Injuries in Mines” A Critical Review

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**Abstract-** In earlier years when mining activities were modest in scale, safety problems too were simple. With the progress in exploitation of minerals, safety of persons employed became matter of concern. Occupational injuries in mines are attributed to many factors. Based on various literature review it may be come at common establishment that there are various factors responsible for work injuries in mines. Statistical tools have been developed in the light of epidemiological principals to see whether there is any role of some personal and impersonal factors in the occurrence of coal miner's injuries. In this review, an attempt has been made to identify the various factors related to work injuries in mines and to estimate the effects on work injuries to mine workers. An accident path model was developed to estimate the pattern and strength of relationship amongst the personal and impersonal variables in accident/injury occurrence. The case study results showed that there are sequential interactions amongst the sociotechnical and personal factors leading to accidents/injuries in mines. Amongst the latent endogenous constructs, job dissatisfaction and safe work behaviour show a significant positive and negative direct relationship with work injury, respectively. However, the construct safety environment has a significant negative indirect relationship with work injury. The safety environment is negatively affected by work hazards and positively affected by social support. The safety environment also shows a significant negative relationship with job stress and job dissatisfaction. However, negative personality has no significant direct or indirect effect on work injury, but it has a significant negative relationship with safe work behaviour. The endogenous construct negative personality is positively influenced by job stress and negatively influenced by social support.

**Index Terms-** Coal, personal factors, Impersonal factors, statistical tools, variables. Personal factors, Impersonal factors, Environment, Statistical tools.

## II. HISTORICAL DEVELOPMENT

History of mines safety in India is closely associated with the development of the Mines Safety Legislation and its updating from time to time as per the need of the mineral industry. Landmark developments in this area in India include the enactment of the Mines Act 1901. Thereafter, from time to time various rules and regulations have been framed to improve the safety standard of mines. The Workmen's Compensation Act, 1923 stated that management requires to pay compensation

## I. INTRODUCTION

With the rapid industrialization and due to the increase in the complex technological operations, industrial safety and health have assumed great importance. The environment in the industries is entirely different from that of the agricultural or commerce and this has a large number of hazards associated with it. These hazards not only affect the individual but affect the whole surroundings including property, live, machinery and equipment. The government also had come up with various legislative measures to safeguard the physical health and occupational safety of the employees. Thus keeping the above factors in consideration a systematic and a scientific way of managing safety affairs have become imperative. It is more relevant when we talk about the mining industry, which is unique and different from the other industries, as it has to deal with many unknowns and has to work against the natural equilibrium. It therefore has a very high accident frequency rates. This occupation is considered to be one of the most hazardous one and this makes it necessary for the mining industry to have more effective accident prevention and safety programs. Since last decade, sea change in the economic, political and technological environment the world over, India is no exception. Lot of opportunities are also daunting challenges for the mining industry. Mining is a hazardous profession. Hence our endeavor to bring down the hazards by all available means to an acceptable level must continue. Work is still a serious problem. Creation of a nationally acceptable and internationally comparable mine safety program is a critical success factor for all safety programs being pursued in the country as far as mining industry is concern.

for injuries on the job regardless of whose fault caused the injury. The Mines Act 1952 reduced the working hours for all miners from 54 hours per week to 48 hours per week for all underground mines. In 1966, the Mines Vocational Training Rules were framed to provide basic training to new entrants and refresher training to mine workers with a view to make them aware of the dangers of workings in mines so that they can work safely. In addition, after nationalization of coal industry in 1973, several measures were taken such as formation of Pit Safety Committee and International Safety Organization in order to reduce accident rates and improve safety performance. Further, development and updating of the mines safety legislation is being done from time to time in keeping with technological advances, incorporating the recommendations of national conferences on safety in mines, outcomes of various

safety committee meetings, findings of research and development work by national research and educational institutes, and the recommendations of the Directorate General of Mines Safety (DGMS) through the issues of technical circulars to the industry from time to time based on experience of the directorate in enforcement of law, statutory inquiry into accidents and analysis of accidents. As a result of stringent government regulations, improved environmental conditions and increased safety management, the conditions in Indian coal mines have definitely become safer. However, it is important to recognize that much remains to be accomplished to achieve the goal of a totally safe mine. In this context, various approaches were undertaken to address the safety problems. The issues of injury prevention problems have been vigorously dealt with in Western countries.

### III. CURRENT STATUS

In the 1980s the importance of human behaviour became widely recognized as a significant contributory factor in the aetiology of mine injuries. Sims showed, for example, that 55% of the haulage and transport injuries reported in the UK Chief Inspector of Mines Annual Report were directly attributable to “human failings” [1]. Human error has been identified as the major causative factor for injuries in mines in a study conducted by the former United States Bureau of Mines [2]. They concluded that while a few injuries are caused by a single factor, human error was the most significant contributing factor and accounted for 93% of the total injuries. Peake and Ritchie suggested in their study that while mechanical and environmental failures are major contributors to many injuries, human behavior plays a significant causative role and consequently must be addressed if any meaningful and long term reduction of mine injuries is to be achieved [3]. Although it is widely recognized that human error

### IV. THE CAUSES OF OCCUPATIONAL INJURIES

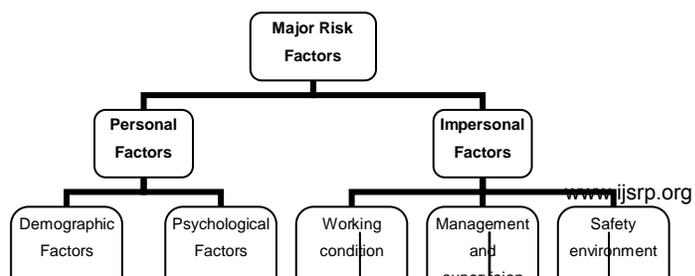
The causes of injuries can broadly be classified into two categories—(i) human causes and (ii) environmental causes.

#### A. Human Causes

Human causes arise out of those deficiencies of an individual himself like unsafe performance, impulsiveness, emotional instability and day dreaming on a job. They also involve such physical inadequacies, violations of safety rules and regulations, absent mindedness arising out of fatigue and job dissatisfaction, and ignoring of safety devices. Job dissatisfaction often has a psychological origin, and may be due to anxiety, job stress, the monotony of the job on which a person is employed, frustration and inadequate incentives, unfair and incorrect method of selection and promotion, the absence of group harmony and social integration, bad leadership and ineffective organization and low social prestige. The frustrating situations include sudden or arbitrary withdrawal of desirable objects of certain privileges which were enjoyed by employees: the creation of distrust in an individual and his ability to work, the creation of distrust on the part of employees of a particular individual in the group; restrictions on opportunities for self expression, discrepancy between an aspiration and the ability to solve a problem. These

is implicated in the vast majority of occupational injuries in mines, the reduction of error potential has received relatively little systematic attention as an approach to injury prevention. Hopkins reported that both Government safety organizations and unions were quite optimistic on safety [4]. They focused on equipment and not on the act of people. Further, he stated that 95% of injuries occur because of the acts of people. At workplaces, workers do something that they are not supposed to do and are trained not to do so, but they do it anyway. Hence it is necessary that the orientation of injury prevention problems should give more focused attention on human behavioural aspects. Mason found that over the past fifty years there had been a dramatic improvement in the British mining industry’s safety record due to engineering and mechanized improvement and achievements [5]. Simpson et al. found that the nature of injury causation in British collieries changed over the years and is now largely behavioural [6]. They found that engineering failures are no longer a major part of the causation of British mining industry’s injuries. Human error, however, now forms the significant part of the causes of most injuries. Studies by the other researchers also indicated the role of human behaviour in mine related injuries [7]. Everyone on a mine site has a ‘duty of care’ around safety and health. This includes mine owners, employees, employee representatives, site managers, corporate and technical staff, contractors, consultants and government officers. The mining and extractive industries’ duty of care also extends to the community in many ways [8]. A person under the influence of drugs or alcohol is more likely to cause a serious injury or death to himself and a co-worker, not to mention damage to company property [9]. Investigations into number of accidents has resulted causes as lack of awareness, lack of adequate training, issues regarding maintenance, design features [10].

situations affect the alertness of an employee, distract him from job, force to lose concentrations on the job, and lead to an injury. Several literatures are available which discussed the elements of human causes responsible for occupational injury.



Job dissatisfaction is one of the predictors of accident. Brief discussed two different models of job satisfaction: top-down, in which satisfaction is derived from how one interprets one's environment, and bottom-up, in which satisfaction is derived from experience of more positive job conditions [11].

#### B. Personality – Job Characteristics

Conceptually, several basic areas of research support the link between personality and perceptions of work characteristics. Research shows that individuals prone to the experience of positive emotions respond favourably to situations designed to induce positive effect, whereas individuals predisposed to experience negative emotions and negative self appraisals are less likely to respond positively to such situations [12]. Research has shown that positively disposed individuals rate characteristics of the task or the job as more enriched than do less positively disposed individuals [13].

#### C. Job Characteristics – Job Satisfaction

The job characteristics model proposed job satisfaction as one of the essential outcomes resulting from intrinsically enriched jobs [14]. According to this model, intrinsic work characteristics positively affect job satisfaction through a perceptual process. Two meta-analysis indicated a positive, moderately strong correlation between perceptual measures of intrinsic job characteristics and job satisfaction [15]. Though perceptual measures of job characteristics correlate more highly with job satisfaction than objective measures do, perceptual measures have been criticized for their potential contamination by common method variance [16]. It is noted, "An individual's view of himself or herself ...with respect to self-evaluation (overall approval and acceptance of himself or herself), plays a central role in the process of interaction with the environment". The job characteristics literature has clearly shown that perceptual measures of intrinsic job characteristics do not perfectly reflect job complexity [17]. Judge et al. showed that job complexity was significantly related to job satisfaction [18].

#### D. Emotional state-Job Stress-Risk Taking Behaviour-accident

Hockey et al. discussing the effects of emotional state on decision making and risk behaviour, suggested that stress may directly affect performance by encouraging the use of shortcuts in cognitive processing, thus reducing mental effort [19]. Shortcuts such as attentional narrowing, reducing cognitive complexity in problem solving, and a shift toward speed at the expense of accuracy may work by reducing the demand on stretched information-processing resources. It is not inconceivable that such changes may lead to an increase in errors. Clearly the effects of stress on cognitive performance and error, and thus on the possibility of an accident, require further research. In particular, it would be useful to clarify whether it is subjective perceptions of stress or reactions to the experience of stress that affect errors and accidents.

#### E. Antecedents of Job Satisfaction and Job Commitment

Fig. Major Risk Factors contributing hazards

#### B. Environmental Causes

Environmental causes arise of unsafe situational and climatic conditions and variations, such as bad working conditions, poor lighting and ventilation, and rough or slippery floors, unsafe storage facilities, unsafe plant layout, bad location, very long hours of work, unsatisfactory behaviour of dominating supervisors, unnecessary or excessive job related strain or tension, extensive noise and carelessness in the handling of sensitive materials like inflammable materials. Some other causes which also lead to occupational injuries are, alcohol drinking while on duty, poor housekeeping, violence and arson on the part of agitating employees. All these causes are physical, psychological or organizational and can be controlled to a great extent if properly looked into. Based on extensive literature survey the view of the researchers on the major environmental causes is cited in the following subsections.

### V. CAUSAL RELATIONSHIP AMONG THE FACTORS

#### A. Working Environment – Job Satisfaction – Injury

Job commitment refers to the extent to which an employee perceives that he or she is connected to a job and involves feelings or psychological attachment, independent of affect. There have been a few studies relevant to establishing the relation between job satisfaction and job commitment. Satisfaction and commitment were related but distinguishable attitudes. Further, he suggested that job satisfaction is associated with the aspects of work environment and thus will develop more quickly than commitment, which would require a worker to make a more global assessment of his or her relationship to the organization. A model developed by Steers describes the antecedents and outcomes of commitment [20]. According to this model, three main categories of variables influence commitment: personal characteristics, work experiences, and job characteristics. Although Steers did not specifically include job satisfaction as an antecedent, he did propose that it would probably influence commitment more, than would job characteristics. Similarly, it was developed a role taking model in their attempt to clarify psychological and structural determinants of the managerial commitment process. Their model identified three groups of factors as antecedents of organizational commitment. Personal attributes, organizational factors, and role-related factors (e.g., work overload, skill of subordinates). Although job satisfaction was not included in their analyses, they suggested that it might be an important predictor of commitment. In a conceptual turnover model, Mobley et al suggested organizational commitment as an attitude to be related to satisfaction and attraction to the present job, but no clear causal relation is hypothesized between satisfaction and commitment [21]. In a model, it was proposed that affective responses (job satisfaction, organizational commitment, job involvement) resulted from three major factors: (a) job expectations; (b) Job characteristics and experiences; and (c) job performance level. It was investigated a multivariate predictive model of organizational commitment and focused on the role of job level and organizational differences. The antecedents in their model included variables from each of Steers' categories. In an article, was used a structural equation approach to examine the causal antecedents and consequences of satisfaction and commitment within turnover models. Their causal model related personal and organizational characteristics to satisfaction, satisfaction to commitment, and commitment to turnover intention. Farkas et al. found that commitment and satisfaction may be either cyclically or reciprocally related [22].

## VI. INJURY EPIDEMIOLOGY

A few epidemiological studies have addressed the role of personal as well as impersonal factors to examine whether these factors have significant statistical associations with occupational injuries in coal mines. Special attention has been paid to human behavioural factors responsible for mine accidents. Epidemiologic studies of occupational injuries have largely been descriptive in nature. These studies describe the distribution of injured persons (number and rates) usually in terms of person, place, and time characteristics and are useful for identifying hazardous industries, occupations and work situations. A frequent limitation of such studies is lack of information on the total population exposed and / or total time of exposure. Case-

control or case-referent studies include injured persons as cases and uninjured persons as controls. By determining the percent of each group exposed to potential risk factors, one can estimate the relative risk of the injury under study exposure. In studies summarized eight case-control studies of occupational injuries. The criteria used to select these studies were: (i) use of case-control methodology, and (ii) cases and controls selected among persons injured and uninjured at work. The results of these eight studies suggest that the work practices and behaviours just prior to the injury (or personal factors within 12 hours before the injury) may be most important from an etiological perspective. However, this is difficult to measure because it entails interviewing the injured employee as soon after the injury as possible. Mortality of iron miners in Lorraine (France) was investigated on epidemiological principles. Epidemiological studies were also conducted to investigate occupational injuries in construction industries and railway firm in recent times [23].

## VII. CONCLUSION

Although epidemiological investigation of occupational injury has become popular in USA, France, UK and Canada, during the last decades and that there is a growing awareness of it in the rest of the world, it is relatively a new area of research in India. So far injury epidemiology has been mainly applied in the chemical industry, roadway safety, railway safety, nuclear processing plant and construction industry. No extensive research in this area has been undertaken therefore required to study the same in coal mining industry in Indian scenario. The literature survey revealed that a wealth of information is available on the role of human elements in injuries and on ways to change unsafe behaviour. The methodology proposed is based on this information. It is important to determine what factors are causing injuries in mines so that appropriate preventive measures can be taken in coal mining industry.

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# First record of *Asperoteuthis acanthoderma* (Lu, 1977) (Cephalopoda: Oegopsida: Chiroteuthidae), from the Arabian Sea

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**Abstract-** The deep sea squid *Asperoteuthis acanthoderma* (family: Chiroteuthidae) is reported here for the first time from the Arabian Sea of the India. A single specimen was collected while conducting a trial fishing with 49.5m Cosmos mid water trawl onboard FORV Sagar Sampada between latitude 11o 47.767'N and longitude 73o 39.065'E at a depth range of 350 to 400 m during the month of October 2013. The morphometric measurements of the specimen are described and are compared with the same species reported from the North Atlantic Ocean. The female specimen measured 788 mm in standard length, 22.50 mm in mantle length, 89.26 mm fin length and weighed 85.38 gm.

**Index Terms-** Deep sea squid, *Asperoteuthis acanthoderma*, Arabian Sea, first record

## I. INTRODUCTION

*Asperoteuthis acanthoderma* (Lu,1997) (family: Chiroteuthidae) commonly known as thorny chiroteuthid squid is generally distributed in the Indo-West Pacific; Celebes Sea, Ryuku Islands, Molucca Sea, New Guinea, Southern Africa; eastern Gulf of Mexico, Gulf Stream Florida and South Atlantic Ocean (FAO, 2010). The first species of *Asperoteuthis* was originally described as *Chiroteuthis acanthoderma* by Lu (1977) from the tropical western Pacific. Nesis (1980) placed this species to the current genus *Asperoteuthis*. Family Chiroteuthidae consist of four genera viz., *Chiroteuthis*, *Asperoteuthis*, *Planctoteuthis* and *Grimalditeuthis*, with about 20 species reported worldwide, 2 or 3 as yet undescribed. The species level taxonomy is poorly understood and the group is very much in need of a comprehensive monograph. Chiroteuthids are bathypelagic or meso-bathypelagic squids and occasionally occur on or in association with the bottom at bathyal depths. Chiroteuthid species are very important as prey of odontocete cetaceans, e.g. sperm whales, Frasier's dolphin, pygmy and dwarf sperm whales, pilot whales, as well as blue sharks, tunas, toothfish and seabirds (FAO, 2010). Judkins et al (2009) discovered the presence of *A. acanthoderma* from the North Atlantic Ocean, Straits of Florida and reported the morphometric measurement and internal anatomy of two samples collected from southwest of Key West, Florida and from Straits of Florida during February 2007 and June 2007 respectively. In this paper, the morphometric measurements of the specimen collected from the Arabian Sea were described and are compared with the same species reported from the North Atlantic Ocean.

## II. MATERIALS AND METHODS

A single specimen of *Asperoteuthis acanthoderma* (Fig. 2) was collected from the Arabian Sea while conducting a trial fishing with 49.5m Cosmos mid water trawl with Thyboron trawl door (Type-7) onboard FORV Sagar Sampada between latitude 11o 47.767'N and longitude 73o 39.065'E at a depth range of 350 to 400 m (Fig.1). Before operation, Deep Scattering Layer (DSL) indicating the presence of mesopelagic fishes was scanned using SIMRAD EK60 and EA60 echo sounder and observed between 350 to 400 m depth. Fishing operation was carried out for 2 hr duration with the help of echo integrator ITI (Integrated Trawling Instrument) interfaced with GPS which enables to know the latitude and longitude positions and two sensors interfaced with net which interpret the fishing depth and temperature at the trawling depth.

Once captured, specimen were frozen and later brought to the laboratory where the sample were identified and the morphometric parameters were noted as described by FAO (2010). The morphometric measurements were measured with a Mitutoyo digital vernier calliper with an accuracy of 0.5 mm. Morphometric characteristics were compared with the specimen reported from the straits of Florida, 16 mi east of Marathon, Florida (UMML 31.3212), which is deposited in the Marine Invertebrate Museum at the Rosenstiel School of Marine Atmospheric Sciences, University of Miami, Florida and with another specimen reported from southwest of Key West, Florida, which is kept in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. Immediately after the observation, the sample were kept in 5% formalin solution for further reference.

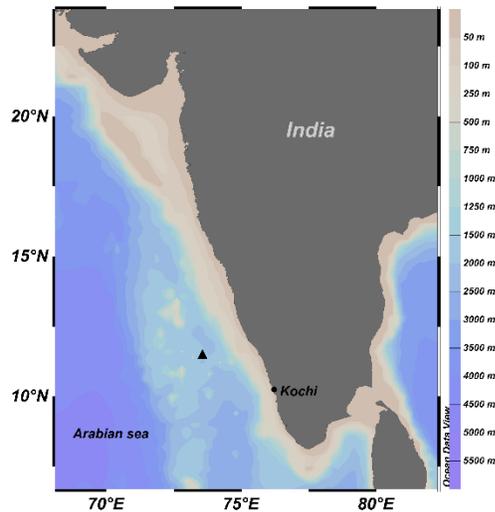


Fig 1. Map showing the study area and triangle mark indicating the sight where *A. acanthoderma* were caught

### III. MATERIAL EXAMINED

A single specimen *A. acanthoderma* (CMFRI, MFD) was caught on the oceanic fishing ground in Arabian Sea (11o 47.767'N 73o 39.065'E)

#### DESCRIPTION

##### Systematics

Kingdom Animalia  
Phylum Mollusca  
Class Cephalopoda  
Subclass Coleoidea  
Order Teuthida  
Suborder Oegopsina  
Family Chiroteuthidae  
Genus *Asperoteuthis*  
*Asperoteuthis acanthoderma* Lu, 1977

Synonyms: *Asperoteuthis famelica* (Berry, 1909), *Chiroteuthis acanthoderma* (Lu, 1977)

Peculiar characteristics of *Asperoteuthis acanthoderma* which makes it different from other species are Y-shaped funnel locking apparatus, sucker ring form and dentition, beak morphology, photophore patch configuration on ventral surface of eyeballs, and numerous small cartilaginous tubercles that cover the mantle, head and the aboral surface of the arms (Judkins et al., 2009). Even though the present specimen collected from Arabian Sea is comparatively smaller in size, the characteristic features are similar to the samples reported by Judkins et al (2009). The mantle is long, narrow, semi gelatinous with dark purple pigmentation. Numerous, minute cartilaginous tubercles cover the mantle, head, and arms. The fins together form an elongate oval shape and are estimated to have been 89.26 mm long. The width of the fins is 75.38 mm at their widest part. Arm formula was III>II>I>IV.

The funnel locking apparatus is in an inverted Y-shape but the measurement of funnel locking apparatus could not be taken as it was in a detached condition. The head is small with 55.34 mm in length and 26.66 mm in breadth. The arms are long and the length ranges from 373 mm to 445 mm. Dorsal and ventral mantle length was recorded as 22.50 mm whereas the mantle breadth was recorded as 37.86 mm and 41.76 mm respectively. Eye diameter was noted as 9.59 mm in the present sample in which is much lesser than the 28 mm eye diameter reported in the specimen collected from Key West by Judkins et al (2009). Outer diameter of mouth of the present sample was measured as 8.29 mm. Total weight of the present sample is 85.38 gm and the standard length was measured as 788 mm. The actual total length of the sample could not be measured as the tentacle was in broken condition. The sucker diameter ranged from 0.70 mm to 1.48 mm. As the present specimen is in smaller in size and the internal organs of the present specimen are significantly in



Fig. 2. *Asperoteuthis acanthoderma* specimen collected from Arabian Sea.

deteriorated condition, detailed analysis of internal anatomy of the sample could not be conducted. The presence of nidamental gland shows this is a female species (Fig. 3).



Fig. 3. Internal organs of the specimen collected from Arabian Sea

The morphometric measurements of the present sample were compared with that of specimens obtained from Key West and Marathon reported by Judkins et al (2009) (Table 1.)

Table. 1. Morphometric measurements (mm) of the Specimen

Character	Arabian Sea*	Key west	Marathon
Maximum length of fin	89.26	Est. 220	460
Maximum width of fin	75.38	340	330
Dorsal Mantle length	22.5	620	1630
Dorsal Mantle width	37.86	190	210
Ventral Mantle length	22.5	n/a	n/a
Ventral Mantle width	41.76	n/a	n/a
Head Length	55.34	230	n/a
Head Width	26.66	35	50
Eye diameter	9.59	28	n/a
Outer diameter of mouth	8.29	n/a	n/a
Arm length 1 R	435	880 (ti)	845
Arm length 2 R	440	895	1030
Arm length 3 R	445	1000	760+
Arm length 4 R	373	560	520
Arm length 1 L	425	655	810
Arm length 2 L	426	680	970
Arm length 3 L	402	897	1100
Arm length 4 L	428	870 (ti)	825
Tentacle length R	243 +	100 +	1560+
Tentacle length L	369 +	n/a	780
Standard length	788 +	n/a	n/a
Total length	788 +	1817	3420
Sucker diameter I R	0.70	4.3	5.3
Sucker diameter II R	1.45	n/a	n/a
Sucker diameter III R	1.44	n/a	n/a
Sucker diameter IV R	1.22	n/a	n/a
Sucker diameter I L	1.22	n/a	n/a
Sucker diameter II L	1.48	n/a	n/a
Sucker diameter III L	1.33	n/a	n/a
Sucker diameter IV L	1.21	4.3	4.5
Secondary fin width	n/a	n/a	235

+ = Features incomplete/broken; ti = to tip, complete; n/a = not determined

\*From the current study

#### IV. CONCLUSION

The occurrence of this species in the Arabian Sea will widen the known distribution of this species to the Indian waters. Very little information is available on the distribution, biology and migratory characteristics of deep-sea squids especially about meso-bathypelagic squids. Therefore, reporting the limited and fragmentary information regarding the occurrence of rare species from different parts of the world would supplement necessary information to understand the life history of the species.

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# Clinical and Immunological Study of Chronic Polyarthritis

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**Abstract-** Aims and objectives: This study is designed to determine the clinical and immunological aspects of patients with chronic polyarthritis, and assess the different causes of chronic polyarthritis using detailed history of the course of the disease along with clinical examination and immunological tests to support an early recognition of the polyarthritis.

Materials and methods: A study on 50 consecutive cases with polyarthritis of duration more than 6 weeks were studied from a time period between July 2012 to September 2014.

Observation and results: In this study, 34% cases were RA, 30% cases were OA, 8% were SLE, 8% were Psoriatic arthritis, 6% were Reactive arthritis, 6% were gouty arthritis, 4% were Sjogrens syndrome, 4% were Takayasu arteritis and Ankylosing spondylitis each.

Conclusion: In conclusion a major cause of chronic polyarthritis is RA followed by OA, SLE and Psoriatic arthritis. An attempt was made to study chronic polyarthritis based on clinical features, laboratory investigations, immunological tests and radiographic changes. However, further studies based on a larger population are awaited in near future for the overall prevalence of different polyarthritis.

burden with more than 40% individuals showing this clinical picture beyond 50 years age.<sup>1</sup>

An array of diseases like rheumatoid arthritis, psoriatic arthritis, systemic lupus erythromatosus, ankylosing spondylitis, Sjogren's syndrome, sarcoidosis, vasculitis, gout, osteoarthritis, hypothyroidism, hyperthyroidism, amyloidosis, acromegaly, multiple myeloma, and metastases can present as chronic polyarthritis. Dr Anne Mies Richie of Southern Illinois School of Medicine states that it is essential for the inflammation of joints to remain for more than 6 weeks to diagnose it as a chronic disease since the management varies according to the duration.<sup>2</sup>

Inflammatory joint conditions are characterised by chronic inflammation of synovial membranes and other structures in and around the peripheral joints and spine, causing risk for destruction of the involved structures and subsequent functional impairment. Frequently, these disorders are generally referred to as "chronic polyarthritis". Studies suggest that approximately 2% of the adult population suffer from an inflammatory joint disorder.<sup>3</sup> The ability to manage activities of daily living (ADL) and the ability to perform in work and recreational activities may be seriously impaired.

## I. INTRODUCTION

Polyarthritis is a widespread disease pattern having a share of 4% as musculoskeletal disorder in the national disease

Figure 1: Rheumatoid arthritis: Deformities present: Swan neck deformity, Boutonnere deformity.



Figure 2: Xray wrist and hand showing erosions, osteopenia suggestive of Rheumatoid arthritis.



**Figure 3: Tophaceous deposition in 1st metatarsal suggestive of gout**



**II. MATERIALS AND METHODS**

A study on 50 consecutive cases with polyarthritis of duration more than 6 weeks were studied from a time period between July 2012 to September 2014.

Joint pain was analysed on grounds of symmetry, sequence pattern, severity grade: on a subjective scale of 1 to 10, aggravating factors, relieving factors, course, swelling, stiffness, fatigue, limitation of movement.

Associated features that occurred concurrently with complaints of joint pain were noted like fever, urinary complaints, rash, diarrhoea, eye complaints like congestion, dryness, redness. Associated co-morbidities were noted: DM, hypertension, TB, heart disease, thyroid disease, psoriasis, previous infections.

Joints were examined on basis of appearance, sites, overlying skin, redness, swelling, range of motion, tenderness, temperature, movements, bursal swelling or tenderness, muscles examination for tone and nutrition. Deformities were noted.

Laboratory investigations included: haemoglobin levels: peripheral blood smear, total leucocyte count, platelet count,

ESR, liver function tests, renal function tests, serum proteins, serum calcium, serum phosphorous, serum uric acid, C reactive protein levels.

Immunological studies included : rheumatoid factor, ASO, ANA blot, specific test: anti Ro/La, anti smith, anti ds DNA, anti CCP, ANCA, CPK.

Radiological investigation: all affected joints were subjected to radiography.

**III. RESULTS**

A total number of 50 cases were studied. There were 14 cases (28%) seen in the age group more than 60 years. 12 cases (24%) were seen in age group of 31 to 40 years. 10 cases each were seen in the age group of 41 to 50 and 51 to 60 (20%). Our study showed 34 females (68%) and 16 males (32%).

Joint pain was described according to symmetry, sequence, severity grade,aggravating factors, relieving factors, course, swelling and stiffness( refer to table 1).

**Table 1: Joint pain wise distribution of cases in study group**

Joint pain		No of cases	Percentage (n=50)
Symmetry	S	39	78
	As	11	22
Sequence	Add	12	24
	Int	36	72
	Mig	2	4
Severity grade	1 – 3	0	0
	4 – 6	22	44
	7 – 10	28	56
Agreevating factors	Const	25	50
	WA	24	48
	WC	1	2
Relieving factors	Rest	48	96
	WM	2	4
Course	Prog	32	64
	Stat	18	36
Swelling	Present	39	78
	Absent	11	22
Stiffness	All day	8	16
	Morning	17	34
	No	25	50

The duration of symptoms was reported mostly in less than 3 years as seen in 23 cases (46%) in our study. 13 cases (26%) showed duration of 4 to 6 years while 14 cases (28%) showed duration of more than 6 years.

Fever was commonest associated feature seen in 29 cases (58%) followed by urinary complaints as seen in 21 cases (42%). Dry eye and conjunctivitis was seen in 9 patients (18%) and rash was in 4 cases (8%). 8 cases (16%) showed addiction to smoking, 6 cases (12%) showed addiction for alcohol followed by 3 cases (6%) with tobacco addiction. Tophi was seen in 2 cases (4%), rash in 7 cases (14%) and salivary gland enlargement was seen in 2 cases (4%). Nail changes were seen in 3 cases (6%).

Joint affection was symmetrical in 36 cases (72%). Swelling was evident in 34 cases (68%). Of these 13 cases were RA, 8 cases were osteoarthritis, 3 were Reactive arthritis, 2 were psoriatic arthritis & SLE each, 1 was Sjogren syndrome. Crepitus was seen in 13 cases (26%) and all were osteoarthritis. 28 cases (56%) showed restricted movement of which 16 cases were RA. 21 cases (42%) showed joint deformities.

20 cases (40%) showed positive anti CCP with p value < 0.0001 which is highly significant. C reactive protein levels were positive in 28 cases (56%) and negative in 22 cases (44%) (refer to table 2).

**Table 2: Association between Immunological test and diagnosis in study group**

Immunological test	RA	OA	SLE	Others	Chi-square	P Value
	n=17	n=15	n=4	n=14		
Rh factor	9	2	2	2	8.65	<0.05
ANA	2	0	4	2	24.12	<0.0001
Anti CCP	16	0	2	2	34.77	<0.0001
ANCA	0	0	0	1	2.62	>0.05
Others	0	0	3	3	20.58	<0.0001

Radiological changes (refer to table 3).

**Table 3: Radiological changes wise distribution of cases in study group**

Radiological changes	No of cases	Percentage (n=50)
Soft tissue swelling	36	72
Erosions	16	32
Osteopenia	35	70
Joint space	28	56
Deformities	22	44
Others	12	24

In our study we found the following distribution of cases (refer to table 4).

**Table 4: Diagnosis wise distribution of cases in study group**

Diagnosis	No of cases	Percentage
R Arthritis	17	34

Osteoarthritis	15	30
SLE	4	8
Psoriatic arthritis	4	8
Reactive arthritis	3	6
Gouty arthritis	2	4
Sjogrens syndrome	2	4
Takayasu disease	2	4
Ankylosing Spondilitis	1	2
Total	50	100

There was no significance found in association of type of polyarthritis with serum albumin ,serum calcium, serum phosphorous and uric acid levels.Comparison between peripheral blood smear and type of polyarthritis showed significance.Renal function tests were increased in SLE and was significant.

#### IV. DISCUSSION

The age at onset of polyarthritis varies widely depending on the disease. For example, 65% of patients with systemic lupus erythematosus (SLE) start manifesting their symptoms between ages 16 and 55 years. Rheumatoid arthritis (RA) peaks between ages 30 and 55<sup>4,5</sup> and Sjögren’s syndrome (SS) between ages 45 and 50<sup>6</sup>. In our study 14 cases were in age group above 60 yrs, 12 cases in 31 to 40 yrs, 10 cases in each 41 to 50 and 51 to 60 years. Polyarthritis is reported more frequently by females than males. 68% cases in our study were females. Nationally, women aged 15 years and older, account for 60% of arthritis cases<sup>7</sup>. Prevalence rates of rheumatoid arthritis are two to three times greater among females than males. Osteoarthritis is more common in females than in males after the age of 54 years.

#### Symptoms

Of 8 variables examined in a study carried out by La Montagna et al<sup>8</sup> symmetric pain was the most potent discriminating feature for rheumatoid arthritis. Psoriatic, reactive and gout are more likely to present with asymmetric involvement.<sup>9,10</sup>. Our study showed most cases having symmetrical joint involvement as majority of cases were rheumatoid and osteoarthritis.

Inflammatory arthritis is associated with prolonged morning stiffness which is generalised and may last for several hours. The duration of the morning stiffness is a rough guide to the activity of the inflammation.Patients with chronic inflammatory arthritis may have chronic synovial thickening and swelling.<sup>11</sup> In our study joint swelling was seen in 39 cases which was significant.

29 cases with polyarthritis had fever as an associated symptom. Low-grade fever is an expected part of having RA.Fever being a

sign of inflammation, is not seen in osteoarthritis and hence is a differentiating factor from RA and Reactive arthritis. Dry eye was seen in 2 cases (4%) of which both were Sjogrens syndrome. Ocular involvement is a major manifestation of Sjogrens syndrome.Tophi were seen in gouty arthritis.Salivary gland enlargement was seen in Sjogrens syndrome.Changes like onycholysis and pitting was seen in psoriatic arthritis.

#### Joint Examination

Swelling was seen in 34 cases out of 50 which is significant. Joint swelling is more prominent in cases like RA, osteoarthritis, psoriatic arthritis and reactive arthritis<sup>184</sup>. Crepitus was present in 13 cases (26%) and were all osteoarthritis cases. Crepitus indicates the presence of irregularities of the articular cartilage, which most commonly are associated with osteoarthritis, injury, or previous inflammation.<sup>11</sup>

Deformities were apparent in 21 cases (42%) of which 14 cases were RA, 2 were Sjogrens syndrome, 2 cases were SLE, while remaining were gouty arthritis and psoriatic arthritis.Rheumatoid disease affects the synovium lining the joints and sheaths of the tendon.<sup>12</sup>

#### Laboratory tests

In our study ESR was significantly raised in RA followed by SLE. It may measure general severity of RA better than CRP, even though it is a poorer measure of inflammation.<sup>13</sup> There was no significance associated in comparison of type of chronic polyarthritis with levels of serum albumin, serum calcium, serum phosphorous and serum uric acid. Serum uric acid was raised in 3 cases of gouty arthritis which is predictable.

C reactive protein levels were raised in 28 cases (56%) in our study.A study carried out by Pearle et al,have demonstrated an association between a marker of systemic inflammation and local synovial inflammation in patients with OA.

#### Immunological tests:

In our study rheumatoid factor was positive in about 15 cases of which 9 were RA cases and remainder were SLE and Sjogrens.Serum RF is detected in RA and other autoimmune

disorders, such as Sjögren's syndrome (SS) and systemic lupus erythematosus (SLE).

Anti CCP was positive in 20 cases of which 17 were RA and 3 were overlap of RA with Sjogrens syndrome with p value <0.0001 which is significant. Hence Anti CCP is highly diagnostic for RA in early stages. 8 cases positive for ANA of which 4 were SLE, 2 were Sjogrens and 1 was Takayasu arteritis. Further differentiation for antibodies specific for diseases was done. Of these, Anti Ro/La was positive in 2 cases of Sjogrens syndrome, Anti ds DNA was positive for 2 cases of SLE, Anti Smith for 1 case of SLE and HLA B27 was positive for 1 case of ankylosing spondylitis.

Anti-Ro and anti-La antibodies, also known as SS-A and SS-B, respectively, are commonly found in primary Sjögren's syndrome. Anti-double stranded DNA (anti-dsDNA) antibodies are highly associated with SLE. They are a very specific marker for the disease, with some studies quoting nearly 100% (Tomar et al).<sup>14</sup>

#### Radiological changes:

In our study, 36 cases (72%) showed soft tissue swelling. Erosions were seen in 16 cases (32%). Osteopenia was seen in 35 cases (70%) while joint space narrowing was seen in 28 cases (56%).

A degenerative process is suspected when joint space narrowing, osteophyte formation, bone sclerosis, and subchondral cysts are seen in the absence of inflammatory changes. If joint space narrowing involves the knee but symmetrically involves the joint with periarticular osteopenia, then an inflammatory arthritis such as rheumatoid arthritis is suggested.<sup>15</sup>

Inflammatory or erosive osteoarthritis can be viewed as a variation of osteoarthritis in that it commonly involves the interphalangeal joints of the hand, and osteophytes are quite obvious.

The radiographic features of gout show erosions that are near a joint but not specifically marginal and they have sclerotic margins that produce a punched-out appearance. Periarticular osteopenia is also absent.

#### V. CONCLUSION

Chronic Polyarthritis is commonly seen in age group of more than 60 years followed by 31 to 40 years with female preponderance. The order of joint pain is commonly symmetrical with early morning stiffness in majority. Joint swelling was a prominent feature noticed in all cases of chronic polyarthritis.. The most common associated feature noticed was fever, followed by urinary complaints. Deformities were commonly present in RA, followed by Sjogrens syndrome and gouty arthritis.. Rheumatoid factor was positive in few cases and was not a significant indicator of the underlying disease. Anti CCP was present in majority cases of polyarthritis of which all were RA, which is significant indicator of underlying disease. The most common radiological changes were soft tissue swelling followed by osteopenia and joint space narrowing. Osteoarthritis was the commonest type diagnosed early with radiographs.

Diagnosis wise distribution of chronic polyarthritis was found to have majority of RA cases followed by osteoarthritis, SLE, Psoriatic arthritis, Reactive arthritis, Gouty arthritis, Sjogrens syndrome, Ankylosing spondylitis and Takayasu arteritis. An attempt was made to study chronic polyarthritis based on clinical features, laboratory investigations, immunological tests and radiographic changes. However, further studies based on a larger population are awaited in near future.

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# Effects of Public Procurement Processes on Organization Performance

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**Abstract-** The general objective of this study was to analyze the effects of public procurement processes on organization performance. It determined and analyzed the gaps in public procurement in county assemblies using county assembly of Mombasa as a case study. This was guided by three specific objectives: to establish the effects of human resource skill level in the procurement department, to identify the influence of stakeholder integration on the performance of the organization and to determine the effects of supplier management on the performance of the organization. There are numerous cases of exaggerated prices, and behind the schedule projects which is contrary to the public procurement and disposal Act 2005. The Public sector for instant has lost billions of shillings out of procurement decisions made by accounting officers who are not necessarily procurement professional. A stratified random sampling technique was used to select the sample; the strata's were derived from the various categories of stakeholders that are involved in the public procurement process directly or indirectly. The study used a proportion of 30% from each stratum to select 111 respondents. The study relied on primary as well as secondary data. Primary data was collected through questionnaires to meet the objectives of the study. The questions were both open ended and closed ended. Secondary data was collected from relevant literature review, business magazines, journals, internet and other relevant material. Responses in the questionnaires were tabulated, coded and processed by the use of a computer statistical package for social science (S.P.S.S) version 20 to analyze the data descriptive statistics such as mean and standard deviation. Tables were used to present responses and facilitated comparison. The study revealed the impact of public procurement process on the organization performance. The research was limited to a public entity and thus the researcher recommend further study in the topic of public procurement process among the parastatals and analysis of the challenges experienced. The study showed a high correlation between stake holder integration and organizational performance as well as a high correlation between human resource skill level and organizational performance. It however showed a weak correlation between suppliers' management and organizational performance. The M.C.A and other County assemblies should also enhance stakeholder involvement in their procurement processes by allowing for more public participation in the process.

**Index Terms-** public procurement, public procurement in county government, supplier management, stakeholder integration, human resource skill

## I. INTRODUCTION

Effectiveness of procurement is a new challenge in the field of purchasing. In many organizations the effects of purchasing have not been determined or evaluated. The procurement effectiveness reporting tool will produce information on the effects of procurement that can be then used in developing the purchasing activities in an organization, (Eyaa&Oluka, 2011).

Public procurement operates in an environment of increasingly intense scrutiny driven by technology, program reviews, and public and political expectations for service improvements (Bolton, 2006). Currently, in Africa, procurement is of particular significance in the public sector and has been used as a policy tool due to the discriminatory and high level of corruption in the country (Bolton, 2006).

Procurement is central to the government service delivery system, and promotes aims which are, arguably, secondary to the primary aim of procurement such as using procurement to promote social, industrial or environmental policies (Cane, 2007). Prior to 2002, public procurement in Kenya was geared towards large and established contractors. It was difficult for new contractors to participate in government procurement procedures. However, public procurement in countries such as South Africa has been granted constitutional status and is recognized as a means of addressing past discriminatory policies and practices (Bolton, 2006).

### Statement of the problem

The public procurement decisions made by different heads of public entities are of great concern. This is due to the tax payers losing huge amounts of money out of such poor decisions. The services rendered out of the procurement activities are of poor quality. There are also numerous cases of exaggerated prices, and behind the schedule projects which is contrary to the public procurement and disposal Act 2005, (Kayode, 2007). The public sector for instant has lost billions of shillings out of procurement decisions made by accounting officers who are not necessarily procurement professional. (Abdilkadiret *et al*, 2013). Instances of this include the Ministry of Transport which has issues in relation to the Kshs 447 billion Standard gauge railway project, Ministry of education in relation to the laptop project which was wrongly awarded and is worth Ksh 24.5 billion and finally, the I.E.B.C awarding a tender to a firm that did not meet the technical threshold required in the specification, which made the whole process of electronic voting to be reversed back to manual systems sending everybody involved in the process into confusion, (E.A.C 2014). Surprisingly all this happens in the helpless eyes of PPOA, which

is put in place to oversight irregular procurement activities. The country governments have also been engaged in endless blame between the leaders and the country assembly members on how some procurement procedures are undertaken. Moreover, threats of impeachment and sabotage have been noticed in recent days, Abdulkadiret *et al.*, 2013).

Mombasa County assembly is one of the county Assemblies currently involved in the procurement struggles between the country executive and the County assembly. Besides, being one of the three Cities including Nairobi County and Kisumu County, the County has more challenges as well as the decline in the tourism sector which is the backbone of the Country's economy. For these reasons Mombasa County assembly is ideal for a study to determine the effect of the procurement practices on performance of the functions of the county assembly.

## II. LITERATURE REVIEW

### 2.1 Theoretical review

#### 2.1.1 Agency Theory

The theory puts a principal-agent relationship between the state Citizens and the County government officers and employees. This arises from the fact that the County government officials and employees are holding resources in trust for the citizens and more specifically the residents of the County and perform all their transactions for and on behalf of these citizens. The theory thus puts it that it is in the best interest of the county government offices to discharge all their duties owing transparency and accountability to their principals who are the residents and citizens, (Thai, 2006).

Moreover, procurement can be viewed as involving at least two parts with different goals, a buyer and one or more vendors competing for the contract. However in addition to the agency relationship between buyer and competing vendors, there may be a number of internal stakeholders possibly with conflicting goals, adding complexity to the procurement process. These groups of internal stakeholders may include the political leaders, the citizens, the interest groups operating with the County, central government, services recipients and the business interest within the County, (Gull, 2010).

The other aspect where agency theory applies is the agency relationship between the procurement department and the user departments such as the assembly, the speaker's chambers, the county representative offices, the secretariat, the County assemble committees as well as other departments within the County assembly. The procurement department does the purchases on behalf of these departments and sections who then are the principals. There is however a conflict in that the user departments have their specifications and desires which at times are not easily met within the public procurement rules, (G.O.K 2005).

#### 2.1.2 Contingency Theory

Unlike agency theory, the contingency theory is more concerned with organizational structure which entails both the formal and the informal organization of hierarchical and information as well as decision making structures within an organization. (Otieno, 2009). The contingency approach to

management has its roots in general systems theory and the open systems perspective. The open systems perspective views the complex organization as a set of interdependent parts that, together, constitute a whole which, in turn, it interdependent with the larger environment. The interactive nature of the elements within the organization and between the organization and the environment result in at least two open system characteristics that is central to the contingency approach. The principle of adaptation asserts that the elements within the system adapt to one another to preserve the basic character of the system. In addition, the principle of equifinality holds that a system can reach the same final state from differing initial conditions and by a variety of paths (Hahn, 2007).

The theory also holds that there are different levels of fit such as technological, human capital quality management and decision making structures each with different performance levels. This then holds that an organization can move from one level of fit to the other gradually by laying out a strategic map which gives guidelines for the gradual change until it gets its optimum level of fit which is the equal performance of all the fit points of the organization. This is the format used by ISO to measure organizational performance and efficiency. This is the aspect adapted in public procurement to determine the level of fit attained by integrating various players in the procurement process, (Demeester&Grahovac, 2005).

Snow et al (2006) argue that as much as an organization may not attain full fit, it can attain a quasi-fit, that is, a structure that only partially fits the contingencies. The assertion is that this quasi-fit status may still increase performance sufficient to produce some expansion in the contingencies. Thus an organization that is in misfit by being below the fit line can follow a growth path of increasing its organizational size and structure by moving into quasi-fit, rather than full fit. For such an organization in misfit, it may increase its structure sufficiently to move up onto the quasi-fit line. This level of fit produces an increase in the performance of the organization, though less than would be produced if the organization had moved into full fit. Nevertheless, this quasi-fit produces a sufficient increase in performance that the organization has new surplus resources that allow it to grow. This increment of growth propels the organization forward into a new state of misfit, which again can be resolved by the organization increasing its structural level sufficient to attain move back onto the quasi-fit line.

Hahn (2007) suggests that contingency theory makes it possible to draw from other management theories. This suggestion conceptualizes a scenario where a firm is faced with decreasing profits and for solving the problem, the management is faced with three possible solutions from three different theoretical foundations such as use of time studies derived from the classical management theory to increase productivity of the workers, or the involvement of workers in improving work methods as given by the behavioral management theory, as well as the establishment of a team of sales and production personnel to coordinate sales and production as proposed for in the systems theory. He then asserts that, rather than doing all three, contingency theory stresses the need to first determine the true cause of the problem and select the action that will offer the best solution. In other words, the solution must fit the problem.

## 2.3 Conceptual Framework

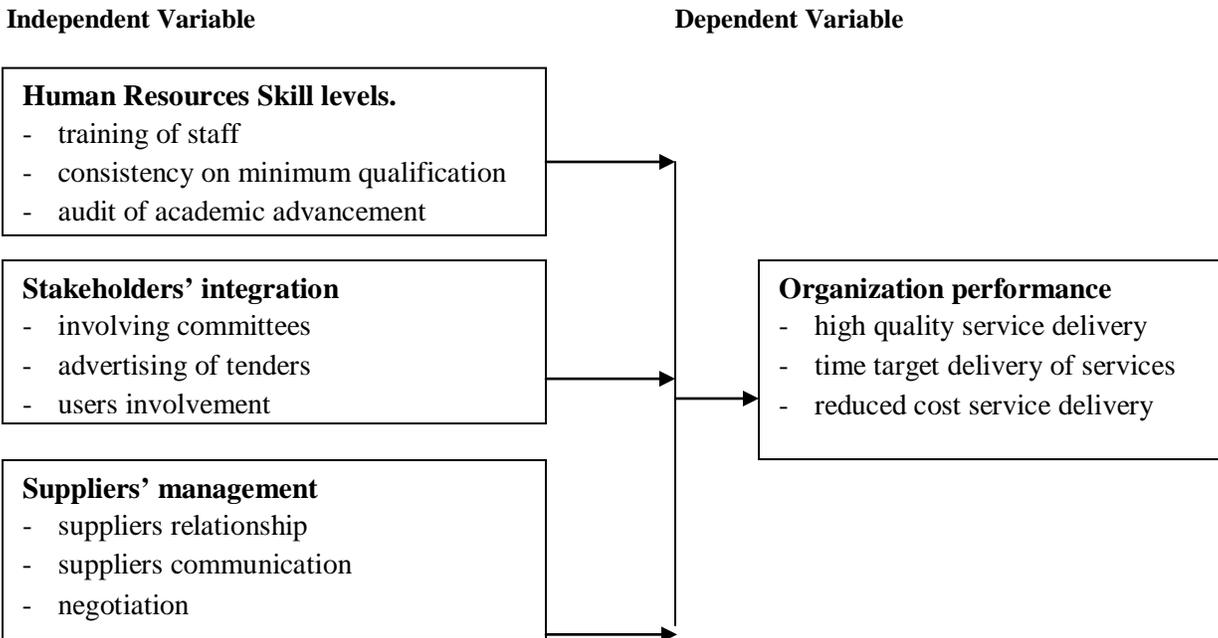


Figure 2.1 Conceptual framework

### 2.3.1 Human Resource skill level in the procurement department.

The human capital theory provides evidence which indicate that training and education raises the productivity of workers by imparting useful knowledge and skills, hence raising workers' future income by increasing their lifetime earnings. (Thai, 2006). According to Kayode (2007), training can solve a variety of manpower problems that slows down optimal productivity and performance. These problems include needs to increase productivity and efficiency, improve the quality and quantity of work boost employees' morale and organizational climate, implement new or change policies or regulations, ensure the survival and growth of the organization, develop new skills, knowledge, understanding and attitudes, provide for succession plan and ensure continuity of leadership, prevent skill obsolescence and cope with the new technological advancement, use correctly new tools, machines, processes, methods or modifications thereof, reduce waste, accidents, turnover, lateness, absenteeism, and other overhead costs and bring incumbents to that level of performance which meets [100 percent of the time] the standard of performance for the job.

### 2.3.2 Stakeholder integration.

Various studies have shown that procurement and revenue management form the core functions of public financial management; particularly within the Medium term Expenditure Framework (MTEF). The main objectives of the MTEF include linking policy, planning, budgeting; achieving fiscal discipline through a realistic macro economic framework; resources allocation, efficiency in line with strategic priorities and operational efficiency through delivery of quality managerial

services. Public procurement within the MTEF is also closely linked to the export market development as well as foreign direct investment into the country (KIPPRA 2007). Within the public sector, the core objectives are set by politicians (Hill, 2011; Osborne and Gaebler, 2008; Lyne, 2007); they make political choices regarding the prioritization and allocation scarce resources. Theoretically, those choices should set the objectives of the procurement strategy, yet of little comparative analysis of politicians and procurement managers' priorities, Murray (2011) demonstrated a lack of correlation.

Besides, participation of stakeholder is also considered part of the corporate social responsibility requirement. This demands that the end user of the product be fully involved in the procurement of products related to that process. The end users would include all the user departments within the assembly, members of the County assembly as well as the general public. (Uyarra& Flanagan, 2009).

### 2.3.3 Suppliers' management.

SQM is seen in terms of the managerial efforts necessary for creating an operating environment in which a manufacturer can integrate its supplier capabilities into its operational processes. These managerial efforts can be clustered into several components, namely management responsibility, supplier selection, supplier development, supplier integration, quality measurement and conducting supplier audits. (Arrowsmith, 2010) state that supplier selection, supplier development and supplier integration can be regarded a forming an SQM system, with management responsibility seen as the driver of the system.

Measuring supplier performance is an important means of modifying managerial behavior, and aligning the relationship with the strategic and operational goals of the buyer firm (Paul *et al*, 2008). Performance measures provide the information necessary for decision makers to plan, control and direct the activities of the organization. They also allow managers to measure performance, to signal and educate suppliers on the important dimensions of performance, and to direct improvement activities by identifying deviations from standards. Many well-known frameworks have been developed to aid in these goals, including the balanced scorecard (Kaplan and Norton, 2009).

**2.4 Critique of the literature review**

Public procurement process is understood to benefit citizens from getting value for their money, provision of quality services and on time provision of the same items and services. (Public Procurement and disposal act, 2005). These benefits have been evaluated in a number of studies however the mere adoption of public procurement process does not ensure superior performance of such organizations because of various challenges of translating public procurement process into a collaborative and integrative process capability (Ellram, 2011).

This affirms that most public entities adopting public procurement process may even suffer from delayed delivery of materials due to the tedious public procurement process. Leenders, (2009) has analyzed why some public entities successfully adopt public procurement process while others fail. Achieving public procurement process fit relies on planned choice and market characteristics. However, more research should be conducted on public procurement process and success on organization performance.

**III. RESEARCH METHODOLOGY**

**3.1 Research Design**

This study adopted a descriptive research design. It is appropriate because it is considered suitable for gathering qualitative information and generating appropriate conclusions with respect to research questions. (Mugenda and Mugenda, 2008). A multiple regression study which involves determination of magnitude and direction of relationship between

the aspects or procurement process and the performance of the County assembly as seen from the service delivery was considered as recommended by Mugenda and Mugenda (2008) for studies focusing on specific variables that need quantitative relationships to be determined.

**3.2 Sample Size and Sampling Technique**

For purpose of manageability, the study was not able to use all the employees in the procurement department of Mombasa County assembly as well as staff from other departments, members of County assembly and suppliers. As a result, the study used a selected representative sample of 10% of the target population as recommended by Mugenda&Mugenda (2008). This was obtained as shown in the table below.

**3.3 Data Collection**

The study used primary data which was obtained using structured and semi structured questionnaires seeking information from the respondents. This allowed for specific direction of response to the structured questions as well as a degree of freedom of response to the semi structured questions. The questionnaire used was based on five point Likert scale for easier analysis. This design of questionnaire is preferred by Kothari (2008) due to its objectivity and precision thus accuracy in analysis. The study used drop and pick method where the questionnaires were collected after three days from all respondents this allowed them time and privacy while responding to the questionnaire.

**IV. FINDINGS AND DISCUSSIONS**

**4.1 Findings**

The study used a standard multiple regression analysis to determine the quantitative relationship between each of the independent variables and the dependent variable. This was expressed using the multiple regression model  $Y = \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \theta$ .

The results were presented in tables below.

**Table 4.1 Model summary**

Model	R	R Square	Adjusted Square	R	Std. Error of the Estimate
1	.942	.938a	.936		.0063

From the model summary given in table 4.1 above it is clear that the adjacent  $R^2$  was 0.936 indicating that a combination of stakeholder integration, human resource skill level and suppliers management explained 93.6% of variations in public procurement processes. This is however; a model summary and more clarifications for each of the variables are given in anova and coefficient results in the following tables.

**Table 4.2 Anova**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	6.95172E2	97	5.5745E2	42.276	.009a
Residual	6.132E3	6	4365.225		
<b>Total</b>	<b>1.364E3</b>	<b>103</b>			

Table 4.2 above clarifies that the regression used 97 degrees of freedom and 6 residuals to come up with the multiple r figures given in table 4.7. The table also gives the significance of 0.009 which is lower than the required 0.05.

**Table 4.3 Coefficients**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
1	Beta	Std. Error	Beta		
(Constant)	0.76	0.27		14.06	0.03
Stake holder integration	0.64	0.01	0.65	1.58	0.03
Human resource skill level	0.51	0.03	0.53	0.93	0.08
Suppliers management	0.43	0.03	0.43	2.32	0.05
<b>Public procurement processes</b>	<b>0.66</b>	<b>0.02</b>	<b>0.67</b>	<b>1.61</b>	<b>0.09</b>

Table 4.3 above shows that there is a high effect of integration on organizational performance as well as a high effect of human resource skill level on organizational performance. The study however shows a weak effect of suppliers' management on organizational performance.

Based on multiple regression model of;  $Y = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \Theta$ . This now translates to  $Y = 0.75 + 0.64 x_1 + 0.51 x_2 + 0.43 x_3$  based on the table 4.3 above.

**V. CONCLUSION AND RECOMMENDATIONS**

**5.1 Conclusion**

The studies reviewed showed various aspects of the procurement process that would impact on the performance of the assembly such as the quality and skills of manpower, supplier management and stakeholder involvement. However, the studies did not give specific quantitative effects of these on the organizational performance. The study thus gave the quantitative relationship between these aspects and organizational performance.

The study showed that stakeholder integration, skill level of the human resource and supplier management have direct correlation with organizational performance such that organizational performance increase with each increment in the effectiveness of the factors. The study being quantitative also allowed for an internal comparison of the correlation of each independent variable with the others.

The study thus shows that stake holder integration in the procurement process has the highest correlation with organizational performance and should be encouraged across all organizations. It also shows that the skill level of the human resource is also a vital contributor to organizational performance thus organizations are encouraged to recruit high skilled human power and further invest in providing additional training.

**5.2 Recommendations**

M.C.A and other County assemblies as well as public institutions should first and foremost streamline their human resource procurement procedures and rules to have high skilled personnel recruited by adhering strictly to the recommended minimum qualifications during recruitments. Training of the workforce should therefore be used to add more skills to the already skilled human resource and align their skills to the jobs at hand.

The M.C.A and other County assemblies should also enhance stakeholder involvement in their procurement processes by allowing for more public participation in the process. The current system includes a lot of vital stake holders but increasing the public participation will ensure integration of all stake holders. This should be done noting that stake holder integration has the highest correlation to organizational performance.

Basing on the findings of this study, future scholars are advised to conduct the following studies:

A study should be conducted to determine the unique features of procurement in County assemblies that make supplier management have a weak correlation to organizational performance of the County assemblies while it has a strong correlation with organizational

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# Factors Affecting Foreign Direct Investment Decisions Among International Companies Investing In Kenya: A Case Study Of Coca Cola Bottlers Mombasa

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**Abstract-** Foreign Direct Investment (FDI) plays a crucial role to speed up the development and economic growth of a country. In particular, developing countries rely heavily on FDI to promote their economy as they face capital shortage for their development process. FDI not only brings in capitals and technology, but also skills into developing countries. And this end is to help the countries grow faster by satisfying the country's needs. The main aim of this study is to explore and determine the factors affecting foreign direct investment decisions among International companies investing in Kenya, find ways in which (FDI) foreign direct investment contributes to the development of Kenyan economy and finally to determine the strategies to attract and retain foreign direct investments in Kenya. The study analysed critically both the theoretical and empirical reviews of the available data before conducting the study to ensure the viability of the study.

The study adds to the discussion on a firm's economic rationale for FDI by analyzing to what extent decision-makers are influenced by their quest for legitimacy and their need to mitigate risk. The economically oriented FDI research addresses the economic rationale of foreign investments, and the institutional perspective helps to explain the extent to which these FDI decisions are influenced by the firm's striving for legitimacy and its quest for mitigating the uncertainty associated with investments in foreign markets. A descriptive research was used. These kinds of studies are means of discovering new meaning, describing what exists, its frequencies and the categorizing information. Stratified random sampling technique was used to select a sample size of 50 employees out of a total workforce of 200 employees from the various departments so as to enable the researcher get a fair representation of the target population. The study analysed critically both the theoretical and empirical reviews of the available data before conducting the study to ensure the viability of the study.

**Index Terms-** Foreign direct investment ,Order Processing Speed ,Official development assistance ,Cost Reduction

## I. INTRODUCTION

Traditionally, research on foreign direct investment (FDI) has focused on a Company's economic motives for international expansion, such as the attractiveness of markets (Caves 1971; Davidson 1980; Gripsrud and Benito 2005), the behavior of competitors (Knickerbocker 1973; Graham 1978), and productive efficiency (Brainard 1997; Markusen and Maskus

2002). More recently, researchers have started to draw on institutional theory to show that social influence factors also play an important role for FDI decisions (Henisz and Delios 2001; Guillen 2002). Although both streams of research provide valuable information on the factors that influence a firm's FDI decision, each stream sheds light on only a part of the picture.

To obtain a more fine-grained understanding of FDI decisions, in this study we combine and contrast central elements of the economic perspective and of the institutional perspective on FDI. A large body of research analyzes FDI from an economic perspective. Traditional FDI theory (e.g., Rugman 1986, or Caves 1971) predicts that firms will invest in foreign markets in order to generate rents by exploiting firm-specific capabilities (e.g., products and knowledge). Furthermore, FDI enables firms to strengthen their strategic position by gaining more favourable access to scarce resources like labour, knowledge etc. (Chen and Chen 1998). While manufacturing firms typically seek to exploit advantages in production costs and access to scarce resources, firms in other industries may be attracted by high rates of as yet unsaturated demand (Gripsrud and Benito 2005). Consequently, the attractiveness of the labour and product markets and market accessibility are economic factors that influence FDI.

## International Companies Investing in Kenya

In contrast to an economic approach, FDI research conducted from an institutional perspective has lagged behind. A few recent studies show that FDI decisions are also affected by the firms' inter-organizational relations with relevant peers. (Martin, Swaminathan, and Mitchell 1998) find that the relations between suppliers and domestic buyers, competitors, and non-competing suppliers have an impact on the occurrence and timing of foreign market entries. (Henisz and Delios 2001 and Guillen 2002) show that firms imitate the risky FDI decisions of peers in their industry or business group. These papers represent additions to economic explanations of FDI, since they clarify the ways in which international expansion moves are influenced either by a firm's inter-organizational relations within its domestic market, or more generally by the firm's embeddedness in a social context.

According to research in institutional theory, imitation of peers is not aimed at gaining economic rents, but at enhancing the firm's legitimacy and at decreasing the uncertainty associated with risky strategic decisions (Cyert and March 1963; DiMaggio and Powell 1983). We assume that both the economic and the institutional perspectives highlight important aspects of a firm's FDI decision. Therefore, we combine and compare the arguments

of these two perspectives both theoretically and empirically. However, the two perspectives share some common ground, since both perspectives account for the phenomenon of parallelism in firm behaviour. Under the economic perspective, firms that optimize independently are attracted by the economic rents a country's market offers, and several firms may follow the same allures. From the institutional perspective, the same mimetic FDI decisions might be caused by the firm's striving for legitimacy within its organizational field. To account for the described similarity in mimetic effects, we start our analysis by exploring those factors that we can easily attribute to either the economic or the institutional perspective. We then describe the common ground between both approaches. To test our hypotheses empirically, we examine German FDI in 21 former Warsaw Pact countries between 1990 and 2003. After the fall of communism in 1990, a whole set of markets opened up to foreign investors. Several of these markets offered cheap resources and unmet demands, so they seemed highly attractive for FDI. However, uncertainty about the viability of such investments was particularly high, because FDI by Western firms was virtually nonexistent in these markets under the communist regime. Although some information on the general political, economic, and social environment of these markets was probably available during the period of our study, it was very difficult to find individuals or entities with rich, first-hand experience.

The study adds to the discussion on a firm's economic rationale for FDI by analyzing to what extent decision-makers are influenced by their quest for legitimacy and their need to mitigate risk. While we do not attempt to provide a comprehensive view on FDI, the combination of economic and institutional arguments does make it possible for us to describe the different characteristics of the same strategic decision from two important perspectives. The economically oriented FDI research addresses the economic rationale of foreign investments, and the institutional perspective helps to explain the extent to which these FDI decisions are influenced by the firm's striving for legitimacy and its quest for mitigating the uncertainty associated with investments in foreign markets. Second, the paper shows that both the economic and the institutional perspectives on FDI explain the same empirical phenomenon of the parallel behaviour of firms. You find that in line with the respective theoretical perspective, the reasons for this parallel behaviour are either linked to an economic rationale or to an institutional rationale. The common ground between the two perspectives highlights the necessity to include both perspectives in any analysis of FDI decisions. Otherwise, the explanatory power of one of the perspectives may be overrated. Third, by combining a theoretical analysis with empirical tests we are able to provide preliminary evidence about the actual explanatory power of the economic and institutional triggers for FDI. Our results indicate that both approaches have a complementary share in explaining the FDI of German firms in Eastern European markets. For economic reasons, the attractiveness of labour markets is an especially important trigger for FDI. From the institutional perspective, prior FDI decisions by prestigious peers play an important role.

### Statement of problem

Kenya is currently under pressure to attract foreign investors to directly invest in major projects such as the LAPSET, Machakos city to name but a few that will help the country transform the country from a low income to a middle income country by 2030. The Jubilee government also wants to deliver on its manifesto by growing the economy by two digits to guarantee re-election come the year 2017. The growth in foreign direct investment (FDI) has been phenomenal in the last three decades. Prior to the recent economic and financial crisis, global FDI had risen to an all-time peak to reach \$1,833 billion in 2007 well above the previous time all high set in 2000. The production of goods and services by an estimated 79,000 multinational corporations and their 790,000 foreign affiliates continued to expand with their FDI stock exceeding \$15 trillion in 2007. Interpretation of these trends are commonly infused with much enthusiasm as growth is believed to be the single most important factor affecting poverty reduction and therefore FDI is central in achieving this objective.

Many developing countries have developed a renewed interest in FDI as a source of capital due to the decline in official development assistance (ODA). FDI usually represents a long-term commitment to the host country and can contribute significantly to gross fixed capital formation in developing countries. FDI has several advantages over other types of capital flows, in particular its greater stability and the fact that it would not create obligations for the host country. In addition to being a source of capital, FDI has other potential benefits to host countries which include technology transfer, new management skills, market know how and job creation. FDI can also be potentially harmful to host economies if results in resource exploitation, pollution, abuse of market power among other problems. Negative consequences of FDI can be avoided with proper regulation.

These real world trends have led to substantial recent interest various disciplines to empirically investigate the fundamental factors that drive the FDI behaviour. There are many theories and studies that have been conducted on FDI determinants. The different approaches do not necessarily replace each other but explain different aspects of the same phenomenon. All these studies point to the fact that no single theory can explain FDI drivers. Most of the studies rely on secondary data and therefore tend to be macro in nature. This study however takes a different approach and utilizes a firm survey data in order to explore the main FDI factors in Kenya. (King'ang'i, 2003) Kenya has had a long history with foreign firms. However over the years, Kenya lost its appeal to foreign firms a phenomenon that has continued to the present. In 2008, Kenya launched vision 2030 where it hopes to achieve global competitiveness and prosperity of the nation. This initiative has seen a renewed commitment to attract FDI to assist in the industrialization process.

The purpose of this study is to identify and analyse the factors affecting foreign Direct Investment decisions among International companies investing in Kenya. Most of FDI in Kenya is export oriented and market seeking. The most important FDI determinants are market size in Kenya as well as within the region, political and economic stability in both Kenya and its neighbours and bilateral trade agreements between Kenya and other countries. (Lemi, 2005). Although many studies have been

done in the area of FDI, a significant number of them are international, conducted in countries such as Saudi Arabia, Malaysia, (Kayonga, 2008 and Kurui, 2008). Those carried out in Kenya focus more on the contributions of FDI in economic development rather than the factors affecting foreign direct investment. This study therefore comes in to fill in the deficiencies in the previous research.

### **General Objective of the study**

The main objective of the study is to determine the factors affecting foreign direct investment decisions among international companies investing in Kenya.

### **Research Questions**

To help the researcher form informed conclusions, the study seeks to answer the following questions:

- i. How does resource allocation influence decision to invest in Kenya?
- ii. How do regulatory policies affect foreign direct investors deciding to invest in Kenya?
- iii. How has corruption interfered with foreign investors in their decision to invest in Kenya.
- iv. What are the contributions of technologies among Foreign Direct Investors on their decision to invest in the Kenyan economy?
- v. How has insecurity affected Foreign Direct Investors on their decision to invest in Kenya?

## **II. RELATED LITERATURE**

### **Theoretical review**

The researcher reviewed present theories and other studies which were carried out by different researchers both in Kenya and international in relation to foreign direct investments to form a strong basis for the study. All the relevant theories and studies were analysed and critiques were made.

### **Production Cycle Theory**

According to Dunning J.H (1993) theory of production cycle implies that there are four stages in the production cycle that is innovation, growth, maturity and decline. According to the theory of the production cycle, after the Second World War in Europe has increased demand for manufactured products like those produced in USA. Thus, American firms began to export, having the advantage of technology on international competitors. If in the first stage of the production cycle, manufacturers have an advantage by possessing new technologies, as the product develops also the technology becomes known. Manufacturers will standardize the product, but there will be companies that you will copy it. Thereby, European firms have started imitating American products that U.S. firms were exporting to these countries. US companies were forced to perform production facilities on the local markets to maintain their market shares in those areas.

### **The Theory of Exchange Rates on Imperfect Capital Markets**

According to Itagaki (1981) and Cushman (1985) analyzed the influence of uncertainty as a factor of FDI. In the only empirical analysis made so far, Cushman shows that real

exchange rate increase stimulated FDI made by USD, while a foreign currency appreciation has reduced American FDI. Cushman concludes that the dollar appreciation has led to a reduction in U.S. FDI by 25%. However, currency risk rate theory cannot explain simultaneous foreign direct investment between countries with different currencies. The sustainers argue that such investments are made in different times, but there are enough cases that contradict these claims.

### **The Internalization Theory**

This theory tries to explain the growth of transnational companies and their motivations for achieving foreign direct investment. The theory was developed by (Buckley and Casson 1976) and then by (Hennart,1982 and Casson, in 1983). In his Doctoral Dissertation, Hymer identified two major determinants of FDI. One was the removal of competition. The other was the advantages which some firms possess in a particular activity Buckley and Casson, who founded the theory demonstrates that transnational companies are organizing their internal activities so as to develop specific advantages, which then to be exploited. Internalization theory is considered very important also by Dunning, who uses it in the eclectic theory, but also argues that this explains only part of FDI flows. Hennart Hymer is the author of the concept of firm-specific advantages and demonstrates that FDI take place only if the benefits of exploiting firm-specific advantages outweigh the relative costs of the operations abroad. According to (Hymer 1976) the MNE appears due to the market imperfection that leads to a divergence from perfect competition in the final product market. Hymer has discussed the problem of information cost for foreign firms respected to local firms, different treatment of government, currency risk.

### **The eclectic paradigm of Dunning**

This theory developed by Prof. Dunning is a mixture of three different theories of direct investments (O-L-I) with the intention to provide a holistic frame work of identifying and evaluating of the factors influencing the initial act of foreign production by an enterprise and the growth of such production (Cyert and March 1963).The word eclectic was used to convey the idea that a full explanation of the transitional activities of enterprise needs to draw upon several strands of economic theory; and that foreign direct investments is just one of a number of possible channels of international economic involvement, each of which is determined by a number of common factors.

### **Empirical review**

According to Nyamwange (2007) Foreign direct investments in Kenya, the objectives of the study were to identify the key factors that influence FDI decisions in Kenya and to explore the empirical relationship between FDI and economic growth in Kenya. The findings of the study indicated that the main determinants of FDI in Kenya are market size (proxied by GDP), stable macroeconomic policies and a level of human capital that is tolerable by investors. The not significant relationship of human capital to overall economic growth suggests that there is a shortage of skilled labour in the Kenya (DiMaggio and Powell 1983). The researcher concluded that FDI in Kenya induces the nation's economic growth. Although the

overall effect of FDI on the whole economy may not be significant, the components of FDI positively affect economic growth and therefore FDI needs to be encouraged. Secondly greater policy sensitivity towards the openness of the economy is needed so that the traded commodities will be beneficial to the economy as a whole. There is need for guided training and integration of the human resources of the country to enable them to contribute positively to economic growth wherever they find themselves employed either with foreign or with indigenous firms and whichever sector they are in. The need for training high quality personnel in the country cannot be overemphasized. According to Karim (2012) Factors affecting foreign direct investments in Malaysia. Karim examined the factors affecting foreign. The study seeks to examine the effects of market demand, labor productivity, socio-economic development and provision of industrial estates on foreign direct investment (FDI) across 13 states and 1 federal territory in Malaysia. The researcher concluded that five explanatory variables were very in an estimated FDI model and all were found significant in influencing FDI inflows in the expected positive direction.

Among these variables, the elasticity of FDI inflows with respect to labor productivity and GDP are high. Raising labor productivity in a state appears the most cost-effective approach for the state government to increase FDI inflows in the short to medium term. In addition, focusing infrastructural development more sharply through industrial estates is needed. In order to increase market demand for output in a state, the development policy of the Malaysian Government is to improve the capability of the state citizens to purchase more consumption goods and services in their state market. To achieve this, narrowing the gaps in development indicators, particularly per capita GDP, between groups of societies and between rural and urban areas in the state is an important strategy. Individuals themselves need to make more efforts towards improving their work performance in economy so that they can improve their living standards.

According to Nourbakhshian et al (2012), the contribution of foreign direct investment into home country's development. The study seeks to examine the benefits of foreign direct investment, the impacts of foreign direct investments on economic growth and there impact on international trade. From

the findings of the study the researcher conclude that that FDI has a positive impact on the economic growth in the receiving countries. They showed that many countries like China, India and Uk use FDI as a advanced business for making economic growth. FDI can be conspicuous source for productivity growth and swifter transformation process in transition country. On the other hand, sometimes FDI theoretically cause both positive and negative spillover effects to the host country.

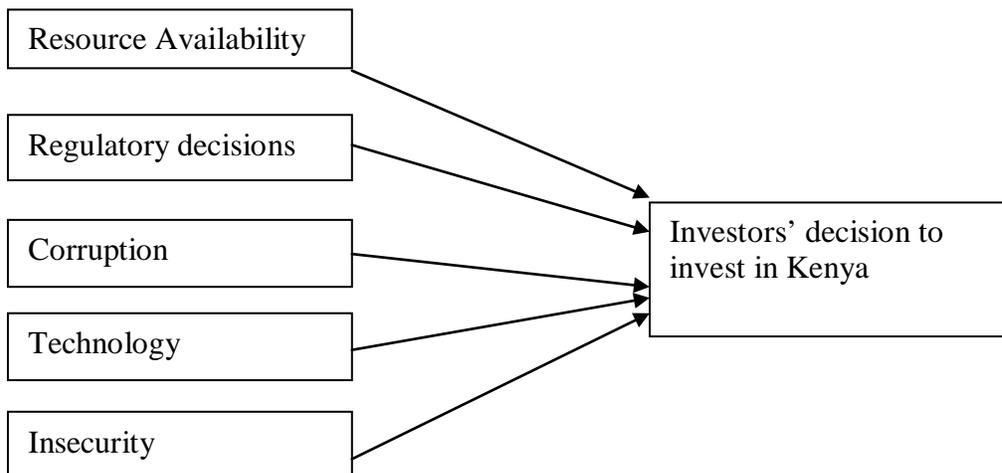
In general ,a multinational companys decision to develop production to another is driven by lower cost and higher deficiency consideration. In the host countries, the benefit of FDI are not limited to promote use of its sources, but also branch from the introduction of new processes to domestic market, learning-by-observing, networks, training of the labour force, and other spillovers and externalities. Due to the "growth - development" benefits FDI assumes to conduct, different countries and places have followed active policies to attract FDI. Most countries, including both developed and various nations which named as emerging nations, have organized investment agencies, and have strategic that include both fascial and financial incentives to attract FDI as well as other that pursue to improve the local regulatory environment and the cost of doing business. In many empirical evidences reveals that FDI plays a key role in contributing to economic growth.

However, the level of development of local financial markets is crucial for these positive impacts to be absolved, and to the best of our apprehension this has not been shown before. Hermes et al (2003) foreign direct investment, financial development and economic growth argue that foreign direct investment may help to raise economic growth in recipient countries but the contribution foreign direct investment can make may strongly depend on the circumstances in the recipient countries. The authers futher argues that the development of the financial system of the recipient country is an important precondition for foreign direct investment to have a positive impact on economic growth and a more developed financial system positively contributes to the process of technological diffusion associated with foreign direct investment.

**Conceptual framework**

**Independent Variables**

**Dependent Variable**



### **Resource Availability**

Countries that are endowed with natural resources would receive more FDI. Very few studies on the determinants of FDI control for natural resource availability (except Gastanaga et al., 1998; Morisset, 2000 and Noorbakhsh et al., 2001). The omission of a measure of natural resources from the estimation, especially for African countries case, may cause the estimates to be biased (Asiedu, 2002). We therefore include the share of minerals and oil in total exports to capture the availability of natural resource endowments. This measure of natural resources has been employed in several studies, including Warner and Sachs (1995), Asiedu and Esfahani (2001) and Asiedu (2002) among others and was available from World Development Indicators 2003.

### **Regulatory Decision**

The Restrictive Trade govern Kenya's competition framework. The Commission lacks the capacity to implement the legislation fully. Practices that seek to block entry into production and that discriminate against buyers are illegal. This puts an unnecessary burden on investors and the Commission. Antitrust legislation governs incoming foreign investment through acquisitions, mergers, or takeovers by antitrust legislation that prohibits restrictive and predatory practices, which prevent the establishment of competitive markets. Antitrust legislation also seeks to reduce the concentration of economic power by controlling monopolies, mergers, and takeovers of enterprises. Kenyan firms carry the heaviest taxation burden in East Africa. This additional burden has raised the cost of doing business in the region's biggest economy and reduced the competitiveness of its firms. Kenyan firms have to contend with different tax payments cutting across different tax regimes, thus placing Kenya as one of the countries with the most complicated tax system in this part of the world.

### **Corruption**

The current coalition government inherited a problem of grand-scale economic and political corruption. In 2003, the Kibaki government enacted the Anti-Corruption and Economic Crimes Act and the Public Officers Ethics Act, setting rules for transparency and accountability, and defining graft and abuse of office. A Public Procurement and Disposal Bill became law in 2005. It establishes a procurement commission to oversee all procurement matters but has proven ineffective in limiting abuse by public officials. Large public procurement programs and military procurement have been at the centre of a number of corruption scandals in recent years. It is a standard hypothesis that openness promotes FDI (Hufbauer et al. 1994). In the literature, the ratio of trade to GDP is often used as a measure of openness of a country and is also often interpreted as a measure of trade restrictions. This proxy is also important for foreign direct investors who are motivated by the export market. Empirical evidences (Jun and Singh, 1996) exist to back up the hypothesis that higher levels of exports lead to higher FDI inflows. We therefore include Trade/GDP in the regression to examine the impact of openness on FDI.

### **Technology**

Foreign direct investors are also concerned with the quality of the labour force in addition to its cost. In fact the cost advantages accrued by lower wages in developing nations can well be mitigated by lowly skilled workers. A more educated labor force can learn and adopt new technology faster and is generally more productive. Higher level of human capital is a good indicator of the availability of skilled workers, which can significantly boost the locational advantage of a country Root and Ahmed (1979), Schneider and Frey (1985), Borensztein et al, (1998), Noorbakhsh et al. (2001) and Asiedu (2002) found that the level of human capital is a significant determinant of the locational advantage of a host country and plays a key role in attracting FDI.

### **Insecurity**

Insecurity also remains a serious problem. Kenya suffered major terrorist attacks in 1998 and 2002. On August 7, 1998, bombs exploded at the U.S. Embassies in Nairobi and Dar es Salaam, Tanzania, killing over 250 and wounding more than 5,000 people. A suicide bomber killed 15 people in an Israeli-owned Mombasa hotel in November 2002. The U.S. maintains a travel warning for Kenya due to the threat of terrorism and violent crime. The shaky situation in neighbouring Somalia has heightened security concerns at a time when Kenya has yet to enact appropriate anti-terrorism legislation.. The violence dissuaded both tourists and potential investors from coming to Kenya. Buyers stopped considering Kenya, resulting in several factories closing. An official government investigation, the Waki Commission, reportedly names several prominent Kenyan politicians as having instigated much of the violence. Political instability and the frequent occurrences of disorder 'create an unfavorable business climate which seriously erodes the risk-averse foreign investors' confidence in the local investment climate and thereby repels FDI away' (Schneider and Frey 1985).

### **Decision to invest in Kenya**

The dependent variable is the end results of the whole process after the implementation of the independent variables. This variable includes foreign investor's decision in investing in Kenya which at the end results into Economic Growth, Productivity Growth, Improved living standards and Socio-economic development. These variables are examined in terms of the impact on growth, productivity of the work force, living standards of the local people and the social – economic development of the host country. Warner and Sachs (1995).

## **METHODOLOGY**

### **Research Design**

This research is a case study of Coca – Cola Company limited Mombasa. A descriptive research was used. According to Shields et al (2006) a descriptive research is one that is concerned with the description of data and characteristic about a population. These kinds of studies are means of discovering new meaning, describing what exists, its frequencies and the categorizing information. The type of research carried out is on, factors affecting foreign direct investment decisions among International Companies investing in Kenya. The researcher used this design due to its flexibility and it also minimizes biasness in

the data collection and analysis. It also gives a much reliable data and credible findings hence better recommendations of the study be made.

**Targeted Population**

The target population includes all the 400 employees of the Coca – Cola company Limited Mombasa. These employees are under various departments namely; administration, Human resource, Marketing, Auditing and procurement.

Simple random sampling technique was used to select a sample size of 100 employees out of a total workforce of 400 employees from the various departments so as to enable the researcher to get a fair representation of the target population.

Respondents were arranged into clusters according to their departments, and sample of respondents were picked randomly from each stratum considering the population in each department. It’s important because it’s possible to select randomly when no single list of population members exists.

**Sampling Techniques, Design, Size and Procedures**

**Table 3.1 showing sample size**

Departments	No. of employees	Sample size	% sample size
Administration	14	4	29%
Marketing	300	60	20%
Procurement	60	20	33%
Human Resource	6	6	100%
Auditing	20	10	50%
<b>Totals</b>	<b>400</b>	<b>100</b>	<b>25%</b>

**Data Collection**

According to Annum (2014) data collection instruments are means through which a researcher uses to gather information (data). These instruments include questionnaires, desk review, observation and interviews.

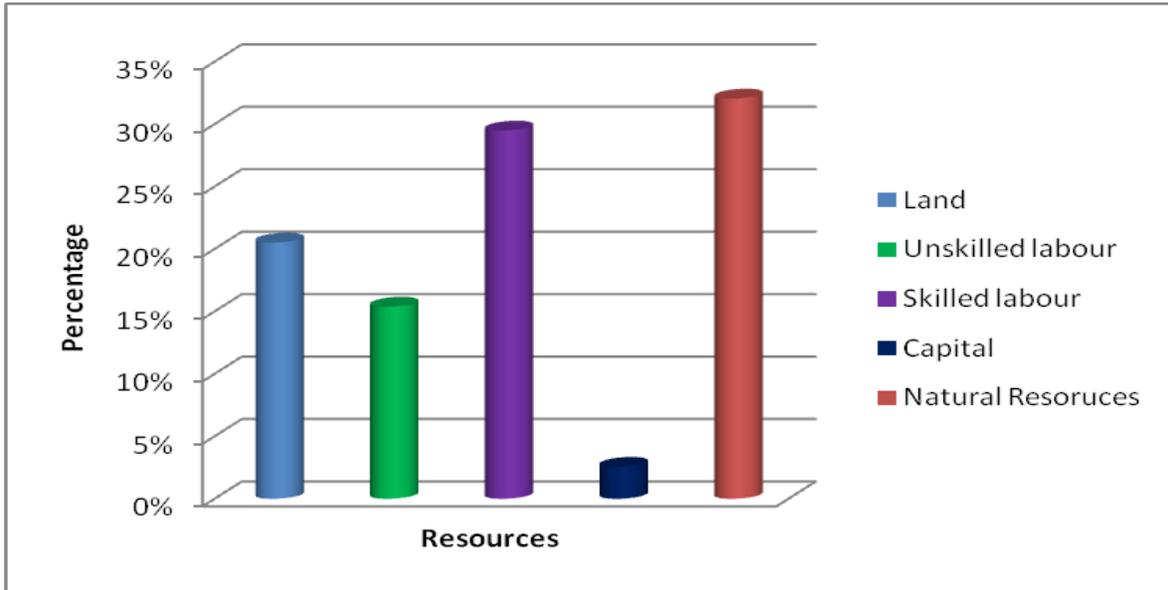
**III. FINDINGS OF THE STUDY**

**Table 4.4 Effect of resource availability on foreign investment decision**

Under this objective, availability of resources affects the foreign direct investment decision as shown in table 4.4 below.

Input Resources	Response rate	Percentage
Land	16	21%
Unskilled labour	12	15%
Skilled labour	23	29%
Capital	2	3%
Natural Resoruces	25	32%
<b>Total</b>	<b>78</b>	<b>100%</b>

**Figure 4.4 showing the effects of resource availability on the FDI decision.**



**Findings**

The responses in table 4.5 indicates that 32% were for availability of natural resources, 29% were for skilled labour, 21% were for land, 15% were for unskilled labour and 3% were for capital.

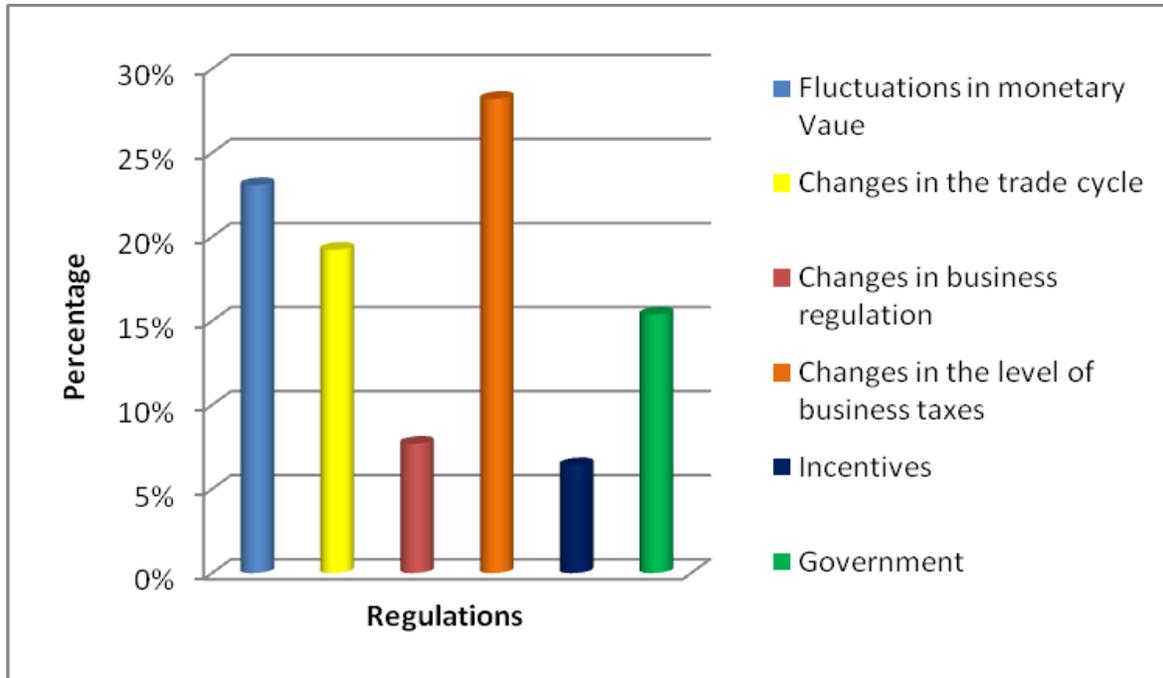
**Analysis**

The results shows that availability of natural resources highly affect positively the Foreign direct investors decision. It is also evident that skilled labour and land also contribute much in the investors decision while capital affects list.

**Table 4.5. Effect regulatory decisions on foreign direct investors**

Regulation	Response rate	Percentage
Fluctuations in monetary Vaue	18	23%
Changes in the trade cycle	15	19%
Changes in business regulation	6	8%
Changes in the level of business taxes	22	28%
Incentives	5	6%
Government	12	15%
<b>Total</b>	<b>78</b>	<b>100%</b>

**Figure 4.5. Effect regulatory decisions on foreign direct investors**



**Findings**

The researcher noted that 28% of the responses were for change in business taxes highly affect the decision of the investors, 23% were for fluctuation in the monitory value of the host country, 19% were for change in the trade cycle in the host country, 15% were change of the government, 8% were for change of business regulation and 6% were for business incentives from the government.

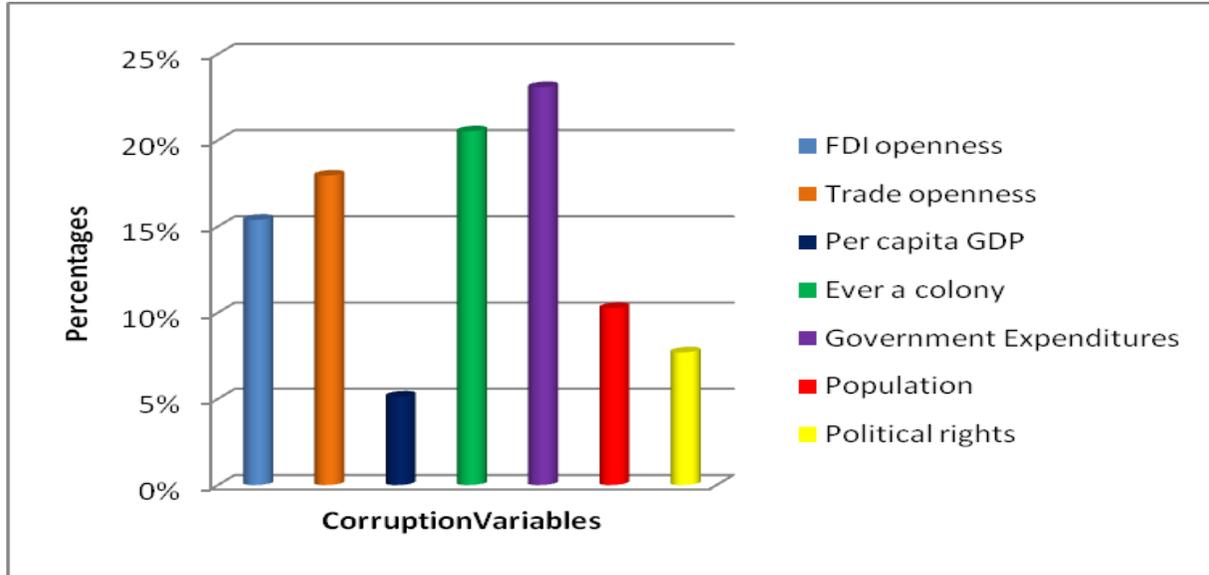
**Analysis**

The decision of foreign direct investors is a subject to several determinants. The result above it is evident that changes in the level of business taxes highly affect decision of the investors. Business incentives offered by the governments is a short term policy therefore it has little effect on the decision of the investors.

**4.6 Effects of corruption on foreign direct investment and the economic growth**

Corruption	Response rate	Percentage
FDI opennss	12	15%
Trade opennss	14	18%
Per capita GDP	4	5%
Ever a colony	16	21%
Government Expenditures	18	23%
Population	8	10%
Political rights	6	8%
<b>Total</b>	<b>78</b>	<b>100%</b>

**4.6 Effects of corruption on foreign direct investment and the economic growth**



**Finding**

The responses in table and figure 4.6 above indicates that government expenditures at 23% 21% were forever a colony, 18% were for trade openness, 15% were for foreign direct investment openness, 10% were for population, 8% were for Political rights and 5% were for per capita GDP.

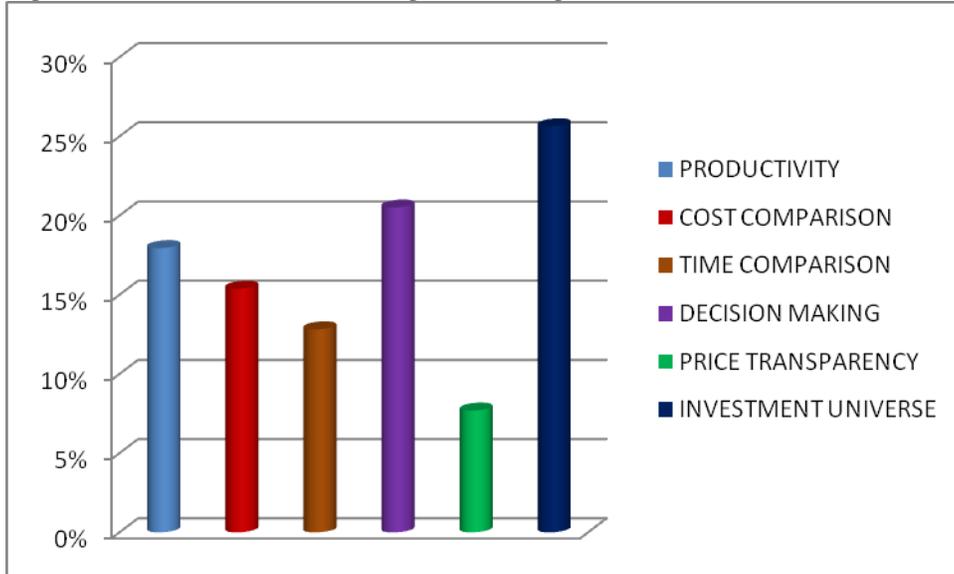
**Analysis**

Corruption is an ethical based on the believes and moral value of the Country. From the result which shows that governmental expenditure is a key corruption indicator of the country’s foreign direct investments effects. The least indication is from the per capita of the host country is not closely related to corruption.

**4.7 Contribution of technologies on Foreign Direct Investors on their decision**

Effects of technology	Response rate	Percentage
Productivity	14	18%
Cost Comparison	12	15%
Time Comparison	10	13%
Decision Making	16	21%
Price Transparency	6	8%
Investment Universe	20	26%
<b>Total</b>	<b>78</b>	<b>100%</b>

**Figure 4.7 Contribution of technologies on Foreign Direct Investors on their decision**



**Findings**

The results shown in table and figure 4.7 clearly shows that investment universe at 26% 21% were for decision making, 18% were for productivity of the company, 15% were for cost comparison, 13% were for time comparison as a result of technology and 8% were for price transparency.

**Analysis**

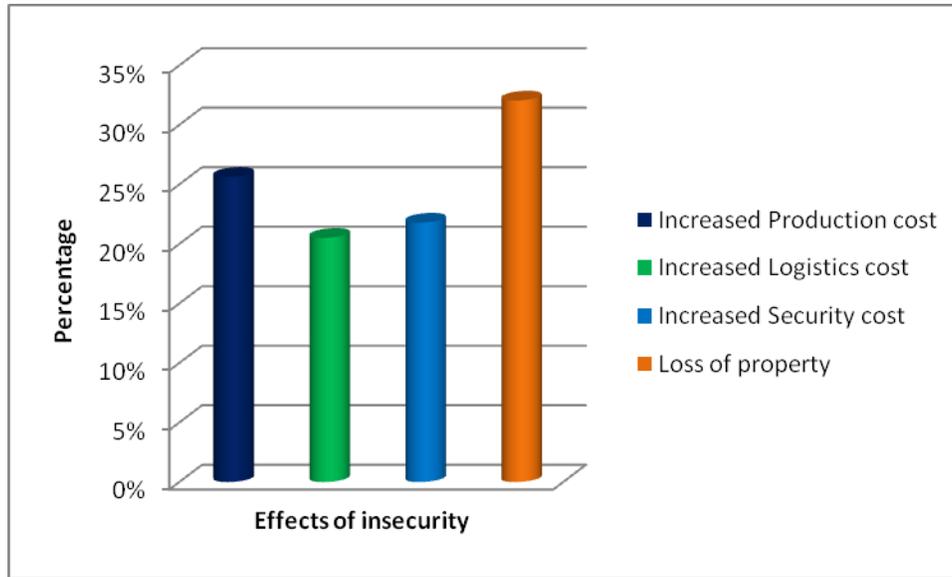
Technology highly affects positively the decision making of the foreign direct investors. The results indicate that investment universe is as a result of technology that boosts the level of decision making. It further indicated that price transparency is affected less by the technology.

**4.8 Effects of terrorism (security) on foreign investors on the decision**

**Table 4.8 Effects of terrorism (security) on foreign investors on the decision**

Insecurity	Response rate	Percentage
Increased Production cost	20	26%
Increased Logistics cost	16	21%
Increased Security cost	17	22%
Loss of property	25	32%
Total	78	100%

**Figure 4.8 Effects of terrorism (security) on foreign investors on the decision**



**Findings**

From the results in table and figure 4.8 above shows that 32% of the responses were for insecurity increases the loss of property of the investors, 26% of the response were for increased production cost, 22% were for increased security cost and 21% were for increased logistic cost as a result of destruction of transport networks

**Analysis**

Insecurity is a risk factor which investors the world over dread. For investors, insecurity in any country is considered a bad omen for business. It sends warning signal to investors to take their investible fund to another country where there is adequate or a semblance of security. Its clear that investors think of the cost involved in investing in unsecure country.

**Summary of the findings**

There was a response rate of 78%. From the various departments represented, the responses were as follows; 2 (3%) from administration, 60 (77%) from production 8(10%) from procurement, 2(3%) from Human resources and the remaining 6 (8%) from auditing department. This shows that a majority of responses were from production department which is the largest department in the organization.

The highest level of education was as ensuing; 5 respondents (6%) primary, 15 (19%) secondary, 28 (36%) college, 22 (28%) bachelors degree, and only 1 (8%) had a masters degree. This means that 10% of the respondents had college education and above. Thus the information obtained from them can be considered reliable as they were well informed about their economic environment and business issues.

The results in table 4.5 indicates that 32% of the were for availability of natural resources, 29% were for skilled labour, 21% were for land, 15% were for unskilled labour and 3% were for capital. Which implies that availability of resources affects positively the decision made by foreign direct investors.

The researcher noted that 28% of the responses were for change in business taxes highly affect the decision of the investors, 23% were for fluctuation in the monetary value of the host country, 19% were for change in the trade cycle in the host country, 15% were change of the government, 8% were for change of business regulation and 6% were for business incentives from the government. The result implies that changes of regulation in the host country affect negatively the decision made by the investors.

The responses in table and figure 4.6 above indicates that government expenditures at 23% 21% were forever a colony, 18% were for trade openness, 15% were for foreign direct investment openness, 10% were for population, 8% were for Political rights and 5% were for per capita GDP.

The results in relation to the object on technology shows clearly that investment universe at 26% 21% were for decision making, 18% were for productivity of the company, 15% were for cost comparison, 13% were for time comparison as a result of technology and 8% were for price transparency. Availability of technology as a resource in the host country affects positively the decision of foreign direct investment of the investors.

Finally the results of the objective on the insecurity of the host country shows that 32% of the responses were for insecurity increases the loss of property of the investors, 26% of the response were for increased production cost, 22% were for increased security cost and 21% were for increased logistic cost as a result of destruction of transport networks. This implies that it is expensive to run business in unsecured places like Somalia therefore insecurity of the country affects negatively the decision to be taken by investors

**IV. CONCLUSION AND RECOMMENDATIONS**

**Conclusions**

In conclusion, the study showed that there are many factors that affect foreign direct investment decisions. However, the availability of resources, security of a location, government and

other regulations, technology and corruption were found to play a major role in the decision making process of international firms on whether to invest in Kenya.

#### 5.4 Recommendations for Policy

The findings of this study have revealed that regulations, corruption, technology and security are important to international firms when considering in Kenya. The national government should therefore formulate good policies and legislations that ensure that Kenya is secure; they are strict and discourage corruption e.g. not interfering with the mandate of the EACC, encourage the advancement of technology and encourage international firms to invest in Kenya.

#### Suggestions for Further Study

The study's main focus was to on the factors affecting foreign direct investment decisions among international companies investing in Kenya. However, further studies may be conducted to establish which of these factors is the most important of them all.

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# Effects of Strategic Planning on Organizational Growth. (A Case Study of Kenya Medical Research Institute, Kemri)

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**Abstract-** This study's main objective was to determine the effects of strategic planning activities on organizational growth. Issues had been raised by employees that the planning process tended to be inflexible and rigid since it operated in changing environment and poor adaptation to changing environment usually affected organization adversely. They perceived strategic planning process being unrealistic separated with actions which hindered growth, thus strategies not linked with actions. The Researcher in the study therefore sought to analyze the effects of strategic planning on organization growth. The specific objectives of the study was to establish the effect of setting objectives on organization growth ,to assess the effect of budgetary allocations on organization growth, to determine the effect of organization structure on organization growth and lastly to analyze the effect of performance review on organization growth. Descriptive research design was used which included questionnaires to be distributed and filled with various top managers, heads of department, middle level managers and general staff members of KEMRI. Target population in this research was Kenya Medical and Research Institute Management. The target population was divided into various management groups including Heads of departments, middle level managers and general staff members. Stratified random sampling method was used. The target population was two hundred employees. Stratified sampling method was used to draw the Sample size of 50 employees and data analyzed by use of Spss.

The findings of the study revealed that strategic planning if well implemented in the organization is effective towards growth. Strategic planning was appropriate, suitable, and reasonable and accepted to the organization. It clearly indicated that strategic planning exist at KEMRI and helped the organization evaluate its business by identifying its long term goals, objectives, organized workforce, monitor performance and allocating resources thus enhancing performance in terms of growth. The researcher recommendations are that set objectives be clear, precise and measurable, organizations to seek more funds which should be directed to research instead of administration, create structures that enable individual teams deal with specifications, Performance review process should enable the actual performance be easily measured and reviewed and in future KEMRI should strive to attain ISO standards to support continuing improvement.

**Index Terms-** Strategic planning, strategic management Performance review ,Organization growth

## I. INTRODUCTION

### Background of the Study

Most firms desire growth in order to prosper and not just to survive. Organizational growth, however, means different things to different organizations. Indeed, there are many parameters a company can select to measure its growth. The most meaningful yardstick is one that shows progress with respect to an organization's stated goals. The ultimate goal of most companies is profit, so net profit, revenue, and other financial data are often utilized as "bottom-line" indications of growth. Other business owners, meanwhile, may use sales figures, number of employees, physical expansion, or other criteria to judge organizational growth. Many firms desire growth because it is seen generally as a sign of success, progress. Organizational growth is, in fact, used as one indicator of effectiveness for small and large businesses and is a fundamental concern of many practicing managers. (Cole,2002)

Ultimately, success and growth of an organization will be gauged by how well a firm does relative to the goals it has set for itself. Strategic planning is a key driver of organizational growth, Since it has to emerge as a strategic business partner helping the top management build an organization that is good not just for today, but for tomorrow and beyond. It is now working with the top management to propel the organization forward. Strategic planning should be reviewed and we stopped looking at what is happening in other strategies and start looking at best Strategic planning practices in large corporates. (Crosby, 1999).

Caplow(2009) States that Problems encountered with organization growth are that business owners seeking to guide their organizations through periods of growth, whether that growth is dramatic or incremental often encounter difficulties. After all, when a firm is small in size, the entrepreneur who founded it and usually serves as its primary strategic and operational leaders can often easily direct and monitor the various aspects of daily business. In such environments, adds that the small business owner can also "understand a larger proportion of the relationships subordinates have with each other and with outsiders. Organizational growth, however, brings with it an inevitable dilution of that "hands-on" capability, while the complexity of various organizational tasks simultaneously increases. "As the organization grows," said Caplow, "control becomes more complex by the mere accretion of numbers. There are ways of reducing the complexity by delegating responsibility.

According to Crosby (1999), organizational growth also triggers an almost inevitable "diminution of consensus about organizational goals." He attributed this "in part to the inherent difficulty of getting a larger number of people who know each other less well to agree about anything, in part to the importation of new people and ideas, but mostly to the brute fact that as an organization grows, its relationships to its members and to the environment necessarily change.

Caplow,(2009) points out that such growth can be particularly disorienting for employee and owner alike: "often the people involved may not realize that anything significant has occurred until they discover by experience that their familiar procedures no longer work and that their familiar routines have been bizarrely transformed .Business owners, then, face a dizzying array of organizational elements that have to be revised in accordance with changing realities. Maintaining effective methods of communications with and between employees and departments, for example, become ever more important as the firm grows. Similarly, good strategic planning practices have to be implemented and maintained. Establishing and improving standard practices is often a key element of organizational growth as well. Indeed, a large business that undergoes a significant burst of growth will find its operations transformed in any number of ways. And often, it will be the owner's advance strategic planning and management skills that will determine whether that growth is sustained, or whether internal constraints rein in that growth prematurely.

Strategic planning has been defined as the process of formulating, implementing and evaluating business strategies to achieve future objectives. Formal Strategic Planning began in the 1950's in the United States of America with leading authorities being Drucker.(Drucker,1970). Ansoff (2007) viewed strategy planning as the common thread in an Organization's business growth and the product scope of an organization. All managers are involved in planning but the nature of policies and plans set out by supervisors will vary with each manager's authority. While senior executives plan the direction of the organization, managers at various levels prepare plans for their own section which are part of the overall aims of the organization. Strategic planning involves selecting enterprise goals and department objectives, then finding ways of achieving them. Plans depend upon the existence of alternatives and decisions have to be made regarding what to do, how to do it, when to do it and by whom it is to be done. A plan is a pre determined course of action which helps to provide purpose and direction for members of an organization. Strategic planning are general and take place at a higher level in the organization and usually have a longer time horizon ranging from three to five years or more with annual updates when need be. (Kreither,2006).

To develop a strategic plan, the plan should contain statement of organization mission and goals, strategies for obtaining and utilizing the necessary technological, marketing, and financial and human resources to achieve organization goals. Strategies for manufacturing process and conducting research and development and utilizing organization and employee competencies. The evolution of the field of strategic planning since its inception has been impressive. From its "humble" beginnings as the limited content of a capstone general management course in the business school curriculum, strategic

management is now a firmly established field in the study of business and organizations. During a relatively short period of time, this field has witnessed a significant growth on organizations. (Barney, 2014; Wenefelt,2004).

Therefore it should be noted that organization growth are marked by either rapid increases in revenues, company shares, profitability and prospects of it to sustain itself in future. Organization growth has its basis to a larger extend on strategic planning of the organization. It's with this respect that strategic planning should be employed by organization to enhance their growth.(Cole, 2002)

## **KEMRI.**

The Kenya Medical Research Institute (KEMRI) is a state corporation established through the Science and Technology (Amendment) Act of 1979, as the national body responsible for carrying out health research in Kenya. Since its inception, KEMRI has developed a critical mass of scientists and technical personnel, to enable it mount a competitive research infrastructure to rank as a leading centre of excellence in health research both in Africa as well as globally.

KEMRI Vision is to be a leading centre of excellence in research for health and its mission is to improve human health and quality of life through research, capacity building, innovation and service delivery. KEMRI has a motto that is to be In Search of Better Health towards the realization of the above stated mission.

The core values of the institute are Purity, uphold purity/sanctity of life. Innovativeness, to be committed to promoting and supporting creativity and innovation. Customer focus, value customers, and we endeavor to be customer focused. Teamwork, believing there is strength in teamwork and therefore, encourages team spirit in what we do. Uprightness/Integrity, upholding zero tolerance to corruption. Respect & fairness, upholding the philosophy of respect and fairness to all and finally Excellence, committed to excellence and highest standards of professionalism.

KEMRI mandates is to carry out research in human health, cooperate with other research organizations and institutions of higher learning on matters of relevant research and training, work with other research bodies within and outside Kenya carrying out similar research, cooperate with the Ministry of Public Health and Sanitation, the Ministry of Medical Services, the National Council for Science and Technology(NCST) and the Medical Sciences Advisory Research Committee in matters pertaining to research policies and priorities and lastly to do all things as appear to be necessary, describe or expedient to carry out its functions.

KEMRI has a service charter that aims to highlight the role of the Institute, promotes its corporate image. KEMRI promotes public awareness and services as per specifications. It responds to all matters promptly and reply to correspondence of all nature within a week unless specified otherwise. They uphold high standards of professionalism in service delivery and zero tolerance to corruption. Their performance is measured through quarterly and annual performance reviews; Act of feedback and comments provided by clients and lastly, review of service charter every three years or earlier as necessitated. By implementing of this Charter all staff members of KEMRI work

collectively towards the implementation of this charter. All departmental heads are responsible for all its implementation and monitoring. The public relations office responsible for monitoring the levels of compliance with Charter. website: [Http://www.kemri.co.ke](http://www.kemri.co.ke)

## 1.2 Statement of the Problem

There has been scarce research on whether parastatals apply strategic planning on their management, (Brendan, 2008). This is partly due to the fact that less attention on quality of services being provided by government bodies. This trend changed due to government refocusing its effort on improvement of public services by implanting strategic planning at their organizations. However, despite claims relating to improvement of public sector through strategic planning implementation, concern has been raised that not all organizations attempting to develop strategic plans are pleased with the process. It observes also that the executives implementing the planning strategies forgot to match its plans with the monetary resources which had to be factored in their organization which hindered growth. (Stonner, 2008).

Issues have been raised by employees that the planning process tended to be inflexible and rigid since it operated in changing environment and poor adaptation to changing environment usually affect organization adversely. They perceive strategic planning process being unrealistic separated with actions which hindered growth, thus strategies not being linked with actions. (Brendan, 2008)

This study sought to establish whether planning strategies were linked with actions in government agencies. The study explored ways in which KEMRI adapted to turbulence environment, questions of how strategic plans at KEMRI are flexible, were addressed and highlighted the role of heads of department that had direct link at planning and implementation of the strategies set. The study therefore sought to identify the effects of strategic planning on organization growth.

## Objectives of this Study

### General Objective

The main objective of this study was to determine the effects of strategic planning activities on organizational growth.

### Specific Objectives.

The specific objectives of this study were:-

1. To establish the effects of setting objectives on organization growth.
2. To assess the effects of budgetary allocations on organization growth.
3. To determine the effects of organization structure on organization growth.
4. To analyze the effects of performance review on organization growth.

## II. RELATED LITERATURE

### Theoretical framework

#### Strategic planning

Strategic planning was about success and failure, about the ability to plan wars and win them; big mergers perhaps the most visible sign of strategic planning can transform the performance

of an organization, make fortunes for shareholders or change the structure of an industry (Scholes, 2002). Ineffective strategic planning can bankrupt companies and win careers of chief executives thus hindering organization growth. Appleby (1994) defines a strategic plan as deciding on major organizational goals and guidelines or policies used in achieving those goals. This planning relies on an unpredicted long term forecast from senior levels of the organization.

According to Campbell (1999) and Thompson and Stickland (2007), a strategic plan is a process that involves assessment of treats and opportunities of an organization, determining weakness and strengths in changing environment. They continue saying that a strategy is laid down to cope with the problem at hand, considering the goals, objectives of the organization. They further defines strategic planning as management tool that continually and systematically evaluate a business, identify its long-term goals and quantifiable objectives, develops a plan to implement, monitor performance, allocated resources, redefine the plan where need be, to ensure the organizational members work towards the defined goals in changing environment. Torok (1997), observes that strategic plan should ask the questions; Why do organizations exists, what it does, where it should go and how it is going to get there. Torok (1997) adds that a strategic plan should encompass, a vision, mission and organizational values. A vision is an insight into the long-term future, which should be short, understood by everyone, describes a static stage. A mission is the route followed to achieve a vision.

Appleby (1994), continues to define a mission as an organization clear objectives depicting its activities hence a narrow purpose. Campbell (1999), further classifies strategic planning into three levels namely corporate, business and functional, which are rated according to time, scope, resources and area. Corporate is the highest level with a span of five to ten years and clearly defines the area of organizational operation and the overall strategic direction. Business is the mid level with a three to five years span involving entry exit guidelines. These strategies not only involve creating of effective and efficient practices and procedures but also suitability and cost effectiveness of this program. The lowest level is the functional level which is short term ranging a year or less and involves entry, exit, and procedures. This stage involves day to day implementation of the program.

Bennett (1996), summarizes the benefit of having strategic plan as follows:- It formulates strategy for the future action and criteria for the future actions. It makes it easier the coordination of divisions, subsidiaries and other component parts of the organisation hence act as the focal point for all operations in the organisation, the organisation can analysis its position through strategy formulation hence know its internal weaknesses and hence how to get a remedy. It makes decision in response to predictable changes, identification of external treats and opportunities. The organisation through speculation of future events may lead to influencing the future for the benefit of the organization growth and after considering all facts important decisions can be made hence avoiding crisis situations.

### Strategic Planning Models

The following models provide a range of alternatives from which organizations might select an approach and begin to

develop their own strategic planning process (McNamara, 2000). An organization might choose to integrate the models, e.g., using a scenario model to creatively identify strategic issues and goals, and then an issue-based model to carefully strategize to address the issues and reach the goals.

**Basic Strategic Planning model**

This very basic process is typically followed by organizations that are extremely small, busy, and have not done much strategic planning before. The process might be implemented in the first year of the non-profit organization to get a sense of how planning is conducted, and then embellished in later years with more planning phases and activities to ensure well-rounded direction for the non-profit. Planning is usually carried out by top-level management.

The basic strategic planning process includes: Identify the purpose (mission statement). This is the statement(s) that describes why the organization exists, i.e., its basic purpose. The statements will change somewhat over the years. Select the goals the organization must reach if it is to accomplish its mission. Goals are general statements about what the organization needs to accomplish to meet its purpose or mission, and address major issues facing the organization. Identify specific approaches or strategies that must be implemented to reach each goal. The strategies are often what change the most as the organization eventually conducts more robust strategic planning, particularly by more closely examining the external and internal environments of the organization. Identify specific action plans to implement each strategy. These are the specific activities that each major function (for example, department, etc.) must

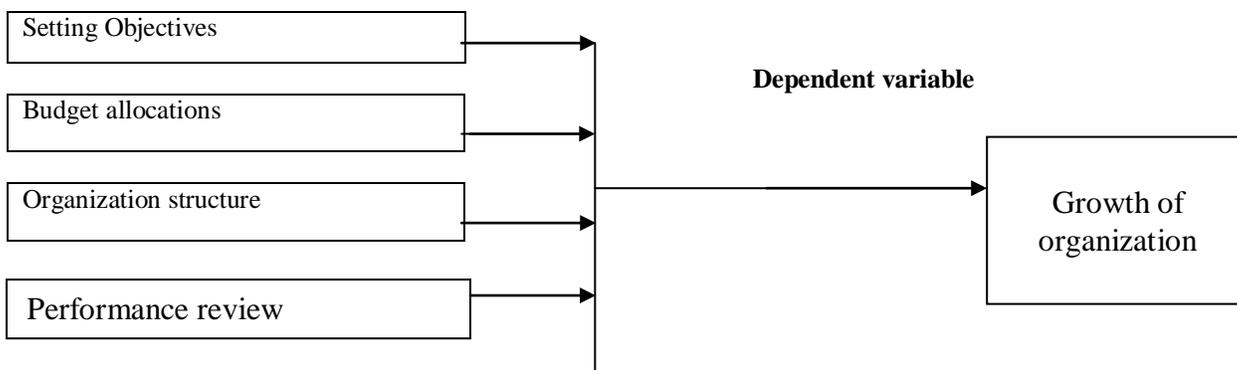
undertake to ensure its effectively implementing each strategy. Objectives should be clearly worded to the extent that people can assess if the objectives have been met or not. Lastly, Monitor and update the plan. Planners regularly reflect on the extent to which the goals are being met and whether action plans are being implemented.

**Issue - Based (or Goal - Based) Planning model**

Organizations that begin with the «basic» planning approach described above often evolve to using this more comprehensive and more effective type of planning. The following depicts a rather straightforward view of this type of planning process, but an organization may not do all of the following activities every year. Thus , External/internal assessment to identify «SWOT» (Strengths, Weaknesses, Opportunities, Threats). Strategic analysis to identify and prioritize major issues/goals. Design major strategies (or programs) to address issues/goals. Design/update vision, mission and values (some organizations may do this first in planning). Establish action plans (objectives, resource needs, roles and responsibilities for implementation). Record issues, goals, strategies/programs, updated mission and vision, and action plans in a Strategic Plan document, and attach SWOT, etc. Develop the yearly Operating Plan document (from year one of the multi-year strategic plan). Perhaps the most important indicator of success of the organization is positive feedback from the organization’s customers. Develop and authorize Budget for year one (allocation of funds needed to fund year one). Lastly, Monitor/review/evaluate/update Strategic Plan document

**Conceptual Framework**

**Independent variables**



**Figure 2.1 Relationships between variables**

**Growth of Organization**

Organizational growth is, in fact, used as one indicator of effectiveness for small and large businesses and is a fundamental concern of many practicing managers. Ultimately, success and growth will be gauged by how well a firm does relative to the goals it has set for itself. HR is a key driver of organizational growth, Since it has to emerge as a strategic business partner helping the top management build an organization that is good not just for today, but for tomorrow and beyond. It is now

working with the top management to propel the organization forward. HR should be reviewed and we stopped looking at what is happening in other strategies and start looking at best HR practices in large corporates. (Crosby, 1999).

Caplow points out that such growth can be particularly disorienting for employee and owner alike: "often the people involved may not realize that anything significant has occurred until they discover by experience that their familiar procedures no longer work and that their familiar routines have been

bizarrely transformed. Business owners, then, face a dizzying array of organizational elements that have to be revised in accordance with changing realities. Maintaining effective methods of communications with and between employees and departments, for example, become ever more important as the firm grows. Similarly, good strategic planning practices have to be implemented and maintained. Establishing and improving standard practices is often a key element of organizational growth as well. Indeed, a large business that undergoes a significant burst of growth will find its operations transformed in any number of ways. And often, it will be the owner's advance planning and management skills that will determine whether that growth is sustained, or whether internal constraints rein in that growth prematurely.

### **Setting Objectives.**

Weinrich, (2007) defines objectives are goals or aims which the management wishes the organization achieve. These are the end points or pole-star towards which all business activities like organizing, staffing, directing and controlling are decided. Only after having defined those points can the manager determine the kind of organization, the kind of personnel and their qualification, the kind of motivation, supervision and direction and the kind of control techniques which he must employ to reach those points. Weinrich further states that objectives should be distinguished from three other words 'vision' 'purpose' and 'mission'. The 'vision' is the dream that an entrepreneur creates in his dream that an entrepreneur creates in his waking hours of his preferred future. In fact it is the root of all objectives. The purpose of an organization its primary role defined by the society in which it operates. Purpose is therefore a broad aim that applies not only to a given organization but to all organizations of its type in that society. The mission of an organization the unique aim that sets the organization apart from others of its type. Objectives are the specific targets to be reached by organization. They are translation of an organization mission into concrete terms against results can be measured.

Bernard (2004) identifies the benefits of setting objectives as follows; it provides a basis for planning and developing other types of plans such as policies, budget and procedures. It acts as motivators for individuals and departments of an enterprise mobilizing their activities with a sense of purpose, it helps in development of effective control that measure results and lead to corrective actions, it facilitates coordination behavior of various groups which otherwise may pull in different directions, they function as a basis for managerial control by serving as standards against which actual performance can be measured, provides legitimacy to organization activities and finally it facilitate better management of organization by providing a basis for leading, guiding, directing and controlling the activities of various departments.

Hugh and Michael (2002) argues that the one or two sentences vision statements most companies make available to the company of course provide only a glimpse of what executives are really thinking and the strategic course they have chartered. Company personnel really have much better understanding where the company is headed and why is revealed in the in the official vision. But the real purpose of strategic vision is to serve as management for giving the organization a sense of direction.

Like any tool, it can be used properly or improperly, either clearly conveying a companies strategic course or not.

Hugh and Michael further raise shortcomings in company vision statements which include: Being vague or incomplete sometimes since is short on specifics about where company is headed or what the company is doing to prepare for future. Being not forward looking because it does not indicate whether or how management intends to alter the company's focus. Being too broad since it is umbrella-like and all inclusive that the company could head in most any direction by pursuing or enter most business. Being uninspiring since it lacks the power to motivate company personnel or inspire shareholder confidence about company's direction or future prospects.

### **Budget Allocations**

Murugan (2006) defines budget as a statement of expected results expressed in numeral terms. It may be called a "quantified" plan. A budget may be expressed in financial terms; in terms of labour hours, units of product, or machine hours; or in any other numerically measurable terms. It may deal with operations, as the capital expenditure budget does, show cash inflow, as cash budget does. However, making a budget is clearly planning. He states that budgeting is a significant part of both planning and the controlling processes and widely used by managers to plan, monitor and control various activities at every level of the organization.

Tosi (1975) identified some of characteristics of efficient budgetary system which include budget oriented towards results, budgetary system should be more effective if the duties and responsibilities for all operations are well defined and rightly assigned budget should be simple and understandable, fair and objective. Budget should be based on documentable information and not simple guesswork and judgment. A quick and two-way communication should be adopted so that the managers get timely information on deviations. Lastly, budget should be viewed as positive and be conducive to self control.

Otley (1998) summarizes the benefits of budgets as follows:-

Budget help managers in integrating personnel efforts within the organization towards a common goal, it acts as a control devices to correct any deviation, it helps in the just measurement of performance, it helps management learn from past experiences, it induces the management to shift attention to future operation since it is part of planning process and forces managers to anticipate and forecast the trend and changes in the external environment and lastly it facilitates communications throughout the organization.

However this Arthur, Shane & Mondy (1990) argue that despite its benefits, budgeting has become crucial to the planning process because budgets are often too rigid and restrictive because HR supervisors are given little free hand in managing their resources, budget may be changed too often or not at all making it difficult for employees to meet performance levels, furthermore, funds are allocated for various activities may not be transferable from one account to another. Budgets are used to evaluate the performance and result but the causes of failures and success are not thoroughly investigated, budgets may used punitively whereby employees regards budgets simply as rating tool for catching their mistakes which lower their morale and

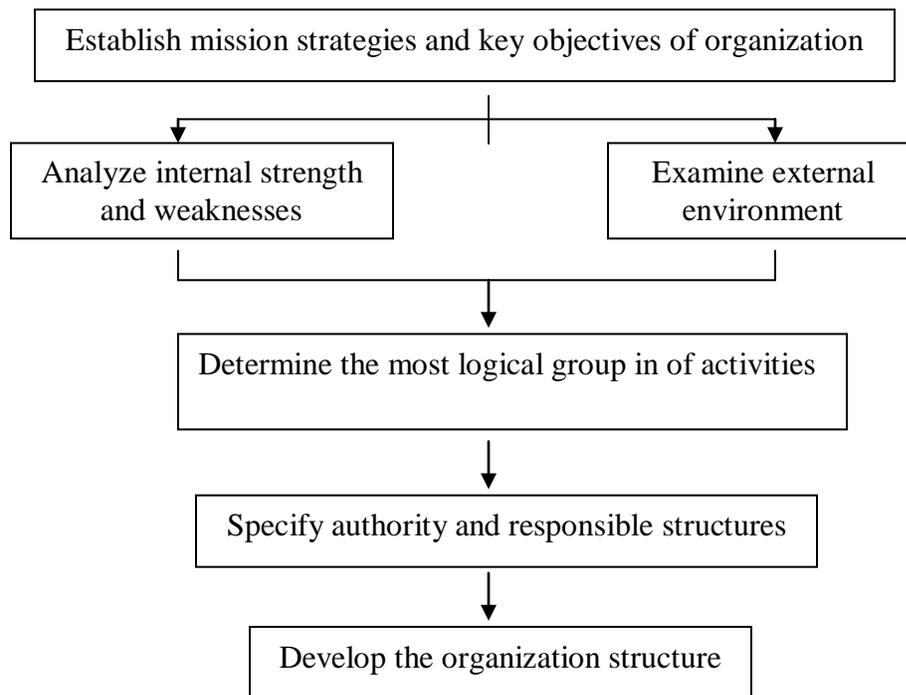
dilute their sense of dedication, budgets make some managers believe that all funds allocated in a budget for a given activity must be spent on that activity which may be detrimental to the organization's effectiveness. Budgeted goals may be perceived as too high often misused particularly during the evaluation of action with the plans and strategies in the light of the latest information. (Otley, 1998)

### Organization Structure

Mullins (1996) defines an organization structure as a pattern of relationships among the positions in the organization and among employees of an organization. Bennett (1996) refers to an organization structure as the system for breaking down the totality of forms work into units and for allocating those units to

people and departments. They are means by which organization achieve their objectives and framework through which activities occur. The organization structure has to keep changing with organization objectives.

Mullins (1996) continues to say that the structure helps in division of work among members, activities are coordinated therefore achieving, the organizational goals and objectives. Channels of communication tasks and responsibilities, work roles and relationships are defined in organization structure. Mullins states further structures are preferred and have occurred due to staff being greatly involved and participative, improved efficiencies and competitiveness.



Source: Bennett R, 1996- "Corporate strategy and business planning" fig 7.1

**Figure 2.2 Steps in Determining Organization structure**

Bennett (1996) considers the following issues as important in structuring an organization:-The firms should have departments, either for functions like personal or marketing, product for geographical regions which. Individual teams deal with its specifications. Best organizations structure as regards needs hierarchical levels of authority and the number subordinate under the control of each line managers should duties and responsible overlap or should each member be held responsible for single functions and specialize in it, should be a decentralizing and centralizing of decision making, activities groupings, departmental sizes, system of appraising and controlling departments, sections and individuals, management hierarchy shape, employees be left with complete already defined duties alone or closely supervised and lastly coordination of activities like delegation of work to lower levels, communication system and who will coordinate.

Mullins (1996) summarizes the objectives of organizational structures as follows: -

Economic and efficient performance and the level of resources utilization, activities of an organization are monitored, accountability of work done by groups or individuals of an organization, coordination of different parts or areas of work in an organization, leads to flexibility which leads to response to future demand and development and adapting to influences of environment.

Manifestation of inappropriate organization structure identified by Bennett (1996), as follows:-Internal communications being poor, bad decisions occurring frequently and slow decision making, demotivation amongst staff, work in various decisions being poorly coordinated, inefficient or effort duplication resulting to high administrative costs, line and staff managers relying badly, true objectives of the organization not

being known to the staff, strategic plans may not be implemented, individuals may pursue personal goals other than organization goals therefore a conflict between the two may occur, activities may be poorly coordinated and lastly people may not be sure of what is expected of them resulting to the number of meetings being excessive.

**Performance Review**

Performance review is defined as process of monitoring the progress of implemented strategy in order to ensure that it is operating properly. Monitoring involves establishing control mechanism so that the feedback from the actual implementation of the strategic plan at each step can be analyzed and evaluated. The monitoring system would also indicate if there are any deviations from the actual expectations so that reasons for such deviations can be investigated and appropriate measures to correct them. (Bateman & Snell, 2004)

Thompson, Strickland and Gamble, (2007) further state that performance review as process of evaluating performance and initiating correcting adjustments. This is monitoring new external developments, evaluating the companies’ development and making corrective adjustments, this is the trigger point for decision whether to continue to change the companies’ vision, objectives, strategy or strategic executive methods. A company direction, objectives and strategies have to be revised any time internal or external conditions warrant. It is to be expected that a company will modify its strategic vision, direction, objectives and strategy over time.

Brendan (2006) states performance review as a process of controlling and assessing results. He adds that if the plans haven’t produced the desired results managers and teams may need to change controls, mission, goals or plans themselves since the lack of planning can lead to paralysis by analysis.

Thompson (2007) argues that it is not unusual for a company to find that one or more of its strategic planning, implementation and execution going as intended, it is achieved unevenly coming quickly in some areas and providing restlessness in others. It is both normal and desirable to periodically assess the strategic execution to determine which aspects are working well and which ones need improvement and then making corrective adjustments through performance review.

**RESEARCH METHODOLOGY**

The researcher used a descriptive research design. Amin (2005) stated that descriptive research is the most commonly used research design and is used to collect data from a sample population at a given time. Further the choice of using descriptive design was preferred since the methods of data collection it utilizes, that was questionnaires were applicable to the study and aided in collecting precise information. It included collecting information by administering questionnaires to KEMRI employees to be able to compile data, analyze and interpret the data from the contents and measuring tools to authenticate this research study. The targeted populations in this research study were 200 employees staff members.

According to Mugenda (2003), for any meaningful and representative research, a sample of at least above 10% is representative enough. Sampling methods involved taking at random a predetermined quantity from a batch of the same kind, a quantity considered adequate and representative of the whole batch. The target population was divided in various management groups including top managers, heads of department, middle managers and general staff members. In this study stratified random sampling methods was used so as to obtain 4 strata’s of the top management, Heads of department, middle level management and General staff members who made up a total of 50 respondents.

**III. DATA ANALYSIS, PRESENTATION AND INTERPRETATION**

**Response Analysis**

The study targeted 50 respondents who are from top level managers, head of departments, middle level managers and general staff. The researcher distributed questionnaires to the respondents and only 40 out of the 50 sample respondents filled-in and returned the questionnaires making a response rate of 80% this means that the sample was well represented in the questionnaire filled and returned as per Table 4.1 below.

On the response rate, the findings were as follows:-

**Table 1.0 Response rate**

<b>Respondents</b>	<b>Frequency</b>	<b>%</b>
Responded	40	80
Did not respond	10	20
<b>Total</b>	<b>50</b>	<b>100</b>

From above table 50 questionnaires were issued to the respondents. 80% responded and 20% did not respond. This response was considered to be representative. According to

Mugenda (2003), for any meaningful and representative research, a sample of at least above 10% is representative enough.

**Effects of strategic planning on organization growth**

The respondent were asked on a five point Likert scale where 5 is strongly agree,4 agree,3 neutral,2 disagree and 1 strongly disagree to state how they agree with the given statements that strategic planning affects organization growth.

**Table 1.1 Effects of strategic planning on organization growth**

	N	Mini mum	Maxi mum	Mean	Std. Deviation
Does KEMRI apply strategic planning in its operation?	40	1	5	4.60	.955
Does Strategic planning enable KEMRI focus ahead and plan appropriately to achieve goals?	40	1	5	4.70	.853
Does Strategic planning assists in gauging its performance?	40	1	5	4.75	.840
Does Strategic planning helps in setting targets to be achieved base on performance?	40	1	5	4.65	1.027
Does Strategic planning enable organization to use effectively organization resources by focusing the resources on key priorities?	40	1	5	4.68	.859
Does Strategic planning help in gearing all departments for one goal and thereby results oriented?	40	1	5	4.58	.903
Valid N (list wise)	40				

From the above table, respondents strongly agreed that KEMRI apply strategic planning in its operation with a mean score of 4.60 and a standard deviation of 0.955. Respondents strongly agreed that strategic planning enabled KEMRI to focus ahead and plan appropriately to achieve goals with a mean score of 4.70 and a standard deviation of 0.853. Respondents strongly agreed on the statement that strategic planning assists in gauging its performance with a mean score of 4.75 and a standard deviation of 0.840. Respondents also strongly agreed that strategic planning helps in setting targets to be achieved based on performance with a mean score of 4.65 and a standard deviation of 1.027. Respondents again strongly agreed that strategic planning enables organization to use effectively organization resources by focusing the resources on key priorities with a mean

score of 4.68 and a standard deviation of 0.859. It was further strongly agreed by respondents that strategic planning helped in gearing all departments for one goal and thereby results oriented with a mean score of 4.58. This clearly indicates that strategic planning affects organization growth in KEMRI from the study findings.

**Organization met objectives**

The respondent were asked on a five point Likert scale where 5 is strongly agree,4 agree,3 neutral,2 disagree and 1 strongly disagree to state how they agree with given statement that KEMRI have met any of the organization objectives through strategic planning implementation.

**Table 1.2 Organization met objectives**

	N	Minimum	Maximum	Mean	Std. Deviation
Has KEMRI met any of the organization objectives through strategic planning implementation?	40	1	5	4.70	.853
Valid N (list wise)	40				

From the above table, respondents strongly agreed that KEMRI have met some of its organization objectives through strategic planning implementation with a mean score of 4.70 and a standard deviation of 0.853 since KEMRI has been able to carry out research in human health, cooperate with other research

organizations and institutions of higher learning on matters of relevant research and training, work with other research bodies within and outside Kenya carrying out similar research, cooperate with the Ministry of Public Health and Sanitation, the Ministry of Medical Services, the National Council for Science

and Technology(NCST) and the Medical Sciences Advisory Research Committee in matters pertaining to research policies and priorities and lastly to do all things as appear to be necessary, describe or expedient to carry out its functions.

The respondent were asked on a five point Likert scale where 5 is strongly agree,4 agree,3 neutral,2 disagree and 1 strongly disagree to state how they agree with the given statements that setting objectives affects organization growth.

**Effects of setting objectives on organization growth**

**Table 1.3 Effects of setting objectives on organization growth**

	N	Minimum	Maximum	Mean	Std. Deviation
Does Setting objectives assists in performance improvement?	40	1	5	4.68	.859
Does setting objectives helps in facilitating better management by providing a basis for leading ,guiding ,directing and controlling activities of various departments?	40	1	5	4.63	.868
Does setting objective enables organization to aim higher to enhance KEMRI growth?	40	1	5	4.48	.960
Does setting objectives bring necessary ground for required changes for growth?	40	1	5	4.35	1.099
Does setting objectives guides organization to achieve its overall goals thus enhance work performance?	40	1	5	4.65	.864
Does setting objectives influence organization growth at KEMRI?	40	1	5	4.72	.847
Valid N (list wise)	40				

From the above table, respondents strongly agreed that setting objectives assists in performance improvement with a mean score of 4.68 and a standard deviation of 0.859. Respondents strongly agreed with the statement that setting objectives helps in facilitating better management by providing a basis for leading, guiding, directing and controlling activities of various departments with a mean score of 4.63 and a standard deviation of 0.868. Respondents also agreed that setting objectives enables organization to aim higher to enhance KEMRI growth with a mean score of 4.48 and standard deviation of 0.960. Respondents agreed again that setting objectives bring necessary ground for required changes for growth with a mean score of 4.35 and a standard deviation of 1.099. Respondents strongly agreed with the statement that setting objectives guides

organization to achieve its overall goals thus enhance work performance with a mean score of 4.65 and a standard deviation of 0.864. Respondents further strongly agreed that setting objectives influence organization growth at KEMRI with a mean score of 4.72 and a standard deviation of 0.847. This clearly indicates that setting objectives affects organization growth in KEMRI from the study findings.

**Budgetary allocation match with the plans set**

The respondent were asked on a three point Likert scale where 3 is Not sure ,2 No and 1 Yes to state if they agree with the given statements that budgetary allocations at KEMRI match with the plans set in the organization.

**Table 1.4 Budgetary allocation match with the plans set**

	N	Minimum	Maximum	Mean	Std. Deviation
Do you think budgetary allocations at KEMRI match with the plans set in the organization?	40	1	3	1.85	.483
Valid N (list wise)	40				

From the above table, majority of respondents stated that budgetary allocations at KEMRI don't match with the plans set in the organization with a mean score of 1.85 and a standard deviation of 0.483 since they have there is limited resources as funds provided for the operations so cannot achieve all that it sets to achieve, more funding allocations not directed to research instead to administration, therefore little emphasis given to the

main objectives of the institution and planning process requires a lot of finance which is not sufficiently provided.

**Effects of budgetary allocations on organization growth**

The respondent were asked on a five point Likert scale where 5 is strongly agree,4 agree,3 neutral,2 disagree and 1

strongly disagree to state how they agree with the given statements that budgetary allocation affects organization growth.

**Table 1.5 Effects of budgetary allocations on organization growth**

	N	Mini mum	Maximu m	Mean	Std. Deviation
Does budgetary allocation encourages further growth by realizing places that requires more funds for further growth?	40	1	5	4.65	.834
Does budgetary allocation enable KEMRI set targets which are met since every item is budgeted for?	40	1	5	4.50	.961
Does budgetary allocation assists KEMRI in coordination therefore achieving goals and objectives?	40	1	5	4.68	.859
Does budgetary allocation act as a control device to correct any deviations at KEMRI?	40	1	5	4.55	1.037
Does budgetary allocation influence growth in KEMRI?	40	1	5	4.60	.871
Valid N (list wise)	40				

From the above table, respondents strongly agreed that budgetary allocation encourages further growth by realizing places that requires more funds for further growth with a mean score of 4.65 and a standard deviation of 0.834, respondents strongly agreed with the statement that budgetary allocation enabled KEMRI set targets which are met since every item is budgeted for with a mean score of 4.50 and standard deviation of 0.961, respondents also strongly agreed that budgetary allocation assists KEMRI in coordination therefore achieving goals and objectives and again strongly agreed that budgetary allocation act as a control device to correct any deviations at KEMRI.

Respondents further strongly agreed that budgetary allocation influence growth in KEMRI with a mean score of 4.60 and a standard deviation of 0.871. From the findings above this clearly indicated that budgetary allocation affects organization growth.

**Roles /positions tailored for growth**

The respondent were asked on a five point Likert scale where 5 is strongly agree, 4 agree, 3 neutral, 2 disagree and 1 strongly disagree to state how they agree with the given statements that roles /positions in KEMRI are well-tailored for its growth.

**Table 1.6 Roles /positions tailored for growth**

	N	Minimum	Maximum	Mean	Std. Deviation
Are roles /positions in KEMRI well-tailored for its growth?	40	1	5	4.63	.868
Valid N (list wise)	40				

From the above table, respondents strongly agreed that roles /positions in KEMRI are well-tailored for its growth with a mean score of 4.63 and a standard deviation of 0.868. This clearly indicates that roles and positions are well structured in KEMRI.

The respondent were asked on a five point Likert scale where 5 is strongly agree, 4 agree, 3 neutral, 2 disagree and 1 strongly disagree to state how they agree with the given statements that organization structure affects organization growth.

**Effects of organization structure on organization growth**

**Table 1.7 Effects of organization structure on organization growth**

	N	Minimu m	Maximu m	Mean	Std. Deviation
Does organization structure assist in channels of communication, task and responsibilities that enables work roles be well defined?	40	1	5	4.55	.876
Does organization structure enable division of work among members activities be coordinated therefore achieving organization goals and objectives?	40	1	5	4.35	1.099

Does structures enable staff to be fully involved hence reducing the KEMRI structural of hierarchy thus creative for organization growth?	40	1	5	4.60	.900
Does an organization structure enable accountability of work done by each staff?	40	1	5	4.52	1.037
Does organization structure in KEMRIs affects its growth ?	40	1	5	4.70	.853
Valid N (list wise)	40				

From the above table, respondents strongly agreed that organization structure assist in channels of communication, task and responsibilities that enables work roles be well defined with a mean score of 4.55 and a standard deviation of 0.876. Respondents agreed that organization structure enables division of work among members activities be coordinated therefore achieving organization goals and objectives with a mean of 4.35 and a standard deviation of 1.099. Respondents also strongly agreed that organization structures enables staff to be fully involved hence reducing the KEMRI structural of hierarchy thus

fully creative for organization growth with a mean score of 4.60 and a standard deviation of 0.900, respondents also strongly agreed that organization structure enables accountability of work done by each staff with a mean of 4.52 and a standard deviation of 1.037 and respondents further strongly agreed that organization structure in KEMRI affects its growth with a mean score of 4.70 and a standard deviation of 0.853. From the findings above this clearly indicated that organization structures affects organization growth.

**Reviewing plans**

The respondent were asked on a four point Likert scale where 4 is not at all, 3 annually, 2 semi-annually and 1 quarterly to state how they agree with the given statements on how often KEMRI review its already made plans after making them.

**Table 1.8 Reviewing plans**

	N	Minimum	Maximum	Mean	Std. Deviation
After making plans, how often do KEMRI review its already made plans?	40	1	4	2.55	.749
Valid N (list wise)	40				

From the above table, respondents stated that after making plans, KEMRI always review it's already made plans annually with a mean score of 2.55 and a standard deviation of 0.749. This clearly indicates from the findings that KEMRI review its plan annually.

**Effects of performance review on organization growth**

The respondent were asked on a five point Likert scale where 5 is strongly agree, 4 agree, 3 neutral, 2 disagree and 1 strongly disagree to state how they agree with the given statements that performance affects organization growth.

**Table 1.9 Effects of performance review on organization growth**

	N	Minimum	Maximum	Mean	Std. Deviation
Does performance review assist in promoting experience, qualifications and better services?	40	1	5	4.25	1.214
Does performance review enable consistency and coherence, thus ensuring the most appropriate and corrective actions taken for organization growth?	40	1	5	4.52	1.037
Does performance review enable KEMRI indicate weak areas and immediate actions taken to correct them?	40	1	5	4.60	.871

Does performance review enable management be able to tell where it has snags or rectify such situations pave way for high standards of growth?	40	1	5	4.55	.876
Does performance review enable KEMRI make corrective adjustments/evaluates and issues redirected to critical areas?	40	1	5	4.35	1.099
Does performance review indicates if there are any deviations from actual expectations so that reasons for deviation can be investigated and corrective measures taken to correct them?	40	1	5	4.43	.874
Does performance review enable KEMRI monitors new external development evaluating organization development and making corrective adjustments?	40	1	5	4.55	.876
Does performance review modify KEMRI vision, direction and objectives?	40	1	5	4.23	1.143
Does performance review affect KEMRI growth?	40	1	5	4.05	1.218
Valid N (list wise)	40				

From the above table, respondents agreed that performance review assisted in promoting experience, qualifications and better services with a mean score of 4.25 and a standard deviation of 1.214. Respondents strongly agreed that performance review enabled consistency and coherence, thus ensuring the most appropriate and corrective actions taken for organization growth with a mean score of 4.52 and a standard deviation of 1.034. Respondents strongly agreed that performance review enabled KEMRI indicate weak areas and immediate actions taken to correct them with a mean score of 4.60 and a standard deviation of 0.871. Respondents strongly agreed with the statement that performance review enabled management be able to tell where it has snags or rectify such situations pave way for high standards of growth with a mean score of 4.55 and a standard deviation of 0.876.

Respondents agreed that performance review enabled KEMRI make corrective adjustments/evaluates and issues redirected to critical areas with a mean score of 4.35 and a standard deviation of 1.099. Respondents also agreed that performance review indicated if there were any deviations from actual expectations so that reasons for deviation could be investigated and corrective measures taken to correct them with a mean score of 4.43 and a standard deviation of 0.874. Respondents strongly agreed that performance review enabled KEMRI monitor new external development evaluating organization development and making corrective adjustments with a mean score of 4.55 and a standard deviation of 0.876. Respondents again agreed that performance review modify

KEMRI vision, direction and objectives with a mean score of 4.23 and a standard deviation of 1.143. Respondents further agreed that performance review affects KEMRI growth with a mean score of 4.05 and a standard deviation of 1.218. From the findings above this clearly indicated that performance review affects organization growth.

**Coefficient of Correlation**

In trying to show the relationship between the study variables and their findings, the study used the Karl Pearson’s coefficient of correlation (r). This is as depicted on Table 4.15 below. According to the findings, it was clear that there was a positive correlation between organization growth and setting objectives shown by a correlation figure of 0.989; organization growth and budgetary allocation shown by a correlation figure of 0.983; there was also a positive correlation between organization growth and organization structure with a correlation value of 0.986; also a positive correlation between organization structure and performance review was noted with a correlation figure of 0.979; A positive correlation was noted between setting objectives and budgetary allocations, organization structure and performance review. There was also positive correction between budgetary allocations with organization structure and performance review. Also there was positive correlation between organization structure and performance review. This showed that there was a strong positive correlation highest being noted in setting objectives and lowest positive correlation in performance review.

**Table 1.10 Correlation**

	Organizational Growth	Setting Objectives	Budgetary Allocation	Organization Structure	Performance Review
Organizational Growth	1				
Setting Objectives	.989	1			
Budgetary Allocation	.983	.993	1		

Organization Structure	.986	.996	.994	1	
Performance Review	.979	.977	.969	.985	1

**Coefficient of Determination (R<sup>2</sup>)**

Table 4.16 showed that the coefficient of determination was 0.981. Coefficient of determination explains the extent to which changes in the dependent variable can be explained by the change in the independent variables or the percentage of variation in the dependent variable (Organizational growth) that is explained by all independent variables. From the findings this meant that 98.3% of organizational growth is attributed and determined by combination of the four independent factors investigated in this study.

**Table 1.11 Coefficient of Determination (R<sup>2</sup>)**

**Model Summary**

Model	R	R Square	Adjusted Square	RStd. Error of the Estimate	Change Statistics	df1	df2	Sig. F Change	
1	.992 <sup>a</sup>	.983	.981	.12276	.983	516.687	4	35	.000

a. Predictors: (Constant), Performance Review, Budgetary Allocation, Setting Objectives, Organization Structure

**ANOVA**

The study used ANOVA to establish the significance of the regression model from which f-significance value of p less than 0.05 was established as shown in Table 4.8. The model was statistically significant in predicting organization strategy implementation that the regression model had a probability of less than 0.05 of giving a wrong prediction. This therefore means that the regression model had a confidence level of above 95% hence high reliability of the results obtained.

**Table 1.12 ANOVA**

**ANOVA<sup>a</sup>**

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	31.146	4	7.786	516.687	.000 <sup>b</sup>
	Residual	.527	35	.015		
	Total	31.673	39			

a. Dependent Variable: Organizational Growth

b. Predictors: (Constant), Performance Review, Budgetary Allocation, Setting Objectives, Organization Structure

**Multiple Regressions**

The researcher conducted a multiple regression analysis as shown in Table 4.18 so as to determine the relationship between organization growth and the four variables investigated in this study. The regression equation was:

$$Y = 0.000 + 0.918X_1 + 0.320X_2 + -0.657X_3 + 0.416X_4 + \epsilon$$

Where

$\alpha$ : is a constant term,

$\beta_n$ : coefficients to be determined

$\epsilon$ : the error term.

Y: the dependent variable (organization growth) measured by the factors influencing organization.

X1: setting objectives index.

X2: Budgetary allocation index.

X3: organization structures index.

X4: performance review index.

According to the regression equation established shown in Table 4.18, taking all factors constant at zero, organization growth will be 0.000. The data findings analyzed also shows that taking all other independent variables at zero; a unit increase in setting objectives will lead to a 0.918 increase in organization growth; A unit increase in budgetary allocations will lead to a 0.320 increase in

organization growth; a unit decrease in organization structure will lead to a -0.657 decrease in organization growth; a unit increase in performance review will lead to a 0.416 increase in organization growth. This therefore implies that four variables have a positive relationship with organization growth contributing most to the dependent variable

**Table 1.13 Multiple Regression Analysis**

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients	Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
	(Constant)	.000	.120		.997
1	Setting Objectives	.918	.260	.904	.001
	Budgetary Allocation	.320	.231	.317	.175
	Organization Structure	-.657	.355	-.676	.073
	Performance Review	.416	.130	.454	.003

a. Dependent Variable: Organizational Growth

**IV. CONCLUSION AND RECOMMENDATIONS**

**Conclusions**

Strategic planning makes decision in response to predictable changes, identification of external threats and opportunities. The organization through speculation of future events may lead to influencing the future events influencing the future for the benefit of the organization growth and after considering all facts. Important decisions can be made hence avoiding crisis situations. It makes it easier for the coordination of divisions, subsidiaries and other component part of the organization hence act as a focal point for all operation in the organization, the organization can analyze its position through strategy formulation hence know its internal weakness and hence how to get a remedy.

From findings, it was concluded that strategic planning if well implemented is effective. Strategic planning was appropriate, suitable, reasonable and accepted to the organization. It clearly indicated that strategic planning exist at KEMRI and helped the organization evaluate its business by identifying its long term goals, objectives, monitor performance and allocating its resources thus enhancing performance in terms of growth. The researcher therefore conclude that in order for a company to enhance its growth it should enable the organization to implement an effective strategic planning so that it can be able to increase its profits, revenue, number of customers, employees thus leading to its growth.

**Recommendations**

After careful analysis of the respondents in research survey, the following recommendations were made that the objectives set should be sound objectives. They should be both clear and attainable, should support one another, must be precise and measurable because the more precise the objective is, the more measurable goal it is and easier to achieve it, and should always remain valid. The objectives should convert the strategic vision into specific performance targets, results and outcomes the company management wants to achieve and then use these objectives as yardsticks for tracking the company's progress and performance.

On budgetary allocations the organization should seek more funds which should be directed to research instead of administration so that a lot of emphasis given to main objectives of institute so that it may be able to achieve all that it sets to achieve. Major act should be emphasized on budgetary allocations at KEMRI when initiating the planning process, so that there is no confusion between budgetary allocation and strategic planning process. Budget should be based on documentable information and not simple guesswork and judgement. It should be viewed as positive and be conducive to self-control. Budgetary allocation system should be more effective if the duties and responsibilities for all operations are well defined and rightly assigned. Budget should be simple and understandable, fair and objective.

Organization structures should enable individual teams deal with specifications. The organization structure should have hierarchical level of authority and the number of subordinate under the control of each line managers, should duties and responsibilities overlap or should each member be held responsible for single functions and specialize in it. It should be a decentralized and centralized of decision making, activities groupings, departmental sizes, system of appraising and controlling departments, sections and individuals, management hierarchy shape, employees be left with complete already defined duties alone or closely supervised and coordination of activities like delegation of work to lower levels, communication system and who will coordinate.

Performance review process should enable the actual performance be easily measured and reviewed. Monitoring system should be able to indicate if there are any deviations from the actual expectations so that reasons for such deviations can be investigated and appropriate measures taken to correct them.

In future KEMRI has also to strive to attain ISO standards as these are worldwide organized standards. The certificates awarded under this program ensure quality of service is maintained. This may go hand in hand with the strategic planning operation at KEMRI for them to be able to sustain itself in future thus enhancing further growth.

## Further Studies

This study is not conclusive and as such it is recommended that further research be undertaken in this area in order to build a cost effective, time saving and quality implementation of strategic planning process to improve organization growth further. There is need to examine further any effort that can enable strategic planning be more effective towards organization growth.

The study proposed further research in the following areas; factors to be considered during strategic planning implementation process for it to be effective towards growth and ways of overcoming factors that undermine planning process towards organization growth.

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# Improving the Productivity of Coconut-Based Farming System through Adoption of Suitable Upland Rice-Legume Combinations

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**Abstract-** The need to maximize farm productivity through efficient use of light energy and soil resource is necessary in attempts to increase food production and mitigate climate change. This study evaluated the productivity of traditional upland rice and legume intercrops planted singly and in combinations under a coconut-based farming system. A split-plot design composed of two factors with three replications was used. The main plots were traditional upland rice varieties (*Kalutak*, *Malido*, *Mansanaya*, *San Pedro*, and PSB Rc 10 as check variety) while sub-plots were legume intercrops (peanut, mungbean, soybean, and no intercrop as control). Growth and yield of crops and return on investment (ROI) were gathered to determine productivity. Results revealed that *Malido* with no intercrop produced the tallest plant, while most tillers were from plots without intercrop. Highest dry grain yield of rice ( $1.42 \text{ t ha}^{-1}$ ) was taken from plots grown to *San Pedro* with no intercrop. Highest dry grain yield of legumes was from plots with *Mansanaya* + soybean ( $0.94 \text{ t ha}^{-1}$ ) and PSB Rc 10 + mungbean ( $0.92 \text{ t ha}^{-1}$ ). Highest ROI (344.40%) was from plots with PSB Rc 10 + mungbean.

**Index Terms-** productivity, coconut-based farming system, traditional upland rice, legume intercrops

## I. INTRODUCTION

Coconut-based farming system is a dominant production system in the agriculture sector ([www.fao.org](http://www.fao.org)). This has been described by various literatures which range from monoculture system to multiple intercropping systems. The monoculture system is usually observed in most coconut areas of the Philippines where the palms are in pure stand. In these areas, coconut palms have existed for years that light energy impinging between coconut stands has been wasted. In order to maximize the productivity of the area in terms of utilizing both the solar energy and the available nutrients in the soil, these vacant spaces can be planted with other crops (Magat, 1990).

Rice is “life” being the staple food of Asia; however it is also the single biggest user of freshwater ([www.irri.org](http://www.irri.org)). The declining availability and increasing costs of water brought about by climate change threaten the traditional way of growing rice

under irrigated conditions. There is therefore a need to utilize upland rice which can thrive under drought conditions.

De Datta (1975) pointed out that inbred upland rice yields are generally low of about 0.5-1.5 t/ha. One of the causes for this low yield is the adaptability to the agro-climatic conditions of the area. Upland farmers instead grow traditional upland rice which is adapted to the local climatic conditions, though their yield potential is not yet established.

Various intercrop combinations were described by Espino et al. (1988) which provide additional income for coconut farmers. Data however, on the productivity of coconut-based farming systems with traditional upland rice and legume combinations are still deficient. Hence, this study was conducted to evaluate the production performance of different varieties of traditional upland rice and legume intercrops under coconut-based farming system. Results of this study will assist policy makers in formulating measures to mitigate the effects of global problem on climate change and provide more meaningful efforts for the development of the agriculture sector.

## II. METHODOLOGY

### A. Experimental Area, Design and Treatments

The study was conducted at the Coconut Breeding Trials Unit in Mambusao, Capiz, Philippines with coordinates of  $11^{\circ} 26'$  north to  $122^{\circ} 32'$  east and an elevation of 174 feet above sea level. The area is slightly sloping (10%) and dominated by clay loam to heavy clay soil with an average annual rainfall of 3,021 mm. Fifty stands of coconut consisting of dwarf variety *Catigan* and hybrid variety WAT x TAC planted in diagonal pattern were considered. The height of palms ranged from 9 m to 15 m with a canopy of 6 m.

The experiment was laid out in 5 x 4 factors in split-plot design with three replications. The field was divided into three blocks and each block was randomly divided into five main plots spaced 50 cm from each other. Each main plot was further randomly divided into four subplots with a spacing of 25 cm from each other. A total of 20 subplots for each block were made; each having a dimension of 3m x 4m.

The main plots were varieties of traditional upland rice, namely: *Kalutak*, *Malido*, *Mansanaya* and *San Pedro*, and PSB Rc 10 as check variety. The sub-plots were legume intercrops such as peanut, mungbean, and soybean, and a control with no intercrop. The various intercrops of traditional upland rice were established by planting them every after two rows of rice plants.

### B. Cultural Practices

The experimental area was thoroughly prepared by plowing and harrowing. Rice was planted by dibbling at the rate of 4 to 5 seeds per hill at a distance of 20 cm between rows and 20 cm between hills. The seeds were covered with fine soil at 2 to 3 cm deep. For the legume species, 4-5 seeds of peanut, mungbean and soybean were drilled in furrows at 50 cm between rows and 30 cm between hills. The seeds were covered with fine soil at approximately 2 to 3 cm deep.

One week after germination, missing hills were replanted following the recommended practices for the various crops. Similarly, thinning was done maintaining 3 seedlings per hill. Pests were controlled employing inter-row cultivation and application of pesticides. Harvesting of crops in the harvestable area was done at physiological maturity. Drying was done to attain 14% moisture content (MC).

### C. Data Gathering and Analysis

Growth and yield components gathered from 10 sample rice plants were plant height and productive tiller count. Dry grain yield data for rice and legumes at 14% MC was obtained from plants within the harvestable area. All growth and yield data were subjected to ANOVA, while DMRT was employed to test significant differences among means. Return on investment (%ROI) was used to determine profitability.

## III. RESULTS AND DISCUSSION

### Plant Height of Rice

Comparing the heights of rice varieties in Table 1, tallest rice plants were *Malido* while the shortest were PSB Rc 10. *Kalutak*, *Mansanaya* and *San Pedro* were medium-statured plants. In contrast to these findings, relatively shorter PSB Rc 10 plants under open field conditions was reported by DA-RFU 6 (undated). The plant heights of traditional upland rice obtained from this study were also higher than those obtained from the research project of Gregorio et al. (2011a). Several field trials made by Baranda et al. (2011) and Launio and Gregorio (2011a) also showed shorter plants. In terms of intercropping legumes to rice, plots without intercrop and those plots intercropped with peanut and mungbean showed taller rice plants. Intercropping soybean to rice produced the shorter rice plants.

A significant interaction effect between varieties and legume intercrops on the plant height of upland rice was also evident in Table 1. Plots grown to *Malido* alone produced the tallest rice plants. This manifests that under monocropping system, *Malido* was the tallest plant. Similar findings were obtained by Villaruz (1994) wherein PSB upland rice grown in

pure stand was significantly taller than those intercropped with legumes. Those plots planted with *Malido* + peanut and *Malido* + soybean also showed taller rice plants. Shortest rice plants were observed from plots grown to PSB Rc 10 + soybean. Plots where PSB Rc 10 + peanut, PSB Rc 10 + mungbean, and PSB alone were grown had also shorter rice plants.

These results imply that each variety tested has different genetic characteristics. In particular, the inherent potential on height was best manifested when the rice plants were grown alone. However, it was evident for *Malido* to tolerate shading when intercropped with legumes and has the ability to compete for the various growth factors with other intercrops.

Table 1. Plant height (cm) at harvest of traditional upland rice varieties grown with legume intercrops under coconut-based farming system.

VARIETY	LEGUME INTERCROPS				MEAN**
	None	Peanut	Mungbean	Soybean	
<i>Kalutak</i>	191.13c	187.47d	180.43f	184.37ef	185.85b
<i>Malido</i>	198.18a	194.4b	191.08c	193.90b	194.40a
<i>Mansanaya</i>	187.47d	182.27f	185.37de	168.46h	180.89b
<i>San Pedro</i>	184.61ef	178.98fg	185.45de	178.70g	181.94b
PSB Rc 10	88.96i	86.72i	86.88i	82.58j	86.29c
MEAN**	170.07a	165.97a	165.84a	161.60b	

Means in column and row having the same letter are not different at 5% level by DMRT.

### Productive Tiller Count of Rice

The productive tiller count among rice varieties did not differ (Table 2). Productive tiller counts of the different varieties ranged from nine to 11 tillers per plant. Higher number of productive tillers was obtained by Baranda et al. (2011), Gregorio et al. (2011b) and Launio and Gregorio (2011b) compared to the findings in this study. DA-RFU 6 (undated) also found higher number of productive tiller for PSB Rc 10. The development of productive tillers somehow depended on different planting densities used for these various studies.

Productive tiller count of rice however varied when intercropped with legumes as shown in Table 2. The most number of productive tillers was recorded from plants with no intercrop. Lesser number of productive tillers was obtained from rice plants with legume intercrops. In this result, it was evident that monocropping had relatively more number of productive tillers compared to intercropping system. Villaruz (1994) had similar findings which can be attributed to plant spacing wherein monocropping provides more space for plant to proliferate while plant spacing is limited in intercropping because of maximum land area utilization with the presence of other crops. Also, the presence of legume intercrops with relatively wider leaves and bushy growth had competed with rice in intercepting light energy; hence least tillers were possibly developed.

Table 2. Productive tiller count of traditional upland rice varieties grown with legume intercrops in coconut-based farming system.

VARIETY	LEGUME INTERCROPS				MEAN <sup>ns</sup>
	None	Peanut	Mungbean	Soybean	
<i>Kalutak</i>	10.02	8.88	9.56	9.83	9.57
<i>Malido</i>	12.76	9.39	9.69	9.94	10.45
<i>Mansanaya</i>	10.80	9.96	9.64	9.37	9.94
<i>San Pedro</i>	11.42	11.76	10.75	9.38	10.83
PSB Rc 10	12.04	10.93	11.16	10.28	11.10
MEAN**	11.41 <sub>a</sub>	10.18 <sub>b</sub>	10.16 <sub>b</sub>	9.76 <sub>c</sub>	10.38

\*\* = highly significant; ns = not significant; means followed by a common letter are not different at 5% level by DMRT.

### Dry Grain Yield of Rice

As shown in Table 3, the grain yield varied among the varieties grown. Regardless of intercrops, *San Pedro*, PSB Rc 10 and *Mansanaya* produced the highest grain yield. *San Pedro* and *Mansanaya* tolerated competition with intercrops since the latter are relatively of short height than the main crop. PSB Rc 10 which matured earlier was able to tolerate competition with mungbean. Being an improved variety also, PSB Rc 10 could contain superior genes for higher yield. This possibly indicates that PSB Rc 10 is more efficient in converting raw materials into food products and consequently into grains.

It is also shown that the grain yield of rice varied as different legume intercrops are planted with it. The highest dry grain yield was obtained when rice was grown without intercrop, while the lowest dry grain yield was produced by plots intercropped with peanut.

Table 3. Dry grain yield (t ha<sup>-1</sup>) of traditional upland rice varieties grown with legume intercrops under coconut-based farming system.

VARIETY	LEGUME INTERCROPS				MEAN**
	None	Peanut	Mungbean	Soybean	
<i>Kalutak</i>	0.46 <sub>h</sub>	0.14 <sub>o</sub>	0.20 <sub>n</sub>	0.40 <sub>j</sub>	0.30 <sub>c</sub>
<i>Malido</i>	0.31 <sub>m</sub>	0.16 <sub>o</sub>	0.93 <sub>e</sub>	0.45 <sub>h</sub>	0.46 <sub>b</sub>
<i>Mansanaya</i>	1.05 <sub>c</sub>	0.32 <sub>lm</sub>	0.68 <sub>f</sub>	0.35 <sub>k</sub>	0.60 <sub>ab</sub>
<i>San Pedro</i>	1.42 <sub>a</sub>	0.50 <sub>g</sub>	0.49 <sub>g</sub>	0.34 <sub>kl</sub>	0.69 <sub>a</sub>
PSB Rc 10	1.12 <sub>b</sub>	0.19 <sub>n</sub>	0.97 <sub>d</sub>	0.41 <sub>i</sub>	0.67 <sub>a</sub>
MEAN**	0.87 <sub>a</sub>	0.26 <sub>d</sub>	0.65 <sub>b</sub>	0.39 <sub>c</sub>	

Means in column and row having the same letter are not different at 5% level by DMRT.

It is interesting to note also that both factors had interacted to affect the dry grain yield of rice. *San Pedro* when grown without intercrop yielded most. Plots grown with PSB Rc 10 alone also produced higher yields though DA-RFU 6

(undated) had higher yield of PSB Rc 10 under open field conditions. The highest grain yield obtained in this study was within the range of 0.5-1.5 t/ha, the yield which upland rice generally obtained according to De Datta (1975). These grain yield data however were relatively lower than those found by Gregorio, et al. (2011a) where the study was made in an open field under monocropping system.

These results imply that each variety differed in terms of their intercropping potential and intercrop suitability. Indeed, the presence of intercrop had influenced the growth of rice and consequently affected the yield. Villaruz (1994) had similar results wherein legume intercrops significantly affected the yield of PSB upland rice.

### Dry Grain Yield of Legumes

As indicated in Table 4, dry grain yield of legumes varied among the rice varieties tested. Highest legume grain yield was obtained from plots grown to PSB Rc 10, *Malido* and *Mansanaya*. The lowest legume grain yield was recorded from plots grown to *San Pedro* and *Kalutak*. Villaruz (1994) had different results where statistical analysis of data revealed that the bean yield of legume intercrops was not affected by PSB upland rice varieties.

Similarly, Table 4 presents that the dry grain yield of legumes significantly varied. Soybean and mungbean produced the highest grain yield; peanut yielded the least. Again, these findings were different from those obtained by Villaruz (1994) wherein bean yield of legume intercrops was the same.

Table 4. Dry grain yield (t ha<sup>-1</sup>) of legumes as intercrops to traditional upland rice under coconut-based farming system.

VARIETY	LEGUME INTERCROPS			MEAN**
	Peanut	Mungbean	Soybean	
<i>Kalutak</i>	0.16 <sub>h</sub>	0.38 <sub>e</sub>	0.45 <sub>d</sub>	0.33 <sub>b</sub>
<i>Malido</i>	0.31 <sub>f</sub>	0.43 <sub>d</sub>	0.69 <sub>b</sub>	0.48 <sub>a</sub>
<i>Mansanaya</i>	0.18 <sub>h</sub>	0.26 <sub>g</sub>	0.94 <sub>a</sub>	0.46 <sub>a</sub>
<i>San Pedro</i>	0.16 <sub>h</sub>	0.51 <sub>c</sub>	0.24 <sub>g</sub>	0.30 <sub>b</sub>
PSB Rc 10	0.26 <sub>g</sub>	0.92 <sub>a</sub>	0.36 <sub>e</sub>	0.51 <sub>a</sub>
MEAN**	0.21 <sub>b</sub>	0.50 <sub>a</sub>	0.54 <sub>a</sub>	

Means in column and row with the same letter are not different at 5% level by DMRT.

Table 4 further presents the significant interaction effect between rice varieties and legume intercrops on the grain yield of legume crops. Using soybean as intercropped to *Mansanaya*, and mungbean as intercropped to PSB Rc 10 produced the highest legume grain yield. Soybean possibly resisted the stress posed by *Mansanaya* which had a moderate height. Mungbean was also

able to withstand competition with PSB Rc 10 since this variety matured earlier with relatively shorter height. Plots with *Kalutak* + peanut, *Mansanaya* + peanut, and *San Pedro* + peanut comparably gave the lowest yield.

*Return on Investment (ROI)*

In terms of ROI, Table 5 shows that PSB Rc 10 had the highest ROI of 73.15%. As to the legume intercrops, growing mungbean with rice had the highest ROI of 173.58%. Considering the various crop combinations, PSB Rc 10 + mungbean was the most profitable crop combination realizing an ROI of 344.40%. The claim of Baines (1980) holds true with these findings stating that generally, intercropping does not reduce the yield of the main crop, but instead gives greater cash returns and higher income per unit area than growing crop in pure stand. In addition, these results agree to PCARR (1987) report noting that in cereals and legume crop combination, intercrop gave greater income of peasant farmers in the tropical countries. Negative returns on investment (in parenthesis) were also noted in some crop combinations indicating that these combinations are losing and not profitable to pursue.

Results of this economic analysis imply that generally, intercropping mungbean was a positive contributor in increasing net income and consequently higher return on investment. Although intercropping entailed additional expense, the composite yield of the main crop and the intercrop resulted to a more profitable production endeavor.

Table 5. Return on investment (%) in the production of traditional upland rice intercropped with legumes under grown-up coconuts.

VARIETY	LEGUME INTERCROPS				MEAN
	None	Peanut	Mungbean	Soybean	
<i>Kalutak</i>	(36.05)	(41.14)	87.83	63.06	18.42
<i>Malido</i>	(64.38)	(1.52)	181.04	118.78	58.48
<i>Mansanaya</i>	21.53	(21.92)	83.44	172.22	63.82
<i>San Pedro</i>	64.58	(10.95)	171.19	(4.21)	55.15
PSB Rc 10	(41.83)	(20.63)	344.40	10.66	73.15
MEAN	(11.23)	(19.23)	173.58	72.10	

IV. CONCLUSION

In conclusion, the rice varieties tested varied in most agronomic parameters. Legume intercrops influenced the production performance of rice. PSB Rc 10 + mungbean combination resulted to higher return on investment.

These results generally imply higher productivity of coconut-based farming system with upland rice and legume intercropping combinations.

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# A Study on Properties of Regularity for Fractional Difference Equations in Stochastic Processes

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**Abstract-** In this paper, we present some results for vector-valued fractional difference equations. We are successful to completely characterize the maximal regularity of solutions for the problem in Lebesgue vector-valued spaces defined on the set  $\mathbb{Z}_+$ . Our approach use as main ingredients Blunck's operator valued multiplier theorem, and the introduction of a special sequence of bounded operators, that we called  $\alpha$ -resolvent families, which will play a central role in the representation of the solution of the problem by means of a kind of discrete variation of parameters formula.

**Key Words:** Difference equation, linear differential equation, existence for nonlinear difference equation.

## I. INTRODUCTION

First studies on time differences of fractional order are due to Kutter. [14] Diaz and Osler introduced in 1974 a discrete fractional difference operator defined as an infinite series. Grey and Zhang [13] developed a fractional calculus for the discrete nabla (backward) difference operator. At the same time, Miller and Ross defined a fractional sum via the solution of a linear difference equation. More recently, Atici and Eloe introduced the Riemann-Liouville like fractional difference by using the definition of fractional sum of Miller and Ross, and developed some of its properties that allow to obtain solutions of certain fractional difference equations. Ferreira introduced the concept of left and right fractional sum/difference and started a fractional discrete-time theory of the calculus of variations. Holm [15,16] further developed and applied the tools of discrete fractional calculus to the arena of fractional difference equations. See also the recent paper for related work. Concerning qualitative properties, Goodrich in a series of papers studied existence of positive solutions and geometrical properties. On the other hand, the theory of discrete fractional equations is also a promising tool for several biological and physical applications where the memory effect appears. For instance, applications to concrete models have been analyzed recently by Atici and Sengul in. In spite of the significant increase of research in this area, there are still many open questions regarding fractional difference equations. In particular, the study of regularity properties on vector-valued Lebesgue spaces  $l_p$  remains an open problem. The maximal regularity property is key to handle vector-valued nonlinear difference equations by operator theoretical methods, because it is a prior and essential step to the use of fixed point arguments, see the monograph . However, the literature on the subject is scarce, and no attempt to study maximal regularity of fractional difference equations has been done.

## II. Regularity of Fractional Differential Equations model

Concepts are needed for the application of Blunck's theorem to fractional difference equations analyzed here in the context of Banach spaces. We also establish the definition of the fractional difference operator that we will use and that seems to be more convenient for our purposes. In this line of ideas, we note the recent paper, where it was proved that many concepts of fractional differences currently used in the literature are simply related by translation. [17]We remark that our definition is at the basis of this equivalence. Introduces a new concept that we called  $\alpha$ -resolvent sequences, denoted by  $S_\alpha(n)$ , as a necessary tool for the study of  $l_p$ -maximal regularity. We show how this tool help us to prove an explicit representation of the solution for the fractional difference equation with initial value  $u(0) = x$ .

$$u(n) = S_\alpha(n)x + (S_\alpha * f)(n - 1), \quad n \in \mathbb{N}$$

On the other hand, the notion of  $\alpha$ -resolvent families has own interest because it should correspond to the vector-valued concept of Mittag-Leffler operator sequence. In this context, gives a interesting characterization, showing that  $\alpha$ -resolvent families must have the form

$$S_\alpha(n) = \sum_{j=0}^n \frac{\Gamma(n-j+(j+1)\alpha)}{\Gamma(n-j+1)\Gamma(j\alpha+\alpha)} T^j, \quad n \in \mathbb{Z}_+$$

the main result of this paper, that shows a characterization of  $l_p$ -maximal regularity of the Equation solely in terms of the data of the problem. In other words, we prove that if a vector valued sequence  $f \in l_p$  is defined on a U M D - space X then the solution u of exists and is such that  $u, \Delta^\alpha u \in l_p$  if and only if the set

$$\{z^{1-\alpha}(z-1)^\alpha(z-1)^\alpha - T\}^{-1} : |z| = 1, z \neq 1\}$$

is R-bounded. Finally, a simpler criteria in case of Hilbert spaces is given.

### III. Nonlinear Fractional Difference Equation model

The existence of solutions for nonlinear fractional difference equations

$$\Delta_*^\alpha x(t) = f(t + \alpha - 1, x(t + \alpha - 1)), \quad t \in \mathbb{N}_{1-\alpha}, \quad 0 < \alpha \leq 1, \\ x(0) = x_0$$

where  $\Delta_*^\alpha$  is a Caputo like discrete fractional difference,  $f: [0, +\infty) \times X \rightarrow X$  is continuous in  $t$  and  $X$ .  $(X, \|\cdot\|)$  is a real Banach space with the norm  $\|x\| = \sup\{\|x(t)\|, t \in \mathbb{N}\}$ ,  $\mathbb{N}_{1-\alpha} = \{1 - \alpha, 2 - \alpha, \dots\}$ .

### IV. Lemmas and Difference Operators

We start with some necessary definitions from discrete fractional calculus theory and preliminary results so that this paper is self-contained.

Let  $v > 0$ . The  $v$ th fractional sum  $f$  is defined by

$$\Delta^{-v} f(t, a) = \frac{1}{\Gamma(v)} \sum_{s=a}^{t-v} (t-s-1)^{(v-1)} f(s) \quad (2.1)$$

Here  $f$  is defined for  $s = a \pmod{1}$  and  $\Delta^{-v} f$  is defined for  $t = (a+v) \pmod{1}$  in particular,  $\Delta^{-v}$  maps functions defined on  $\mathbb{N}_a$  to functions defined on  $\mathbb{N}_{a+v}$  where  $\mathbb{N}_1 = \{t, t+1, t+2, \dots\}$ . In addition,  $t^{(v)} = \Gamma(t+1)/\Gamma(t-v+1)$ . Atici and Eloe pointed out that this definition of the  $v$ th fractional sum is the development of the theory of the fractional calculus on time scales.

Let  $\mu > 0$  and  $m-1 < \mu < m$ , where  $m$  denotes a positive integer,  $m = \lceil \mu \rceil$  ceiling of number. Set  $v = m - \mu$ . The  $\mu$ th fractional Caputo like difference is defined as

$$V. \quad \Delta_*^\mu f(t) = \Delta^{-v} (\Delta^m f(t)) = \frac{1}{\Gamma(v)} \sum_{s=a}^{t-v} (t-s-1)^{(v-1)} (\Delta^m f)(s), \quad \forall t \in \mathbb{N}_{a+v} \quad (2.2)$$

Here  $\Delta^m$  is the  $m$ th order forward difference operator

$$(\Delta^m f)(s) = \sum_{k=0}^m \binom{m}{k} (-1)^{m-k} f(s+k) \quad (2.3)$$

For  $\mu > 0$ ,  $\mu$  non integer,  $m = \lceil \mu \rceil$ ,  $v = m - \mu$ , it holds

$$f(t) = \sum_{k=0}^{m-1} \frac{(t-a)^{(k)}}{k!} \Delta^k f(a) + \frac{1}{\Gamma(\mu)} \sum_{s=a+v}^{t-\mu} (t-s-1)^{(\mu-1)} \Delta_*^\mu f(s), \quad (2.4)$$

Where  $f$  is defined on  $\mathbb{N}_a$  with  $a \in \mathbb{N}$

In particular, when  $0 < \mu < 1$  and  $a=0$ , we have

$$f(t) = f(0) + \frac{1}{\Gamma(\mu)} \sum_{s=1-\mu}^{t-\mu} (t-s-1)^{(\mu-1)} \Delta_*^\mu f(s) \quad (2.5)$$

**Lemma 4.1.** A solution  $x(t): \mathbb{N} \rightarrow X$  is a solution of the IVP if and only if  $x(t)$  is a solution of the following fractional Taylor's difference formula:

$$x(t) = x_0 + \frac{1}{\Gamma(\alpha)} \sum_{s=1-\alpha}^{t-\alpha} (t-s-1)^{(\alpha-1)} f(s + \alpha + 1, x(s + \alpha - 1)), \\ 0 < \alpha \leq 1, x(0) = x_0 \quad (2.6)$$

Proof. Suppose that  $x(t)$  for  $t \in \mathbb{N}$  is a solution, that is  $\Delta_*^\alpha x(t) = f(t + \alpha + 1, x(t + \alpha - 1))$  for  $t \in \mathbb{N}_{1-\alpha}$ , then we can obtain according to Theorem 2.3.

Conversely, we assume that  $x(t)$  is a solution of (2.6), then

$$x(t) = x(0) + \frac{1}{\Gamma(\alpha)} \sum_{s=1-\alpha}^{t-\alpha} (t-s-1)^{(\alpha-1)} f(s + \alpha + 1, x(s + \alpha - 1)) \quad (2.7)$$

On the other hand, Theorem 2.3 yields that

$$x(t) = x(0) + \frac{1}{\Gamma(\alpha)} \sum_{s=1-\alpha}^{t-\alpha} (t-s-1)^{(\alpha-1)} \Delta_*^\alpha x(s) \quad (2.8)$$

Comparing with the above two equations, it is obtained that

$$\frac{1}{\Gamma(\alpha)} \sum_{s=1-\alpha}^{t-\alpha} (t-s-1)^{(\alpha-1)} [\Delta_*^\alpha x(s) - f(s + \alpha + 1, x(s + \alpha - 1))] = 0 \quad (2.9)$$

Let  $t=1, 2, \dots$ , respectively, we have that  $\Delta_*^\alpha x(s) - f(s + \alpha + 1, x(s + \alpha - 1))$  for  $t \in \mathbb{N}_{1-\alpha}$ , which implies that  $x(t)$  is a solution.

**Lemma 4.2.** One has

$$\sum_{s=1-\alpha}^{t-\alpha} (t-s-1)^{(\alpha-1)} = \frac{\Gamma(t+\alpha)}{a\Gamma(t)} \quad (2.10)$$

Proof. For  $x > k, x, k \in R, k > -1, x > -1$ , we have

$$\frac{\Gamma(x+1)}{\Gamma(k+1)\Gamma(x-k+1)} = \frac{\Gamma(x+2)}{\Gamma(k+1)\Gamma(x-k+1)} = \frac{\Gamma(x+3)}{\Gamma(k+1)\Gamma(x-k+1)} \quad (2.11)$$

That is,

$$\frac{\Gamma(x+1)}{\Gamma(x-k+1)} = \frac{1}{k+1} \left[ \frac{\Gamma(x+2)}{\Gamma(x-k+1)} - \frac{\Gamma(x+1)}{\Gamma(x-k)} \right] \quad (2.12)$$

Then

$$\begin{aligned} \sum_{s=1-a}^{t-a} (t-s-1)^{(a-1)} &= \sum_{\substack{s=1-a \\ t-a-1}}^{t-a} \frac{\Gamma(t-2)}{\Gamma(t-s-a+1)} \\ &= \sum_{\substack{s=1-a \\ t-a-1}}^{t-a} \frac{\Gamma(t-2)}{\Gamma(t-s-a+1)} + \Gamma(a) \\ &= \sum_{s=1-a}^{t-a-1} \frac{1}{\alpha} + \left[ \frac{\Gamma(t-s+1)}{\Gamma(t-s-\alpha+1)} - \frac{\Gamma(t-2)}{\Gamma(t-s-\alpha)} \right] + \Gamma(a) \\ &= \frac{\Gamma(t+a)}{\alpha\Gamma(t)} \end{aligned} \quad (2.13)$$

Let  $v \neq 1$  and assume  $\mu + v + 1$  is not a non positive integer. Then

$$\Delta^{-v} t^{(\mu)} = \frac{\Gamma(\mu+1)}{\Gamma(\mu+v+1)} t^{(\mu+v)} \quad (2.14)$$

In particular,  $\Delta^{-v} a = a\Delta^{-v}(t+\alpha-1)^{(0)} = (a/\Gamma(v+1))(t+\alpha-1)^{(v)}$ , where  $a$  is a constant. The following fixed point theorems will be used in the text. This difference makes that fractional difference equation with the Caputo like difference operator is more similar to classical integer-order difference equation.

### VI. Application

It is interesting to note that in case  $\alpha = 1$  we have from the above theorem

$$S_1(n) = \sum_{j=0}^n \frac{\Gamma(n+1)}{\Gamma(n-j+1)\Gamma(j+1)} T^j = \sum_{j=0}^n \frac{n!}{\Gamma(n-j)!j!} T^j = \sum_{j=0}^n \binom{n}{j} T^j = (I+T)^n,$$

We will need the following lemma that is of independent interest.

#### Lemma 5.1

Let  $0 < \alpha < 1$ ,  $a: \mathbb{N}_0 \rightarrow \mathbb{C}$  and  $S: \mathbb{N}_0 \rightarrow X$  be given. Then  $\Delta^\alpha(\alpha * S)(n) = (\alpha * \Delta^\alpha S)(n) + S(0)\alpha(n+1)$ ,  $n \in \mathbb{N}_0$

Holds.

Proof. By definition, we have

$$\begin{aligned} \Delta^\alpha(\alpha * S)(n) &= \Delta \circ \Delta^{-(1-\alpha)}(\alpha * S)(n) \\ &= \Delta^{-(1-\alpha)}(\alpha * S)(n+1) - \Delta^{-(1-\alpha)}(\alpha * S)(n) \\ &= (k^{-(1-\alpha)} * \alpha * S)(n+1) - (k^{-(1-\alpha)} * \alpha * S)(n) \\ &= \sum_{j=0}^{n+1} (k^{-(1-\alpha)} * S)(n+1-j)a(j) - \sum_{j=0}^n (k^{-(1-\alpha)} * S)(n-j)a(j) \\ &= \sum_{j=0}^n [(k^{1-\alpha} * S)(n+1-j) - (k^{1-\alpha} * S)(n-j)]a(j) + (k^{1-\alpha} * S)(0)a(n+1) \\ &= \sum_{j=0}^n \Delta(k^{1-\alpha} * S)(n-j)a(j) + k^{1-\alpha}(0)S(0)a(n+1) \\ &= \sum_{j=0}^n \Delta^\alpha S(n-j)a(j) + S(0)a(n+1) \end{aligned}$$

Proving the lemma Now we are ready to prove the second main result of this section Let  $0 < \alpha < 1$ , and  $f: \mathbb{N} \rightarrow X$  be given. The unique solution of with initial condition  $u(0)=x$  can be represented by  $u(n) = S_\alpha(n)u(0) + (S_\alpha * f)(n-1)$ ,  $n \in \mathbb{N}$

Proof: Let  $n \in \mathbb{N}$  be given. We have  $\Delta^\alpha u(n) = \Delta^\alpha S_\alpha(n)u(0) + \Delta^\alpha (S_\alpha * f)(n-1)$ . Where by definition

$$\Delta^\alpha S_\alpha(n) = \Delta^\alpha k^\alpha(n) + T\Delta^\alpha(k^\alpha * S_\alpha)(n-1).$$

Note that  $\Delta^\alpha k^\alpha(n) = \Delta \circ \Delta^{-(1-\alpha)}k^\alpha(n) = \Delta(k^{1-\alpha} * k^\alpha)(n) = \Delta^1 k^\alpha(n) = 0$ , therefore using Lemma 3.6 we obtain

$$\Delta^\alpha S_\alpha(j+1) = T\Delta^\alpha = \Delta(k^\alpha * S_\alpha)(j) + k^\alpha(0)T S_\alpha(j+1) = T S_\alpha(j+1),$$

For all  $j \in \mathbb{N}_0$ . Hence  $\Delta^\alpha S_\alpha(n) = T S_\alpha(n)$  and from (3.4) we have

$$\Delta^\alpha u(n) = T S_\alpha(n)u(0) + \Delta^\alpha (S_\alpha * f)(n-1).$$

Now, again by Lemma we get For all  $j \in \mathbb{N}$ . Therefore from we conclude that

$$\begin{aligned} \Delta^\alpha u(n) &= T S_\alpha(n)u(0) + \Delta^\alpha (S_\alpha * f)(n-1) + f(n) \\ &= T S_\alpha(n)u(0) + T (S_\alpha * f)(n-1) + f(n) \\ &= T [S_\alpha(n)u(0) + (S_\alpha * f)(n-1)] + f(n) \\ &= T u(n) + f(n). \end{aligned}$$

### Conclusion:

In this paper, we considered the initial value of fractional difference equation and Non linear fractional difference equation with the caputo link difference operators. We obtained the sufficient condition for existence of all solutions regularity of fractional differential equation model and non-linear fractional difference equation model of the system of difference equation is investigated.

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# Effects of DC to AC Conversion in Traction Sub Station of Mumbai

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**Abstract-** Electric Traction in Mumbai has successfully completed the conversion of overhead power supply system from 1500 Volt D.C. to 25KV A.C. June 2015. This is nothing short of an achievement considering the fact that engineers did it without disturbing current services and creating trouble for the 42 lakh commuters in their day-to-day travelling. Electric Traction is oldest (1925) and largest mode of transportation in Mumbai city, connecting various suburban to commercial center. This paper studied the harmonics due to this A.C. Electric Traction in supply grid, at Thane Traction substation in Mumbai. High reliability and reduced maintenance of AC motor has also enabled Railway boards to increase the number of train. This paper compares the voltage and current patterns and harmonic presence in AC supply at Traction substation.

**Index Terms-** Traction, Harmonics, Traction substation (TSS), Total Harmonic distortion.

## I. INTRODUCTION–MUMBAI TRACTION

Electric traction in suburban areas of Mumbai started with 1.5 kV (Kilovolt) DC supply in year 1925 and now it is running with 25 KV AC supply in three different region of Mumbai. With the advancement of Induction motor and huge development in power electronics devices in parallel this conversion decision has been taken by Raiway. With the continuous increment in the use of train and technology frequency of the trains rounds and speed is also increased.

**DC supply system:** Input Source is 22 kV, 3 phase, 50Hz, AC supply, which is step down to 750 volts at Traction Substation. As the traction is handling huge load it consumed very high current. There were 66 substations managing this load., it was not economical and also impractical. Therefore, new concept of enhancing capacity by increasing voltage and reducing current i.e. 25 kV traction system was undertaken. The total cost of the project is Rs 1,299.91 crore. The major benefits of this conversion include seamless operation on 25000 Volt electric traction is the saving towards lease charges of Rs. 14.5 crore per annum. Due to energy efficiency associated with AC traction system, energy savings of Rs. 51 crore per annum would be achieved, besides staff savings of Rs. 3.5 crore per annum. Another major benefit of this work is that incoming traction power supply has been shifted from Maharashtra State Electricity Board to TATA which is cheaper by Rs. 2.05 per unit, thereby resulting into annual saving to the tune of Rs. 12 crore/annum. Therefore, total recurring annual savings would be about Rs. 81

crore. In addition, increased traffic flows, improvement in speed and sectional capacity, reduced cost of operation and substantially higher reliability. [1]

Initially, up to 2013 dual voltage EMUs have been inducted in to service which can operate on both 1.5 kV DC and 25 KV AC. Using power electronic equipments, 25 kV voltage is converted to Variable Voltage and Variable Frequency AC supply, which is then fed to the 3-phase induction motors fitted in the motor coaches. During braking, traction motors work as generators and nearly 35% of the electric energy is fed back into the traction supply.

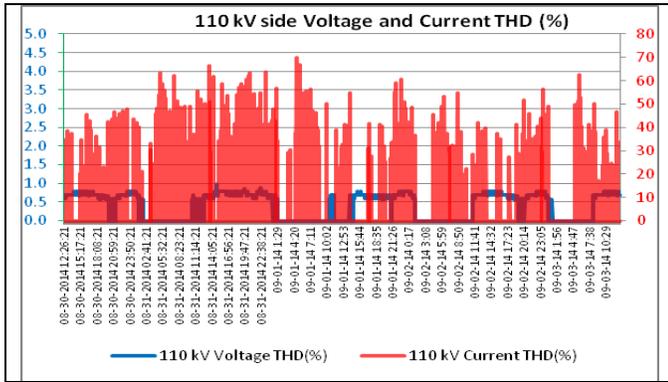
In AC traction system, 110 kV, 2 phase, 50 Hz supply is step down to 25 kV using single phase transformers at TSS. These 110 kV supply is taken from MSETCL (Maharashtra State Electricity Transmission company limited) and Tata Power. Due to the transition through neutral section or during driving braking mode traction equipments are badly effected

These can also affect other consumer devices and their demand. The power quality problems such as voltage unbalance and fluctuation, harmonic, and power factor compensation problems of electric traction system require detailed analysis to realize their effects [2]

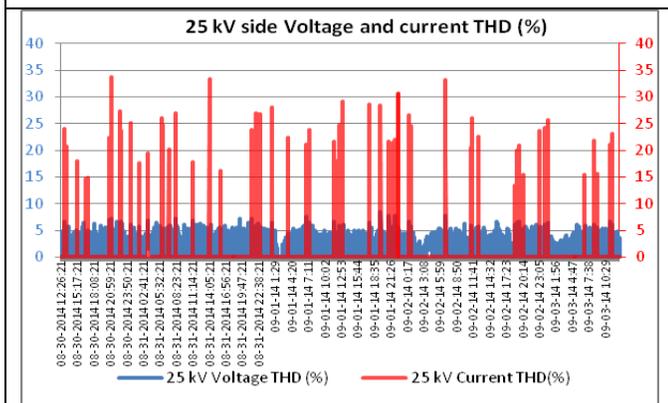
### *Traction Network*

A typical 25 kV traction scheme system is shown in figure-1. Author has taken this scheme for Thane TSS. This station both AC as well as DC supply is available but the analysis is done on AC supply side only. Present system inside the coach consist of rectifier, four quadrant chopper. Inverter which are the main sources of the harmonics. This will causes the poor voltage regulation .The induction motors will run with the low power factor (0.7-0.8).The voltage variation and harmonics together cause an abnormal operating condition such as heating in induction motors, weakling insulation, cables and capacitors. Current harmonics in motor winding causes Electromagnetic Interference ,heating losses in various





**Fig. 6. THD in Voltage and Current at HV side of Single phase transformer**



**Fig. 7. THD in Voltage and Current at LV side of Single phase transformer**

III. RESULTS

Voltage and current THD values for 25 kV AC system is given in table-I from the measurement following are the inference

Voltage maximum THD in EHV source supply (110 kV) for new 25 kV AC traction supply is comparatively less (Voltage max. THD <1.0 %) Voltage maximum THD of 25 kV traction system is in the range of 8.4 %.Maximum current during the given period is 69Amp and for 25 KV maximum have been reached to 35 Amp.

For new AC traction supply, though current are less, but maximum current THD are high.

For AC traction supply, average voltage THD of 110 kV source system is comparable, but 25 kV traction supply is quite high.

**TABLE 1 Current and Voltage THD for 25 kV Ac traction supply**

Voltage level	25 kV AC Traction Supply		
		Maximum	Average
25 kV	Voltage THD (%)	8.4	2.2
	Current THD (%)	33.7	0.42

Voltage level	25 kV AC Traction Supply		
		Maximum	Average
110 kV	Voltage THD (%)	0.97	0.37
	Current THD (%)	69.8	4.5

IV. SOLUTION STRATEGY

In the present locomotive which is Siemens made capacitor bank is installed to reduce the THD at certain level .This is connected between the chopper and inverter circuit. There are various methods for reducing the harmonics like using LC filters, Resonant arm filters, OTT filters, transformer connection. In 1970, the concept of multilevel inverter has been introduced and till date nearly various topologies have been implemented .Recent developments in power electronics have made the multilevel converter technology a practical solution to industrial complexity. Multi-level inverters are the modification of basic bridge inverters. They are normally connected in series to form stacks of level. Basic multilevel inverters are Diode-Clamped Multilevel, Flying capacitor converter, Cascade full bridge inverter etc. At present level-2 to level-81 inverter are being designed and used. But as the number of levels is increasing harmonic distortion is decreases, with elevated complexity and higher cost. It is evident that the multilevel concept will be a prominent choice for power electronic systems in future years, especially for medium-voltage operation.

Present traction inverter system can be simulated in MATLAB by gathering more detail from inverter manufacturer and harmonic distortion can be studied/calculated. By using this inverters it is possible to improve the performance of Induction motor.The existing system can be replaced by higher level inverter for reducing the harmonic content in current and voltage,

ACKNOWLEDGMENT

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# Library Trends Journal: A Bibliometric Study

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**Abstract-** The present study focused on the articles published in library trends journal from the year 2008-2014. The references cited in the articles have also been studied. Various parameters have been identified to study the journal articles and the references like Year wise publications, authorship pattern etc.

**Index Terms-** Library Trends, Bibliometric study, Citation

Library Trends Journal-*Library Trends* is a quarterly journal published by John Hopkins University Press. It is an essential tool for professional librarians and educators alike. Every issue explores critical trends in professional librarianship, and includes practical applications, thorough analyses, and literature reviews. Each issue brings readers in-depth, thoughtful articles, all exploring a specific topic of professional interest. Every year, *Library Trends* covers a wide variety of themes, from special libraries to emerging technologies.

## I. INTRODUCTION

Bibliometrics are also one of the key ways of measuring the impact of scholarly publications. If an article is published in a journal with a high impact factor, which is determined in part by the number of citations to articles within a particular journal, this raises the publishing profile of the author. The number of citations to that article over time are also a key measure of the productivity and the impact of that scholar. The subject of bibliometrics was first defined by Pritchard (1996) as “The application of mathematical and statistical methods to books and other media”. It involves the analysis of a set of publications characterized by bibliographic variables such as the author(s), the place of publication, the associated subject keywords, and the citations. The methods of bibliometrics (and the closely related specialisms of informetrics, scientometrics and webometrics (Hood and Wilson, 2001)) are used to investigate an increasing range of topics, including: the frequency distributions that characterize the use of words and phrases in text databases; the extent to which websites are linked together; longitudinal studies of the development of academic disciplines; and the extent to which individuals, research groups or institutions are published or cited in the literature (Bar-Ilan, 2008; Borgman and Furner, 2002; Cronin, 1984; Garfield, 1979; Thelwall et al., 2005; Wilson, 1999). This last application is of particular current importance as publication and citation measures are increasingly being used as performance indicators relating to the quality of the research of an individual or of an institution.

## II. SCOPE

The study is confined to the articles published in Library Trends journal and also the data is collected from the cited articles. The period considered for the study is from 2008-2014. The study has been done keeping in view the growth and development of the journal believed to be significant for publishing an article.

## III. OBJECTIVES

The objectives of the study are:

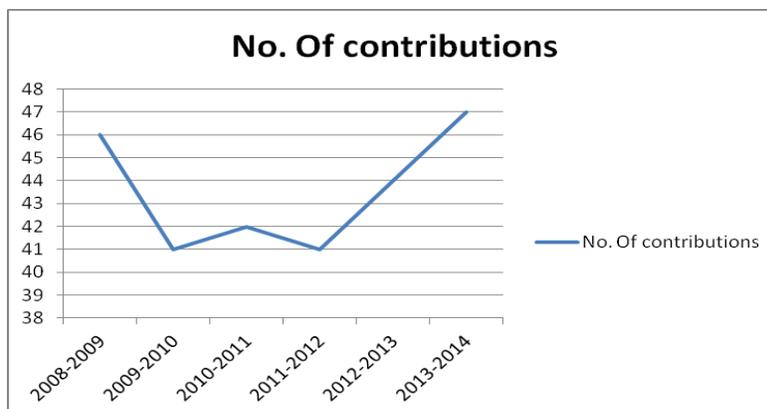
1. To examine the articles published yearly in the journal
2. To investigate the Issue wise distribution of articles
3. To find out the authorship pattern followed in the journal
4. To investigate the length of articles published in the journal
5. To examine the year wise distribution of cited articles.
6. To study the authorship pattern of cited articles.

## IV. ANALYSIS OF THE STUDY

The analysis of the articles and references cited in each article published in the journal has been done.

**Table 1. Year wise distribution of articles**

Year	Vol. No.	No. of issues	No. Of contributions	Percentage
2008-2009	57	4	46	17.62
2009-2010	58	4	41	15.70
2010-2011	59	4	42	16.09
2011-2012	60	4	41	15.70
2012-2013	61	4	44	16.85
2013-2014	62	4	47	18.00
Total		24	261	99.96



**Figure 1**

Table 1 displays the number of contributions made in Library trends journal in different years considered for the study. 47 (18%) articles are published in Vol No 62 published in 2013-

2014. 41 (15.70%) contributions are made in Vol 58 and Vol 60 published in the year 2009-2010 and 2011-2012 respectively.

**Table 2. Issue wise distribution of articles**

Month	Volume Number						Total
	57	58	59	60	61	62	
Summer	8	8	20	12	15	13	76
Fall	12	14	0	11	10	16	63
Winter	17	8	11	10	11	12	69
Spring	9	11	11	8	8	6	53
Total	46	41	42	41	44	47	261

Table 2 depicts the issue wise distribution of articles of the journal. 76 articles are published in the issue released during summer followed by 69 articles published during Winter. 53

articles are published during spring time which is less in number as compared to Summer, Fall and Winter. 47 articles are published in Vol 62 followed by 46 articles published in Vol 57.

**Table 3. Authorship Pattern**

Year	No of authors				Total
	1	2	3	More than 3	
2008-2009	27	8	4	7	46
2009-2010	23	9	6	3	41
2010-2011	14	17	7	4	42
2011-2012	29	8	3	1	41
2012-2013	22	14	6	2	44
2013-2014	30	10	6	1	47
Total	145	66	32	18	261
Percentage	55.34	25.19	12.59	6.8	99.92

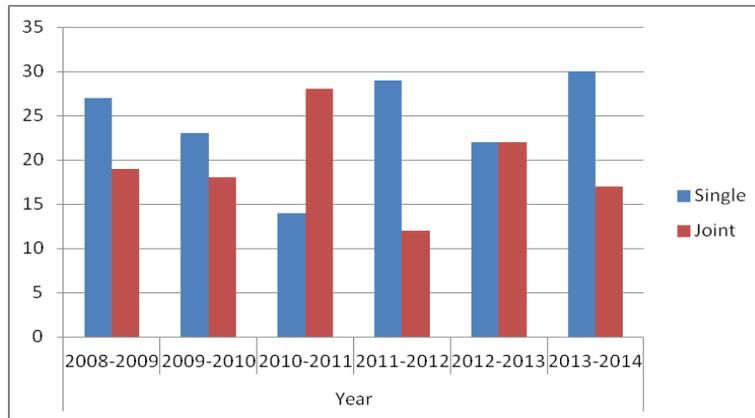
Table 3 shows the authorship pattern followed by the journal in different years. 55.34% single authors made the contributions in the articles published followed by two authors with 25.19. 30 articles are published by single author during the

year 2013-2014 followed by 29 articles during the year 2011-2012. 17 articles are contributed by two authors during the year 2010-2011 followed by 14 articles during the year 2012-2013.

Only 12.59% articles are contributed by three authors followed by 6.8 articles with more than three authors.

**Table 4. Year wise Authorship Pattern**

Authorship	Year						Total	Percentage
	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014		
Single	27	23	14	29	22	30	145	55.55
Joint	19	18	28	12	22	17	116	44.44
<b>Total</b>	46	41	42	41	44	47	261	99.99

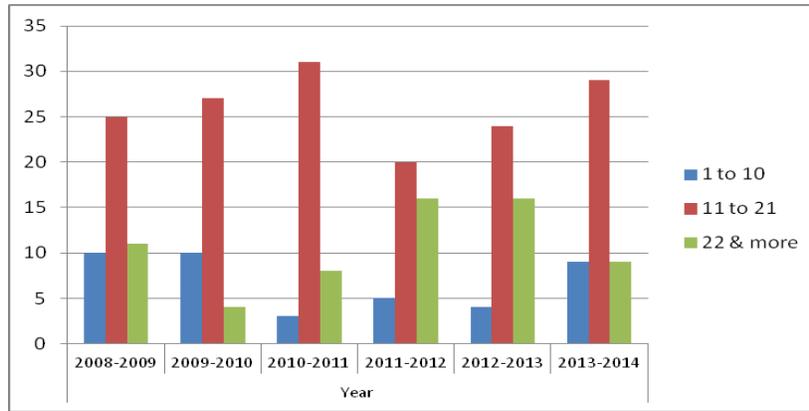


**Figure 2**

Table 4 shows the collaboration of single and joint author in publishing the articles during various years. Every year single authors have contributed more than joint authors in publishing the articles except in the year 2010-2011 where joint authors have contributed more. In a nutshell over the years single authors have been contributing more than joint authors.

**Table 5. Length of articles**

Pages	Year						Total	Percentage
	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014		
1 to 10	10	10	3	5	4	9	41	15.7
11 to 21	25	27	31	20	24	29	156	59.77
22 & more	11	4	8	16	16	9	64	24.52
<b>Total</b>	46	41	42	41	44	47	261	99.99

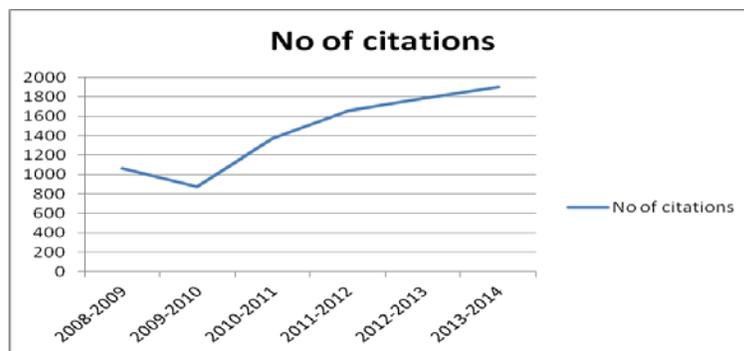


**Figure 3**

Table 5 displays the length of the articles published in the articles. The articles published during 2008-2014 very few articles are of 1 to 10 pages. Maximum no of articles are of 11 to 21 pages. In brief 59.77% percentages of articles are lengthy and 15.7% of articles are short in length.

**Table 6. Year wise distribution of citations**

Year	No of citations	Percentage
2008-2009	1068	12.33
2009-2010	873	10.07
2010-2011	1375	15.87
2011-2012	1658	19.14
2012-2013	1786	20.62
2013-2014	1901	21.94
Total	8661	99.97



**Figure 4**

Table 6 displays the year wise distribution of citations. An analysis of citations included in the articles published in the journals has been done. 21.94% of citations are included in the year 2013-2014 followed by 20.62% of citations in 2012-2013. Over the years there is a developing trend in the production of citations in the articles.

**Table 7. Authorship Pattern of Citations**

Authorship Pattern	Number of citations	Percentage
Single Author	6640	77.38

Two Authors	1265	14.74
Three Authors	421	4.9
More than 3 authors	255	2.97
Total	8581	99.99

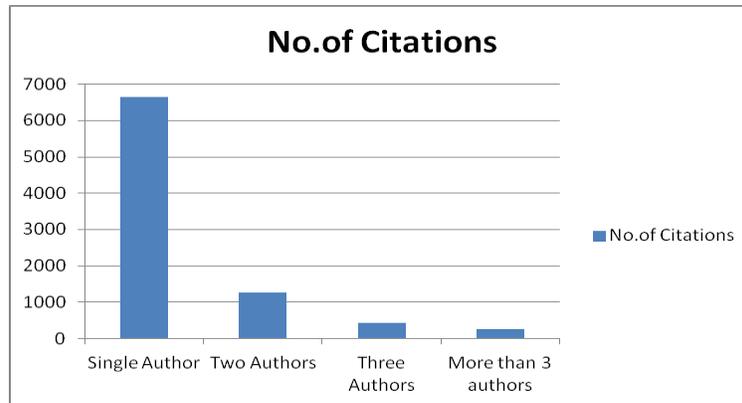


Figure 5

Table 7 displays the pattern of authorship in the citations. 77.38% of citations involve contributions of single authors followed by 14.74% of citations are of two authors. Only 4.9% citations engage the contributions of three authors followed by 2.97% of citations are of more than three authors.

#### V. CONCLUSION

The study revealed that 261 number of articles are published in the Library Trends journal . Maximum numbers of articles are published in Summer and Winter. Single authors have contributed more in publishing the articles. During the year 2013-2014 single authors have contributed more and during the 2010-2011 joint authors have contributed more. From 2008-2014 maximum number of articles published are lengthy in nature. During the year 2013-2014 21.94% of citations are produced. 77.38% of citations involve contributions of single authors.

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# Effect of type 2 Diabetes mellitus on Presentation and Treatment response of Sputum positive Pulmonary Tuberculosis

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## Abstract-

**Back ground:** Tuberculosis (TB) is a disease of global burden almost 1/3<sup>rd</sup> of population are affected by Mycobacterium tuberculosis. approximately 9 million each year are newly affected and 2 million die from the disease. Diabetes mellitus (DM) is emerging as an epidemic which increases the risk of development of TB by 3 times. DM will increase the infective forms (sputum positive) of TB there by increasing the no. of patients infected by a source case. DM will affect both clinical presentation and treatment response of pulmonary tuberculosis. Mechanisms for increased development of TB/ increased severity of TB in diabetics are-

- Hyperglycemia favors the growth of organisms in tissues.
- Indirect effects on immune function –
- Decreased activation of macrophages due deposition of lipids in RES.
- Decreased IFN –Gamma levels.
- Altered innate and type 1 cytokine expression.
- An over synthesis of ACTH, vitamin A deficiency, over production of Glycerol.
- On treatment – Pharmacogenteic interactions b/w Rifampicin and diabetic agents and decreased absorption of Rifampicin in patients with diabetes.

**Objectives:** To compare clinical, microbiological and radiological characteristics of sputum positive Pulmonary Tuberculosis (PTB) in subjects with and without Diabetes mellitus at presentation and during their course of treatment.

**Methods:** Total of 96 sputum positive PTB subjects admitted were divided into two groups based on whether they had DM or not, consisting of 32 subjects in group with DM and 64 in group without DM. their clinical characteristics were noted at presentation and compared in two groups. Sputum and chest xray severity were compared at presentation and both groups were followed up during their treatment course which consists of daily Anti tubercular drugs (ATT), Isoniazid, Rifampicin, Ethambutol, Pyrazinamide. Response to treatment was noted in both the groups.

**Results:** Subjects with DM were older than subjects without DM. In both groups 75% were males. Clinical characteristics like fever, cough and breathlessness were similar in both the groups at presentation. Sputum severity was more in patients with DM at presentation. Chest xray severity was similar in both groups at presentation, lower zone involvement is more in subjects with DM 62.5% of patients with DM and 34.4% of patients without DM. At 2 months sputum

smear is positive in 12.5% of patients with DM and 9.4% of subjects without DM. Chest xray was far advanced in grade in 37.5% of patients with DM and 18.8% of patients without DM. 31.2% of subjects were continued on intensive phase treatment in subjects with DM and 9.4% subjects without DM. At the end of 6 months sputum was not available in 62.5% of patients with DM and 71.9% of patients without DM. cxr grading was similar in both the groups, xray normalized in 37.5% of patients with DM and 48.4% of subjects without DM. 31.25% of patients were still continued on treatment in group with DM and 10.9% in subjects without DM.

**Conclusion:** No significant difference in clinical presentation in two groups at presentation. Lower zone involvement is more in patients with DM and sputum conversion is late in patients with DM requiring longer duration of treatment compared to subjects without DM.

**Index Terms-** Mycobacterium tuberculosis, Tuberculosis, Diabetes Mellitus, Anti tubercular drugs.

## I. INTRODUCTION

Tuberculosis (TB) is one of the infectious diseases most common worldwide. Tuberculosis continues to be a major global health problem. It remains a major source of morbidity and mortality throughout the world; one-third of the world's population is estimated to be infected with *Mycobacterium tuberculosis*. Current TB control measures what we have focuses on the detection and treatment of those with infectious forms of the disease and to prevent further transmission of the organisms.(1) Despite of the enormous success of this strategy in control of tuberculosis, the incidence of TB is declining slowly globally, at less than 2.2% annually.(2) The research community is working for an effective strategy for prevention of Tuberculosis for several decades. Current preventive strategies against TB lowered the incidence but the problem is still there. Therefore the focus of research has now shifted to the previously untargeted risk factors involved in the spread of TB. One such factor is diabetes mellitus (DM).The global burden of DM is rising; the prevalence is estimated to reach 438 million by 2030, and more than 80% of the adult cases will be in newly developed or developing countries. Diabetes mellitus (DM) is becoming a global epidemic and India.DM increased the risk of acquiring TB by 2-3 times, and is also risk factor for poor treatment outcomes of TB.A 52% increase in diabetes prevalence recorded over the

last 3 years in the 22 highest TB burden countries is thought to be responsible for a rise in diabetes-associated TB cases from 10% in 2010 to 15% in 2013. It is therefore important to address the global diabetes epidemic in order to help improve TB prevention and optimize clinical care for people with TB/diabetes co-morbidity.(3)The diagnosis of Diabetes implies death sentence with in five years before the discovery of insulin and the cause of death is usually infection, mostly Tuberculosis.(4) TB occurs in an increasing frequency among diabetics and appears to aggravate Diabetes, with patients requiring higher doses of drugs either insulin/ oral hypoglycemic for glycemic control. With the advent of effective AntiTubercular drugs and hypoglycemic agents, the prognosis of pulmonary tuberculosis complicated by diabetes is not as grave as it was in the past. DM causes dysfunction of the immune system thereby can increase the susceptibility to various infections including TB. DM also affects the pulmonary physiologic functions.(5) At the same time, TB can also increase the blood glucose levels and trigger “latent diabetes” or be a factor in its decompensation. DM is known to modify the clinical features of pulmonary tuberculosis.(6) The radiological involvement may also be different in diabetics with higher rate of lower field involvement first described by Sosman and Steidl(7) and thus leading to misdiagnosis of Tuberculosis. The Ant tubercular drugs like Rifampicin and Pyrazinamide can influence the glycemic control and conversely DM can also have negative effect on TB treatment.(8) DM has been associated with increased risk of treatment failure and relapse in TB patients as mentioned by several studies.(9) Experts have raised concern about the merging epidemics of tuberculosis and diabetes particularly in the low to medium income countries like India and China that have the highest burden of TB in the world, and are experiencing the fastest increase in the prevalence of DM. There is good evidence that DM makes a substantial contribution to TB incidence. The huge prevalence of DM in India, may be contributing to the increasing prevalence of TB. This study looks at the link between these two merging epidemics.

**II. MATERIALS AND METHODS**

The present study was conducted from October 2012 – September 2014, in the inpatients admitted in Kasturba hospital, Manipal after obtaining institutional ethical committee clearance (IEC 396/2012).

**Study method:** Prospective cohort study.

**Sample size:** 32 in patients with DM group and 64 in patients without DM group. Sample size was calculated based on following formula:

$$n = \frac{[z_{1-\alpha/2} \sqrt{P_1(1-P_1)} + z_{1-\beta} \sqrt{P_2(1-P_2) + P_1(1-P_2)}]^2}{(P_1 - P_2)^2}$$

$P_1$ - Proportion of disease (incidence) present in the unexposed group.

$P_2$ -Proportion of disease (incidence) present in the exposed group.

$$P_1 = (RR) P_2 \bar{P} = \frac{P_1 + P_2}{2}$$

RR – Anticipated Relative Risk.

$\alpha$ - Significance level (0.05),  $1 - \beta$  – Power of the study (80%).

N=26 per group with RR of 2.

(Minimum sample size in each group should be 22).

We have taken in 1:2 ratio for patients with DM and without DM, 32 patients were taken in DM group and 64 patients in patients without DM group. All newly detected sputum positive pulmonary Tuberculosis patients during our study period selected and screened them for diabetes (RBS, FBS, PPBS or HbA1C), presence or absence of diabetes was by ADA 2012 criteria<sup>(10)</sup> and divided them into two groups whether they have diabetes or not.

They have been selected into the study after informed consent after fulfilling inclusion and exclusion criteria

**Inclusion criteria:**

1. Age: more than 18 years.
2. Newly diagnosed sputum positive pulmonary tuberculosis patients with and without DM.

**Exclusion criteria:**

- Other forms of tuberculosis – including sputum negative TB.
- Retroviral disease and other immunosuppressive diseases, patients on steroids.
- Cirrhosis of liver,
- Patients who cannot be followed up during their treatment period,
- Not on regular treatment – defaulters &MDR TB.

Their clinical details at presentation (symptoms, history and examination) were noted and were analyzed as typical for tuberculosis or not. 6 classical symptoms were taken as typical for tuberculosis and for each patient Symptom Score was calculated based on number of these 6 symptoms that patient presented with

**Symptom Score:**

- |                   |                |
|-------------------|----------------|
| 1. Cough          | 4. Fever       |
| 2. Expectoration  | 5. Weight loss |
| 3. Breathlessness | 6. Hemoptysis  |

Other symptoms were taken as atypical symptoms like easy fatigability, chest pain not typical of pleuritic type, vomiting. At the time of admission based on patients ability to perform daily living activities Karnfosky performance score was calculated for each patient.<sup>(11)</sup>

**Table 1: Karnofsky Performance scoring**

<ul style="list-style-type: none"> <li>• Able to carry on normal activity and to work</li> <li>• No special care needed</li> </ul>	100	Normal; no complaints; no evidence of disease
	90	Able to carry on normal activity; minor signs or symptoms of disease
	80	Normal activity with effort; some signs or symptoms of disease

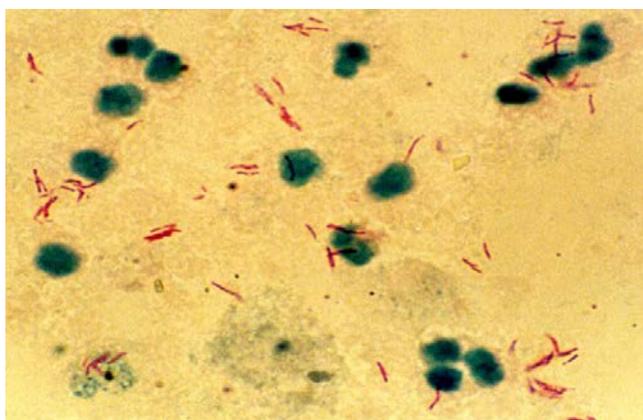
<ul style="list-style-type: none"> <li>• Unable to work</li> <li>• Able to live at home and care for most personal needs</li> <li>• Varying amount of assistance needed</li> </ul>	70	Cares for self; unable to carry on normal activity or to do active work
	60	Requires occasional assistance but is able to care for most of own personal needs
	50	Requires considerable assistance and frequent medical care
<ul style="list-style-type: none"> <li>• Unable to care for self</li> <li>• Requires equivalent of institutional or hospital care</li> <li>• Disease may be progressing rapidly</li> </ul>	40	Disabled; requires special care and assistance
	30	Severely disabled; hospital admission is indicated although death not imminent
	20	Very sick; hospital admission necessary; active supportive treatment necessary
	10	Moribund; fatal processes progressing
	0	Dead

Their body weight and height were measured and BMI was calculated.

Confirmation of Tuberculosis was done by Sputum smear microscopy (AFB staining by Ziehl-Neelssen method) and microscopic smear was graded into 3 categories based on severity.<sup>(112)</sup>

1. + - 1-9 bacilli per slide
2. ++ - 10 or more bacilli per slide
3. +++ (numerous) - 10 or more bacilli in most oil immersion fields.

**Figure 1: Zeihl-neelssen staining – AFB smear**



Chest x-ray was analysed noted the presence or absence of cavities, number and location of cavities, infiltrates or air space opaicitcs, consolidation, hilar enlargement, fibrosis, pleural effusion, pneumothorax and for any other findings.

Cxr was graded into minimal, moderately advanced and far advanced categories as per national Tuberculosis association USA 1961 guidelines.<sup>(112)</sup>

**Table 2: Grading of severity of pulmonary TB active disease in the CXR**

<ol style="list-style-type: none"> <li>1. <b>Minimal</b> -Slight to moderate density, no cavities, small part of one\both lungs, total extent not &gt; volume of lung one side the space above 2<sup>nd</sup> chondrosternal junctions and T4\T5</li> <li>2. <b>Moderately advanced</b> -Slight to moderate density lesions one\both lungs. Total extent &lt;disseminated lesions total volume of one lung or equaling in both lungs or dense and confluent lesions 1\3 the volume of one lung, total diameter of cavities if present &lt;4 cm.</li> <li>3. <b>Far Advanced</b> -More extensive than moderate.</li> </ol>
---

Comparison of clinical, microbiological and radiological parameters between patients with diabetes and without diabetes was done at presentation.

All the patients have been started on treatment with 4 first line Anti Tubercular Drugs.

1. Isoniazid
2. Rifampicin
3. Ethambutol
4. Pyrazinamide.

For diabetes patients who were known diabetic or newly detected diabetic were put on Antidiabetic medications (Oral Hypoglycemic agents or Insulin or Both) as per clinician decision and patient response along with 4 drug ATT mentioned as above.

Patients have been followed up during their treatment period and they were evaluated at 2months and 6 months period in clinical microbiological and radiological aspects.

Their symptoms were analysed at follow up and were graded as per symptom score mentioned above.

Sputum smear analysis was done for patients whoever can give sputum for examination and analysed as positive for AFB or not.

Chest x-ray at each follow up was done and graded as mentioned above.

Treatment which they were on were noted during follow up ( whether they were on intensive phase or continuation phase or completed both and stopped treatment).

Continuation phase was with 2 drugs – Isoniazid and Rifampicin.

Patients with and without DM were compared in clinical improvement, sputum conversion and radiological improvement at each visit and treatment differences between the two groups was observed and analyzed.

**Statistical analysis:**

- Mean was calculated for continuous variables which were normally distributed.
- Median was calculated for continuous variables which were non-normally distributed.
- Pearson’s Chi square analysis was used for categorical variables and Fischer’s exact test when necessary.
- Independent sample Student t test was used for normally distributed continuous variables.

- Mann Whitney U test was used for non normally distributed continuous variables.
- Data was analyzed using SPSS 20.

### III. RESULTS

#### A. Baseline characteristics:

Of 96 patients, who were pulmonary tuberculosis proven by sputum positivity, 32 were with diabetes mellitus and 64 were without diabetes mellitus.

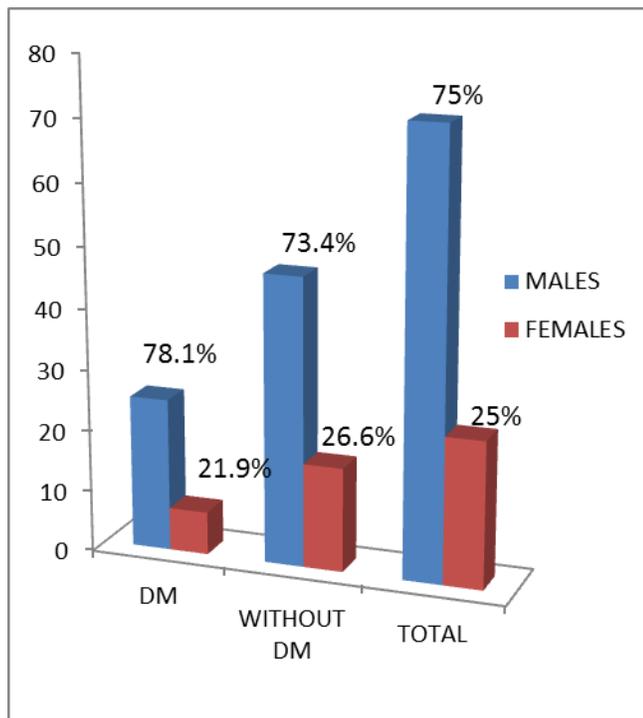
Mean age distribution is around 16 years later in diabetics than in non-diabetics.

Males are more in number than females with no gender difference in presentation among two groups of patients observed.

**Table 3: Age Distribution among two groups**

	N	Mean	SD	Min.	Max.
PTB+DM	32	54.63	9.8	36	85
PTB	64	37.95	15.6	17	75

**Figure 2: Sex distribution**



71.9% of patients in PTB group were from village compared to 53.1% in patients with DM, significant number of people were from city in patients, but not statistically significant.

Patients with Diabetes Mellitus presented after long duration of symptoms (>6 weeks duration) with significant P value (0.015).

**Table 4: Duration of symptoms**

IN Weeks	PTB+DM	PTB
<4 weeks	12(37.5%)	14(21.9%)
4-6 weeks	5(15.6%)	29(45.3%)
>6 weeks	15(46.9%)	21(32.8%)

Clinical characteristics at presentation were similar in both the groups. No significant difference between the two groups among presentation, but patients with DM presented with more atypical symptoms for tuberculosis like easy fatigability and chest pain (non pleuritic) which was statistically significant (P value -0.035). Weight loss was more in patients without DM than in patients with DM, this is in contradictory to what we expect.

**Table 5: Symptoms at presentation**

Symptom	PTB+DM	PTB	p value
Cough	31(96.9%)	63(98.4%)	
Expectoration	29(90.6%)	60(93.8%)	
Breathlessness	6(18.8%)	8(12.5%)	
Hemoptysis	4(12.5%)	6(9.4%)	
Fever	24(75%)	54(84.4%)	
Weight loss	15(46.9%)	35(54.7%)	
Symptom score(>4)	14(43.8%)	35(54.7%)	0.3
Karnofsky scoring(<80)	9(28.1%)	15(23.4%)	0.6
Atypical symptoms	11(34%)	10(15.2%)	0.035

Baseline characteristics were comparable in both groups.

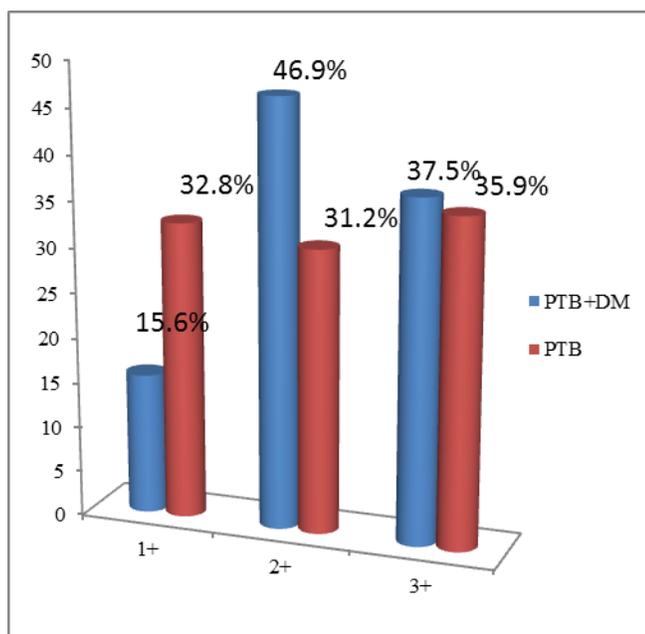
**Table 6: Baseline characteristics**

	PTB+DM(SD)	PTB(SD)
BMI	21.65(2.9)	18.11(2.86)
HB	12.4(1.6)	11.8(1.93)
ESR	53.39(20.37)	51.22(23.03)
TC	9764.52(3613.54)	10254.69(3360.83)
FBS	191.13(64.61)	89.63(12.33)
GLYCO HB	10.54 (2.23)	5.60(0.33)

Mean HBA1C in DM group at presentation was 10.54 and in patients without DM group was 5.6. Mean HB was more in patients with DM group than in patients without DM. Mean BMI was more for patients with DM than in other group.

Sputum severity grading based on sputum microscopy by Zeihll-Neelsen method was similar in both the groups at presentation with p value of 0.168 which was not significant statistically. No significant difference between the two groups in sputum severity at presentation, less severe (1+) in 32.8% of patients in PTB group without DM compared to 15.2% in DM group. Sputum was 3+ in 37.5% of patients in DM group and 35.9% in group of patients without DM.

**Figure 3: Sputum severity at presentation**



**Radiological findings:**

**Grade of x-ray at presentation:** No significant difference in severity of X-ray at presentation between the two groups. Far advanced is slightly more in patients with DM. Xray at presentation was Minimal 12.5% of patients with DM and 14.1% of patients without DM, Moderately advanced in 31.2% with DM and 35.9% of patients without DM and Far advanced in 56.2% of patients with DM and 50% of patients without DM.

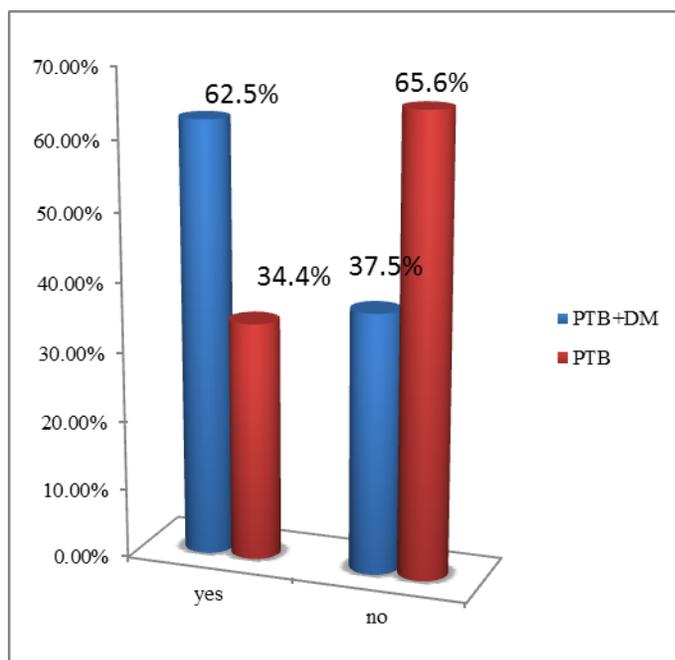
**Table 7: Grade of X-ray:**

Grade	PTB+DM	PTB
Minimal	4(12.5%)	9(14.1%)
Moderately Advanced	10(31.2%)	23(35.9%)
Far Advanced	18(56.2%)	32(50%)

Fisher Exact test was used. P value of 0.87.

No difference between upper zone involvement in two groups, but patients with DM had more number of lower zone involvement. Lower zone involvement is more in patients with DM than in patients without DM which was statistically significant (p value of 0.009). No significant difference between the two groups in cavities except slightly higher in patients with DM, present in 37.5% of patients with DM and 35.9% of patients without DM.

**Figure 4: Lower zone involvement**



No difference in other features of X-ray presentation in both groups.

**Table 8: Other x-ray characteristics**

Presentation	PTB+DM	PTB
Pleural effusion	1 (3.1%)	1(1.6%)
Pneumo thorax	0(0%)	1(1.6%)
Consolidation	11 (34.3%)	18 (28.12%)
Bronchiectasis	2 (6.1%)	1 (1.6%)
Lung abscess	1 (3.1%)	0(0%)
Miliary	1 (3.1%)	2 (3.1%)

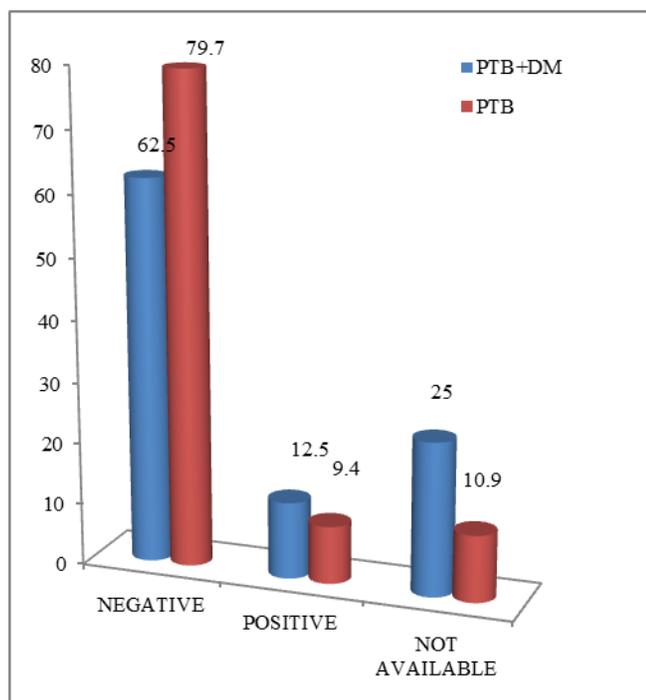
**At the end of 2 months:**

Significant number of people (40.6%) in diabetes group still have symptoms compared with the other group without diabetes

(20.3%) at the end of 2 months, which are cough and expectoration in most of the patients (P value – 0.045).

Sputum microscopy was still positive for AFB in 12.5% of patients with DM and 9.4% of patients without DM. Sputum conversion at the end of 2 months was more in tuberculosis patients without diabetes mellitus compared to patients with diabetes mellitus, but it is not statistically significant (P value 0.13).

**Figure 5: sputum microscopy at 2 months**



**X-ray at 2 months:**

X-ray was normal at 2 months in 9.4% of patients with DM and 12.5% of patients without DM, still far advanced in 37.5% of patients with DM and only 18.8% of patients without DM.

Improvement of X-ray at 2months was more in patients without DM.

X-ray at the end of 2months is still severe (Far advanced) in more number of patients with Diabetes Mellitus compared to the other group which is statistically significant (P value of 0.046). Cavity was persisting in 3 patients in DM group (9.4%) and 5 patients in without DM group (7.8%) at 2months.

**Table 9: X-ray severity at 2 months:**

X-ray at 2months	PTB+DM	PTB
Normal, Minimal, Moderately advanced	20(62.5%)	52(81.2%)
Far Advanced	12 (37.5%)	12(18.8%)

**Treatment at 2 months:**

At the end of 2 months significant number of people with Diabetes mellitus group are still continued to be on intensive regimen (31.2%) compared to the group without Diabetes mellitus (9.4%). (P value was 0.007).

**Table 10: Treatment at 2 months**

At end of 2months	PTB+DM	PTB
Completed intensive phase	22 (68.8%)	58 (90.6%)
Continued on intensive phase	10(31.2%)	6(9.4%)

Pearson chi square analysis was used. p value was 0.007 – significant.

**At the end of 6 months:**

Clinical picture at the end of 6 months showed improvement in both the groups; almost all the patients were asymptomatic in both groups except 2 patients. Only 2 patients in diabetes group still have persisting cough and expectoration. One patient is of COPD with recurrent respiratory tract infections, negative for AFB. Other patient turned to be MDR TB.

No significant difference between the two groups in sputum conversion P value – 0.45, positive in 1 patient with DM (3.1%) and none in patients without DM.

X-ray normalized at 6 months in 37.5% of patients with DM and 48.4% of patients without DM. Improvement of X-Ray is more in patients without DM compared to the other group but it is not statistically significant.

Patients without tuberculosis completed treatment by 6 months in most of the patients compared to the patients with diabetes mellitus significantly (P value -0.014). 6 (9.4%) patients developed ATT induced hepatitis in patients without DM and only 1 (3.1%)

**IV. DISCUSSION**

**DEMOGRAPHIC PROFILE:**

Present study was conducted from September 2012- august 2014, included 96 patients with sputum smear positive pulmonary tuberculosis, of which 32 were with type 2 Diabetes mellitus (DM) and 64 were without diabetes after fulfilling the inclusion and exclusion criteria.

Mean age of patients with DM was 54.63 years and patients without DM was 37.95, which was statistically significant (P <0.001). This finding is correlating with other studies (6, 10) which also showed significant age difference between the two groups. This can be explained by high prevalence of type 2 DM in older age group.

Present study showed more number of males in both groups with no difference in sex distribution in both groups. Study by Alisjahbana et al (10) also did not show difference between two groups, and Study by Shingla et al (2) also showed more number of males than females. It can be attributed to socio-cultural factors that lead to a higher risk of exposure to

*M.tuberculosis* in men and /or to a under diagnosis in women, primarily due to fewer opportunities among women to obtain medical services (11).

In our study in DM group 53.1% patients belong to rural place and 71.9% in group without DM. This finding is correlating with study by Corona et al (12) which also showed high rural incidence in patients without DM.

#### **AT PRESENTATION:**

**Duration of symptoms at presentation:** In our study more number of patients presented after 6 weeks of onset of symptoms belong to diabetes group 46.9% compared to 32.8% in patients without DM, this can be explained by more number of atypical symptoms in patients with DM which they might attribute to diabetes and thus delay their approach to healthcare center.

**Duration of diabetes at presentation:** In our study out of 32 patients, 10 (31.25%) were newly detected diabetes, 10 (31.25%) patients were with >5 years of diabetes, 12 (37.5%) of patients were with <5 years of detection of diabetes.

**Clinical profile:** Low grade fever and cough are the most common presenting symptoms which were almost similar in both the groups, correlating with Alisjahbana(10) et al and study done by shingla et al(6). There was no significant difference in two groups in other symptoms at presentation. Restrepo BI et al(13) conducted a study on Type 2 DM and Tuberculosis in United states (Mexico and Texas) which was the first reported large study of the role of Type 2 DM in a population comprising of all patients with TB identified in the control programs both in Texas and Mexico. This study also showed cough and fever were the most common presenting symptoms.

We calculated symptom score based on 6 symptoms typical of tuberculosis, as explained in methodology. In our study symptom score (SS) of >4 was observed in 43.8% of patients with DM and 54.7% of PTB patients without DM. Alisjahbana et al (10) study showed SS>4 in 63.8% of patients with DM and 48.5% of PTB patients without DM. Our study results are conflicting with study by Alisjahbana et al (10), which showed more number of symptoms in patients with DM than in without DM, but our study showed more number of symptoms in PTB patients without DM than in diabetic patients. This could be due to more number of patients in our study with atypical symptoms of tuberculosis. Karnofsky performance score was calculated for each patient based on their ability to carry out self-activities as mentioned in methodology. In our study patients with Karnofsky score (KS) of <80 were 28.1% of patients in DM group and 23.4% in patients without DM group. In study by Alisjahbana et al (10) KS was <80 in 45.7% of patients with DM and 29.4% in patients without DM group. Our study results are correlating with this study.

**Sputum microscopy:** Sputum microscopy results of our patients at diagnosis in our study showed

1. + in 15.6% of patients with DM and 32.8% of patients without DM,
2. ++ in 46.9% and 31.2% of patients with DM and without DM groups respectively,
3. +++ (numerous AFB) in 37.5% of patients with DM and 35.9% of patients without DM.

This did not show any significant difference between the two groups.

vStudy done by Shingla et al (6) showed numerous AFB in 65.2% of patients with DM and 54.1% of patients without DM, which was statistically significant with p value of 0.008.

Study done by Lalitha et al which showed +++ in 16.7% of patients with DM and 12% of patients without DM (p value of 0.147) which was not significant statistically.

The findings of the above studies are matching with our study.

Sputum severity when compared with control of hyperglycemia, based on GlycoHB, it showed that 90% of patients with severe sputum grade (3+) in patients with DM are poorly controlled DM (GlycoHB>8.0%).

#### **Regarding other baseline characteristics:**

- In our study Mean HBA1C in patients with DM was 10.54 and 5.6 in patients without DM. In our study most of the patients 28 of 32 (87.5%) patients with Tuberculosis had HBA1C of >8(uncontrolled diabetes) at presentation and only 4 of 32 (12.5%) had <8 in patients with DM, this finding suggests that Tuberculosis is more prevalent in patients in diabetic with poorly controlled glycaemia.
- Study done by Muhammed and Hassan (14) in 2010, to know the effect of hyperglycemia on tuberculosis included 326 diabetic patients of which 25 proven to have tuberculosis. Their study showed 80% of tuberculosis patients had GlycoHB of >7.0%.This finding of our study matches with the above study; this shows patients with poorly controlled glycaemia have high chances of developing tuberculosis infection.
- Baseline HB was more in patients with DM (Mean of 12.4) than in patients without DM (mean of 11.9), more number of patients without DM have anemia than patients with DM, this finding is correlating with study by Alisjahbana et al(10) which showed HB of 13.8 and 11.1 in patients with DM and without DM respectively. Associated obesity (good nutritional status) in type 2 DM can explain this finding.
- BMI was 21.65 in patients with DM and 18.11 in patients without DM, this is correlating with study by Alisjahbana et al(10) which also showed same finding of low BMI in patients without DM, this also can be explained by associated obesity and Insulin resistance in patients with DM which is contributing to high BMI.
- No difference in number of patients with the habit of smoking were almost equal in both the groups, so effect of smoking on pulmonary tuberculosis was equal in both the groups.
- With regard to drug resistance in our study only 4 of our patients were resistant to one of the first line drugs at presentation, 3 (1 H, 1 R, 1 Z) belong to DM group and 1(to Streptomycin) patient without DM. as the numbers are very small not analyzed. In Alisjahbana et al(10) study showed drug resistance more in patients without DM, Isoniazid resistance in 8.9% of patients with DM and 15.6% of patients without DM. Resistance to Rifampicin in 1.8% of patients with DM and 6.6% in patients without DM.

#### **Regarding the radiological findings:**

We have analyzed different radiological presentations in both groups and compared with each other and X-ray was graded

into mild, moderately advanced and far advanced categories as explained in methodology, and compared between two groups.

Our study showed minimal X-ray finding at presentation in 13 patients totally of which 9 (14.1%) patients were in DM group and 4 (12.5%) patients were without DM. Far advanced in 18 (56.2%) of patients with DM and 32 (50%) of patients without DM. There is no difference in Far advanced x-ray in two groups at presentation except slightly more in patients with DM.

Alisjahbana et al (10) study showed far advanced x-ray at presentation in 52.6% of patients with DM and 50.9% of patients without DM, which was not statistically significant. This finding matches with our study.

Our study showed Cavities in 37.5% (15) of patients with DM and 35.9% (16) of patients without DM, out of these 5 patients had multiple cavities, 4 of which belong to patients without DM and only 1 patient with DM had multiple cavities. Study by Qazi et al(17) showed 20% of patients with DM had cavities. Study by Shaik MA et al(18) showed that PTB DM group of patients had significantly higher frequency of cavitory lung lesions compared to PTB without DM group (50.8% versus 39.0%,  $p=0.005$ ). Study by Wang et al (19) showed 19.2% of patients with DM had cavities and 10% of patients without DM had cavities, which was statistically significant with a P value of 0.015. Study by Alisjahbana et al (10) showed more number of cavities in patients without DM than in patients with DM (40% patients with DM and 52.4% in patients without DM). Study by Carriera et al (20) in Portugal in 2012 also showed more number of cavities in patients without DM than with DM (82.1% in non-diabetic group and 63.4% in diabetic group, which was statistically significant  $P=0.01$ ). Different studies have contradictory results in this regard, as far as our study is concerned, it showed more number of cavities in diabetic patients but was not statistically significant.

Significant difference was there between two groups in our study in zone of involvement. Lower zone involvement (which is not typical of Tuberculosis) is present in 20 (62.5%) patients with DM and 22 (34.4%) patients without DM which was statistically significant, mid and lower zone involvement in 22 (68.75%) of patients with DM and 41 (64.06%) of patients without DM. there is more atypical involvement in patients with DM.

Study done by Shaikh MA et al(18), showed PTB DM group of patients had increased frequency of lung lesions confined to lower lung field compared to PTB group (23.5% versus 2.4%,  $p<10^{-4}$ ), this finding is correlating with our study. Study by Qazi et al (17) showed 54% of lower zone involvement in patients with DM.

Study by Wang et al(19) results are contradictory to the above results, this study showed more number of patients without DM had lower zone involvement (15.2% in patients with DM and 22% in patients without DM), but it was not significant statistically.

Study by Carriera et al (20) also showed significant number of patients with DM had lower zone involvement than patients without DM.

In our study upper zone involvement is present in 50% of patients with DM and 56.2% of patients without DM. Our study showed involvement of right lung more commonly than left lung and bilateral involvement in patients with DM. 50% of the

patients had right lung and 25% had left lung involvement. 25% of people showed bilateral involvement. Study by Qazi et al(17) showed right side involvement in 56% of patients, left side in 26% and bilateral in 16% of patients, This findings match with our study results.

#### AT THE END OF 2 MONTHS:

**Clinical improvement:** According to symptom score (based on scoring) was 0 in 59.4% (19) of patients with DM and 75% (48) of patients without DM. Score was 2 in 40.6% of patients with DM and 20.3% of patients without DM. This was statistically significant with P value of 0.045. From the above findings of our study, which showed improvement in clinical symptoms in both the groups after starting ATT, but the improvement is more in patients without DM than patients with DM.

**Sputum microscopy:** At the end of 2 months in our study tested for patients who could provide sputum for testing, some patients were not getting sputum for testing.

Sputum microscopy results at the end of 2 months in our study showed

1. Negative in 62.5% (20) of patients with DM and 79.7% (51) of patients without DM.
2. Positive in 12.5% (4) of patients with DM and 9.4% (6) of patients without DM.
3. Not available for testing in 25% (8) of patients with DM and 10.9% (7) of patients without DM.

Sputum conversion was more in patients without DM, but it was not statistically significant.

Study by Alisjahbana et al (10) showed sputum conversion rates of 71.3% in patients with DM and 84.3% in patients without DM. Sputum microscopy after 2 months of intensive phase was positive in 18.1% of patients without DM and 10% of patients with DM. This was not significant statistically after adjusting for confounding factors (like sputum severity at presentation, x-ray grade at presentation) in their study.

Study by Park et al(21) in Korea on 2011 studied 492 patients out of which 124 were with DM, when compared sputum culture results at 2months 14 patients showed positive at the end of 2 months out of which 8 were with DM and 6 were without DM.

In a meta-analysis by Baker et al (16) published in BMC 2011, showed that 9 studies observed sputum culture conversion at the end of 2 months, out of which 3 studies showed relative risk of  $<1$  for conversion with DM at 2or3 months, while another 6 showed  $RR>1$ , with RR ranging from 0.79 -3.25 in different studies. Another study in their analysis found a trend towards increased time to sputum conversion with diabetes (P value-0.09).

**Radiological findings:** In our study when radiological findings at 2months were compared, improvement was more in patients without DM and patients with DM were still in far advanced x-ray in a comparable number which was statistically significant (P value – 0.046).

#### Chest x-ray Grading at 2months:

1. Normal in 3 (9.4%) of patients with DM and 8 (12.5%) patients without DM

2. Minimal in 9 (21.8%) of patients with DM and 15 (23.4%) of patients without DM.

3. Moderately advanced in 8 (25%) of patients with DM and 29 (45.3%) of patients without DM.

4. Far advanced in 12 (37.5%) of patients with DM and 12 (18.8%) of patients without DM.

Radiological improvement at 2 months is more in patients without DM, as more patients in DM group were still in far advanced stage radiological who were initially comparable to each other.

**Treatment at 2 months:** At the end of 2 months some of the patients in both groups completed intensive phase and has been started on continuation phase. Some patients in both groups were continued on continuation phase based on sputum microscopy results if positive or if sputum is not available for testing their treatment continuation in intensive phase has been decided based on x-ray improvement and clinical improvement.

In our study 68.8% of patients with DM were changed to continuation phase and remaining 31.2% of patients were continued on intensive phase. In patients without DM group 90.6% were completed intensive phase of treatment and 9.4% were continued on intensive phase. This was statistically significant with P value of 0.007. More number of patients in our study still required intensive phase treatment at the end of 2 months when compared with patients without DM.

#### AT THE END OF 6 MONTHS:

**Clinical improvement:** Clinical picture at the end of 6 months showed improvement in both the groups; almost all the patients were asymptomatic in both groups except 2 patients. Only 2 patients in diabetes group still have persisting cough and expectoration. One patient is of COPD with recurrent respiratory tract infections, negative for AFB. Other patient turned out to be MDR TB.

**Sputum microscopy:** In our study sputum smear examination was not available for most of the patients, due to patient were not able to give sputum for examination which was the most frequent limitation for sputum sample collection on outpatient basis. In the available samples, sputum microscopy results of the patients there is no difference in both groups.

1. Negative in 11 (34.4%) of patients with DM and 25 (39.1%) of patients without DM.

2. Positive in only one patient in DM group and none in patients without DM.

3. Not available for testing in 22 (62.5%) of patients with DM and 39 (71.9%) of patients without DM.

It was not compared statistically as it was positive in only one patient.

Alisjahbana et al (10) study showed significant number of positive sputum culture results at the end of 6 months in DM group (22.2%), compared in patients without DM (9.6%) with P value of <0.05, diabetes remained as significant risk factor for sputum conversion even after adjusting for confounding factors with an adjusted OR of 2.69.

#### Radiological findings:

Chest x-ray at 6 months improved in both the groups.

1. Normal in 37.5% of patients with DM and 48.4% in patients without DM.

2. Minimal in 43.8% of patients with DM and 34.4% of patients without DM.

3. Moderately advanced in 15.6% of patients with DM and 17.2% of patients without DM.

4. Far advanced in 3.1% that is in one patient with DM and none in patients without DM.

Radiological improvement at the end of 6 months was more for the group without diabetes mellitus.

**Treatment T 6 months:** In our study at the end of 6 months, treatment was completed in 68.8% of the patients with DM and 31.2% were still continued on continuation phase and in patients without DM group 89.1% completed treatment and 10.9% were continued on treatment.

Most patients with DM were continued on treatment at the end of 6 months, this was statistically significant with p value of 0.014 and one patient in DM group has been started on 2nd line ATT as he was turned out to be MDR TB during the course of treatment.

Continuation of ATT in patients without DM group can be explained by their ATT induced hepatitis and other risk factors and in patients with DM continuation of drugs might be due to effect of diabetes on ATT drug's efficacy. As DM decreases the absorption and causes lower concentrations of Anti TB drugs particularly Rifampicin(22)

**Other conditions during treatment:** ATT induce hepatitis in our study was diagnosed in 7 patients, out of which only one patient was with DM and other 6 patients were without DM. according to our study Hepatitis due to ATT was more common in patients without DM. this could be due to associated malnutrition in patients without DM (low BMI In patients without DM), a predisposing factor for ATT induced hepatitis.

#### V. CONCLUSION

- Patients with DM present at a later age compared to those without DM.
- No significant difference in symptom presentation in both groups at presentation even though atypical symptoms like easy fatigability are more common in DM group which lead to delayed presentation.
- Uncontrolled hyperglycemia is associated with high prevalence of Tuberculosis.
- Significant Lower zone involvement is observed in patients with DM.
- Slightly delayed sputum smear conversion rates at 2months (at the end of intensive phase) in DM group though not significant statistically.
- Most of the Patients with DM required longer duration of intensive and continuation phase.

#### VI. LIMITATIONS OF OUR STUDY

- Sputum culture for Tuberculosis and sensitivity testing (for MDR) was not included because of financial constraints.
- Sputum smear examination for all the patients was not available at the end of 6 months.

- Not compared between controlled and uncontrolled hyperglycemia, in view of small number of patients in controlled diabetic status.

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# Emerging Social Change in India through Sanskritization at Iskcon

(With Special Reference to the Iskcon Vrindavan (U.P.),  
Jaipur (Raj.), Mayapur (W.B.), Ujjain (M.P.) & Delhi)

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## I. INTRODUCTION

Society, religion and sanskritization are complementary to and are internally linked with one another. A society successfully and ethically exists only when religion governs it, and religion often leads to sanskritization. Religion ideally serves several functions. It gives meaning and purpose to life, reinforces social unity and stability, serves as an agent of social control, promotes psychological and physical well-being, motivates people to work for positive social change through sanskritization, promotes traditional views about gender roles, and engender intolerance towards people whose religious faith differs from one's own.

The relationship between religion and social change is not fixed or cast in stone. It can vary depending on the nature of particular religions, the culture in which they are located, and the type of social structures at any particular time and place. Giddens's idea of reflexivity can be instructive. It suggests that while religion is a social construct, it also becomes a structure and influences society in many, often unanticipated ways. Religion essentially brings about social change in society and it provides the people of different sections of the society a platform to imbibe what sacred is and to give up

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what profane is. Sanskritization is a particular form of social change found in [India](#). It denotes the process by which [castes](#) placed lower in the caste hierarchy seek upward mobility by emulating the [rituals](#) and practices of the upper or dominant castes. According to M.N. Srinivas, Sanskritization is not just the adoption of new customs and habits, but also includes exposure to new ideas and values appearing in Sanskrit literature. He says that the words [karma](#), [dharma](#), [paap](#), [maya](#), [samsara](#) and [moksha](#) etc. are the most common Sanskritic theological ideas which become common in the talk of people who are sanskritized. Sanskritization is a process by which lower castes seek upward mobility by emulating the rituals and practices of upper or dominant castes. Srinivas defined it as a process by which "a low

or middle Hindu caste, or tribal or other group, changes its customs, ritual ideology, and way of life in the direction of a high and frequently twice-born caste.

The International Society for Krishna Consciousness (ISKCON), known colloquially as the Hare Krishna movement or Hare Krishnas, is a [Gaudiya Vaishnava](#) religious organisation. ISKCON was founded in 1966 in New York City by [A.C. Bhaktivedanta Swami Prabhupada](#) who is worshipped by followers. Its core beliefs are based on select traditional [Hindu scriptures](#), particularly the Bhagwad gita and the Srimad Bhagwatam. ISKCON says it is a direct descendant of Brahma-Madhva-Gaudiya Vaishnava Sampradaya. The appearance of the movement and its culture come from the [Gaudiya Vaishnava](#) tradition, which has had adherents in India since the late 15th century and Western [converts](#) since the early 1900s in America, and in England in the 1930s.

ISKCON was formed to spread the practice of [bhakti yoga](#), in which those involved (bhaktas) dedicate their thoughts and actions towards pleasing the [Supreme Lord, Krishna](#). ISKCON today is a worldwide confederation of more than 700 centres, including 80 farm communities, some aiming for self-sufficiency, 70 [schools](#) and 100 restaurants. In recent decades the most rapid expansions in membership have been within [Eastern Europe](#) and [India](#).

Change is inevitable. The present century is particularly notable for the social change in the marginalized through sanskritization. There are several ways that witness it, but the ISKCON temples all over India where everyday and especially on Sundays there can be seen a large gathering of people performing various rituals together in a mood of perfect collective consciousness is so noticeable. Indeed, in India the ongoing process of Sanskritization is quite successful as the members of the so-called lower castes are making attempts to change their destiny through the various centres of religion, and particularly through ISKCON.

## II. AIMS & OBJECTIVES OF THE STUDY

1. To study and be familiar with the implications of the major religions in India and world at large and to interpret them in the context of social change in India
2. To concentrate on the element of secularism in religion and to interpret it in the present scenario at ISKCON
3. To visit, observe, study and be familiar with the history of ISKCON and its implications
4. To be familiar with the teachings of Prabhupada and to explore in them the seeds of social change and sanskritization
5. To explore the influence of Prabhupada on the people of the various religions, castes and creeds all over the world, and particularly in USA
6. To interpret religion as a powerful means of social change
7. To study M.N. Srinivas's concept of Sanskritization and apply it to the scenario of social change in India through ISKCON
8. To observe and interpret ISKCON all over India as great and effective platform of Sanskritization
9. To be familiar with the people's unshakable faith in the powers of Lord Krishna and ISKCON
10. To study and interpret the cause and effect relationship of the popularity of ISKCON all over India as centres of spiritual peace
11. To observe the scenario of Sanskritization at ISKCON at the specified above mentioned five study areas.

## III. OVERVIEW OF LITERATURE

Throughout history, religion has continued to be a central part of societies and human experience, shaping how individuals react to the environments in which they live. Since religion is such an important part of societies around the world, sociologists are very interested in studying it. [Sociologists study](#) religion as both a belief system and a social institution. As a belief system, religion shapes what people think and how they see the world. As a [social institution](#), religion is a pattern of social action organized around the beliefs and practices that people develop to answer questions about the meaning of existence. As an institution, religion persists over time and has an organizational structure into which members are socialized. Classical, seminal sociological theorists of the late 19th and early 20th century such as Durkheim, Weber, and Marx were greatly interested in religion and its effects on society. Like those of [Plato](#) and [Aristotle](#) from ancient Greece, and Enlightenment philosophers from the 17th through 19th centuries, the ideas posited by these sociologists continue to be examined today. More recent prominent sociologists of religion include [Peter L. Berger](#), [Robert N. Bellah](#), [Thomas Luckmann](#), [Rodney Stark](#), [William Sims Bainbridge](#), [Robert Wuthnow](#), [Christian Smith](#), and [Bryan R. Wilson](#).

## IV. CONCEPTUAL FRAMEWORK

Each [major sociological framework](#) has its perspective on religion. For instance, from the [functionalist perspective of sociological theory](#), religion is an integrative force in society

because it has the power to shape collective beliefs. It provides cohesion in the social order by promoting a sense of belonging and [collective consciousness](#). This view was supported by [Emile Durkheim](#). A second point of view, supported by [Max Weber](#), views religion in terms of how it supports other social institutions. Weber thought that the religious belief systems provided a cultural framework that supported the development of other social institutions, such as the economy. While Durkheim and Weber concentrated on how religion contributes to the cohesion of society, [Karl Marx](#) focused on the conflict and oppression that religion provided to societies. Marx saw religion as a tool for class oppression in which it promotes stratification because it supports a hierarchy of people on Earth and the subordination of humankind to divine authority. Lastly, symbolic interaction theory focuses on the process by which people become religious. In fact, Sociology of religion provides an extensive significance of religion and it brings into the notice that religion in all the centuries has played a dominant role in bringing about a positive social change in society.

## V. RESEARCH QUESTIONS OR HYPOTHESIS

- Religion is a great power and has a vital force to lead the people in a community towards the sacred modes of living.
- Religion, society and sanskritization are complementary to and internally linked with one another.
- The marginalized in India are joining the process of sanskritization for the sake of a respectable social and cultural status,
- Sanskritization is a process which allows the marginalized to raise their social and cultural status by imbibing the cultural modes of the members of the upper Hindu castes and by practicing their modes of worship and rituals.
- All the religious institutions in India witness a scenario of sanskritization.
- The marginalized take sanskritization as a panacea to all their problems that prevent them from joining the main stream of the nation.
- ISKCON temples all over the world and particularly all over India allow the people from the different castes, creeds and religions to worship and perform rituals there in perfect harmony with one another.
- Sanskritization essentially is bringing about a positive social change and the rays of hope to the marginalized in India.
- The ISKCON temples all over India directly or indirectly teach the people a lesson of secularism, and lead the people to spiritual peace.
- ISKCON is bringing about a tremendous socio-cultural and religious change in India.
- The success of the process of sanskritization in India is apparent at the ISKCON temples in particular.

## VI. RESEARCH METHODOLOGY

The study is an empirical one based on the observation method and in accordance with all the steps of scientific method suggested by the eminent social scientists for the researchers. It was conducted on 300 units of information (60 from each of the specified study areas) selected randomly which includes the pilgrims, localites, concerned authorities etc. In order to visualize the emerging trends of social change through ISKCON temples in India the research scholar made a participant observation. For the purpose of the study both the primary data collected through the schedule technique and interviews and the secondary data collected from the secondary sources were used. All through it, the hypotheses was tested. The cause and effect relationship was studied minutely and thus, finally, a generalization was made. All through the work the objectivity was strictly observed by the scholar, and the central focus was made on all those things relating to ISKCON that are bringing and are likely to bring about a tremendous social change, and that are allowing the marginalized an effective platform for their social upliftment.

## VII. KEY FINDINGS

- The entire Indian society reflects a positive social change these days, a change that has opened new vistas of education, modernity and progress to all.
- Sanskritization is a popular ongoing social process which is tremendously drawing the people from the lower sections towards it.
- Almost each of the members of the marginalized sections is eager to join it for the sake of social upliftment and social change.
- ISKCON is making a tremendous contribution to the success of the process of sanskritization.
- ISKCON hails everyone whosoever visits it as a member or as a visitor.
- ISKCON does not observe the casteism or regionalism, and allows everyone to mix up with others for the sake of chanting and for the performance of the rituals.
- ISKCON is a perfect platform which reflects a live scenario of social change and sanskritization.
- The Indian marginalized in particular joins ISKCON for the sake of their upliftment and raised status.

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# Internal Barriers for Women Career Advancement in Sri Lankan Hotel Industry (with special reference to five star hotels)

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**Abstract-** Hospitality industry underscores a high inequality in women's empowerment and career advancements in most of the countries. The issue is more critical in the developing countries like Sri Lanka where as they face many challenges, often concentrated in low status, low paid and unsecure jobs in the hotel industry. With the increased number of women workforce who enrolled with higher education in the past few decades, a proportional incensement for women employees has not been rooted in the higher managerial positions in most of the Sri Lankan hotels. As concerns tourism presents a wide range of prospects for an individual in the international arena, most of the hotels still do not recruit, promote or assist women workers. Women are seldom in find managerial positions. In recent years, the increased number of women in the hotel industry and their underrepresentation in top management positions has made women's status in the industry a great concern. The purpose of the study was to examine the extent to which women face internal barriers in order to grant the routes to reach more opportunities for women career advancement. The study was done on 67 women executives from five star hotels in Sri Lanka. Organizational culture was traced as the major internal barrier for women employees in Sri Lankan hotels where as gender equity, lack support, and personal characteristics encountered the issue. Career advancement was apprehended by cross industry concern, strategic management, decision making and own initiatives.

**Index Terms-** barriers, career advancement, hospitality, internal

## I. INTRODUCTION

The tourism and hospitality sector has become an economic and social phenomenon, demonstrating above average growth for the fifth consecutive year since the 2009 economic crisis and being set to create 70 million new jobs over the next 10 years (Baum, 2015) where the hospitality industry is one of the world's largest employers (Reigel, 1998). Contributing to the achievement of the Third Millennium Development Goal – "promote gender equality and women's empowerment", women work force has been majored internationally: 33% in 1960, 43% in 1990 and 40% in 2000 (2.8 billion) which increased by 200 million compared to last decades on the past several decades. There has been an improvement in the number promoted to higher positions; women represented 20% - 40% of management position in about 60 countries (ILO, 2004).

Within the tourism and hospitality industry, women in hospitality make up close to 70% of the total workforce, under

take over 70% of all work in the informal hospitality sector (Sinclair, 1997), however paradoxically there is a marked underrepresentation of women in senior positions, with women holding less than 40% of all managerial positions, less than 20% of general management roles and between 5-8% of board positions (Baum, 2015). Regardless of these improvements, women continue to be inequitably hired, promoted, and rewarded. Unskilled or semi-skilled women tend to work in the most vulnerable jobs, where they are more likely to experience poor working conditions, inequality of opportunity and treatment, violence, exploitation, stress and sexual harassment" (Baum, 2013). Many corporate executives and managers, almost all men, argue that women have not made significant progress because they do not have the required educational backgrounds, skills, and work experience. These executives view the slow rise of women rather than discrimination (Fernandez, 1993 cited by Zhong, 2006). Although most young men and women are promoted based on performance, a gender gap still exists in the rate of promotions and women are at a disadvantage (Cobb & Dunlop, 1999).

As a result of the size and relevance of the sector within the global economy, more women have enrolled in higher education, which is viewed as a quicker route to the top level of management. Education and training providers have strong commercial interest in enabling its continued growth and development, and associated with this, in enhancing the talent pipeline in order to unlock the potential of women in the workplace. (Zhong, 2006; Baum, 2015).

Sri Lanka is now a top rated travel destination with many accolades from the New York Times, Emirates Holidays and The Lonely Planet Guide. Female population in Sri Lanka was last measured at 51.14 percent in 2013 and percentage of working-age population at 50.71 in 2013, according to the World Bank. Women play a critical role in the Sri Lankan economy and are the backbone of several of the most economically important sectors for the country including tea, garments, and migrant workers. Further, it records that 31 percent of total employees in non-agricultural sector (service and industry sector) represents women employees including hotels and restaurants in 2009 according to the World Bank. Hospitality employers should look for smart, accomplished and driven women to think out of the box to create dramatic change in the industry.

## II. THEORETICAL BACKGROUND

Being the fastest growing economic sector in the country, it has created nearly 125,000 employment for persons and the government has targeted 500,000 employments by 2016 (Sri Lanka Tourism Development Strategy – 2010). Due to the male dominated work places around the world, career development theories have been developed for men, and may not represent the nature of women’s careers (Schrieber, 1998). Therefore, researchers argues that women’s careers cannot be explained appropriately by traditional theory which emphasizes men’s careers. Theories of women career development indicated that women have been devaluated both in theory and in social context (Bierema & Opengart, 2002). Researchers have identified a number of factors that function as barriers to women’s career advancement; Gender discrimination and sexual harassments (Woods & Kavanaugh, 1994; Woods, 1994); glass ceiling

(Knutson & Schmidgall, 1999; Bily & Manoocheri, 1995; Schwartz; Brownell, 1994); pay inequalities (Fagenson & Jackson, 1994; Sparrowe and Iverson 1999, Umbreit & Diaz, 1994); old boy network (Brownell, 1994; Diaz & Umbreit, 1995); working family conflict (Brownell, 1998; Mallon & Cassell, 1999), organizational culture (Eagly and Wood, 1991; Eagly & Johnson, 1990; Vianen and Fischer, 2002). Weber (1998) found that perceived importance of career constraints are: old boy network, lack of assertiveness, male bias and stereotyping, family and work conflict, insufficient career planning, and unhelpful boss. Models and theories such as Human Capital Theory (Becker, 1975 cited by Zhong, 2006) and The New Home Economics Theory (Becker, 1981, 1985 cited by Zhong, 2006) also have been guided some of the research on gender - based income disparity. Based on the literature, following conceptual framework was constructed.

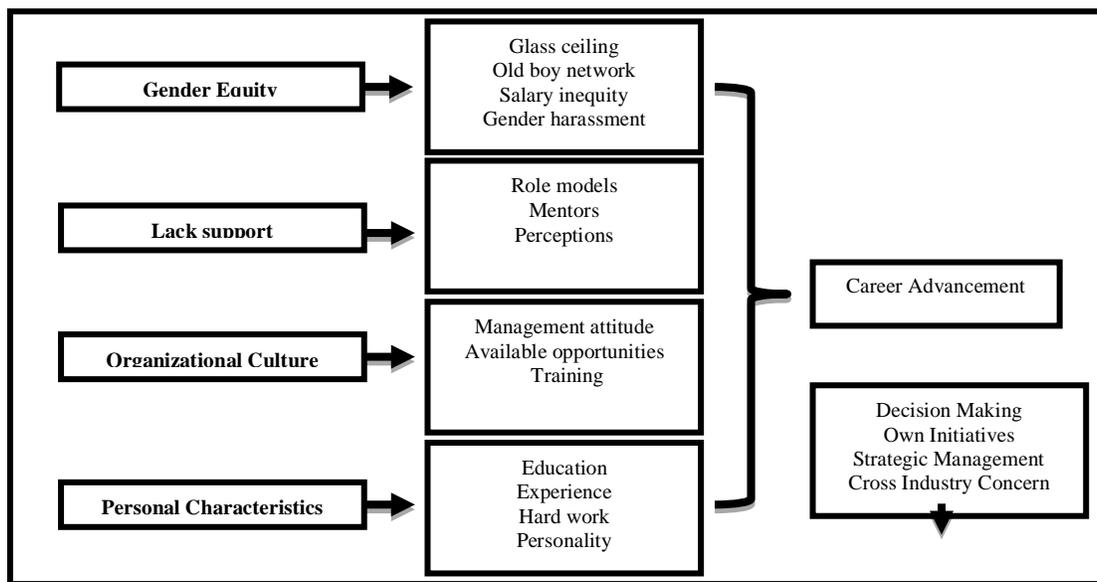


Figure 01: Conceptual Framework (Based on Literature)

Objective of this research was to identify and analyze internal barriers for women career advancement in Sri Lankan hotel industry.

## III. METHODOLOGY

There were thirteen five star hotels were in Sri Lanka according to the statistics given by Sri Lanka Tourism Development Authority (SLTDA). The population for the study was total number of women executives working in five star hotels in Sri Lanka, 67 number of respondents were selected using stratified sampling technique. Mainly primary data were used for the study collected through a self-developed questionnaire with five point likert scale (5= strongly agree to 1= strongly disagree) whereas direct interviews and secondary data also were utilized to achieve research objectives accordingly. Primary data were analyzed using descriptive analysis, and Pearson Co- relation Coefficient with SPSS software. Cronbach's alpha Reliability Test was used to measure internal

consistency and the alpha coefficient for the 18 variables were 0.812 suggesting that the items have excellent internal consistency.

### Hypothesis

#### Hypothesis A

H<sub>A 0</sub>: Gender equity related barriers do not negatively influence on women career advancement in hotel industry

H<sub>A 1</sub>: Gender equity related barriers negatively influence on women career advancement in hotel industry

#### Hypothesis B

H<sub>B 0</sub>: Lack of support related barriers do not negatively influence on women career advancement in hotel industry

H<sub>B 1</sub>: Lack of support related barriers negatively influence on women career advancement in hotel industry

#### Hypothesis C

H<sub>C 0</sub>: Organizational Culture related barriers do not negatively influence on women career advancement in hotel industry

$H_{C1}$ : Organizational Culture related barriers negatively influence on women career advancement in hotel industry

**Hypothesis D**

$H_{D0}$ : Personal characteristics related barriers do not negatively influence on women career advancement in hotel industry

$H_{D1}$ : Personal characteristics related barriers negatively influence on women career advancement in hotel industry

**IV. RESULTS AND DISCUSSION**

**Profile of the sample**

Sample of 67 women executive employees were consisted 57 percent single, 34 percent married and 9 percent divorced. Majority of women executive employees (67 percent) were in 26 to 40 age category.

**Descriptive analysis**

**01. Internal barriers**

According to the recorded mean values through descriptive analysis were fallen under moderate and highly moderate categories. Highest value which women employees have to face was the organizational culture (3.92) follows gender equity (3.89), lack support (3.87), and personal characteristics (2.7) stayed in between the range of  $2 < X < 4$  tend to be there are internal barriers for women career advancements.

Internal Barriers	Mean	SD
Gender Equity	3.89	0.35
Lack Support	3.87	0.39
Organizational Culture	3.92	0.37
Personal Characteristics	2.67	0.24

**Table 01: Internal barriers for women in hotel industry**

Barriers	Pearson correlation	P value
Gender Equity	-0.329	0.007
Lack support	-0.295	0.015
Organizational culture	-0.299	0.014
Personal characteristics	0.204	0.184

**Table 03: Internal barriers and women career advancement in hotel industry**

Person correlation results for gender equity and career advancement (-0.329) was fallen within  $-0.5 < r < 0$ , implies a weak negative correlation between gender equity related barriers and career advancement. Thus the P value is less than 0.05 ( $P=0.007$  &  $\alpha > P$ ), leads to reject null hypothesis ( $H_{A0}$ ), resulted to accept alternative hypothesis ( $H_{A1}$ ) that there is a significant negative relationship between gender equity related barriers and women career advancement in hotel industry.

$H_{A0}$ : Gender equity related barriers do not negatively influence on women career advancement in hotel industry

$H_{A1}$ : Gender equity related barriers negatively influence on women career advancement in hotel industry

Each barrier were measured with the mean and standard deviation using given indicators as in the conceptual framework. Gender harassments was the major barrier under gender equity ( $M=3.89$ ,  $SD=0.39$ ) followed by glass ceiling (3.89), salary (2.65), and old boy network (2.62) with the standard deviation of 0.34, 0.7 and 0.88 respectively. Perceptions ( $M=4.12$ ,  $SD=0.34$ ) were the major barrier under lack support where role models ( $M=3.89$ ,  $SD=0.39$ ), and mentors ( $M=2.62$ ,  $SD=0.86$ ) followed respectively. Organizational culture represented management attitudes (3.89) followed by available opportunities (3.64), and training (3.56) deviated 0.38, 0.32 and 0.39 respectively where as hard work ( $M=3.64$ ,  $SD=0.24$ ) recorded as the major barrier under personal characteristics followed by personal characteristics (2.67), education (2.65) and experience (2.17).

**02. Career advancement**

Career advancement indicators were fallen in between  $2 < X < 3$  tend to be less opportunities for career advancements as recorded mean values through descriptive analysis with lower moderate category. Cross industry concerns were under moderated category (2.69) follows strategic management (2.65), decision making (2.44), and own initiatives (2.26).

Career advancement dimension	Mean	SD
Decision making	2.44	0.57
Own initiatives	2.26	0.52
Strategic management	2.65	0.70
Cross industry concerns	2.69	0.24

**Table 02: Career advancement of women in hotel industry**

**Pearson Co- relation Coefficient analysis**

Pearson co-relation analysis was done to analyze the correlation between internal barriers and women career advancement in hotel industry to test hypothesis A, B, C, and D.

$P=0.007 < \alpha$ , reject null hypothesis ( $H_{A0}$ ) and accept alternative hypothesis ( $H_{A1}$ ): Gender equity related barriers such as glass ceiling, gender harassment, old boy network, and salary inequity issues are negatively influence on women career advancement in hotel industry.

Lack of support related barriers for women career advancements implies a weak negative correlation (-0.295) fallen within  $-0.5 < r < 0$  with P value of 0.015 which is less than alpha value of 0.05 ( $\alpha > P$ ). Hence, the null hypothesis ( $H_{B0}$ ) was rejected indicating a significant negative relationship between lacks of support related barriers and women career advancement in hotel industry.

$H_{B0}$ : Lack of support related barriers do not negatively influence on women career advancement in hotel industry

$H_{B1}$ : Lack of support related barriers negatively influence on women career advancement in hotel industry

$P=0.015 < \alpha$ , reject null hypothesis ( $H_{B0}$ ) and accept alternative hypothesis ( $H_{B1}$ ), lack support related barriers such as role models, job characteristics and perceptions on women employees negatively influence on women career advancement in hotel industry.

Pearson correlation value of the organizational culture and the career advancement (-0.299) was fallen to the range of  $-0.5 \leq r < 0$ . Consequently it represents a weak negative correlation between organizational culture and women career advancement. The P value of 0.14 which is less than alpha value of 0.05 ( $P < \alpha$ ) denotes a significant negative relationship which leads to reject null hypothesis ( $H_{C0}$ ) of the study.

$H_{C0}$ : Organizational culture related barriers do not negatively influence on women career advancement in hotel industry

$H_{C1}$ : Organizational culture related barriers negatively influence on women career advancement in hotel industry

$P=0.014 < \alpha$ , reject null hypothesis ( $H_{C0}$ ) and accept alternative hypothesis ( $H_{C1}$ ), organizational culture related barriers such as management attitudes, lack of available opportunities for women employees, and lack of training negatively influence on women career advancement in hotel industry.

Pearson correlation results for the personal characteristics of women and their career advancement (0.204) shows a weak positive relationship within the range of  $0 \leq r < +5$ . P value shows the value of 0.184 which is higher than alpha value ( $P > \alpha$ ) implies that there is no significant relationship between personal characteristics of women and career advancement leads to accept the null hypothesis ( $H_{D0}$ ) of the study.

$H_{D0}$ : Personal characteristics related barriers do not negatively influence on women career advancement in hotel industry

$H_{D1}$ : Personal characteristics related barriers negatively influence on women career advancement in hotel industry

$P=0.184 > \alpha$ , accept null hypothesis ( $H_{D0}$ ) that personal characteristics related barriers for women employees in the hotel industry such as educational qualifications, experience, difficulties to hard works, and personality do not negatively influence on women career advancement in hotel industry.

Pearson correlation for the overall barriers encountered by women in hotel industry for their career advancement was -0.369 fallen to the range of  $-0.5 \leq r < 0$  represents a weak negative relationship which is statistically significant according to the P value of 0.002 ( $P < \alpha$ ) encountered to interpret that the identified barriers leads to make less opportunities for women career advancement in hotel industry.

## V. CONCLUSION AND RECOMMENDATIONS

The result of this study revealed that negative relationship between barriers and career advancement of women. Gender harassment and perceptions are considered as a huge barrier in hotel industry. Glass ceiling, lack of role models, management attitudes, available opportunities and lack of training are also

considered as a barrier for career advancement by respondents. Perceptions which under estimate women capability also is a barrier for career advancement. In Sri Lanka, a significant proportion of women are disadvantaged in labor force especially in the hospitality industry. Women are as well educated as males, but job opportunities for women are limited to only a few departments in the hotels whereas males have a wider range to choose from leads to cut women in strategic level positions. Female workers are also far more vulnerable to sexual harassment at the workplace and, given social attitudes and limited job options, are almost invariably forced to suffer in silence. Such issues discourage women from looking for work and may also account for low female participation rates.

Research identified that gender has impacted on chances of receiving promotions that have higher expectation of performance and effort from women compared to men. Insufficient number of role models in the highest levels of position also identified as a barrier. If there enough level of role models in hotel industry, it will be a motivate factor for females to join the industry and it will reinforce women capability to reach top levels of administration positions such as CEOs, general managers, etc. Personal characteristics such as education level, experience, personality and hard work were considered as facilitating factors for the career advancement. Women have sufficient educational qualification, experiences and personal characteristics for their career progression. But due to other barriers the career progressions were limited to certain extent. The career advancement of women employees caused to decrease when they have to confront with more barriers.

Woman employees play an important role within the industry. Currently, the responsibility of preparing women to be involved in to a successful career in hospitality industry has been taken by the educational institutes. In future women contribution for human resource is vital factor, due to ongoing current tourism projects. Therefore it is an imperative factor that woman employees should get a supportive environment, motivation and satisfaction in order to provide a superior service to the hotel industry. The policy measures needed to enable women to progressive career advancement in hospitality industry and access superior jobs that pay better wages. A supportive working environment should be created in the industry with a persuaded attitudes and perceptions towards women employees. A positive reinforcement should be given to encourage such as more flexible work arrangements, investments on skill training, provision of a secure environment by maintaining law and order for women to travel to and from work to emphasize more favorable organizational culture for female employees in the hospitality industry. Women should be well represented to be working at professional or decision-making level rather than a service or clerical.

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# Microarray analysis reveal differential expression of microRNAs in triple negative breast cancer and normal breast cells

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**Abstract-** The Triple-Negative Breast Cancer (TNBC) subtype accounts for 15 percent of all breast cancers and is characterized by the lack of estrogen, progesterone, and HER2/Neu receptors. The objective of this study is to compare and contrast microRNA expression level profiles from triple-negative breast cancer versus normal breast cell lines. MicroRNA was extracted from normal (AG11132) and TNBC (HCC1806, HCC70, and MB157) cell lines and subjected to microarray analysis. Microarray analysis revealed that a number of microRNAs (miR-21, 34a, and let-7 family miRNAs) were shown to be differentially expressed in TNBC versus the normal breast cell lines. It was shown that TNBC cells have a differential microRNA expression profile when compared to normal cells. Microarray analysis revealed that microRNA expression profiles cluster the TNBC cells separately from the normal cells. The findings suggest that microRNAs could potentially be used as biomarkers to diagnose TNBC, and could potentially be used as drug-targeted therapies in the future.

**Index Terms-** triple negative breast cancer, breast cancer, microRNA, microarray

## I. INTRODUCTION

Breast cancer is the uncontrolled growth of abnormal tissues occurring in the breast. Some tumors in the breast can grow slowly, potentially up to 10 years by the time a lump can be felt, but some tumors are aggressive and grow much faster [1]. Breast cancer have four known subtypes: normal-like, luminal-like, HER-2-positive, and basal-like [2]. Triple-negative breast cancer or TNBC is a subtype of breast cancer that usually falls into the basal-like category, and is described as a heterogeneous disease comprising of multiple tumors that are associated with histological patterns and different biological and clinical behaviors and have no known biomarkers [3]. Triple-negative breast cancer accounts for about 15 percent of all breast cancers. It is characterized by cancer cells that lack estrogen, progesterone and HER2 receptors. For this reason, these tumors do not respond to hormone therapies or HER2-targeted treatments [4].

MicroRNAs are short single stranded molecules that are involved in regulation of gene expression and play a role in influencing the pathways that are known to be responsible for the progression of many diseases such as cardiovascular disease, fibrosis, and cancer [5, 6]. While microRNAs are transcribed from genes, they do not encode for proteins. The function of microRNAs is to prevent the translation of messenger RNAs/mRNAs into proteins by triggering the degradation of these mRNAs and can be classified as oncogenic or tumorigenic [6].

According to a study published in 2014 by Gasparini et al, microRNAs can be used to classify Triple-Negative Breast Cancer malignancy into six different subtypes, which could lead to new screening methods, prognostic markers, and perhaps new targeted treatments for this aggressive form of breast cancer. The six different TNBC subtypes were identified through gene expression profiling as: basal-like 1 (BL1), basal-like 2 (BL2), immunomodulatory, mesenchymal, mesenchymal stem-like, and luminal androgen receptor-expressing. The most common of these subtypes is basal-like as it is often clinically related to TNBC. All of these subtypes have different rates of incidence, risk factors, prognosis and response to treatment. Sub-classification is necessary to better identify molecular-based therapeutic targets, select biomarkers, discover new drugs, and design clinical trials that will enable alignment of TNBC patients to appropriate targeted therapies [7]. Therefore, this study seeks to report on baseline expression patterns of microRNAs in triple-negative breast cancer cell lines as compared to normal breast cells using microarray analysis. These baseline microRNA expression profiles may provide an insight into potential TNBC miRNA biomarkers that may be targeted for cancer therapies in the future.

## II. MATERIALS AND METHODS

Cell Lines: Triple-negative breast cancer cell lines HCC1806, HCC70, and MDA-MB-157 were purchased from American Type Culture Collection (Manassas, VA). Normal breast cell line A11132 was purchased from Coriell Institute for Medical Research (Camden, NJ). Cell lines HCC1806 and HCC70 were both grown in RPMI-1640 (Thermo Scientific; Rockford, IL) containing 10% fetal bovine serum (FBS) and 1% penicillin and streptomycin (P/S) (Hyclone Laboratory; Logan Utah). AG11132 was grown in MEGM (Lonza; Walkersville, MD). MDA-MB-157 was grown in L-15 (Thermo Scientific; Rockford, IL). All cell lines were maintained in 5% CO<sub>2</sub> at 37°C. All of the cells were grown to 95% confluence, counted, pelleted, and then stored at -80°C.

Microarray Hybridization and Analysis: A total of eight cell pellets, two of each cell line (AG11132, HCC1806, HCC70, and MB157) ran as duplicates, designated as 1&2 and were sent frozen on dry ice to Beckman Coulter Genomics (Morrisville, NC) in accordance with Beckman Coulter Genomics' specifications for microRNA extraction and processing. One hundred nanograms of total RNA were labeled with fluorescent dye Cy3 using the miRNAs Complete Labeling Kit (Agilent Technologies, Palo Alto, CA) following the manufacturer's protocol. The Cy3 labeled RNA was hybridized to an Agilent Human miRNAs Microarray 8X15K Release 14.0 array and the generated data was analyzed using Partek Genomics Suite at North Carolina A&T State University. The microarray text data was imported into Partek Genomics Suite software for comparison analysis. The controls used in this experiment were the normal breast tissue cell line AG11132, and the TNBC cancer cell lines were the MDA-MB-157, HCC1806, and the HCC70 cell lines. The mean & median microRNA signals and gene name are the categories that were filtered out of the original cell line data, and then the data from the duplicate cell lines were merged. Determination of under and over expression of the microRNA values were done initially through literature reviews to assist in narrowing down microRNAs to analyze using quantitative or real time-PCR. Heat maps and hierarchical clustering of the microRNA signal expression profiles were performed using Partek Genomics Suite.

Partek Genomics Suite Analysis: Partek Genomic Suite incorporates data and allows for analysis of this information in a variety of different methods. Importation of data into Partek can be done in several different ways; data can come from different array chips (i.e., Agilent or Affymetrix) and/or text files. This study utilized the text file importation method which was simple set of steps where specific data that correlated to this research was included in analysis in Partek Genomic Suite. The process for using chips such as Affymetrix or Agilent has several more dialogue boxes that must be completed prior to importation of files. Controls used in this experiment were designated as the normal breast tissue cell line AG11132 (1&2) and TNBC cancer cell lines were identified as MDA-MB-157 (1&2), HCC1806 (1&2), and HCC70 (1&2). The raw hybridization data received from Beckman Coulter was filtered to include the mean & median signals for microarray analysis. From this data the individual cell lines were then filtered out individually and merged based on the cell line type. There were two sets of data for each cell line as it was run on the microarray chip in duplicates. Finally, all the cancer cell lines were combined onto one spreadsheet. Determination of under- and overexpression of these values were in part determined through literature reviews.

## III. RESULTS

### Microarray Analysis Reveal the Differential Expression of MicroRNAs

The average microRNA g-mean signals from the microarray analysis performed on four breast cell lines (AG11132, HCC1806, HCC70, and MDA-MB-157) ran as duplicates on the Agilent Human miRNAs Microarray 8X15K Release 14.0 array were compared using Partek Genomics Suite. Figure 1 shows the initial hierarchical clustering and revealed that while the HCC70 and MDA-MB-157 cells clustered together the HCC1806 cells clustered as an outlier. The normal cell line, AG11132, clustered separately.

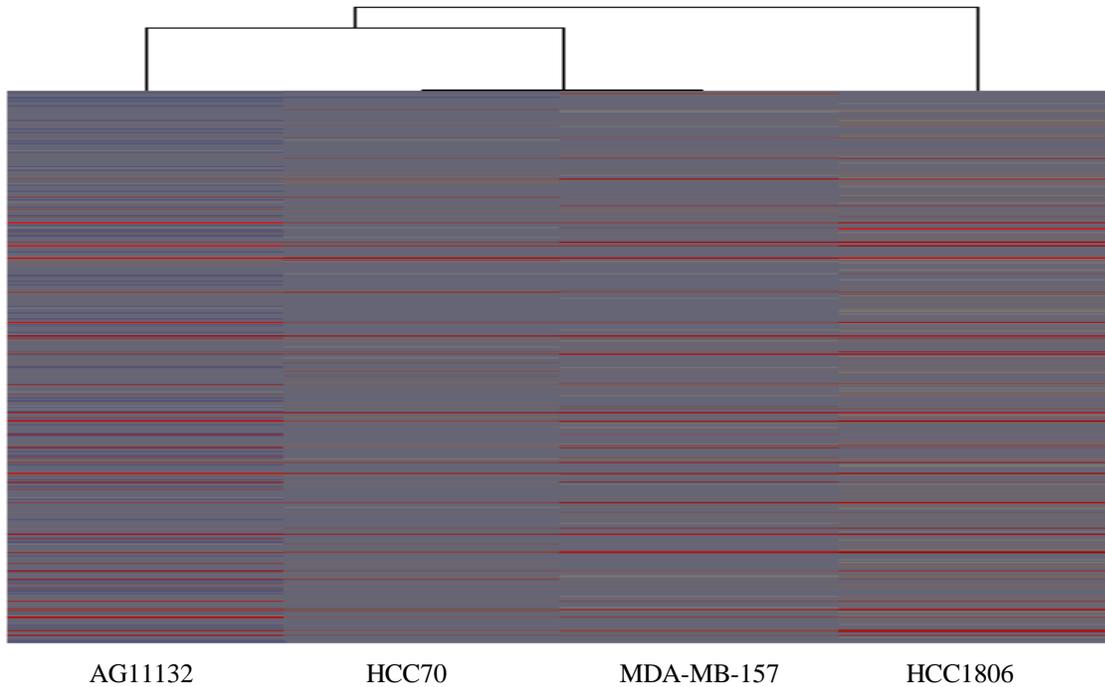


Figure1: Hierarchical clustering of g-mean average signals of microRNAs in breast cell lines ran as duplicates on Agilent Human miRNAs Microarray 8X15K Release 14.0 microarray

The hierarchical clustering in Figure 1 contained signals from all of the 12,000 miRNA transcripts from the array chip. An extensive literature review was conducted to identify from the array chip miRNAs that were associated with some type of cancer. Table 1 list the miRNAs associated with cancer that were downregulated or suppressed in the TNBC cells when compared to the normal breast cell line. The signals represent the average of the g-mean signal and may not necessarily be significantly different from the control AG11132 cell line. The suppressed miRNAs that were revealed in the table were consistent with miRNAs that are believed to be tumor suppressive and therefore be downregulated in cancer cells.

Table 1: MicroRNAs downregulated or suppressed in TNBC Cell Lines (g-mean hybridization signal)

MicroRNA	AG11132	MDA-MB-157	HCC1806	HCC70
miR-27a	243	189	153	230
miR-29a	560	153	162	424
miR-100	375	40	68	260
miR-34a	256	48	98	68
let-7a	1299	573	743	602
miR-125b	59	44	52	48
miR-203	647	43	49	43
let-7f	471	380	233	198
miR-503	67	43	47	45
miR-424	78	43	46	46

Table 2 list the miRNAs associated with cancer that were upregulated or overexpressed in the TNBC cells when compared to the normal breast cell line. The upregulated miRNAs from Table 2 are consistent with miRNAs that have been reported as having oncogenic properties.

Table 2: MicroRNAs upregulated or overexpressed in TNBC Cell Lines (g-mean hybridization signal)

MicroRNA	AG11132	MDA-MB-157	HCC1806	HCC70
miR-222	43	45	53	44
miR-16-1	39	42	46	42
miR-195	41	80	47	43
miR-155	40	43	51	51
miR-421	39	41	45	43
miR-126	39	45	50	59
miR-335	38	42	43	41
miR-145	40	43	50	42
miR-34b	38	43	54	44
miR-10b	41	43	50	42
miR-103	103	121	119	147

Table 3 list the remaining miRNAs that were associated with breast cancer, but reveals that they were differentially expressed within the TNBC breast cancer subtype.

Table 3: MicroRNAs differentially expressed in TNBC Cell Lines (g-mean hybridization signal)

MicroRNA	AG11132	MDA-MB-157	HCC1806	HCC70
miR-221	47	44	52	48
miR-141	100	65	95	127
miR-21	717	528	908	775
miR-205	150	50	160	230
miR-20a	166	218	105	170
miR-24	205	187	200	360
miR-191	41	38	42	38
miR-210	106	68	56	139
miR-29b	69	48	56	69
miR-107	94	94	122	132
let-7i	158	148	225	107

Figure 2 is a hierarchical cluster of the 32 miRNAs listed in Tables 1, 2, and 3 and have been reported to play a role in breast cancer. The cluster shows that the TNBC cells clustered together and separately from the normal breast cell line, AG11132.

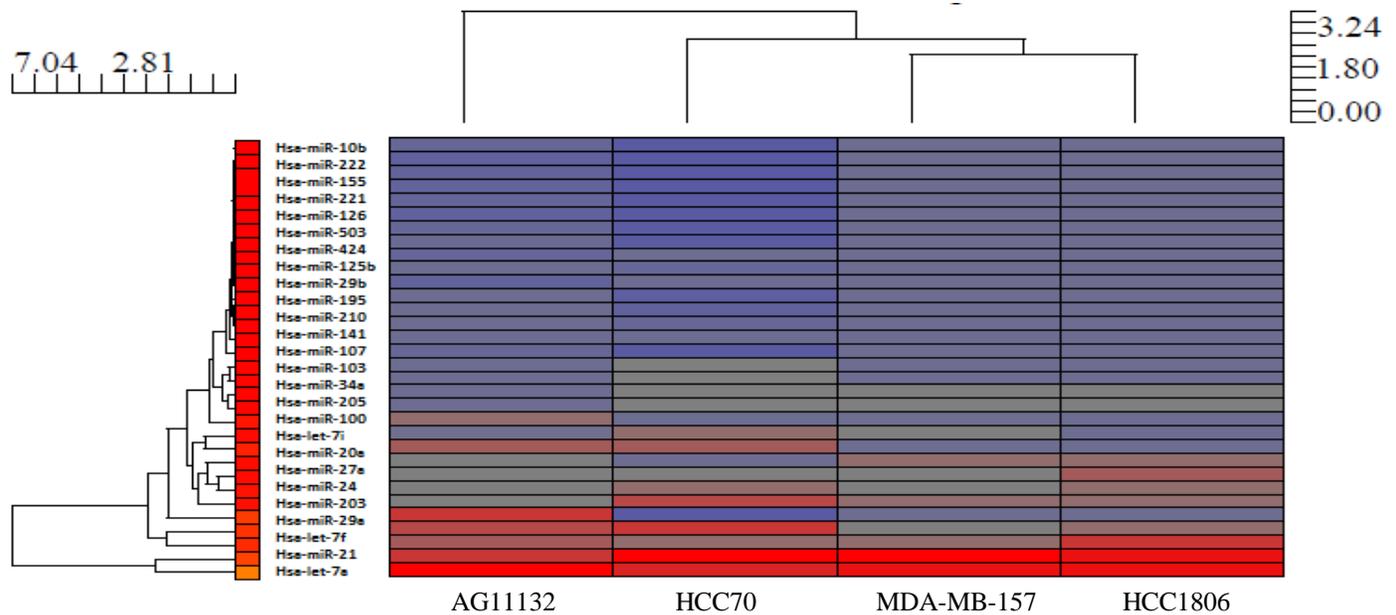


Figure 2: Hierarchical clustering of g-mean average signals of 32 microRNAs associated with cancer in breast cell lines ran as duplicates on Agilent Human miRNAs Microarray 8X15K Release 14.0 microarray

#### IV. DISCUSSION

This study compared the baseline g-mean signal microRNA expression profiles from triple-negative breast cancer and normal breast tissue cell lines using microarray analysis. MicroRNA expression profiles revealed a differential expression pattern in triple-negative breast cancer cells when compared to normal breast tissue cells. Previous research reports suggest that the over or under expression of microRNAs have a significant impact on the expression of protein-coding genes. While some of the differences in the baseline expression levels of microRNAs are not significant or in some cases negligible, it has not been established what fold change in the expression level has an impact on the microRNAs role in the cell. MicroRNAs have the ability to play a role in regulation of gene expression or in tumorigenesis, by acting as oncogenes or tumor suppressors [8]. Other reports have described altered expression of microRNAs in cancer tissues compared to normal tissues, suggesting that these microRNAs could potentially represent novel clinical and prognostic markers [2]. This research is novel because of its usage of cell lines that could serve as model systems to investigate deeper molecular level potential TNBC biomarkers and drug therapeutic targets. These findings may help to provide individualized therapeutic options based on the microRNA expression profile of a TNBC patient. More studies need to be conducted to determine the physiological effects that these microRNAs at these basal expression levels have on the cell and whether they pose an increase risk to cancer.

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# Physiological responses of chickpea genotypes for drought tolerance under induced moisture stress

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**Abstract-** Thirty chickpea genotypes were evaluated for moisture stress tolerance imposing by PEG-6000 in growth chamber, at Phytotron facility, Department of Botany, MPKV, Rahuri during *Rabi*-2013. The germination test and seedling growth under control and moisture stress were recorded to study the genotypic variation for moisture stress tolerance. Ten seeds were sown in germination paper and water stress treatments (0, -0.4 and -0.6 bar solution) create by Polyethylene glycol (PEG-6000). PEG-6000 (Distilled water, 178 and 223 mg) dissolving in 1 L of half strength Hoagland's nutrient solution separately to create water stress treatments of control, -0.4 and -0.6 bar, respectively. The experiment was laid out in a completely randomized design with two replications for each experimental unit. The observations on germination count at every 2 days interval upto 8 days and seedling length and dry matter after 8 days were taken. The genotypic variation was statistically significant for all the parameters. On the basis of stress parameters, the genotypes, NBeG 47-1, PBC-161 and BBG-2 for germination, GJG-1010 and PBC-161 for seedling growth and NBeG 47-1 and PBC-161 for higher dry matter production were found to be moisture stress tolerance.

**Index Terms-** Chickpea, moisture stress, PEG solution, germination, seedling growth, dry matter and vigour index.

## I. INTRODUCTION

Water, the most important component of life, is rapidly becoming a critically short commodity for humans and their crops. Shortage of water limits plant growth and crop productivity in arid regions more than any other single environmental factor (Boyer, 1982). Chickpea (*Cicer arietinum* L.) is a staple food of the world. It is one of the most important pulse crops which provide more calories in the form of starch and proteins; besides vitamins and diet than any other food crop. Water stress reduces crop yield regardless of the growth stage at which it occurs in chickpea. Arid and semi arid environment besides other factors may induce water stress during crop growth and development, results a reduction in crop yield (Ashraf et al., 1995). In spite water stress is recognized as an important factor that affects chickpea growth and yield, differences among cultivars were found in response to soil moisture restrictions. Turgor maintenance plays an important role in drought tolerance of plants which may be due to its involvement in stomatal

regulation and hence photosynthesis (Ludlow *et al.*, 1985). Water is essential at every stage of plant growth from seed germination to plant maturation. Water stress reduces crop yield regardless of the growth stage at which it occurs the adverse effect of water stress on crop yield may be more pronounced at some particular growth stage (El-Far and Allan, 1995) depending upon the nature of crop species and even genotypes within the species. To cope with drought stress to have handsome crop growth and yield, breeding for drought tolerance can best be accomplished by selecting for grain yield under field conditions (Richards, 1978), but such procedures require full season field data. It is not always an efficient approach, especially in mesic locations. An alternative may be to screen material under laboratory or greenhouse conditions using seedlings as test material. Several physiological characteristics have been reported as being reliable indicators for the selection of germplasm possessing drought tolerance. These characteristics include seed germination and seedling growth in nutrient solutions with low osmotic potential (Ashraf et al., 1992; Blum, 1980; Richards, 1978), the degree of electrolyte leakage (cell membrane stability, CMS) from drought-damaged leaf cells and the water relations of plants (Dedio, 1975; Ashraf et al., 1992). Screening of different crop plants to abiotic stresses is used to find out most resistant variety (Zafar-ul-Hye et al., 2007). While screening genotypes for most drought sensitive and most drought tolerance it was considered that the success of these approaches under green house and lab conditions depends on their same behavior under field condition also.

## II. MATERIALS AND METHODS

### 1.1 Seed treatment and preparation of stress solution.

The seed surfaces were sterilized with 10% sodium hypochlorite solution for five minutes and wash three times with distilled water. The polyethylene glycol (PEG-6000) was dissolved in 1 L of half strength Hoagland's nutrient solution for creating moisture stress. Pure Hoagland's nutrient solution is used as control, while 178 and 223 mg of polyethylene glycol (PEG-6000) was added separately in 1 ltr Hoagland's nutrient solution for stress treatment as -0.4 and -0.6 bar solution, respectively.

### 2.2. Experimental set-up

Thirty chickpea genotypes were evaluated for drought stress tolerance efficiency in growth chamber, at Phytotron facility, Department of Botany, MPKV, Rahuri during *Rabi*-2013. In between paper method was adopted for germination test. Ten seeds were sown in germination paper. The experiment was laid out in a completely randomized design with two replications for each

experimental unit. The control (0.0 Mpa) and water (-0.4 and -0.6 Mpa) stress treatments were given by prepared solutions. Five ml of appropriate treatment solution applied daily on each germination roll having good drain. The germination count was undertaken at every two days interval from sowing and expressed on per cent basis. The root, shoot and seedling length and dry matter of seedling was recorded after 8 days.

**2.3. Collection of data and statistical analysis**

Percentage of germination stress tolerance index is determined by Almudaris (1998)

$$GP (\%) = \frac{\text{Total number of germinated seeds}}{\text{Total seed sown}} \times 100$$

Promptness index is the percentage of seed which germinate at 2nd, 4th, 6th and 8th day of observation as indicated by nd2, nd4, nd6 and nd8 (Sammar Raza, 2012).

$$PI: nd2 (1.00) + nd4 (0.75) + nd6 (0.50) + nd8 (0.25)$$

Vigour Index (VI) was calculated by using the formula of Abdul-Baki and Anderson (1970).

$$VI = \frac{TG (\%) \times \text{seedlings length (mm)}}{100}$$

Germination Stress Index (GSI) was calculated using the formula;

$$G.S.I. (\%) = \frac{\text{Promptness index of stressed seeds}}{\text{Promptness index of control seeds}} \times 100$$

Germination rate index (GRI) was calculated by the formula given by Almudaris (1998);

$$GRI = \frac{G_1}{1} + \frac{G_2}{2} + \dots + \frac{G_x}{x}$$

G1, G2... Gx represents the percentage of germination in first, second and x<sup>th</sup> day after sowing respectively

Mean germination time (MGT) calculated according the formula given by Ellis and Roberts (1981);

$$MGT = \frac{\sum (ni/di)}{\sum ni}$$

ni: number of germinated seeds and di: day of counting

Germination index (GI) according to the equation by Kader and Jutzi (2004);

$$GI = \frac{\sum (T_i \times N_i)}{\sum N_i}$$

T<sub>i</sub>: number of day after sowing  
N<sub>i</sub>: number of germinated seeds in the day

Coefficient of velocity (CV) = (number of germinated seeds per day) according to formula given by Kader and Jutzi (2004).

$$CVg = \frac{\sum N_i}{100} \times \sum (T_i \times N_i)$$

After 8 days, germination percentage, stress index (SI), stress susceptibility index (SSI) and germination stress tolerance index (GSI) is determined by Sammar Raza (2012)

$$SI = 1 - \left[ \frac{\text{Promptness index of stressed seeds (PI}_0\text{)}}{\text{Promptness index of control seeds (PI}_1\text{)}} \right]$$

$$SSI = \frac{1 - [PI_0/PI_1]}{D} \quad D = 1 - \frac{\text{Population mean of PI}_0}{\text{Population mean of PI}_1}$$

$$GSI (\%) = \frac{PI_0}{PI_1} \times 100$$

After 8 days seedlings were harvested and their seedling length were recorded. The stress index (SI), stress susceptibility index (SSI) and seedling length tolerance index (SLSI) is determined as below and Seedling (Sammar Raza, 2012).

$$SI = 1 - \left[ \frac{\text{Seedling length under stressed condition (SL}_0\text{)}}{\text{Seedling length under control condition (SL}_1\text{)}} \right]$$

$$SSI = \frac{1 - [SL_0/SL_1]}{D} \quad D = 1 - \frac{\text{Population mean of SL}_0}{\text{Population mean of SL}_1}$$

$$SLSI (\%) = \frac{SL_0}{SL_1} \times 100$$

After drying the plant in oven at 70°C for 24 hours, the dry matter stress tolerance index is determined by Sammar Raza (2012).

$$SI = 1 - \left[ \frac{\text{Seedling dry weight under stressed condition (DM}_0\text{)}}{\text{Seedling dry weight under control condition (DM}_1\text{)}} \right]$$

$$SSI = \frac{1 - [DM_0/DM_1]}{D} \quad D = 1 - \frac{\text{Population mean of DM}_0}{\text{Population mean of DM}_1}$$

$$DMSI (\%) = \frac{DM_0}{DM_1} \times 100$$

The mean data analyzed for analysis of variance by Panse and Sukhatme (1985).

### III. RESULTS AND DISCUSSION

Present studies show genotypic variations in germination, promptness index, seedling length, dry matter and seedling vigour grown under 0, -0.4 and -0.6 Mpa. However, not all these parameters were not proved to be equally effective for screening the genotypes for their tolerance to stress. It was claimed by Fernandez (1992) that selection based on STI (stress tolerance index) would help to evaluate the higher stress tolerance genotypes with good yield potential. Bouslama and Schapaugh (1984) reported same findings in soybean. However, there are other reports (Richards, 1978) indicating germination as a useful criterion in screening for water stress tolerance. Several factors disproved seed quality such as the age of the seed, abiotic factors during plant life, growth and development, harvest and post harvest conditions etc. The response of genotypes may be different to different factors, which could be reflected in their respective seed performances.

The data indicated significant variation among genotypes for germination percentage. Significantly highest germination percentage was recorded in NBeG-165 (100%), BBG-2 (97.5%), C-705 (95%) and BG-30-35 (95%) on 4<sup>th</sup> day, JG-34 (40%) on 6<sup>th</sup> day and NDG-11-12 (15%) and RKG-11-301 (15%) on 8<sup>th</sup> day under controlled condition (Table 1). While under, moisture stress imposed by -0.4 Mpa, BBG-2 (80%), NBeG 47-1 (75%) and PBC-161 (70%) on 4<sup>th</sup> day, BDNG-2003-1 (50%), CSJ-724 (50%), RKG-201-95 (45%), GJG-1001 (40%) and CSJ-739 (40%) on 6<sup>th</sup> day and CSJ-563 (50%), H-09-54 (50%), Vishal (50%), JG-29 (45%), NBeG-165 (45%) and NDG-11-12 (45%) on 8<sup>th</sup> day recorded the highest germination percentage. The genotypes, BBG-2 (70%), PBC-161 (55%) and NBeG 47-1 (50%) 4<sup>th</sup> day, GCP-101, GJG-1010, PBC-136, RKG-11-301, GJG-10-12, NBeG 47-1, Digvijay and Vijay (40%) on 6<sup>th</sup> day and CSJ-563 (75%) and Phule G-0305-3 (70%) on 8<sup>th</sup> day under the moisture stress imposed by -0.6 Mpa maintained higher germination percentage. Ashraf et al. (1992) concluded that under moisture deficit, germination is not the standard for predicting plant's drought tolerance.

The promptness index analysed under control and stress condition revealed that, the genotypes, NBeG-165 (75.00%), BBG-2 (74.37%), C-705 (73.75%) and BG-30-35 (73.75%) had higher promptness index under controlled condition. While, BBG-2 (68.75 and 65%), NBeG 47-1 (67.50 and 60.00%) and PBC-161 (65.00 and 58.75%) maintained higher promptness index under stress imposed by -0.4 and -0.6 Mpa bar solution of PEG, respectively (Table 2). It is interesting to note that, the similar genotypes maintained minimum SI and SSI and maximum GSI. Therefore, these genotypes can be considered as moisture stress tolerance.

The productivity of genetically different varieties and their consistency is determined by seedling growth plus the correlation of other parameters like dry matter accumulation, Plant height and root length. The seedling length recorded on 8<sup>th</sup> day, the genotypes, JG-34 (26.80 cm), RKG-201-95 (26.50 cm) and BG-30-35 (25.30 cm) under control, NBeG 47-1(12.03 cm), BBG-2 (9.50 cm) and JG-34 (8.85) under -0.4 Mpa stress and NBeG 47-1 (8.00 cm), JG-34 (7.35 cm), BG-30-35 (6.98 cm) and PBC-136 (6.95 cm) under -0.6 Mpa stress recorded the highest seedling length (Table 3). Amongst the genotypes under study, GJG-1010 and PBC-161 maintained minimum SI, SSI and maximum SLSI under stress imposed by -0.4 and -0.6 Mpa bar solution of PEG. In addition to this, GJG-1010 under -0.4 Mpa and PBC-161 under -0.6 Mpa recorded lower SI, SSI and higher SLSI. On the basis of this parameter, GJG-1010 and PBC-161 seems to be moisture stress tolerant.

After drying the seedlings in oven at 70°C for 24 hours, seedling dry matter and calculated SI, SSI and DMSI are presented in table 4. The genotype, NBeG 47-1 maintained higher rate of seedling dry matter under control (1.77 g) and stress under -0.4 Mpa (1.70 g) and -0.6 Mpa (1.18 g). This genotype also maintained minimum SI and SSI and maximum DMSI at -0.4 Mpa stress and the genotype PBC-161 at -0.6 Mpa stress situation. In addition to this, RKG-201-95 (1.77 g) and BG-30-35 (1.75 g) under control, BBG-2 (1.52 g), JG-34 and BG-30-35 (1.32 g) stress at -0.4 Mpa and BG-30-35 (1.11 g) and PBC-136 (1.09 g) stress at -0.6 Mpa. In addition to this, NBeG 47-1 at -0.4 Mpa, while, PBC-161 at -0.6 Mpa recorded lower

rate of SI and SSI and higher rate of DMSI. On that basis, NBeG 47-1 and PBC-161 were found better for maintaining this parameter. Brukner and Frohberg (1987) reported DSI (dry matter stress tolerance index) as a parameter for measuring genotypic yield potential under drought stress conditions. For identifying healthy and vigorous seed lots capable of establishing appropriate populations under deficit soil moisture conditions or under abiotic stress (Ibrahim et al., 2007), the germination test of seed may be useful, but these genetic differences may not be related to subsequent growth of seedling and seed yield.

Germination rate index (GRI) and mean germination time (MGT) were comparatively higher under controlled condition than moisture stress induced by PEG-6000 (Table 5). The genotypes, NBeG-165 (25.0% & 2.5 days), BBG-2 (24.79% & 2.5 days) and C-705 and BG-30-35 (24.58% & 2.5 days) under control, BBG-2 (23.13% & 2.3 days), NBeG 47-1 (22.71% & 2.3 days), PBC-161 (22.08% & 2.2 days) and JG-16 (20.83% & 2.1 days) under stress at -0.4 Mpa and BBG-2 (22.08% & 2.2 days), PBC-161 (20.42% & 2.0 days), NBeG 47-1 (20.42% & 2.0 days) and Vijay (19.17% & 1.9 days) under stress at -0.6 Mpa maintained higher GRI and MTG, respectively (Table 5). On the basis of this parameter BBG-2, PBC-161 and NBeG 47-1 were found better for moisture stress condition.

The values for germination index (GI) and coefficient of germination velocity (CVg) were higher under stress condition than the control (Table 6). It indicated that the germinability will be delayed by imposing the stress. The low germination index and coefficient of germination velocity is the desirable direction for stress tolerance. In the present investigation, the genotypes, NBeG-165 (40.00% & 4.00), BBG-2 (40.50% & 4.05), C-705 (41.00% & 4.10) and BG-30-35 (41.00% & 4.10) under control, BBG-2 (45.00% & 4.50), NBeG 47-1 (46.00% & 4.60) and PBC-161 (48.00% & 4.80) and JG-16 (52.00% & 5.20) under moisture stress at -0.4 Mpa PEG and BBG-2 (48.00% & 4.80), JG-34 (50.00% & 5.00), NBeG 47-1 (52.00% & 5.20) and PBC-161 (53.00% & 5.30) under moisture stress at -0.6 Mpa PEG maintained minimum germination index and coefficient of germination velocity, respectively. On the basis of this parameter, BBG-2, PBC-161 and NBeG 47-1 were found better for moisture stress condition.

On the basis of germination percentage, promptness index and other stress parameters under moisture stress imposed by PEG-6000, the promising genotypes were NBeG 47-1, PBC-161 and BBG-2. However, the genotypes, GJG-1010 and PBC-161 on the basis of seedling length and NBeG 47-1 and PBC-161 on the basis of dry matter of seedling were found to be better for moisture stress. The genotypes, BBG-2, PBC-161 and NBeG 47-1 maintained higher vigour index. Therefore, the genotypes, NBeG 47-1, BBG-2 and PBC-161 for germination, GJG-1010 and PBC-161 for seedling growth and NBeG 47-1 and PBC-161 for higher dry matter production can be considered as moisture stress tolerant genotypes.

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Sr. No.	Genotype	Controlled			-0.4 Mpa PEG			-0.6 Mpa PEG		
		4 <sup>th</sup> day	6 <sup>th</sup> day	8 <sup>th</sup> day	4 <sup>th</sup> day	6 <sup>th</sup> day	8 <sup>th</sup> day	4 <sup>th</sup> Day	6 <sup>th</sup> day	8 <sup>th</sup> Day
1	GCP-101	85.00	15.00	0.00	45.00	30.00	25.00	35.00	40.00	25.00
2	JG-16	80.00	15.00	5.00	60.00	20.00	20.00	40.00	20.00	40.00
3	JG-29	75.00	25.00	0.00	30.00	25.00	45.00	25.00	20.00	55.00
4	NBeG-165	100	0.00	0.00	30.00	25.00	45.00	15.00	35.00	50.00
5	GJG-1010	85.00	10.00	5.00	25.00	35.00	40.00	0.00	40.00	60.00
6	HIR-55	75.00	20.00	5.00	35.00	25.00	40.00	20.00	30.00	50.00
7	CSJ-563	75.00	20.00	5.00	20.00	30.00	50.00	5.00	20.00	75.00
8	NDG-11-12	70.00	15.00	15.00	25.00	30.00	45.00	20.00	25.00	55.00
9	BBG-2	97.50	2.50	0.00	80.00	15.00	5.00	70.00	20.00	10.00
10	RKG-201-95	85.00	10.00	5.00	35.00	45.00	20.00	20.00	30.00	50.00
11	CSJ-724	85.00	10.00	5.00	25.00	50.00	25.00	15.00	30.00	55.00
12	GJG-1001	90.00	10.00	0.00	40.00	40.00	20.00	40.00	25.00	35.00
13	Phule G-0204-16	75.00	25.00	0.00	60.00	10.00	30.00	35.00	20.00	45.00
14	Phule G-0752	80.00	20.00	0.00	25.00	45.00	30.00	10.00	35.00	55.00
15	PBC-136	85.00	15.00	0.00	25.00	40.00	35.00	5.00	40.00	55.00
16	C-705	95.00	5.00	0.00	30.00	25.00	45.00	15.00	35.00	50.00
17	JG-34	60.00	40.00	0.00	35.00	35.00	30.00	5.00	20.00	45.00
18	BG-30-35	95.00	5.00	0.00	35.00	30.00	35.00	20.00	35.00	45.00
19	CSJ-739	85.00	15.00	0.00	45.00	40.00	15.00	35.00	35.00	30.00
20	IPC-2008-76	90.00	10.00	0.00	40.00	35.00	25.00	10.00	25.00	65.00
21	H-09-54	80.00	20.00	0.00	25.00	25.00	50.00	25.00	20.00	55.00
22	RKG-11-301	70.00	15.00	15.00	35.00	40.00	25.00	25.00	40.00	25.00
23	BDNG-2003-1	85.00	10.00	5.00	35.00	50.00	15.00	30.00	25.00	45.00
24	PBC-161	70.00	30.00	0.00	70.00	20.00	10.00	55.00	25.00	20.00
25	GJG-10-12	80.00	15.00	5.00	35.00	20.00	45.00	10.00	40.00	50.00
26	NBeG 47-1	80.00	10.00	10.00	75.00	20.00	5.00	50.00	40.00	10.00
27	Phule G-0305-3	80.00	10.00	10.00	35.00	30.00	35.00	10.00	20.00	70.00
28	Digvijay	75.00	25.00	0.00	35.00	30.00	35.00	15.00	40.00	45.00
29	Vishal	70.00	30.00	0.00	30.00	20.00	50.00	10.00	30.00	60.00
30	Vijay	80.00	20.00	0.00	50.00	30.00	20.00	40.00	40.00	20.00
	Mean	81.25	15.7	3.00	39.00	30.50	30.50	23.67	30.00	45.00
	SE ±	6.48	6.44	2.92	6.66	6.49	5.77	6.02	5.07	5.86
	CD	18.75	18.6	8.44	19.27	18.76	16.70	17.40	14.68	16.96

**Table 1. Germination percentage influenced by chickpea genotypes under moisture stress induced by PEG-6000**

S N	Genotypes	Promptness index (%)			SI		SSI		GSI	
		0.0 Mpa	-0.4 Mpa	-0.6 Mpa	-0.4 Mpa	-0.6 Mpa	-0.4 Mpa	-0.6 Mpa	-0.4 Mpa	-0.6 Mpa
1	GCP-101	71.25	55.00	52.50	0.23	0.25	0.90	0.68	77.16	73.65
2	JG-16	68.75	38.75	50.00	0.44	0.26	1.73	0.71	55.89	72.62
3	JG-29	68.75	48.75	42.50	0.29	0.38	1.14	1.04	70.91	61.82
4	NBeG-165	75.00	45.00	41.25	0.40	0.45	1.57	1.22	60.00	55.00
5	GJG-1010	70.00	53.75	35.00	0.23	0.5	0.91	1.36	76.79	50.00
6	HIR-55	67.50	52.50	42.50	0.22	0.41	0.87	1.13	77.93	63.31
7	CSJ-563	67.50	42.50	32.50	0.37	0.5	1.46	1.36	62.77	48.35
8	NDG-11-12	63.75	45.00	41.25	0.29	0.31	1.15	0.85	70.60	64.58
9	BBG-2	74.37	68.75	65.00	0.08	0.12	0.30	0.34	92.43	87.40
10	RKG-201-95	70.00	53.75	42.50	0.23	0.37	0.91	1.01	76.82	60.66
11	CSJ-724	70.00	50.00	40.00	0.28	0.41	1.12	1.11	71.52	57.22
12	GJG-1001	72.50	55.00	51.25	0.24	0.29	0.95	0.80	75.86	70.69
13	Phule G-0204-16	68.75	57.50	47.50	0.16	0.3	0.64	0.81	83.60	69.05
14	Phule G-0752	70.00	48.75	38.75	0.30	0.45	1.19	1.21	69.64	55.36
15	PBC-136	71.25	47.50	37.50	0.33	0.44	1.29	1.21	67.04	52.59
16	C-705	73.75	46.25	41.25	0.37	0.43	1.46	1.17	62.73	55.95
17	JG-34	65.00	51.25	25.00	0.21	0.62	0.83	1.67	78.85	38.46
18	BG-30-35	73.75	50.00	43.75	0.32	0.38	1.26	1.02	67.80	59.39
19	CSJ-739	71.25	57.50	51.25	0.19	0.29	0.76	0.80	80.73	71.98
20	IPC-2008-76	72.50	53.75	36.25	0.26	0.5	1.01	1.36	74.14	50.00
21	H-09-54	70.00	43.75	42.50	0.38	0.39	1.47	1.07	62.50	60.71
22	RKG-11-301	63.75	52.50	45.00	0.18	0.31	0.69	0.84	82.46	70.77
23	BDNG-2003-1	70.00	55.00	46.25	0.21	0.36	0.83	0.99	78.80	66.35
24	PBC-161	67.50	65.00	58.75	0.04	0.13	0.15	0.35	96.30	87.04
25	GJG-10-12	68.75	47.50	40.00	0.31	0.41	1.21	1.11	69.05	58.13
26	NBeG 47-1	67.50	67.50	60.00	0.00	0.11	0.00	0.30	100	88.89
27	Phule G-0305-3	67.50	50.00	35.00	0.26	0.48	1.02	1.31	74.07	51.85
28	Digvijay	68.75	50.00	42.50	0.27	0.37	1.07	1.01	72.82	61.77
29	Vishal	67.50	45.00	37.50	0.33	0.44	1.31	1.21	66.67	55.56
30	Vijay	70.00	57.50	55.00	0.18	0.21	0.70	0.58	82.14	78.57
	Mean	69.56	51.83	44.00	0.25	0.36	1.00	0.99	74.60	63.26
	SE±	1.82	4.15	2.69	0.07	0.05	0.26	0.14	6.16	4.24
	CD@5%	5.26	12.00	7.77	0.19	0.14	0.75	0.39	17.81	12.27

**Table 2. Promptness index (Pi) and germination stress indices influenced by chickpea genotypes under moisture stress induced by PEG-6000**

\*SI: Stress index, SSI: Stress susceptibility index, GSI: Germination stress tolerance index

SN	Genotypes	Seedling length (cm)			SI		SSI		SLSI	
		0 Mpa	-0.4 Mpa	-0.6 Mpa	-0.4 Mpa	-0.6 Mpa	-0.4 Mpa	-0.6 Mpa	-0.4 Mpa	-0.6 Mpa
1	GCP-101	19.80	6.00	4.05	0.70	0.79	1.11	1.08	30.5	20.6
2	JG-16	21.30	6.60	5.25	0.69	0.75	1.11	1.02	30.9	24.7
3	JG-29	17.80	6.00	4.90	0.72	0.72	1.15	0.98	28.3	27.8
4	NBeG-165	21.40	7.90	6.15	0.55	0.71	0.88	0.97	44.8	28.8
5	GJG-1010	11.70	8.20	4.05	0.30	0.65	0.47	0.88	70.4	35.2
6	HIR-55	16.80	8.50	5.35	0.49	0.68	0.79	0.92	50.6	32.4
7	CSJ-563	20.10	6.95	3.75	0.65	0.81	1.04	1.10	34.8	18.8
8	NDG-11-12	17.20	5.85	4.60	0.66	0.73	1.05	0.99	34.5	27.1
9	BBG-2	22.30	9.50	6.40	0.57	0.71	0.91	0.97	43.1	28.5
10	RKG-201-95	26.50	4.95	3.90	0.81	0.85	1.30	1.16	18.7	14.8
11	CSJ-724	19.60	8.25	5.02	0.58	0.74	0.93	1.01	42.1	25.7
12	GJG-1001	17.50	8.20	5.30	0.53	0.70	0.85	0.95	46.7	30.5
13	Phule G-0204-16	17.90	7.80	5.65	0.56	0.69	0.90	0.93	43.8	31.5
14	Phule G-0752	23.70	6.65	5.65	0.72	0.76	1.15	1.03	28.2	24.2
15	PBC-136	20.10	8.30	6.95	0.58	0.65	0.93	0.89	41.6	34.6
16	C-705	20.20	8.65	5.70	0.57	0.72	0.91	0.98	42.9	28.2
17	JG-34	26.80	8.85	7.35	0.67	0.73	1.07	0.99	33.1	27.4
18	BG-30-35	25.30	7.85	6.98	0.69	0.72	1.10	0.98	31.1	27.6
19	CSJ-739	21.80	8.40	5.90	0.61	0.73	0.98	0.99	38.6	27.1
20	IPC-2008-76	22.60	8.30	5.65	0.63	0.75	1.01	1.02	36.8	25.0
21	H-09-54	20.50	6.50	3.30	0.68	0.84	1.09	1.14	31.7	16.1
22	RKG-11-301	18.40	7.55	6.10	0.59	0.67	0.94	0.91	41.4	33.3
23	BDNG-2003-1	20.90	7.75	5.88	0.63	0.72	1.01	0.98	37.1	28.1
24	PBC-161	15.20	7.50	6.00	0.51	0.61	0.81	0.83	49.3	39.1
25	GJG-10-12	18.90	7.10	3.75	0.62	0.80	0.99	1.09	38.0	19.8
26	NBeG 47-1	23.30	12.03	8.00	0.48	0.66	0.78	0.89	51.6	34.3
27	Phule G-0305-3	24.20	7.35	5.85	0.70	0.76	1.11	1.03	30.4	24.3
28	Digvijay	18.90	7.20	5.45	0.62	0.71	1.00	0.96	38.0	29.1
29	Vishal	18.20	7.10	3.80	0.61	0.79	0.98	1.08	39.0	20.9
30	Vijay	24.20	8.45	5.65	0.65	0.77	1.05	1.04	34.9	23.3
	Mean	20.44	7.67	5.41	0.61	0.73	0.98	0.99	38.8	27.0
	SE <sub>±</sub>	0.97	0.72	0.66	0.04	0.04	0.07	0.05	4.45	4.03
	CD@5%	2.80	2.07	1.91	0.13	0.12	0.21	0.16	12.84	11.64

**Table 3. Seedling length and stress indices influenced by chickpea genotypes under moisture stress induced by PEG-6000**

\*SI: Stress index, SSI: Stress susceptibility index, SLSI: Seedling length stress tolerance index

S N	Genotypes	Seedling dry weight			SI		SSI		DMSI	
		0.0 Mpa	-0.4 Mpa	-0.6 Mpa	-0.4 Mpa	-0.6 Mpa	-0.4 Mpa	-0.6 Mpa	-0.4 Mpa	-0.6 Mpa
1	GCP-101	1.54	0.79	0.62	0.49	0.60	1.41	1.25	51.0	39.9
2	JG-16	1.63	0.82	0.74	0.50	0.55	1.43	1.14	50.3	45.1
3	JG-29	1.44	0.75	0.71	0.48	0.51	1.38	1.05	52.1	49.3
4	NBeG-165	1.63	1.10	1.01	0.32	0.38	0.93	0.79	67.5	61.9
5	GJG-1010	1.32	1.11	0.64	0.16	0.52	0.46	1.07	84.1	48.5
6	HIR-55	1.41	1.21	0.77	0.14	0.45	0.40	0.94	86.0	54.8
7	CSJ-563	1.60	0.85	0.54	0.47	0.66	1.35	1.38	53.1	33.8
8	NDG-11-12	1.41	0.74	0.66	0.47	0.53	1.36	1.10	52.7	47.0
9	BBG-2	1.68	1.52	1.07	0.10	0.36	0.27	0.76	90.4	63.6
10	RKG-201-95	1.77	0.65	0.62	0.63	0.65	1.82	1.36	36.7	34.7
11	CSJ-724	1.57	1.12	0.72	0.28	0.54	0.82	1.12	71.6	46.0
12	GJG-1001	1.44	1.11	0.77	0.23	0.46	0.66	0.96	77.0	53.7
13	Phule G-0204-16	1.44	1.06	0.87	0.26	0.39	0.75	0.82	73.8	60.7
14	Phule G-0752	1.71	0.85	0.87	0.50	0.49	1.44	1.02	49.9	51.1
15	PBC-136	1.60	1.15	1.09	0.28	0.32	0.81	0.67	71.9	67.8
16	C-705	1.61	1.06	0.90	0.34	0.44	0.98	0.92	65.8	55.8
17	JG-34	1.71	1.32	1.15	0.23	0.33	0.66	0.68	77.1	67.4
18	BG-30-35	1.75	1.32	1.11	0.24	0.37	0.70	0.76	75.6	63.3
19	CSJ-739	1.68	1.16	0.92	0.31	0.45	0.89	0.94	68.9	54.6
20	IPC-2008-76	1.70	1.13	0.85	0.34	0.50	0.96	1.05	66.5	49.7
21	H-09-54	1.67	0.80	0.40	0.52	0.76	1.50	1.58	47.9	23.9
22	RKG-11-301	1.48	1.00	0.99	0.33	0.33	0.94	0.69	67.2	66.6
23	BDNG-2003-1	1.62	1.05	0.91	0.35	0.44	1.01	0.91	65.0	56.4
24	PBC-161	1.36	0.97	0.95	0.29	0.30	0.83	0.63	70.9	69.5
25	GJG-10-12	1.54	0.87	0.59	0.43	0.62	1.24	1.28	56.7	38.4
26	NBeG 47-1	1.77	1.70	1.18	0.04	0.33	0.12	0.69	95.8	66.7
27	Phule G-0305-3	1.73	0.90	0.91	0.48	0.47	1.38	0.98	51.9	52.8
28	Digvijay	1.51	0.89	0.80	0.41	0.47	1.18	0.97	59.0	53.0
29	Vishal	1.44	0.87	0.61	0.40	0.58	1.14	1.21	60.4	42.4
30	Vijay	1.74	1.19	0.82	0.32	0.53	0.91	1.10	68.4	47.1
	Mean	1.58	1.03	0.82	0.34	0.48	0.99	0.99	65.6	52.3
	SE±	0.02	0.02	0.02	0.01	0.01	0.04	0.03	1.50	1.61
	CD@5%	0.06	0.07	0.06	0.04	0.04	0.12	0.09	4.34	4.65

**Table 4. Seedling dry matter (g) and stress indices influenced by chickpea genotypes under moisture stress induced by PEG-6000**

\*SI: Stress index, SSI: Stress susceptibility index, DMSI: Seedling dry matter stress tolerance index

Sr. No	Genotype	Germination rate index (GRI)			Mean germination time (MGT)		
		Control	-0.4 Mpa	-0.6 Mpa	Control	-0.4 Mpa	-0.6 Mpa
1	GCP-101	23.75	19.38	18.54	2.4	1.9	1.9
2	JG-16	23.13	20.83	18.33	2.3	2.1	1.8
3	JG-29	22.42	17.29	16.46	2.2	1.7	1.6
4	NBeG-165	25.00	17.29	15.83	2.5	1.7	1.6
5	GJG-1010	23.54	17.08	14.17	2.4	1.7	1.4
6	HIR-55	22.71	17.92	16.25	2.3	1.8	1.6
7	CSJ-563	22.71	16.25	13.96	2.3	1.6	1.4
8	NDG-11-12	21.88	16.88	16.04	2.2	1.7	1.6
9	BBG-2	24.79	23.13	22.08	2.5	2.3	2.2
10	RKG-201-95	23.54	18.75	16.25	2.4	1.9	1.6
11	CSJ-724	23.54	17.71	15.63	2.4	1.8	1.6
12	GJG-1001	24.17	19.17	18.54	2.4	1.9	1.9
13	Phule G-0204-16	22.92	20.42	17.71	2.3	2.0	1.8
14	Phule G-0752	23.33	17.50	15.21	2.3	1.8	1.5
15	PBC-136	23.75	17.29	14.79	2.4	1.7	1.5
16	C-705	24.58	17.29	15.83	2.5	1.7	1.6
17	JG-34	21.67	18.33	10.21	2.2	1.8	1.0
18	BG-30-35	24.58	18.13	16.46	2.5	1.8	1.6
19	CSJ-739	23.75	19.79	18.33	2.4	2.0	1.8
20	IPC-2008-76	24.17	18.96	14.79	2.4	1.9	1.5
21	H-09-54	23.33	16.67	16.46	2.3	1.7	1.6
22	RKG-11-301	21.88	18.54	16.04	2.2	1.9	1.6
23	BDNG-2003-1	23.54	18.96	17.29	2.4	1.9	1.7
24	PBC-161	22.50	22.08	20.42	2.3	2.2	2.0
25	GJG-10-12	23.13	17.71	15.42	2.3	1.8	1.5
26	NBeG 47-1	22.92	22.71	20.42	2.3	2.3	2.0
27	Phule G-0305-3	22.92	18.13	14.58	2.3	1.8	1.5
28	Digvijay	22.92	18.13	16.04	2.3	1.8	1.6
29	Vishal	22.5	17.08	15.00	2.3	1.7	1.5
30	Vijay	23.33	20.00	19.17	2.3	2.0	1.9
	Mean	23.30	18.65	16.54	2.33	1.86	1.65
	SE <sub>±</sub>	0.56	0.85	0.83	0.06	0.09	0.08
	CD@5%	1.61	2.46	2.39	0.17	0.25	0.24

**Table 5. Germination rate index (GRI) and mean germination time (MGT) influenced by chickpea genotypes under moisture stress induced by PEG-6000.**

Sr. No.	Genotype	Germination index (GI)			Coefficient of germination velocity (CVg)		
		Control	-0.4 Mpa	-0.6 Mpa	Control	-0.4 Mpa	-0.6 Mpa
1	GCP-101	43.00	56.00	58.00	4.30	5.60	5.80
2	JG-16	45.00	52.00	60.00	4.50	5.20	6.00
3	JG-29	45.00	63.00	66.00	4.50	6.30	6.60
4	NBeG-165	40.00	63.00	67.00	4.00	6.30	6.70
5	GJG-1010	44.00	63.00	72.00	4.40	6.30	7.20
6	HIR-55	46.00	61.00	66.00	4.60	6.10	6.60
7	CSJ-563	46.00	66.00	74.00	4.60	6.60	7.40
8	NDG-11-12	49.00	64.00	67.00	4.90	6.40	6.70
9	BBG-2	40.50	45.00	48.00	4.05	4.50	4.80
10	RKG-201-95	44.00	57.00	66.00	4.40	5.70	6.60
11	CSJ-724	44.00	60.00	68.00	4.40	6.00	6.80
12	GJG-1001	42.00	56.00	59.00	4.20	5.60	5.90
13	Phule G-0204-16	45.00	54.00	62.00	4.50	5.40	6.20
14	Phule G-0752	44.00	61.00	69.00	4.40	6.10	6.90
15	PBC-136	43.00	62.00	70.00	4.30	6.20	7.00
16	C-705	41.00	63.00	67.00	4.10	6.30	6.70
17	JG-34	48.00	59.00	50.00	4.80	5.90	5.00
18	BG-30-35	41.00	60.00	65.00	4.10	6.00	6.50
19	CSJ-739	43.00	54.00	59.00	4.30	5.40	5.90
20	IPC-2008-76	42.00	57.00	71.00	4.20	5.70	7.10
21	H-09-54	44.00	65.00	66.00	4.40	6.50	6.60
22	RKG-11-301	49.00	58.00	54.00	4.90	5.80	5.40
23	BDNG-2003-1	44.00	56.00	63.00	4.40	5.60	6.30
24	PBC-161	46.00	48.00	53.00	4.60	4.80	5.30
25	GJG-10-12	45.00	62.00	68.00	4.50	6.20	6.80
26	NBeG 47-1	46.00	46.00	52.00	4.60	4.60	5.20
27	Phule G -0305-3	46.00	60.00	72.00	4.60	6.00	7.20
28	Digvijay	45.00	60.00	66.00	4.50	6.00	6.60
29	Vishal	46.00	64.00	70.00	4.60	6.40	7.00
30	Vijay	44.00	54.00	56.00	4.40	5.40	5.60
	Mean	44.35	58.30	63.47	4.44	5.83	6.35
	SE <sub>±</sub>	1.46	2.59	2.73	0.16	0.26	0.27
	CD@5%	4.22	7.49	7.89	0.46	0.75	0.79

**Table 6. Germination index (GI) and coefficient of germination velocity (CVg) influenced by chickpea genotypes under moisture stress induced by PEG-6000.**



# Applications of Suprasegmental in EFL Classroom: A Short Review

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**Abstract-** Although there have always been controversies around the importance of two levels of phonology (segmental and suprasegmental) in language teaching history, today there is a general consensus that both of these should be taken into consideration to reach the goals of pronunciation instruction. However, time shortage is a factor that forces the teachers to set priorities and be selective of materials that have more crucial role in understanding and being understood than others both in segmental and suprasegmental level. The touchstone of this review is to examine the degree to which suprasegmentals affect comprehensibility. This work concludes that suprasegmentals play an important and crucial role in pronunciation teaching.

**Index Terms-** Segmental, suprasegmental, teaching pronunciation, phonology, EFL

## I. INTRODUCTION

Phonology has played many different roles in the English as a foreign language (EFL hereafter) classroom, from a virtually non-existent role in the traditional grammar translation approach to being the main focus of the audio-lingual method through its emphasis on minimal pairs, phonemes, drills and dialogue works. Until recently, phonology and other aspects of language were thought to have been best learned through a building-block, "bottom-up approach." Over the years there has been, however, a shift away from this atomistic view of language learning towards a more holistic, "top-down approach" which has been reflected in both syllabus and material design, as well as in testing and in classroom practice (Thornbury 1993). The current emphasis on *pronunciation* teaching is on the broader phonological aspects of connected speech, and their link to meaning on discourse level, and has resulted in renewed interest in the place of pronunciation in communicative language teaching (Evans & Jones 1995). It is a holistic and integrated approach to pronunciation teaching through focus on the suprasegmental aspects of phonology.

## II. SUPRASEGMENTAL DEFINED

In phonetics and phonology, any speech may be divided into two: segmental and suprasegmental (Ladefoged 2006). The term *segment* is "any discrete unit that can be identified, either physically or auditorily, in the stream of speech. Vowels and consonants are considered as small segments of the speech, which together form a syllable and make the utterance. Therefore, segmental features are related to vowels and consonants (Richards, Platt & Platt, 1992; Ladefoged 2006). *Suprasegmental* is a term used in phonetics and phonology to refer to a vocal effect which extends over more than one sound segment in an utterance, such as intonation, stress or juncture pattern. Therefore, the specific features that are superimposed on the utterance of the speech are known as suprasegmental features (Richards, Platt & Platt, 1992; Ladefoged 2006; Crystal 2008). The word "supra" means above or beyond the segmental value. It refers to properties of an utterance that apply to groups of segments, rather than to individual segments. Suprasegmentals

are also called “**music of a language**” and they are not limited to single sounds but often extend over syllables, words, or phrases (Ladefoged 2006). Suprasegmental features are aspects of speech that involve more than single consonants or vowels. They are features of spoken language which are not easily identified as discrete segments. If learners know features from the smallest component of spoken language or segments to the larger one or suprasegmental units, they are likely to achieve better listening and speaking. The alternative terms of suprasegmentals are ‘plurisegmental’, ‘non-segmental’, ‘Prosody’ and ‘superfix’ (Richards, Platt & Platt, 1992; Ladefoged 2006; Crystal 2008).

### III. SIGNIFICANCE OF SUPRASEGMENTALS

The importance of suprasegmentals may be denied in the teaching and learning of pronunciation. Firstly, it improves English accent and pronunciation which play key factors in accent reduction and speaking ability in general. If we want our speech to be understood in the classroom, we need to help our students learn and practice both individual sounds and the overall musical pattern of the language. Secondly, the researchers have proved that roughly one half of people’s communication is taken up by listening and listening is; therefore, an essential skill that students need to develop foremost when studying English as a second or foreign language. Thirdly, suprasegmental is the basic structure of spoken language which is different from the written language which is usually marginalised in day to day learning and teaching of English. Finally, Students of language and those who plan careers in language teaching, coaching, therapy, acting, and speaking benefit greatly as they can influence meaning by intonation, stress, rhythm and other suprasegmental features. Hence, the knowledge of seven major types of suprasegmental features that exist in almost all languages of the world (assimilation, intonation, stress, rhythm, elision, linking, and juncture) are very significant for learning pronunciation of a language. The different languages of the world make their own choices of suprasegmentals which differ from each other.

### IV. APPROACHES OF TEACHING SUPRASEGMENTALS

Where is the place of pronunciation instruction in language teaching programs? Which level of pronunciation – segmental or suprasegmental – should be emphasized? These are some of the few doubts that come into the minds of instructors of pronunciation. In fact, pronunciation instruction has had a changing status in language teaching history. In Jones’s words (1994), it has waxed and waned within different approaches. Today, this field is experiencing a new period in which segmental aspects are emphasized along with suprasegmental features. How the teacher designs the lesson for teaching suprasegmentals is a challenging task. The nuances of rhythm, sentence stress and intonation are incredibly complex and difficult to master. One reason for the students' difficulty is the sound system of English. In many settings, areas like pragmatics and pronunciation get passed over for vocabulary and grammar. This is often due to lack of time or syllabus demands. Fortunately, this is changing and English teachers across the world have begun devoting more and more class time to discourse level communication.

One area of English pronunciation that is worth focusing on is the stress-timed quality of English. The amount of time it takes to say a sentence depends on the number of syllables that receive stress in the sentence - not the total number of syllables. Many beginning learners focus on reading and pronouncing each word correctly and fully. By assigning equal weight to each syllable, they give their speech a choppy-sounding, unnatural rhythm that can affect their comprehensibility. Therefore, focusing students' attention on the stress-timed factor of English may assist them in sounding more natural and fluid in their speech.

Today, with the new generation of the Communicative Approach, the International Phonetic Alphabet is re-introduced in textbooks. Concerning suprasegmentals, teachers do sometimes let learners know about the special rhythm of English as a stress-timed language by giving regular taps on a desk, or by clapping their hands. Yet, a regrettable lack of a more thorough teaching of suprasegmental is widely observable.

## V. METHODS OF TEACHING SUPRASEGMENTALS

By its very nature when we teach English pronunciation, segmentals appear to be studied at the expense of suprasegmentals. Vowels and consonants are the basis for English pronunciation. Usually, it consists in the same repetitive exercises, that is, minimal pair drills (e.g. beat vs. bit, leave vs. live), spotting the odd one (e.g. break, great, steak, breath), or simply repeating words after the teacher. Brown (1995) challenges the very usefulness of the most widespread type of exercise that is the minimal pair drill, which he describes as a “not very meaningful exercise”. The scope of pronunciation teaching is all the more reduced as it displays not only an enormous advantage of segments over suprasegmentals, but also of vowels over consonants.

The authors assert that suprasegmental features are treated by EFL teachers as “peripheral frills” and their remarks are not worth rejecting. Studies have proved that EFL teachers very often see suprasegmental features as difficult to teach and learn, even if they are aware of their paramount importance. In fact, many authors and researchers acknowledge that suprasegmentals should be granted a more important status than segmentals in English pronunciation teaching, in as much as they are the basic structure of spoken language. It is found that the suprasegmentals control the structure of information”, and they are “far more important” in communication. As a justification to that it is remarked that individual sounds can be inferred from the context, whereas suprasegmental errors cannot be helped or lessened by the context.

For example, if a learner says I cooked the meat in a pen, with pen instead of pan, the context makes it possible to guess the intended word straight-away without too much mental correction from the listener. On the other hand, in response to he went on holiday, a rising intonation or misplacement of the nucleus in where did he go? Unequivocally expresses surprise or the need for confirmation, and not a real question asking for new information.

## VI. METHODOLOGICAL GAP

Literatures reveal that there is a clear cut methodological gap in teaching and learning suprasegmentals and they are as follows:

**1.** In practice, even in English studies at university level where pronunciation is thoroughly taught, syllabi usually start with articulatory phonetics, the phonemes and the teaching of the International Phonetic Alphabet (IPA), then transcription practice, and only in last position suprasegmental is taught, with syllable structure and stress in the middle position. In the proposed pattern, segments are put in the backdrop and are only attributed a secondary role.

**2.** According to Birjandi & Nodoushan (2005), “it is clear that improvement of students’ production of rhythm must start with the improvement of our understanding, closely followed by a much needed revision of what teachers are taught”. The origin of the problem here is what teachers themselves are taught, as is only when they will be able to teach what should be taught primarily, and assign to segmentals a more secondary role. This just shows that English teachers are often not trained enough in phonology.

**3.** One of the major problems that still subsists and is raised by many researchers is the lack of integration between research findings and language classes, i.e. the need for collaboration between researchers and teachers. As it is argued that the approach to any discipline should be governed by “theoretical findings in the sciences on which the discipline rests”. Despite the growing research on prosody and the acknowledgement of its importance in communication, EFL teaching methods still do not integrate the findings.

The need for a re-evaluation of the teaching of suprasegmentals in ESL and EFL contexts has been very much praised. A better place given to rhythm, stress, and other prosodic aspects is believed to make learners improve both their production and perception skills. A short term pronunciation course should focus first and foremost on suprasegmentals as they have the greatest impact on the comprehensibility of the learner’s English. Many recent investigations have concluded that the suprasegmentals should be made aware of as early as the very beginning of the L2 learning process, even before vowels and consonants are studied.

Resulting from this overview of English pronunciation teaching, it appears that a revised version of EFL teaching should first and foremost put pronunciation before the teaching of grammar and vocabulary, and prosody before segments. It cannot be denied that further research should investigate these claims in more detail.

#### VII. TECHNIQUES OF TEACHING SUPRASEGMENTALS

Avery and Ehrlich (1992) suggest **conducting**, which refers to moving the arms and hands in concert with the rhythm, stress and intonation of a sentence, word or phrase. This technique works quite well, especially if it is done in an exaggerated manner.

Other techniques such as **tapping out** the rhythm of a phrase or **using nonsense syllables** to illustrate difficult intonation patterns, or **slowing down and speeding up utterances** as a technique to help develop fluency, are also quite effective. By exaggerating the elements of connected speech at different speeds, students who are hesitant or pause inappropriately in their speech can be helped to sound more natural and fluent. **Back chaining** is extremely helpful when students are having problems with the rhythm of an utterance, especially longer than usual ones. By beginning at the back, the intonation contour of the original sentence is preserved. **Shadowing**, which makes quite a demand on students as they try to keep up with the recorded voice and eventually are left with to their own devices as the sound is lowered, is always enjoyed and can be extremely beneficial as students are stretched and pushed towards native speaker speed and delivery.

#### VIII. MATERIALS FOR TEACHING SUPRASEGMENTALS

##### Content Words and Function Words

In English, there are two types of words: content words and function words. Content words are principle words that express meaning. They include nouns, main verbs, adjectives, question words, demonstratives and adverbs; and they all receive stress. Function words are those words that have little or no meaning themselves but help express grammatical relationships. These words include articles, prepositions, auxiliaries, and pronouns.

**Step I:** The teacher reads an example sentence aloud to students, first by pronouncing each word carefully (i.e., teacher talk,) and then a second time using natural speed and intonation.

**Step II:** The teacher asks students, which seems more natural. Pair students and have them discuss the differences between the two readings. Then using the ideas the students come up with, explain the concepts of stress - timing and how English makes use of this device.

**Step III:** Talk about the differences between stressed words and non-stressed words. Point out to students that content words (nouns, most verbs, adjectives, etc.,) receive stress, where function words (determiners, prepositions and pronouns) do not.

**Step IV:** Lay the content/function game. Pair students and hand out a sheet to each pair. Ask students to identify which words are content words and which words and function words. Check the answers as a class.

##### Examples

- |              |             |              |                 |
|--------------|-------------|--------------|-----------------|
| 1. birds (c) | 6. just     | 11. doctor   | 16. he          |
| 2. as (f)    | 7. quickly  | 12. next to  | 17. in order to |
| 3. many (f)  | 8. worms    | 13. however  | 18. slam dunk   |
| 4. went      | 9. the      | 14. activity | 19. cambridge   |
| 5. with      | 10. mustard | 15. eat      | 20. in front of |

Then, using some of the words from the exercise, write out two sentences on the board underlining the stressed words in both. Ask students to try reading the sentences aloud. Point out how each sentence seems to take approximately the same length in 'stress time.' For example: Say, 'Birds eat worms.' Then say, 'The birds will eat the worms.'

### Content Sentences and Function Sentences

**Step I:** Pair students and hand out the following content/function example sentence. Ask students to look over the example sentences and underline the words that receive stress.

#### Examples

1. The cat chased the mouse across the street.
2. I'd like fries with that, please.
3. Could you tell me the quickest way from here to London station?
4. France is bracing for fresh mass protests over a controversial new labor law.
5. Of course, Olivia is not at all sleepy.

**Step II:** Ask students (in pairs,) to read the sentences with the appropriate intonation after they have decided which words need stress. (It may be helpful to show students how to mark sentences for intonation using dots-for-emphasis and slashes / for pauses.) Encourage students to add as many dots above the content/ function words as possible until the sentence takes an almost sheet music appearance.

**Step III:** Next have students read the sentences again, first with each word pronounced equally (syllable timed) and then again using their stress-timed versions.

#### Nonsense Sentences

According to Avery and Ehrlich (1992) by working with nonsense words rather than English words, students can be trained to listen for the acoustic signals of stress-particularly those words that are said more loudly, more clearly and more slowly. Further, by using nonsense words the teacher can ensure that students' full attention is on the words that receive stress.

Read the sentences aloud, with students marking the stressed and unstressed words. To help illustrate the function of suprasegmentals, the use of dots to indicate stress and length may be helpful for this exercise. Again, encourage students to mark the stressed words with bigger dots, smaller dots for those words that receive less emphasis. For savvy or advanced students, teach intonation arrows for pitch change and slashes and sharp marks to indicate juncture or pauses.

For example, the teacher could read the following sentences with the stressed words as indicated by the dots (or, if students are more comfortable using an underlining method, have them continue to underline content words). Be careful to reduce the nonsense function words:

- **Model:** The pilots flew their planes expertly.
  - Son geefies flugged min hox wazily.
- **Model:** My dear old friend is busy in the garden.
  - Hy fiss pold deesh tut looty wo um trewy.

#### Examples

1. a. Kai dupe chu me lo runt, Sprunt
1. b. Model: I'll meet you at the bank, Frank.
2. a. la rove dirk um tink.
2. b. Model: The X marks the spot.
3. a. don me wanana fil yo zeeking to la pillypolally.
3. b. Model: It was another day of losing for the 76ers.
4. a. Boa my wee jah bloppy-go.
4. b. Model: Six times seven is 42.

5. a. Germ twa lee bosen ra choley.

5. b. Model: "John," said the teacher, "is lazy."

#### IX. PARADIGM SHIFT

New approaches to language teaching shift the focus of attention in language instruction from individual phonemes to suprasegmentals and other features of the larger context of utterances. These include prosody, phonological fluency, voice quality, and gestures. A basis is provided for instruction and student practice of the entire communicational complex in which pronunciation is situated (Pennington, 1989). As a result of this shift, researchers' focus has also been changed from segmental features to suprasegmental characteristics of pronunciation. By way of Cross (2002) seeks to compare the suprasegmental features of Japanese with English to illustrate that an analysis of the similarities and differences between English and Japanese pronunciation is a useful, and perhaps necessary, starting point for gaining a better understanding of those suprasegmentals in English which require particular attention. In another study Shelton (2008) tries to raise awareness of how voice quality and intonation can convey meaning. Among other researches which relate to the role of suprasegmental features in pronunciation teaching reference should be made to Jones and Evans's (1995) study dealing with the role of voice quality in pronunciation teaching. The authors in this study explore the role of voice quality in the teaching of pronunciation and argue that since voice quality encompasses so many aspects of phonology, it provides a useful point of departure for pronunciation work. They describe a teaching technique in which the concept of voice quality is used in communicative practice to give students the opportunity to identify meaningful aspects of suprasegmental pronunciation, and see how they fit into the overall pattern of connected speech.

#### X. CONCLUSION

By starting with the suprasegmental areas of pronunciation, we can put pronunciation practice in its rightful place, viewing it in the same light as grammar, syntax, and discourse: as a crucial part of communication. Pronunciation needs to be seen as more than correct production of individual sounds, and should be integrated into the communication class, linking pronunciation with listening comprehension, and allowing for meaningful pronunciation practice. In fact, a journey of a thousand miles begins with the first step!

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# COMPARATIVE STUDY OF 'BOD', 'DO' AND pH OF DISTILLERY TREATED AND UNTREATED WASTE WATER

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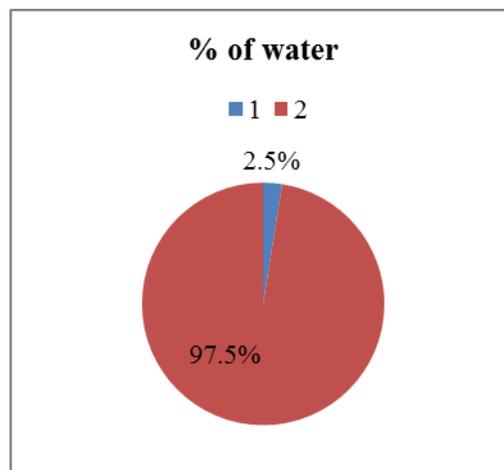
**Abstract-** Industrial processes create a variety of wastewater pollutants; which are difficult and costly to treat. The present study is under taken to assess the level of physiochemical parameters of the distillery spent wash. These parameters will compare with Bureau of Indian Standards. Untreated effluent is found to have high contents of BOD, and low contents of DO. According to the permissible limit suggested the Bureau of Indian Standards the untreated effluents is toxic to plant so it is not permissible for irrigation. The results reflect that the treated effluents are not highly polluted and they satisfy the Bureau of Indian Standards values and therefore can be used for irrigation purposes. It is one of the most complex, and strongest organic industrial effluent, having extremely high BOD values. Because of the high concentration of organic load. The paper reviews the status of BOD, DO and pH values before and after treatment of the distillery wastewater.

**Index Terms-** Distillery spent wash, BOD, DO and pH.

## I. INTRODUCTION

Water is one of the most important compounds required for every existing of life. Adequate supply of fresh and clean drinking water is a basic need for all human beings on the earth, yet it has been observed that millions of people worldwide are deprived of this. Without clean water neither human nor the environment, which sustain them, can survive. Chemically it is a compound of two hydrogen atoms and one atom of oxygen. About 97.5% of world's water occurs as salt water, of the remaining 2.5%, two third occurs as snow and ice in the polar and alpine region so only about 1% of global water occurs as liquid fresh water. Groundwater is the underground water that occurs in the saturated zone of variable thickness and depth, below the earth's surface. More than 98% of fresh water present on the earth surface is in the form of ground water while streams, lake and rivers hold only 2% of the total available water therefore ground water is the most valuable natural resource. The demand for water has increased over the year and this has led to water scarcity in many parts of the world. The situation is aggravated by the problem of water pollution or contamination. Resent study have shown that groundwater is highly susceptible to pollution from natural as well as anthropogenic activities such as municipality sewage, industrial effluent, and agricultural field

run off and leaching, landfills refuse dumps, septic tanks and improper collection of solid wastes. Quality of ground water is for important like its quantity. When we talk of the quality of ground water, it means some



Series 1: Drinking water on the Earth  
Series 2: Nondrinking water  
Fig 1 Total global water content [45]

peculiar characteristics of water in relation to a particular use. In safe water and inadequate sanitation is the world's leading cause of human illness. Disease and death are directly attributable to the lack of these essentials. Safe drinking water is vital human needs for health and efficiency. Determination of physical chemical bacteriological and heavy metals characteristics of water is essential for assessing the suitability of water for drinking, irrigation and industrial uses. Various standards has been laid down by various agencies such as the World Health Organization (WHO), the U.S Environmental Protection Agency (USEPA), the Bureau of Indian standards (BIS) & the Indian Council of Medical Research (ICMR) etc for determining the quality of water for various uses. Any physical chemical and biological change in water quality that adversely affects living organism or make water unsuitable for desired use can be considered pollution. According to the Natural Excessive use of pesticide and chemical fertilizers in farms aggravates the problem. India produces 11 million tones of fertilizer every year and much of it ultimately percolates down to the ground water sources and contaminates it.

Also Distilleries industries are one of the most polluting industries. In India there are about 579 sugar mills and 295 distilleries with a total installed capacity of 3198 million litres per annum and a yearly production of 1587 million litres alcohol. Alcohol is produced from molasses by two type of fermentation processes, Praj type and Alfa Laval distillation. In Praj type one litres alcohol produced about 12-15 litres of spent wash where as in the Alfa Laval continuous fermentation and distillation process only 7-8 litres of waste water per litres of alcohol is produced. The effluent coming from distillery industry is highly polluted which when seeps into the ground ultimately contaminated the ground water. [43]

**1.1 Pollution And Toxicity Profile Of Distillery Effluent**

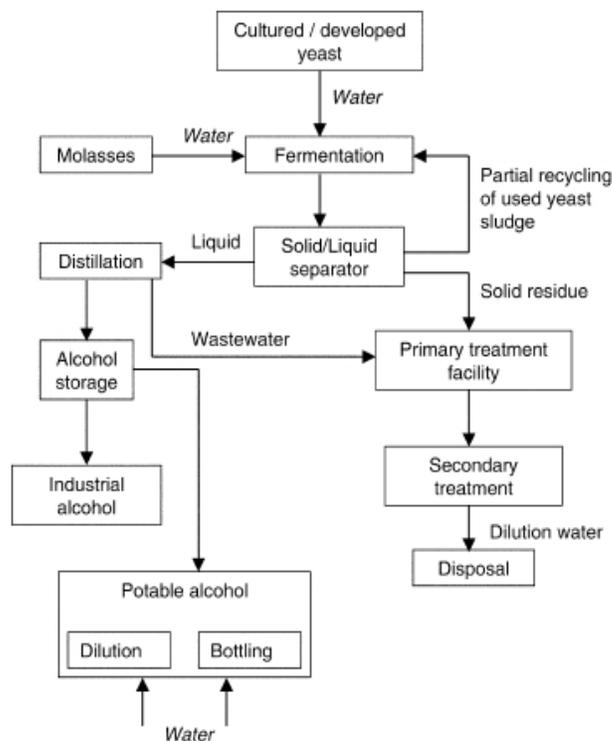
The production and characteristics of spent wash are highly variable and dependent on feed stocks and various aspects of the ethanol production process. Wash water used to clean the fermenters, cooling water blow down, and boiler water blow down further contributes to its variability, [8]. In a distillery, sources of wastewater are stillage, fermenter and condenser cooling water and fermenter wastewater. The liquid residues during the industrial phase of the production of alcohol are liquor,

**1.2 General Physico-Chemical Characteristics**

Parameter	Range
Colour	Dark brown
Odour	Unpleasant burnt sugar
pH	3.8-4.4
Total solids (mg/L)	60000-90000
TSS (mg/L)	2000-14000
TDS(mg/L)	58000-76000
TVS (mg/L)	45000-65000
COD (mg/L)	70000-98000
BOD (mg/L)	45000-60000
Total nitrogen as N (mg/L)	1000-1200
Potash as K2O (mg/L)	5000-12000
Phosphate as PO4 (mg/L)	500-1500
Sodium as Na (mg/L)	150-200
Chlorides as Cl (mg/L)	5000-8000
Sulfates as SO4 (mg/L)	2000-5000
Acidity as CaCO3 (mg/L)	8000-16000

Typical characteristics of distillery spent wash, [27]

**Schematic Of Alcohol Manufacturing Process:**



**Fig. 2**Manufacturing process of alcohols

sugarcane washing water, water from the condensers and from the cleaning of the equipment, apart from other residual water. This extract is extremely polluting as it contains approximately 5% organic material and fertilizers such as potassium, phosphorus and nitrogen. The amount of water used in this process is large, generating a high level of liquid residues, [6]. The MSW is a potential water pollutant in two ways. First, the highly coloured nature of MSW can block out sunlight from rivers and streams, thus reducing oxygenation of the water by photosynthesis and hence becomes detrimental to aquatic life. Secondly, it has a high pollution load which would result in eutrophication of contaminated water courses, [11]. Due to the presence of putriciable organics like skatole, indole and other sulphur compounds, the MSW that is disposed in canals or rivers produces obnoxious smell. Undiluted effluent has toxic effect on fishes and other aquatic organisms. Spent wash also leads to significant levels of soil pollution and acidification in the cases of inappropriate land discharge. It is reported to inhibit seed germination, reduce soil alkalinity, and cause soil manganese deficiency and damage agricultural crops [1] - [18]. However, effect of distillery effluent on seed germination is governed by its concentration and is crop-specific. In a study by Raman the germination percent in five crops decreased with increase in concentration of the effluent [30]. The germination was inhibited in all the five crops studied with concentration exceeding 50%. At the same time, organic wastes contained in distillery effluent are valuable source of plant nutrients especially N, P, K and organic

substrates if properly utilized [29]. For instance, distillery effluent in combination with bio amendments such as farm yard manure, rice husk and Brassica residues was used to improve the properties of sodic soil [18]. The use of fungi for bioconversion of distillery waste into microbial biomass or some useful metabolites have been recently reviewed by Friedrich. [12].

## II. AVAILABLE TECHNOLOGIES

### 2.1 Traditional Treatment Practices

Most of the wastewaters from different distillery sources were historically discharged directly into the soil or in ground water. Reich proposed one of the first treatment systems; a continuous integrated method to concentrate the stillage by fermentation, where the fermenter discharge was centrifuged and the yeast that was not recycled was drum-dried for use as an animal feed [31]. The stillage was concentrated to 70 to 80% solids and then neutralised with potassium carbonate ( $K_2CO_3$ ). The concentrated, neutralised wastewater was passed through low-temperature carbonising retorts and activated at 870°C, and the resultant carbon underwent aqueous extraction to produce potash fertiliser (potassium oxide ( $K_2O$ )), potash liquor and char. A decade later, Montanani reported on the slightly more developed Tibrocal system, in which stillage was neutralised with lime [calcium oxide ( $CaO$ ) or calcium hydroxide ( $Ca(OH)_2$ )] and then evaporated in 10 cm shallow containers, again for use as a fertiliser [24]. Other similar schemes were proposed by Chakrabarty and Yamauchi With the difference that crystallised potassium sulphate was produced instead of potassium oxide. [7]- [42]. In Europe, distillery wastewater was incinerated, normally yielding 34.7% of potash fertiliser and 2.2% phosphorus oxide (or ceramic oxide ( $P_2O_5$ )) [33]. Another method was distillery wastewater concentration to 30 to 40° Brix, followed by spray drying and combustion at 700°C, with the resultant ash being collected at the column base [15]. Similar methods were used with small variations, such as concentration of the stillage to 60% solids and spray drying into fuel gases, [10]. Tartrate removal has also been used as pre-treatment step [38]. Fluidised bed combustion of stillage, followed by heat recovery, has also been suggested [19]. However, scale formation was reported as a problem in some of the incineration and evaporation schemes, and the energy costs were prohibitive. Jackman reported on Brazilian efforts to reduce scaling and to raise the ash fusion temperature by adding other chemicals. [16] The French practice was to concentrate the stillage to 60% solids and then use it as a fertiliser at an application rate of 2.5 to 3.0 tonnes per hectare [20]. Monteiro considered this method uneconomical in the Brazilian context. [25]. the extraction of specific chemicals from wine distillery wastewater for sale as by-products has been conducted to offset the costs of wastewater treatment and to improve subsequent treatment and disposal [44]. Gypsum ( $CaSO_4 \cdot 2H_2O$ ) was recovered by the addition of seed crystals to the stillage at 80°C and stirring at 22 to 25 rpm for 60 minutes. This alleviated the problem of gypsum precipitation in cases where stillage was to be used for fodder yeast growth. Potassium and its double salt ( $K_2SO_4 \cdot 5CaSO_4 \cdot H_2O$ ) can also be removed from wastewater concentrated to 30 to 60° Brix [17]. It is found that stillage concentrated to 60 to 80° Brix formed coagulate when soluble phosphate was added and the

temperature was increased to 105 to 120°C [2]. The coagulate was then dried further and used as a fertiliser or ruminant fodder. Dubey stated that glycerol and germ oil were other chemicals that could be recovered from distillery wastewaters, but, even as late as 1980, distillery wastewater or stillage was still usually just evaporated to provide animal feed or fertiliser, or incinerated for the possible recovery of the potash [35].

### 2.2 Current Treatment and Disposal Options

More recent wine distillery wastewater treatment includes methods to remove recalcitrant compounds by physicochemical processes using distillery waste water and biologically-treated distillery wastewater [28]. In one case example, the physicochemical treatment of biologically-treated wastewater using conventional coagulant iron pickling wastewater supplemented with coagulant aid generated an effluent with COD in the range 940 to 1780 mg/L and a BOD of 25 to 30 mg/L. During this study, the colour of the treated wastewater was in the range of 580 to 1100 platinum cobalt units. It was recommended that the waste sludge from this industry be utilized as a substitute for conventional coagulants. Wastewater generated after chemical coagulation could be further treated efficiently by using 8 g/L of activated carbon with a contact time of 45 min to reduce residual COD to <250 mg/L to meet discharge limits [28]. Anodised graphite anodes were found to be suitable for the treatment of wine distillery wastewater, especially in the presence of supporting electrolytes such as sodium halide, or sodium chloride, which was found to be the most effective in the degradation of polyphenols [22]. Later a combination of the Fenton coagulation/ flocculation process (using  $H_2O_2/Fe_{2+}$ ) for the treatment of wine distillery wastewaters obtained a 74% reduction in COD under optimized conditions [3]. The worldwide scarcity of water is a strong incentive for recovering clean water for reuse from wastewaters. Nataraj investigated the treatment of distillery spent wash by removing the colour and the contaminants using a combination of NF and RO processes [26]. Due to the high fluxes obtained, significant rejection rates of total dissolved solids (TDS), COD, potassium and chloride concentrations were achieved. The absence of heat energy requirements in this application. And the high rate of mass transfer generated by RO showed that a large amount of clean water could be permeated economically instead of being vaporized by energy-intensive evaporation Processes or steam distillation using tall towers. Water reclaimed by NF and RO is suitable for use in both municipal and industrial applications. Chemical oxygen demand was considerably reduced in distillery wastewaters in India in order to reduce the cost of wastewater disposal. This process emphasized the recovery and recycling of valuable chemicals contained in the wastewaters [26]. Some methods of treatment of wine distillery waste water result in single cell production, the production of organic acids for sale in the industrial market, and the production of viable biological products, including enzymes, astaxanthin, plant hormones and biopolymers such as chitosan [41]. Glycerol recovery, first suggested in 1974, was finally achieved towards the end of the 20th century by concentrating wastewater to 60% solids, followed by the addition of quicklime (calcium oxide ( $CaO$ )) and ethanol, which led to the precipitation of 90% of the glycerol that was present. Germ oil was obtained by heating distillery

wastewater, centrifuging at 6000 g and extracting the oil solvent from the lightest fraction. As with the generation of fertilizer for direct land application, the economics of any treatment method rely heavily on the financial value that can be assigned to the resultant product. The pre-treatment of wine distillery waste water with ozone improves its kinetic behavior during anaerobic digestion, but at the same time decreases COD removal efficiencies [4] - [23]. Martin investigated the ozonation of vinasse in trying to reduce COD. [23]. Vinasse is known to be chemically very complex because of the high content of polyphenols, which delay biological processes such as anaerobic digestion. As a result, ozonation is seen as a desirable chemical pre-treatment prior to biological treatment because it is capable of converting the inhibitory and refractory compounds into simpler, low molecular weight compounds that are more readily degradable by microorganisms. Ozonation of aromatic compounds usually increases their biodegradability. However, in many cases the chemical pre-treatment used to make the waste biodegradable diminishes the COD of the wastewater, although intermediate compounds of higher microbial toxicity can be generated, depending on the type of ozonation used as pre-treatment [23]. In such cases, an alternative chemical oxidant has been used, and the treatment of wine distillery wastewater in a continuous reactor using a combination of ozonation and aerobic degradation in activated sludge systems has also been investigated [4]. In this combined system, oxidation by ozone achieved a reduction in the organic substrate concentration of 4.4 to 18%, while removal of the content of phenol compounds in the range of 50 to 60% was achieved. Aerobic degradation of these vinasses by activated sludge in experiments using varying hydraulic retention time (HRT) and substrate concentration provided organic substrate removal in the range of 12 to 60% [4]. Ozonation of this aerobically pre-treated vinasse led to an increase in COD removal efficiency from 16 to 21.5%, as well as higher rate constants [4]. Schafer later applied membrane filtration with concomitant chemical treatment in the management of wastewaters containing natural organic problems [34]. COD removal efficiencies were improved in aerobically pre-treated and then ozonated wastewaters [4].

### III. EXPERIMENTAL VIEW

#### 3.1 Preparation of bagasse activated carbon (BAC):

Bagasse are collected from sugar industry and dried in oven at 110°C followed by sieving with mesh of pore size 425 . The sieved particles were washed several times with water and dried at 110°C for 6 hours in hot air oven to remove all the moisture content. The dried bagasse was then treated in combination with concentrated H<sub>2</sub>SO<sub>4</sub> and H<sub>3</sub>PO<sub>4</sub> in ratio of 1:1 by volume, as activating agent to produce activated carbon. The sample was then washed with distilled water and soaked in 1% sodium carbonate solution for about 8 hours. The washing of sample with distilled water was continued until the pH of wash water turned to neutral. The samples were dried in hot air oven at 110°C for 24 hours. The final adsorbent are stored in airtight containers before using for adsorption studies. High moisture content is not desirable as it dilutes the adsorption capacity of the activated carbon and thus, larger dosages would be required. High ash content is not desirable as ash is the residue that

remains when the carbonaceous material is burned off, the ash content indicates the inorganic constituents (mainly minerals such as silica, aluminum, iron, magnesium and calcium), associated with the carbon sample. These metals might leach from the activated carbon during adsorption and affect their performance adversely by competitive adsorption with the adsorbate. Hence, the prepared BAC was analyzed for pH, moisture content, conductivity, volatile matter content and ash content.

#### 3.2 Dissolved Oxygen

The various gases which may get dissolved in water due to its contact with atmosphere or the ground surface may be nitrogen, methane, hydrogen sulphide, carbon dioxide and oxygen. The concentration of oxygen gas in river water is important. Oxygen gas is generally absorbed by water from the atmosphere; Algae and other tiny plant life of water also give oxygen to the water, but are being consumed by unstable organic matter for their oxidation. Hence, if the oxygen present in water is found to be less than its saturation level, it indicates presence of organic matter and consequently making the water suspicious. Dissolved oxygen is required for the respiration of aerobic microorganisms as well as all other aerobic life forms. However oxygen is slightly soluble in water. The rate of biochemical reactions that uses oxygen levels tends to be more critical in summer because the stream flows are usually lower and thus the total quantity of oxygen available is also lower. The presence of dissolved oxygen in wastewater is desirable because it prevents the formation of noxious odors. The presence of oxygen in water in dissolved form is necessary to keep it fresh and sparkling. Dissolved oxygen is also important to aquatic life because detrimental effect can occur when DO levels drop below 4-5 mg/L, depending upon the aquatic species. Oxygen levels that remain below 1-2 mg/L for few hours can result in fish kills.

#### 3.3 Hydrogen Ion Concentration (pH):

The pH value of water is measure of its alkalinity or acidity. More accurately the pH is a measure of the hydrogen ion concentration in water. Mathematically this is the logarithm to the base 10 of reciprocal of the hydrogen ion concentration of pure water. Thus a pH value of 7 indicates neutral solution, neither alkaline nor acidic. A pH less than 7 indicates an acidic solution indicates the presence of carbonate of calcium and magnesium and a pH value of 8.5 or above usually indicates appreciable exchangeable solution.

#### 3.4 Biological Oxygen Demand

The extent of oxygen consumed by the organic matter present in water sample is known as Biochemical Oxygen demand (BOD). The BOD of raw water will indicate the extent of organic matter present in the water. If sufficient oxygen is present in water, the useful aerobic bacteria production will flourish and cause the biological decomposition of waste and organic matter, thereby reducing the carbonaceous material from the water. The amount of oxygen required in the process until oxidation gets completed is known as BOD. Polluted waters will continue to absorb oxygen for many months, till the oxidation gets completed and it is not practically possible to determine this ultimate oxygen demand. Hence the BOD of water during the first five days at 20°C. The dissolved oxygen is measured after the period of incubation. The difference between the original oxygen content and the residual oxygen content will indicate the

oxygen consumed by the water sample in five days. If BOD of water is zero it means that no oxygen is required and thus no organic matter is present. The extent of pollution of sewage and other industrial wastewater is also measured by determining the values of their BOD.

### 3.5 Reagents Used

**Ferrous Ammonia Sulphate (FAS):** It was prepared according to the standard method by adding to about 9.80 gram FAS and 5 ml H<sub>2</sub>SO<sub>4</sub> in 250 ml distilled water.

**Sulphuric Acid :** It was prepared by adding 2.75 gram of and 272 ml of H<sub>2</sub>SO<sub>4</sub> in 500 ml distilled water Then it was allowed to stand for one day to dissolve AgSO<sub>4</sub>.

**Potassium Dichromate (K<sub>2</sub>CR<sub>2</sub>O<sub>7</sub>):** It was prepared by dissolving 16.65 gram of HgSO<sub>4</sub>, 83.5 ml H<sub>2</sub>SO<sub>4</sub> and 2.45 gram K<sub>2</sub>CR<sub>2</sub>O<sub>7</sub> in 500 ml distilled water.

**Phosphate Buffer:** It was prepared by adding 8.5 gram pot. Hydrogen phosphate, 21.75 gram Di Pot. Hydrogen phosphate, 33.4 gram di sodium hydrogen phosphate and 1.7 gram Ammonium chlorides dissolved in 500 ml distilled water and then dilute with 1litre distilled water.

**Magnesium Sulphate:** It was prepared by adding 22.5 gram Magnesium sulfate in 1 liter distilled water.

**Ferric Chloride (FECL):** It was prepared by adding 2 gram FECL 1 liter distilled water.

**Calcium Chloride:** It was prepared by adding 27.5 gram calcium chloride in 1 liter distilled water.

**Magnousulphate (MnSO<sub>4</sub>):** It was prepared by adding 364 gram MnSO<sub>4</sub> in 1 liter distilled water.

**Alkali Azide:** It was prepared by adding 125 gram NAOH Sodium hydrogen pallets, 37.5 gram potassium Iodide and 2.5 gram Sodium Azaid (NAH<sub>3</sub>) in 250 ml distilled water.

**Sodium Thiosulphate of 0.025 Normality :** It was prepared by adding 6.205 gram in 1 liter distilled water.

**Starch Indicator:** It was prepared by adding 2 gram starch powder and 0.2 gram salicylic acid in 100 ml distilled water.

**Potassium Chromate:**It was prepared by adding 12.5 gram Potassium Chromate in 100 ml distilled water and then after 12 hours filter the solution and add 250 ml distilled water.

S.N	Parameter	Treated Effluent	BIS standards
1	Colour	Light Brown	-
2	Temperature	38°C	-
3	pH	6.8	6.5-9.0
4	DO	2.3 mg/l	4-6 mg/l
5	BOD	38000 mg/l	500000 mg/l

### 3.6 Observation Table 1

Table 2

S.N	Parameter	Untreated Effluent	BIS standards
1	Colour	Light Brown	-
2	Temperature	40°C	-
3	pH	4.6	6.5-9.0
4	DO	1.3 mg/l	4-6 mg/l
5	BOD	35000 mg/l	500000 mg/l

The Physico-chemical parameters of treated and untreated effluent viz. BIS standards

#### 3.6.1 DO in effluent before treatment and after treatment

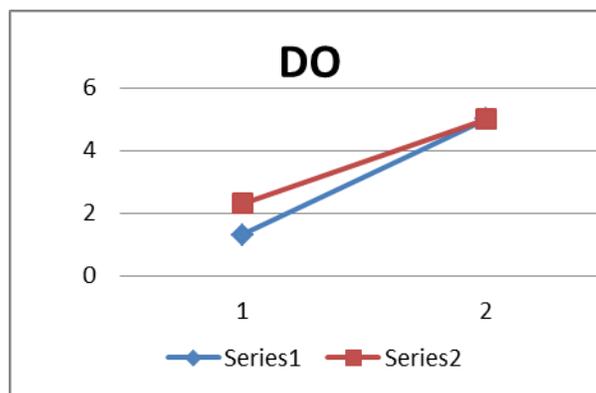
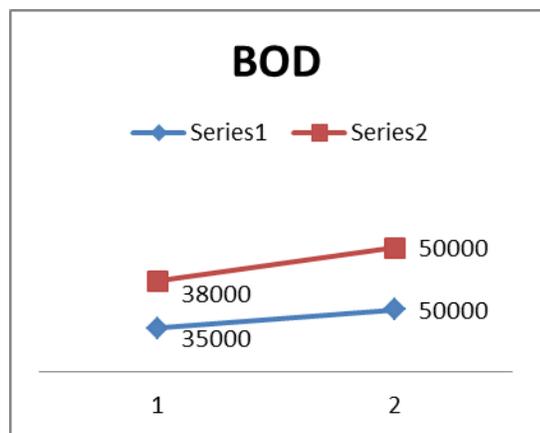


Fig. 3 Series 1: DO of untreated effluent

Series 2: DO of treated effluent

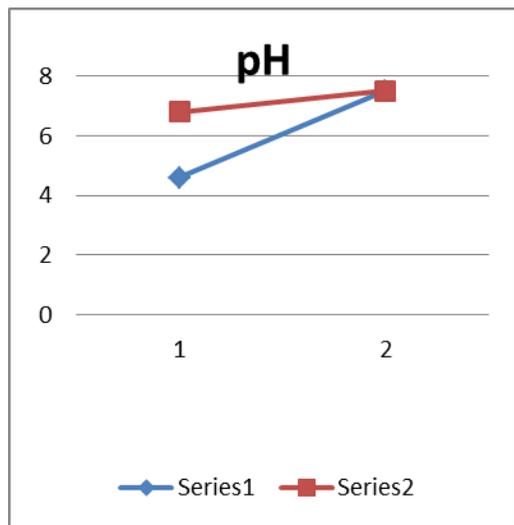
#### 3.6.2 BOD in effluent before treatment and after treatment



**Fig. 4 Series 1: BOD of untreated effluent**

Series 2: BOD of treated effluent

### 3.6.3 pH in effluent before treatment and after treatment



**Fig. 5 Series 1: pH of untreated effluent**

Series 2: pH of treated effluent

## IV. CONCLUSION

One of the most important environmental problems faced by the world is management of wastes. Now-a-days emphasis is laid on waste minimization. Pollution prevention focuses on preventing the generation of wastes, while waste minimization refers to reducing the volume or toxicity of hazardous wastes by water recycling and reuse.

Here we conclude that the treatment are very important part of distillery spent wash, the major treatment as BOD concentration. We see that the BOD concentration is very high before treatment and it is reduces after treatment. If BOD values is high then the aquatic resion my not properly works

The low contents of DO which is toxic to plants, so itis not permissible for irrigation. Treated effluent of distillery plant

which is well balanced of chemicalsif it is diluted with other fresh water, will be suitablefor irrigation purposes.

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# The Systems Theory of Management in Modern Day Organizations - A Study of Aldgate Congress Resort Limited Port Harcourt

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**Abstract-** This paper examines the systems theory of management in modern day organizations with an highlight on an indigenous company based in Port Harcourt. In this work, an introductory perspective was captured to show an understanding of what the systems theory is all about, revealing the input-output model. The paper categorizes the systems theory into two thought areas: the cybernetic and closed systems on one side and the biology and open systems on the other side, and differentiations made. Systems theory focuses on the relations between the parts, rather than reducing an entity into its parts or elements. The organization is considered as a system having integrated parts that must be coordinated for efficiency and effectiveness. The null hypothesis of no relationship between application of system theory of management and organizational success was rejected. The study found that the organization under study adopts systems approach. The study recommends that modern organizations should adapt systems approach to enhance corporate growth and profitability.

**Index Terms-** system, management, organization, technology and firms.

## I. INTRODUCTION

Scientists and philosophers have long wrestled with the problem of how they understand and make sense of our world. There are both descriptive and prescriptive approaches to understanding our world. On the descriptive side, theories of cognition, perception and thinking describe how we humans organize stimuli and make sense out of them. On the prescriptive side, there are two approaches to making sense of the world. The first is reductionism and the other is a systems approach. Reductionism asserts that the best way to understand new phenomena is to study the functioning or properties of its individual parts. For example, the best way to understand the working of the human body would be to break it into its components, (organs, muscles, tissues, bones, and cells) and to study the properties of each element (Miller and Rice, 1967).

Systems theory focuses on the relations between the parts. Rather than reducing an entity such as the human body into its parts or elements (e.g. organs or cells), systems theory focuses on the arrangement of and relations between the parts and how they work together as a whole. The way the parts are organized and how they interact with each other, determines the properties of that system. The behaviour of the system is independent of the

properties of the elements. This often referred to as a holistic approach to understanding phenomena.

Flood and Jackson (1991) define a system as a complex and highly interlinked network of parts exhibiting synergistic properties-the whole is greater than the sum of its parts. It is a collection of interrelated parts acting together to achieve some goal which exists in the environment. Also, system is defined as a set of objects together with relationships between the objects and between their attributes related to each other and to the environment so as to create or form a whole (Schoderbek et al, 1985). Further, Checkland (1981) defines a system as a model of a whole entity, which may be applied to human activity.

With respect to management, system simply refers to a set of different independent parts working together in interrelated manner to accomplish a whole. It is with this essence that synergism appears. For instance, an organisation is formed by different departments, sections, and units composed of individuals and groups which are independent, but working together to achieve a common goal with the aim of turning organizational vision into reality.

This paper is aimed at showcasing the systems theory of management in modern day organizations in Nigeria. This is to be achieved with the study of a key player in the hospitality industry in the city of Port Harcourt – Aldgate Congress Resort Limited.

This paper aims at studying the systems theory of managing organizations. Emphasis has been made on the application of this theory in the management of modern day organizations. For this purpose, a modern day organization based in Port Harcourt was chosen as a case study.

The present day organization is faced with the challenges of adoption of a specific style of management in its day to day operational decision making. These could be seen manifesting in a variation of several management philosophies that has evolved over the years. Theories exist that are drawn from the scientific management school, the classical organization theory school, the behavioural school and the relations theories. Others are the management science school and some recent developments in management theory; the systems approach and the contingency approach respectively.

Over the years transcending down history, organizations have either adopted a particular management model or a combination of models. Whichever model that is adopted, the survivability and maximisation of profit is often a key objective for operations. This paper is out to uncover the level of the application of systems theory in the running of modern day

organizations. This is borne out of the reality that this theory is one amongst many models. Its numerous benefits when applied is factorial to any organization's growth and therefore has necessitated a study of this nature.

## II. STATEMENT OF THE PROBLEM

The management of organizations in Nigeria vary in approach, style and content from one organization to another. Each organization decides on a particular line of management to implement what it finds suitable to its objectives. Sometimes, management styles, not easily discernable and definable are seen operational in some organizations. This is mostly prevalent in organizations owned by individuals or family members.

However, the emphasis of this research is on the management of modern day organizations through the application of the systems theory of management. There is a general tendency for concepts and management approaches to change with time. Within a modern day organizational framework, contemporary management issues in the likes of the way to manage, is a key decision making factor. Is systems approach to management being applied in modern day organizations? Are there issues arising from the adoption of this systems theory to management? This and many more posers are what this research is out to provide answers to.

## III. OBJECTIVES OF THE STUDY

Indigenous organizations are subjects of a variety of management models which sometimes, are not premised on any professional and categorically established study. It is however observed that while some are moving the shore of the business world with growth and success, others are finding survivability, a huge mirage. The reasons for these differences are not farfetched. Wrong business decisions manifesting in the inability to forecast appropriately, adoption of an inappropriate management style, investing wrongly and the application of weak cost and internal control measures are some of the factors responsible for business stagnation and non survivability.

This paper is objectively geared at showing an understanding of what the systems theory is all about, its application in management, especially with modern day organizations. The import of organizational management with the systems theory and practises are examined. Its relevance in modern day organizations vis-a-vis other contemporary management theories are also discussed.

## IV. THEORETICAL FRAMEWORK

The work of Ludwing Von Bertalanffy (1973) recognized the need of any organization to interact with its external environment, unlike what was proposed by classical school theorists like Max Weber, F. Taylor and Fayol who viewed organization as closed system. To him, for survival of an organization like the way living organism survives, should operate in open system and not closed system. This is what made his work to make system concepts become recognized world-wide as approach to be adapted by organization for their

efficiency and effectiveness in the dynamic and changing environments.

He was against reductionism, arguing that, real system are open and do interact with external environment, where he emphasized on holism while solving organization problems.

Therefore, open system changed the way of thinking about organizational management from mechanical view of organization. It looks at management as an open-ended process. It emphasized detachment, objectivity and control. Today organizations are perceived as an open ended process of coordinating purposeful individuals whose actions stem from applying their unique interpretations to the particular situations confronting them. For instance, in current situation, an organization which will not be sensitive to its environment will hardly survive. Things like technology, social and economic phenomena are not static but are always changing, hence organizations are needed to adopt in order to survive.

It is also through interaction with its external environment the organization gets its inputs in term of raw material, labour and process them, and lastly emits as output to its environment for selling or capital investment. Take example of Aldgate Congress Resort Ltd., it gets its raw materials from environment and also sells its products to the same environment, and through feedback it adjusts itself in order to meet the requirement of its customers, and hence survival.

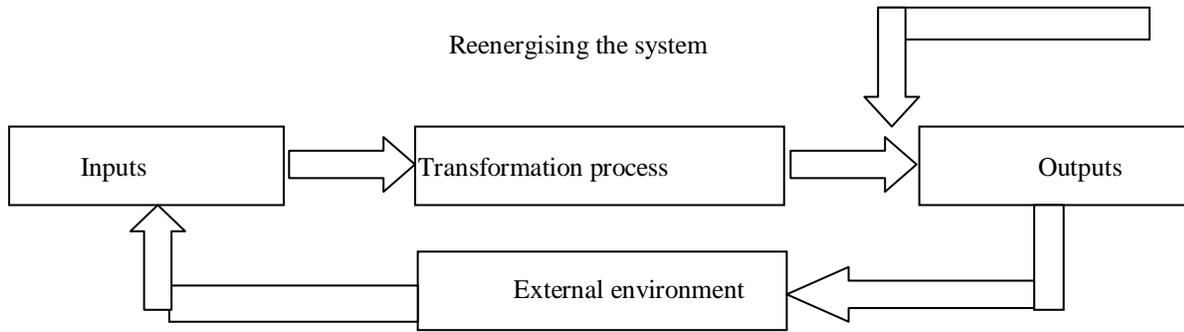
## V. LITERATURE REVIEW

A profuse body of knowledge exists in this field of systems theory. There have been several published studies on systems theory in management. This wealth of knowledge amassed through theoretical postulations and vigorous empirical investigations have helped in directing the attention of researchers towards conceptualizing how it has helped in boosting organizational growth through its application.

## VI. UNDERSTANDING SYSTEMS THEORY

Organizational management systems consist of many internal subsystems that need to be continually aligned with each other. As companies grow, they develop more and more complex subsystems that must coordinate with each other in the process of transforming inputs to outputs (McShane and Von Glinow, 2003). These interdependencies can easily become so complex that a minor event in one subsystem may amplify into serious unintended consequences elsewhere in the organization.

Every organized enterprise does not exist in a vacuum. It is rather known to depend on its external environment – which is a part of a larger system, such as the industry to which it belongs, the economic system and the society (Weihrich et al, 2008). According to them, the organization receives inputs, transforms them and exports the outputs to the environment as shown in the basic input-output model below.



**Fig.2.1: Input – output model**

Source: Wehrich, et al (2008).

In their own opinion, the above model requires expansion and development into a model of process, or operational management that indicates how the various inputs are formed through the managerial functions of planning, organizing, staffing, leading and controlling. However, the following sub topics are the basic components of a system.

**i) Inputs -**

The composition of inputs from the external environment may include people, capital, managerial skills as well as technical knowledge of skills. It also includes the various claimants – groups of people making demands on the organization; such as employees, consumers, suppliers, stockholders, federal, state and local governments.

**ii) Transformation process –**

In an organizational system, inputs are transformed in an effective and efficient manner into outputs. This can be viewed from different perspectives. Focus can be on such management functions as finance, production, personnel and marketing.

**iii) External variable –**

As a component of the systems model, the external environment plays a key role in the transformation of inputs into outputs. While it is true that organizations have little or no power to change the external environment, they have no alternative but to respond to it.

**iv) Outputs –**

Inputs are secured and utilized by transformation through the managerial functions – with due consideration for external variables into outputs. Outputs of different kinds vary with the organization. They usually include many of the following; products, services, profits, satisfaction and integration of the goals of various claimants to the organization.

**v) Reenergizing the system –**

It is worthy of note that in the systems model of management process, some of the outputs become inputs again. Apparently, the satisfaction and new knowledge or skills of employees become important human inputs. Similarly, profits are reinvested in cash and capital goods, such as machinery, equipment, buildings and inventory.

Buttressing what Wehrich et al had written, Amobi and Nnabuike (1999), revealed that the systems theory has been likened by many management experts to the three – part production process of an organizational activity. They revealed

that Katz and Kahn in their analysis of the basic properties of an organization had also identified the input – throughout – output process.

**VII. TYPES OF SYSTEMS**

**1) Cybernetics and closed systems thinking:**

The field of cybernetics exemplifies the modern version of closed systems thinking and it is attributed to the work of Norbert Wiener.

In 1949, Norbert Wiener, a distinguished mathematician and engineer at MIT (Massachusetts Institute of Technology) discovered this over lunch with a colleague who was a neurosurgeon. The development of the field of Cybernetics allowed diverse disciplines to communicate about their problems in the common language of systems theory. More importantly, it allowed a common set of principles to be applied to problems of control and regulation. It has been seen that the principles of system design that allowed ancient mariners to steer ships with “governors” were the same principles that allowed mechanical engineers to design thermostats for air-conditioning units, industrial engineers to control product quality, astronomers to describe the behaviour of planets, and accountants to design budgetary control systems. These systems can be seen as returning to equilibrium after being disturbed by regulating themselves through feedback information.

The cybernetic closed systems model is the intellectual base for traditional cost and quality management approaches. Another key idea in closed systems is the increase in entropy or the tendency to maximum disorder. This is because the system is closed to the environment and has no ability to import energy to counteract the growth in entropy. This view, exemplified by the second law of thermodynamics, means that closed systems will inevitably tend to breakdown from an increase in entropy.

**2) Biology and open systems thinking:**

Open systems theory has its foundations in biology, particularly Darwin's work on the evolution of the species. The popular version of open systems theory is attributed to Ludwig Von Bertalanffy who used the term ‘general systems theory’ to describe the main ideas and to distinguish them from closed systems thinking. Bertalanffy maintained that closed systems thinking was not appropriate to study biological phenomena

because biological systems interact with their environment, grow and survive. However, the environment of living organisms is less forgiving and often the luxury to learn from errors does not exist.

There are **four main differences** between closed and open systems theory. Each difference is discussed below.

**1. Relations with the external environment.** Open systems theory focuses on the interchange between a system and its environment. Biological organisms are open systems because they constantly evolve and adapt to the needs of their environment. Their behaviour is a response to the threats and resources available in the environment in which they exist.

**2. Variables considered.** A second area, which differentiates open and closed systems thinking, is the number of variables included. A closed system has a few variables. An open system typically deals with a more complex set of interrelationships. Cost and quality, viewed from a closed systems perspective, are internal variables that need to be managed within the boundaries of a firm. In an open system, cost and quality are viewed as externally driven variables that must be managed by understanding the environmental influences on these variables.

**3. Form of regulation or control.** As shown in Figure 1, closed systems use error-controlled regulation. This is control after-the-fact. Open systems use anticipatory control. They are regulated by anticipating errors before they occur and taking corrective measures before final output. Like a mouse, open systems anticipate a cat's next move. Waiting for feedback from errors is usually fatal. This form of regulation is called 'feed forward' control. If cost is to be managed as an open system, it should be controlled before a product is produced and not after.

**4. Purpose of Regulation.** Unlike closed systems, open systems are not interested in returning a system back to some predetermined stable state. They recognize that the purpose of regulation is to adjust and move the system on a dynamic path. Open systems seek continuous improvement and not just stability. They are said to achieve a dynamic equilibrium. Like living systems, most organizations operate in constant interchange with their environment. They have many complex interactions and interrelationships within their boundaries.

## VIII. SYSTEMS THEORY AND EFFECTIVENESS

In everyday conversation, the term system is used. A variety of meanings and interpretations are given to describe accounting systems, inventory control system, a car's ignition system, an ecological system and the Nigerian tax system. Each system consists of elements or characters that interacts (Gibson et al (1997)). According to them, system theorists propose that systems can be categorized in three ways:

### a. Conceptual systems (a language) -

Organizations use the notion of a system to view their internal and external world and how the parts relate and interact with each other. By viewing the individuals, groups, structure, and process of organizations in terms of a system, organizations are able to identify common and uncommon themes that help explain the behaviour and effectiveness of people. Identification of themes or patterns is important because it helps to explain how

effective an individual, group or entire organization is, in terms of goals (Peterson, 1994).

### b. Concrete systems (machines) –

Systems theory enables us describe an organizations' internal and external behaviour. Internally, it can be seen how and why people inside the organizations perform their individual and group tasks. Externally, an organization's transactions with other organizations and institutions can be assessed. All organizations acquire resources from a larger environment of which they are part of, and in turn, provide the goods and services demanded by the larger environment.

### c. Abstract systems (culture of an organization) -

The organization is one element of a number of elements interacting interdependently. The flow of inputs is the basic starting point in describing the organization. Every organization is part of an industry (a larger system), a society (a yet larger system), and increasingly, a global economy (perhaps the largest system of all).

Systems theory can also describe the behaviour of individuals and groups within an organization. An input (cause) can be processed by an individual mental and psychological process to produce a particular output (outcome).

## IX. SYSTEMS THEORY AND FEEDBACK

According to Gibson et al (1997), the concept of the organization as a system that is related to a larger system, introduces the importance of feedback. Organizations depend on the environment not only for its inputs, but for the acceptance of outputs. Consequently, they must develop means for adjusting to environmental demands. Simply put, feedback refers to information that reflects the outcomes of an act or series of acts by an individual, group or organization.

## X. ORGANIZATION AS A SYSTEM

The classical approach emphasized the technical requirements of the organization and its needs – organization without people; the human relations approaches emphasized the psychological and social aspects, and the consideration of human needs – people without organizations (Mullins L.J., 2005).

Mullins argued that the systems approach attempts to reconcile these two earlier approaches and the work of the formal and informal writers. According to him, attention is focussed on the total work organization and the interrelationships of structure and behaviour, and the range of variables within the organization. This approach can be contrasted with a view of the organization as separate parts. He further revealed that the systems approach encourages organizations to be viewed both as a whole and as part of a larger environment. This implies that any part of an organizational activity affects all other parts.

The business organization is an open system where there is continual interaction with the broader external environment of which it is a part. The systems approach sees the organization within its total environment and emphasizes the importance of multiple channels of interaction. The systems approach views the organization as a whole and involves the study of the organization in terms of the relationship between technical and

social variables within the system. Change in one part, technical or social will affect other parts and thus the whole system.

The organization is seen as being made up of interrelated parts known as subsystems. These subsystems work together to contribute to the survival and success of the entire organization.

The system concept and its application in modern day management is a key concept of systems science. According to Von Bertalanffy (1968), the term system implies a set of elements standing in interactions. He defined system as complexes of elements standing in interaction, expressed in different forms. It is a set of activities (functions) that are connected both in time and space by a set of decision-making and behaviour evaluation (that is control) practice (Hall & Fagen, 1956).

Waring (1996) defines a system at a simple level as a recognisable whole, which consists of a number of parts (called components) that are connected up in an organised way (the system's structure). These components interact, that is, there are processes going on. This basic description covers the popular idea of interconnected parts and processes as in the central heating system. It is further argued that, system approach to management implies the application of systems ideas such as emergence and hierarchy (layered structure), communication and control to address problem situations (Jackson, 1995).

#### QUALITIES OF AN IDEAL SYSTEM

According to Harry (1990) the following elements are indicators of a quality system:

**a) Components:** A system consists of more than one part called component elements of a system. A component refers to anything that is part of a system or sub-system. The term element implies the smaller components that one would wish to identify separately. Organization of a system is the specification of relations between its elements.

**b) Connection:** These components of a system are connected together.

**c) Structure:** The form of this connection is fixed in an organized way called structure. The concepts of structure and organization become more interesting in large systems, where more than just one or two possible structures or organizations may be considered.

**d) Interaction:** The components affect each other by their presence in or removal from the system which results from mutual interaction with the systems environment.

**e) Process:** the changes resulting from these interactions are called processes.

**f) Holism and emergent properties:** A system is a whole which exhibits properties which only have meaning in terms of the interactive processes of its components.

**g) Identity:** The properties of a system that enable it to be identified and separated from other things which are not part of the system.

**h) Environment:** There are things which are not part of the system, which significantly affect it, but which the system can only marginally influence, called the environment of the system.

**i) Conceptualization:** a system is a concept whose particular form reflects the aims and values of the individual or group whose concept it is (Harry, 1990).

Like living systems, most organizations if not all, operate in constant interchange with their environment. They have many complex interactions and interrelationships within their boundaries. To survive, organizations must grow and achieve a dynamic equilibrium rather than simply return to a steady state. It is for these reasons that general systems theory has come to be applied to the study of organizational phenomena such as design of management planning and control systems.

#### XI. HYPOTHESIS

In investigating the systems theory of management in modern day organizations, the following hypothesis is posited:

- 1) Ho – There is no relationship between application of systems theory of management and organizational success.
- 2) Ha – There is a significant relationship between application of systems theory of management and organizational success.

#### Research Methodology:

The study adopts the exploration and survey methods to carry out the research.

A preliminary survey of an organization in Port Harcourt that is seen to be composed of subsystems and interrelated parts is made. A survey involves the use of a representative sample of the population for the study and using the results to generalize for the population. It has been identified by Aaker and Day (1980) to have the advantage of being versatile and therefore amenable to virtually every setting and to research objectives whether a descriptive or casual design. It is also a veritable tool in collecting a great deal of data about an individual or organization at one time.

Matters arising from the systems theory of management in modern day organizations have been looked into to ascertain their degree of adoption and benefits to the organization, individual, group and society at large. Historical trends have been followed to show the level of systems theory application that have manifested over time.

#### Study Population and Sampling:

The study population was drawn from a list of three (3) variegated departments within the study organization in Port Harcourt. This would be extracted, and would serve as the study population.

Based on the responses obtained from the preliminary survey, only those respondents that consent to applying the systems theory of management would be selected as the sample size for the second stage of the research which is also the main study.

#### Respondents of the Study:

The analysis of the questionnaire and the interpretations that follow were simple, clear and logical. A total number of thirty (30) questionnaires were administered. Distribution on each of the three major departments was based on accessibility. The tabulated analysis of the total number of questionnaire administered and the percentage degree of responses is shown in table below.

**Table .Distribution / and collection of the questionnaire:**

Departments	Questionnaires Administered	Questionnaires Retrieved	% Respondents
Administration	10	8	80
Food & Beverages	10	9	90
Housekeeping	10	9	90
<b>TOTAL</b>	<b>30</b>	<b>26</b>	<b>87</b>

From the table, it could be seen that the instrument administered recorded various degrees of success based on the concerned departments of the subject organization. While an 80% retrieval success was recorded from the administration department, a 90% respondent level was recorded for department of food and beverages. The recorded respondent levels for the housekeeping department were at 90%.

## XII. FINDINGS AND DISCUSSIONS

This section is aimed at presenting the findings of this paper work and also to relay discussions bothering on the subject matter – the system theory of management in modern day organization (A case study of Aldgate Congress Resort Limited, Port Harcourt).

### Findings:

Investigations reveal that the system theory of management is relatively in practice in Aldgate Congress Resort Limited. The organization as a system has a composition of subsystems that make up the whole system. These are seen in the departmentalization / sectionalisation of the system. Each subsystem is supervised by a head of department who controls and coordinates every activity of that department. He in turn reports to a manager who is in charge of the system as a whole. An observable relationship exists among the subsystems revealing that the components of the systems are connected together. For instance, the subsystems are seen in the likes of the following departments: front office, food and beverage, housekeeping, marketing and accounts.

At the organization of study, the connection among subsystems is fixed in an organized way and is structurally made explicit. The practise of the system theory in this organization is instrumental to the formal flow of communication by which the organization is operationally manned. It has been observed also that the success (surpluses) recorded in both monthly and annual statement of accounts can be partially attributed to the adoption of the systems theory in the management of the organization. This theory has been noted to strike a balance between the classical approach and the human relation approach of management in an organization.

Another veritable findings made at Aldgate Congress Resort is that the organization as a whole was seen as a subsystem of a larger system. It regularly made interactions with other subsystems (of its kind), complementing efforts of each other in the larger system context.

### Discussions:

This study has shown that even while the systems theory is of been practised in the organization of case study, certain issues, challenges and prospects have cropped up in the course of its application. These have contributed immensely to the recommendations that are made in section iv of this paper.

Bureaucratic applications on operations were observed to be fundamental elements of the systems theory in Aldgate Congress Resort. Because of its structured and systemized nature, issues relating to daily operations are subjected to bureaucratic functions. This sometimes leads to lost man hours which encourages losses if not strictly monitored.

There is also the issue of contingency or situational decision making bothering on the prevalent situation. Since the organization has a private ownership of 100%, it was discovered that decision making is most at times centralized. Strategic decisions and policy formulations are principally in the hands of the chief executive. Situational forces were seen to be responsible for the decisions that regulate the system without recourse to the essentials of policy formulation. This contingency approach co opted into the systems theory manifests in a dual feedback system. At one end of the pole, it tremendously salvages situations that would probably have represented the organization negatively in the larger system. However, at the other end of the pole, it could lead to operational drawbacks if wrongly presented and interpreted.

## XIII. SUMMARY, CONCLUSION AND RECOMMENDATIONS

### Summary

Like living systems, most organizations if not all, operate in constant interchange with their environment. They have many complex interactions and interrelationships within their boundaries. To survive, organizations must grow and achieve a dynamic equilibrium rather than simply return to a steady state. It is for these reasons that general systems theory has come to be applied to the study of organizational phenomena. However in this paper work, we have looked into its application in a modern day indigenous organization.

### Conclusion

In conclusion, Systems Theory is an abstract philosophical framework that nonetheless entails a highly empirical and investigative form of management science. Systems Theory suggests an evolutionary explanation for the dominance of management in contemporary society. It also clarifies the role of complex organisations in modern society; and predicts that the complexity of organisations, and therefore the role of management, will probably continue to increase – at least for so long as the efficiency-enhancing potential of complexity can continue to outweigh its inevitably increased transaction costs.

### Recommendations

The systems theory of management in modern day organizations is a veritable scholarly tool for the academic world. It fosters additional management knowledge to the business world thereby increasing the survivability and profitability ratios of these organizations.

In the light of the conceptual work done on this subject matter, the following recommendations are hereby made for modern day organizations in particular and the business world in general on issues bothering on the adoption of the systems theory in management.

1) For corporate growth and profitability, modern day indigenous organizations should manage their organizations applying the systems theory of management. This is because of its bridging ability and interfacing strength in the classical and human relations approaches to managing organizations.

2) The structured nature of the systems theory enables the organization to function effectively without much friction. Chains of command and lines of authority are clearly spelt out because of the inevitable subsisting relationships between subsystems. Recommendation is hereby made for organizations to adopt the systems approach to guarantee orderliness and constancy of operations.

3) Because of the element of contingency that crops up in daily organizational management and which is evident in the organization of study, it is recommended that modern day managers should apply a "systency approach" to the management of their outfits. This terminology of ours implies the management of an organization using the systems and contingency approaches simultaneously. Their ratio of effective application is a function of the manager's decision and situational forces surrounding the manager at that point in time.

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# Flat Sheet Membrane Using Silica from Sugarcane Bagasse as Additive: Effect of Morphology

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**Abstract-** The work describes is primarily concerned with the fabrication and testing of flat sheet membrane. The aim of this research is to investigate the morphology of flat sheet membrane that uses silica from sugarcane bagasse as an additive. Six flat sheet membranes were then fabricated by varying the dope formulation. Membrane surface and cross-section area were analysed by scanning electron microscope (SEM). The analysis of SEM shows that the addition of silica from sugarcane bagasse changed the surface structure of the membrane especially at top layer and sub layer. The performance of flat sheet membrane were determined based on flux of pure water permeate, rejection sodium chloride solution and molecular weight cut off. The results indicate that the addition of 3% of silica give the best rejection and highest flux where successfully do rejection of 75.35 % and 42.65 L/m<sup>2</sup>hr water flux. The molecular weight cut off results shows that the membrane having solute rejection beyond 70% and categorized on their nominal molecular weight cut off.

**Index Terms-** Additive, Flat sheet, Membrane, Morphology, Sugarcane bagasse

## I. INTRODUCTION

Membrane has gained an important place in chemical technology and are used in a wide range of applications. Technologies of membrane has become a better solution in the process of water purification, component of important procedure and apparatus in most medical sector, food industry, cosmetic industry and other industries. Nowadays, modifications of materials used in the formulation of membrane via phase inversion and processing parameters that involve in the preparation have been intensively studied [1]. The thermodynamic and kinetics properties of the membrane during the formulation process may alter the membrane structure and performance. One method that commonly used to improve the performance of membrane is addition of additive into membrane formulation. Study by [2, 3] stated that small quantity of additive being added into the formulation may cause significant changes to the characteristics of membrane. Previous study by [4] used glycerol as organic additive for blended polymer of polyvinyl alcohol and polyethylene glycol stated that the additive may acts as anti-fouling mechanism. The presence of the glycerol on the top layer of thin film composite membrane had increased the hydrophilicity of the membrane's surface [4]. Other studies by [5], found that by addition of SiO<sub>2</sub> in the membrane formulation will enhances fouling resistance ability, molecular weight cut off,

pore radius, pore density, and surface porosity of the membrane. However, different types of silica produce different effects on membrane properties. Therefore in this study, silica extracted from sugarcane bagasse was used as an additive for flat sheet membrane fabrication.

## II. EXPERIMENTAL PROCEDURES

### A. Extraction of Silica

Sugarcane bagasse will be collected from nearby plantation. The sugarcane bagasse samples were undergoes hydrolysis, refluxing, precipitation and washing process to extract the pure silica. Silica was used as an additive in membrane preparation.

### B. Preparation of flat sheet Membrane

The PSf were dried by temperature 50°C for 24h before use in casting formulation. Then, casting formulations were prepared by dissolving the ratio between Psf: DMAc: PVP: Silica. The six dope composition formulae for membrane formulation involve constants amount of Psf, 21% and DMAc, 71%. The PVP: Silica ratio is 7:1, 6:2, 5:3, 4:4, 3:5 and 2:6 respectively. Psf was added into the vessel containing the solvent DMAc and stirred continuously by using a magnetic stirrer to make sure the polymer is well mixed. This procedure was repeated until all the required amount of polymer is added. This process was controlled at desired range 60°C temperature and 400 rpm speed. The solution was stirred until it become homogeneous. Next, the additive, PVP was added in the solution and followed by additive silica from sugarcane bagasse. Then, the mixing process was continued until a homogeneous solution is obtained. After that, the dope solution was poured and cooled in a clean one liter storage glass bottle. The above steps is surface treatment of membrane fabrication process which involved evaporating the solvent on the membrane surface by allowing air being sucking out of the air hood. Later on, the dope solution undergo coagulation steps where the membrane sheets were immersed into appropriate liquid at appropriate temperature so that the membrane will harden and detach from the casting plate. The dope solution was cast using casting knife with range thickness 100-125 µm and immersed into coagulation bath containing distilled water under room temperature. The flat sheet membrane was air-dried for 24 hour at room temperature (27°C). Finally, the membranes then were cut in ring shape about 6 cm diameters before placed in the cell.

### C. Membrane Analysis

Membrane morphology was examined using a scanning electron microscope (SEM). Membrane were immersed in liquid nitrogen, fractured carefully then coated with gold prior to SEM analysis [6]. The performance of flat sheet membrane was evaluated based on pure water permeation fluxes (PWP) and solute rejection rates (SR) [7]. Molecular weight cut off of the flat sheet membrane was determined by identifying an inert solute rejection SR of 70-100% in steady state of experiment [6]. The concentration of solute the feed and permeate were determined by UV Spectrophotometer.

### III. RESULTS AND DISCUSSION

#### A. Membrane Morphology

Table I shows the summarization results of morphology based on surface and cross-sections area and performance in terms of pure water flux, NaCl rejection and molecular weight cut off. The SEM image indicates that the membrane were found dense skin layer at top of surface. SEM image shows macrovoids on the membrane surface that forming spongy microstructures. Basically, the SEM image of cross section describes an asymmetric structure consisting of dense top layer, a porous sub-layer and a small portion of spongy-like structure between bottom surface layers. The top layer acts as a separation layer whereas the sub-layer provides the mechanical strength for membrane. The finger-like structure beneath the top surface layer becomes large void near the bottom surface layer. The result was similar to the previous work by [6, 8, 9] showed the membranes consist of a dense skin layer at top surface and short finger-like structure. This relates to high rejection due to the effective rejection that flow through dense skin layer and finger-like structure explaining the high water flux obtained [8].

From the cross section area images, the membrane structure was changed in terms of finger like, pore size at top and bottom layers and interconnectivity by adding silica to the casting solution. By increasing percentage of silica from 1% to 3%, it is significant that the finger like structure at the sub-layers and middle layers become longer and the spongy structure at bottom layer tend to be a finger like structure with bigger size. However, as the percentage of silica increase from 4% to 6 %, the finger like structure decreases. This is due to the separation of membrane with DMAc solvent solution is decreases and slow precipitation inside membrane layer. Principally, the precipitation started from the outer surface due to thermodynamic instability between dope and water in coagulation tank. Then, it is followed by dispersion of solvent into the coagulation bath and non-solvent into the cast film [1]. Thus, the result indicate that the straight and longest finger like structure was at dope S3 which give the best permeation compared to short finger like structure. In fact, the pore size at the top layer of membrane for dope S3 is the smallest hence lead to the better rejection.

#### B. Pure water permeation fluxes and solute rejection rates

From Table I, the flux is increase when the percentage of silica increases up to 3%. The PWF of 1% silica is 28.90% L/m<sup>2</sup>hr, 2% silica is 33.62 L/m<sup>2</sup>hr and 3% silica is 42.65 L/m<sup>2</sup>hr, this increases trend might due to the increased of hydrophilicity properties of membrane. The PWF were slightly similar after addition of 4% to 6% silica. In this study, the optimum flux rate can be considered at membrane which contains 3% of silica which indicate more hydrophilicity and attracts water molecules into the membrane. Moreover hydrophilicity properties also may facilitate water penetration through the membrane thus enhancing the flux [1]. In terms of salt rejection, the results indicated that at the first 3% of SCBN, the salt rejection were slightly similar approximately 75.33 % rejection. Then, the salt rejection shows gradually decreased from 75.35 % to 71.18 % with addition of 4% to 6% silica. According to the results, the 3% silica show the highest NaCl rejection of 75.35% due to the optimal mixture of silica that result in good hydrophilic properties. The high hydrophilicity membrane may reduce interaction between hydrophobic contaminants and the membrane surface; hence, the rejection properties were improved effectively [1]. This is clearly show by the rejection properties when silica is added as additive in nanofiltration membrane. However, with more addition of silica, it is result to low NaCl rejection. This may be due to crystalline effect of the silica that has low compatibility when mixed with polymer. Therefore, the small particles can be a small defect and this surely will affect the rejection value.

#### C. Molecular Weight Cut Off (MWCO)

In this study, the MWCO of the membrane were investigated using different reference solutions which are 1000 Da and 400 Da. Molecules having a molecular weight larger than the MWCO of a membrane will not pass through the membrane. Figure 1 shows the percentage of solute rejection for six dope formulation of flat sheet membrane. The result indicates that, the MWCO of all six dope formulation membrane having solute rejection beyond 70%. An increase in silica content from 4% to 6% for decreases the percentage of solute rejection from 92.53% to 92.38% for 1000 Da and from 76.93% to 76.79% for 400 Da respectively.

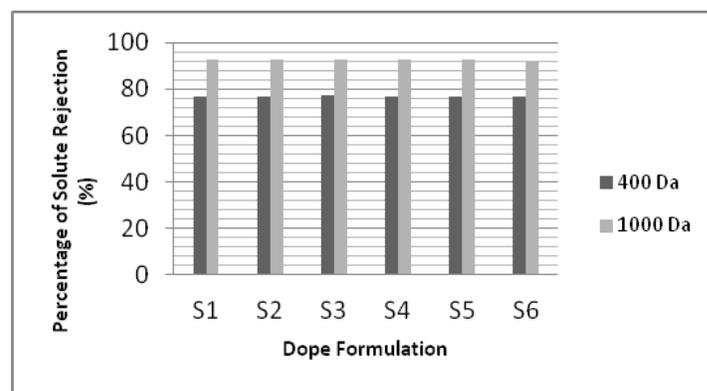
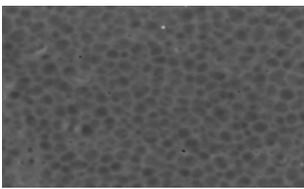
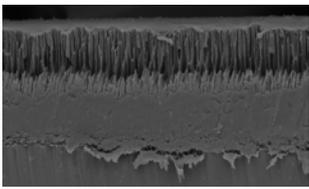
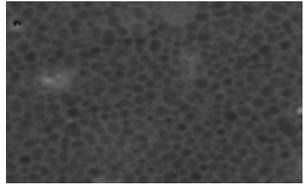
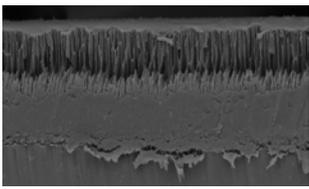
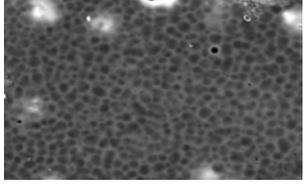
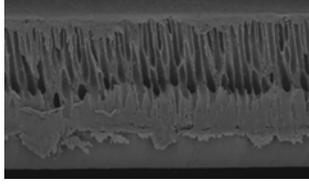
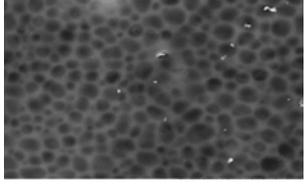
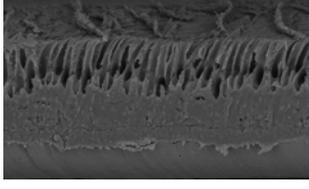
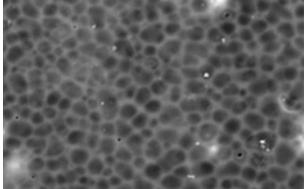
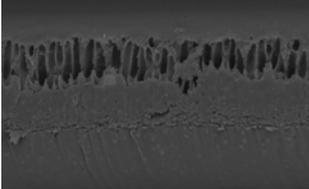
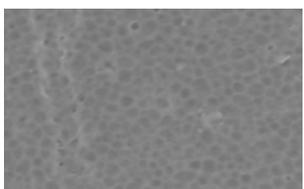
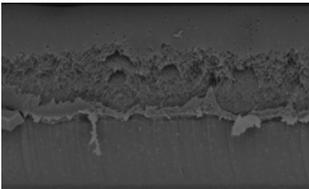


Figure 1: Molecular Weight Cut Off Test

Table I: Result on Morphology, Flux, Rejection and MWCO

Membrane	Pure water Flux (L/m <sup>2</sup> hr)	NaCl Rejection (%)	Molecular Weight Cut Off test (%)		Scanning Electron Microscopy	
			400 Da	1000 Da	Surface	Cross-section
S1	28.90	75.40	76.93	92.47		
S2	33.62	75.23	77.00	92.5		
S3	42.65	75.35	77.14	92.6		
S4	41.96	74.40	76.93	92.53		
S5	42.90	73.49	76.79	92.49		
S6	42.64	71.18	76.91	92.38		

#### IV. CONCLUSION

In conclusion, the morphology and performance of prepared flat sheet membranes using silica as additive were successfully investigated. The best formulation of flat sheet membranes was dope S3. From the results and analyses, it found that the membrane performance of dope S3 with addition of 3% silica give the best rejection of 75.35 % and 42.65 L/m<sup>2</sup>hr water flux. From the observation using SEM, the membranes consist of a dense skin layer at top surface, it relates with the results which have higher rejection due to the effective rejection that flow through dense skin layer. The result indicates that dope S3 has straight and longest finger like structure, smallest pore and good interconnectivity which give the best permeation.

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# Figure out the weight loss percentage of three thread fleece fabric composed of different fibres for abrasion on the technical back side

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**Abstract-** Abrasion resistance is used to quantify the service life of the textile material in normal use. The aim of this study is to measure the deterioration of three thread fleece knit fabric due to abrasion. To conduct these work three different types of three thread fleece (all cotton, cvc/poly/cotton, all PC) fabrics were selected. The test was carried out in the technical back side of the fabric because of the presence of loose and course fleecy yarn where the possibility of fibre loss is higher than technical face side. The weight loss percentage of the fabric both in grey and finished state were measured at every 500 cycles interval on Martindale instrument according to ISO 12947-3:1998. The result showed that the rate of weight loss percentage was raised with increment of the cycle, and a measurable effect found in the weight loss percentage of polyester based three thread fleece fabric yarn after 500 cycles than the others. It was also observed that for all cotton based fleece fabric variation in loss of weight in grey to finished state was not so remarkable, but the weight loss percentage was found higher in all CVC, polyester, cotton based fleece fabric.

**Index Terms-** Abrasion resistance, Three thread fleece, Weight loss percentages (%), Technical back side, Grey state, Finish state.

## I. INTRODUCTION

Knit fabrics will find wider use in time since they can be produced more easily for a lower cost, and they are more flexible. However, knit fabrics are less stable than woven fabrics since they are produced with low twist yarn and have a slack construction, as a result of which they have a low abrasion resistance.

Invisible fleecy is a plain plated structure composed of a face and binding yarn with a fleecy backing yarn tucked into the technical back at every fourth wale to mesh only with the binding yarn. The face yarn prevents the arms of the fleecy tucks being visible between the wales on the face, which would spoil its clean appearance. The fleecy inlay is spread across the technical back by centering the fleecy tucks of the next three-feed sequence on the middle of the three needles that missed the fleecy yarn in the previous sequence. In fleecy fabrics, the fleece yarn fibres (usually in the form of inlaid yarn) become entangled and indistinguishable from the base yarn on the effect side, despite having been separately supplied during knitting. [1]

Abrasion resistance is the ability of a fabric to resist surface wear caused by flat rubbing contact with another fabric. Abrasion resistance of the textile materials is very complex phenomenon and affected by many factors, mainly classified as follows: Fiber, yarn, fabric properties and finishing processes. Some of these parameters affect fabric surface whereas some of them has an influence on internal structure of the fabrics. [2]

Abrasion occurs during wearing, using, cleaning or washing process and this may distort the fabric, cause fibers or yarns to be pulled out or remove fiber ends from the surface. The first stage of abrasion is small balls entanglement because of the loose fibers unravels from the fabric surface during usage and washing. Eventually the fibers which bind the balls to the surface breakdown and a hole occur. If the sock consists of synthetic fibers with natural fibers, during rubbing action natural fibers, which give the desirable properties of the sock, move away, only synthetic fibers remain. This gives the sock undesirable appearance and decrease the overall fabric thickness. [3]

There are many factors, such as the yarn spinning system, fabric construction and finishing operation, which affect the abrasion resistance and pilling performance. With certain precautions taken in fabric production, the abrasion resistance and pilling performance of knit fabrics can be developed positively.

The initial effect of abrasion on the surface of a fabric is the formation of fuzz as the result of two processes, the brushing up of free fiber ends not enclosed within the yarn structure and the conversion of fiber loops into free fiber ends by the pulling out of one of the two ends of the loop. Gintis and Mead consider that the fuzz formation must reach a critical height, which is dependent on fiber characteristics, before pill formation can occur. [4]

Dessouki H. A. E. found that the abrasion resistance value of socks can be increased by a number of measures; use of thicker yarns, adding PA to the structure, adding elastic yarns to the structure. [5]

Jerkovic I. et al. compared four abrasion testers, which are used for the automobile sector. [6]

Abrasion is generally only one of several factors contributing to wear performance or durability as experienced in the actual use of the material [7], but abrasion behavior is an important property of textile materials that governs the quality and efficiency of processing

and the performance of products [8]. Abrasion is the mechanical deterioration of fabric components by rubbing them against another surface [9]. Therefore it is affected by many factors in a very complex, and as yet little understood manner [10].

The Martindale tester is used for both the abrasion, pilling resistance of fabrics, and straight line test by adjusting three moving parts, each one has three setting levels; making twenty seven paths possibilities. According to the standards there are only three types of motion to perform different tests. Therefore the aim of Kotb N. A. et al [11] study is to evaluate the effect of other setting possibilities on abrasion behavior.

Akaydin M. et al. [12] determined the effects of dyeing, knit construction and the thread yarn production type on the abrasion resistance and pilling performance of jersey and interlock fabrics were produced from 100% cotton ring and compact yarns.

Rashid M.R. et al. [13] investigated the abrasion resistance and seam stretchability of knitted fabrics using ring and compact spun yarn on three different knitting structures single jersey, rib and interlock were produced from these yarns.

Jerkovic I. et al. [14] compared three abrasion tests with different abrasive elements using car seat upholstery structures.

## II. EXPERIMENTAL DATA

100% Cotton, Cotton/polyester/cotton, 100% Polyester, CVC/polyester/cotton, CVC/polyester/CVC and Cotton/Polyester/CVC fibers are mostly used in fleece. So in this research, the effect of commonly used fibers to abrasion resistance was investigated. For this purpose the specifications of selected specimens shows in Table (1)

**Table 1: Selected yarn for experiment**

Material	Yarn count
100% Cotton	30 <sup>s</sup> /30 <sup>s</sup> /12 <sup>s</sup>
100% PC	34 <sup>s</sup> /34 <sup>s</sup> /22 <sup>s</sup> (52% 48%)
CVC/polyester/cotton	30 <sup>s</sup> (60% 40%)/75D/20 <sup>s</sup>

Samples were prepared on a 34"X20G JIUNN LONG, Taiwan fleece circular knitted machine in Micro Fiber Group Ltd. Each sample was made 5kg. Specimen for grey abrasion test was separated and rest of the samples was sent for dyeing and finishing. Standard dyeing and finishing process was followed for average color and finished specimen was ready for abrasion resistance test.

In this study, abrasion resistance values were measured on the basis of weight loss percentage by using Martindale instrument

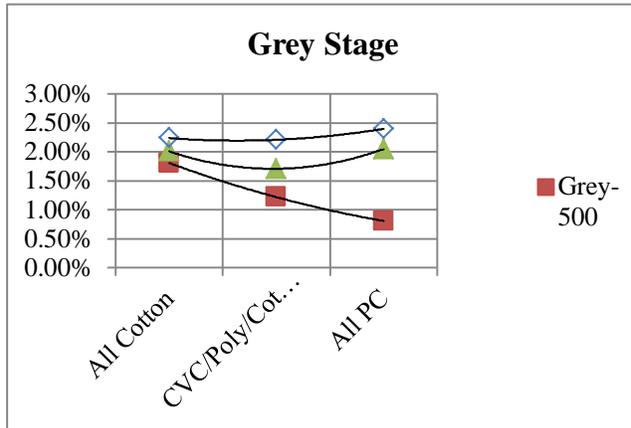
according to ISO 12947-3:1998 with the standard load 9kpa. [15]

After performing all the testing the following table was generated and tabulated:

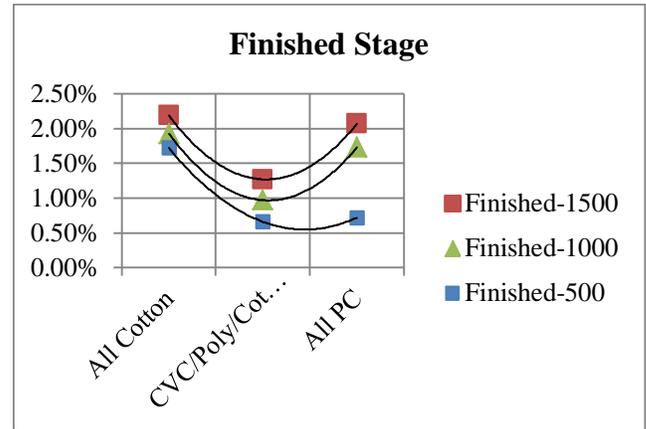
**Table 2: Weight loss percentages (%) of three thread fleece fabric (without brush)**

Yarn type	Wt loss % after 500 cycle		Wt loss % after 1000 cycle		Rate of increase of wt loss % (Grey 500-grey 1000)	Rate of increase of wt loss % (finish 500-finish 1000)	Wt loss % after 1500 cycle		Rate of increase of wt loss % (Grey 1000-grey 1500)	Rate of increase of wt loss % (finish 500-finish 1000)
	Grey-500	Finished-500	Grey-1000	Finished-1000			Grey-1500	Finished-1500		
All Cotton	1.81	1.72	2.01	1.93	0.11	0.12	2.24	2.19	0.11	0.13
CVC/Poly/Cotton	1.22	0.66	1.71	0.97	0.40	0.47	2.21	1.27	0.29	0.31
All PC	0.81	0.72	2.05	1.73	1.53	1.40	2.40	2.07	0.17	0.20

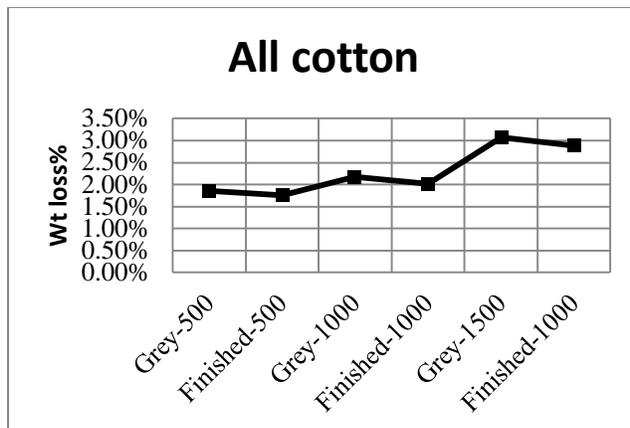
III. RESULTS AND DISCUSSIONS



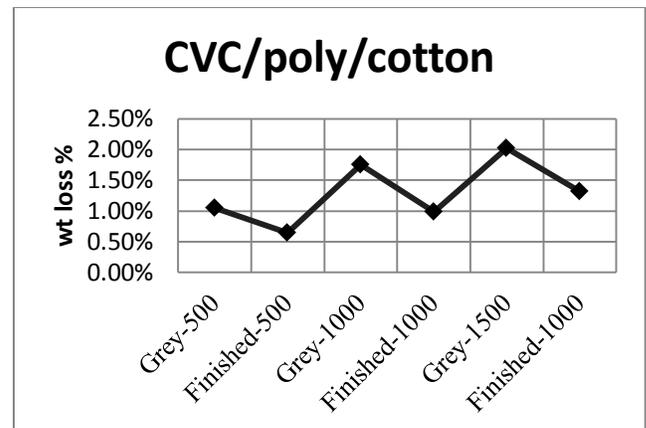
Graph 1: Weight loss percentages (%) of three thread fleece fabric (without brush) in grey state.



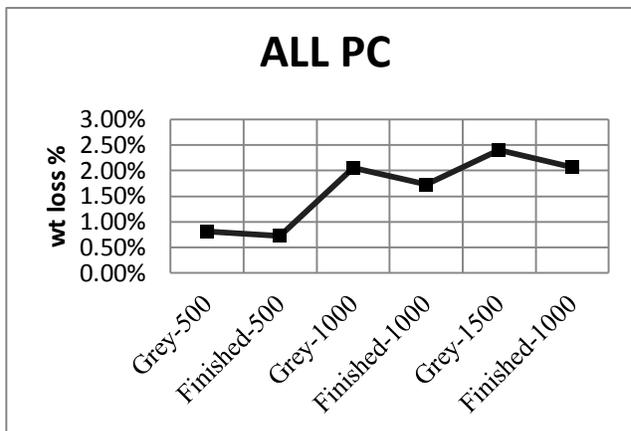
Graph 2: Weight loss percentages (%) of three thread fleece fabric (without brush) after finishing



Graph 3: Weight loss percentages (%) of three thread fleece fabric (without brush) in case of all cotton yarn



Graph 4: Weight loss percentages (%) of three thread fleece fabric (without brush) in case of CVC yarn



Graph 5: Weight loss percentages (%) of three thread fleece fabric (without brush) in case of all PC yarn

Above illustrated table 2 and Graph 1 and 2 it clearly indicate that the weight loss percentage of fleece fabric is increased with the increase of cycle number for all fabric in both grey and finished state. And it is maximum at 1500 cycle. Very interesting fact was found for all polyester based three thread fleece fabric that is weight loss percentage after 500 cycles is very low in compare with all cotton based fleece fabric. But after 1000 cycles and 1500 cycles it shows very similar values like all cotton based fleece fabrics. A remarkable change in the rate of weight loss percentage increase is found in between 500 to 1000 cycle for PC fleece fabric as compared with others. The reason behind it may be the higher strength in polyester fibre, higher cycle is required for its deterioration. From the illustrated table 1, it is also shown that in 500 cycles with the increase of polyester in fabric the rate of weight loss percentage is not raised. For all cotton it is 1.81%, for cvc/poly/cotton 1.22%, and for 0.81%. But after 500 cycle, the rate of weight loss percentage is raised with the increase of polyester percentage in the fabric. And this percentages reach at 2.40% after 1500 cycles for polyester based fleece fabric which is very much higher than cotton (2.24% after 1500 cycles) and cvc (2.21% after 1500 cycles) and it is shown on table 1, chart 1.

From the table 2 and graph 3, 4 and 5, it is also observed that after finishing of the fabric weight loss percentages of every sample is lower than its grey stage. But in case of CVC /polyester/cotton threaded fleece fabric; grey to finish weight loss percentage is very much measurable. 100% Cotton based three thread fleece fabric maintains very uniform weight loss percentages after every 500 cycles for both grey and finish state. In case of polyester based fleece fabric, weight loss percentage is approximately same for both grey and finished state at 500 cycles. But after that it shows higher weight loss percentage in grey state than finished state.

#### IV. CONCLUSION

In this study, the results of abrasion resistance on the basis of weight loss percentage of three thread fleece fabric varied with the number of cycle, fibre composition and different state were analyzed. The summary of this observation was that higher number of cycle raise the deterioration effect on the fabric surface and enfeebles the yarn. Polyester based three thread fleece showed lower abrasion resistance after 500 cycles and a remarkable change in the rate of weight loss percentage is observed in between 500 to 1000 cycles. Also the results showed that the weight loss percentage in grey state was higher than the finished state for all fabric. The presence of high polyester fibre in the fabric show higher abrasion resistance than cotton based fleece fabric because of its higher strength.

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# A retrospective study to analyze acute & chronic side effects of radiotherapy in patients of head and neck cancer

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## Abstract-

**Background and purpose:** Use of Radiotherapy in head and neck cancer is widely accepted and it is becoming standard treatment for head and neck cancer. In addition to some advantages of radiotherapy, patients experience various side effects. The aim of the study was to analyze acute and chronic side effects of radiotherapy in cancer of head and neck. Learning of these side effects will help doctors to plan treatment for patients and may help better ways to treat cancer.

**Materials and method:** 1010 patients were studied retrospectively. Patients' data recorded between year 2006 and 2013 were evaluated. Study was presented before the members of ethics committee. Ethics committee members reviewed the study carefully. After valuable feedback and careful consideration the ethics committee cleared the study. Records were kept in the departmental patient registry and were retrieved from computer database. Sr no. name of patient, age, gender, type of cancer, type of radiation therapy given to the patient, dose of radiation, acute and chronic side effects seen after radiotherapy were recorded in CRF. From the collected data percentage of different side effects observed with different radiotherapy was calculated. Side effects with different radiotherapy took place in different weeks. Percentages of acute and chronic side effects were calculated on basis of week.

**Results:** Out of the 1010 patients included in the study, 93% were males and 7% were females. The mean age of patients was 55.9 years. Most number of patients had tumor in the buccal mucosa (n=200). Other locations where tumors were found were tongue, vocal cord, hypopharynx, base of tongue, nasopharynx, hard and soft palate, tonsils, parotid and maxilla. Four types of radiotherapy were given to patients namely 2D (8.9%), 3D CRT (10.8%), IGRT (39.6%) and IMRT (40.5%). The patients undergoing 2D therapy had more number of side effects, acute as well as chronic, as compared to patients undergoing the other therapies with the most common acute side effects being mucositis, skin darkening, loss of taste, pain and localized hair loss. In 2D and 3D therapies, most acute side effects appeared in the 4th week whereas in IGRT and IMRT, most acute side effects appeared in the 5th week. Regarding the chronic toxicities, the most commonly occurring were dryness of mouth, cough and subcutaneous fibrosis. Other toxicities occurring in a minority of the patients were hoarseness of voice, dental problems and ear problems. Again, these toxicities were more prominent in patients undergoing 2D therapy and 3D therapy. Very small

number of patients taking IGRT or IMRT were affected by any of these problems, ultimately proving that IGRT and IMRT are the safest options to opt for during radiotherapy for cancer, not only because of the lesser number of people suffering from the side effects but also because of the later onset of these effects.

**Conclusion:** The results of this study point to the fact that intensity of side effects of radiotherapy depend not only on the dosage of the therapy but also on the type of radiotherapy being given to the patients. Also, it can be seen that the onset of the side effects also depends on the type of radiotherapy. All the side effects were observed in all therapies with different onset of action and in varying proportions.

**Index Terms-** Head & Neck Cancer, IMRT, 3D-CRT, IGRT, Radiotherapy, Chemotherapy, Cancer.

## I. INTRODUCTION

Cancer is a disease of cells, the basic unit of our body. The term cancer is not used for a single disease but for group of disease. There is a close connection between cell cycle and cancer. Cell cycle is the process through which cells keep dividing into daughter cells and perform their function in orderly way and then they die. But sometimes if in cell cycle control mechanism if any problems take place number of unnecessary cells are produced by cell division cycle. Cell cycle is disrupted in cancer. Normally old cells die and new cells take their place. Cells divide and proliferate in regular fashion but in cancer, body's own cells become out of control and they proliferate and spread in abnormal way. It has been found that there is a decrease in sensitivity towards signals that balance proliferation, adherence and dying process. The proliferation increases in tremendous way as well, these cells do not die instead they produce cell mass called tumor. Cell tumors are of two types. First is benign tumor and another is malignant tumor. Benign tumors are generally harmless; they slowly grow at the site of origin and do not spread to the other part of the body. They grow more slowly compared to malignant tumor. Even benign tumors are not totally harmless. They are dangerous if they start originating near vital organ and push on the vital organ of the body like brain. Unlike benign tumor malignant tumors are not steady. They are cancerous and dangerous. They spread very rapidly to the other part of the body. Malignant tumors are responsible for the metastasis.

Similarly head and neck is a broad terminology which involves epithelial malignancies arising in pharynx, larynx, oral cavity, nasal cavity and paranasal sinus. Large numbers of head and neck cancers are squamous cell carcinoma in nature. More than 40,000 people in US develop head and neck cancer each year and approximately 14,000 people die because of head and neck cancer each year. Head and neck cancer involves various sites in body with aggressive biological behavior. 3% to 7% and 50% 75% new cancer develop in lungs or upper aero digestive tract due to progression of the head and neck tumor. Often the patients with head and neck cancer develop a second primary tumor. Regional lymph node involvement in advance stage H&N cancer patient is about two third. Initially distant metastasis is absent but it develops in about 10% of patients afterwards. Tobacco and alcohol drinking are the two main factors involved in developing head and neck cancer. Their contribution in development of this disease is thought to be 80%. Other than tobacco and alcohol, there is number of factors responsible for this cancer. Treatment modality in head and neck cancer is slightly complicated. Medical experts like medical oncologist, radiation oncologist, radiologist, head and neck surgeon and sometimes dentists and plastic surgeons are also needed for management of the treatment. Patient factors like swallowing, aspiration, organ involvement, concomitant illness and stage of tumor, spread of disease, tumor location are helpful to plan the treatment of head and neck cancer. Radiotherapy and surgery are the standard treatment for early stage cancer of H&N with cure rate achievement of 60-90%. For locoregionally advance disease and patients with metastases, traditional approach for treatment is radiotherapy after surgery and chemotherapy plus radiation. This has cure rate in 35-40% patients. [1]

## II. AIMS & OBJECTIVE

To analyze acute and chronic side effects of radiotherapy in cancer of head and neck & to compare and contrast acute and chronic side effects of different radiotherapy given in patients of head and neck cancer.

## III. Methodology

Data from Hospital's database were captured between 1<sup>st</sup> Jul 2014 to 1<sup>st</sup> Jan 2015 for period of six months.

The criteria for inclusion were as follows. 1) Patient should be 18 years or older 2) Patient should have head and neck cancer confirmed histologically 3) Patient should have undergone radiotherapy 4) Patients of both genders. There were no exclusion criteria because decision of radiotherapy was already taken by the clinician.

Demographic data collected were patient name, age and gender. Patients who received radiotherapy had different types of head and neck cancer like cancer of buccal mucosa, base of tongue, larynx, hypopharynx, vocal cord, pharynx, Supraglottis, nasopharynx, hard and soft palate, parotid gland and tonsils. Most of the patients were having squamous cell carcinoma of head and neck. Staging of cancer was done as per TNM classification. Patients with varying degree of cancer were included. External beam radiotherapy was given to all the

patients. Patients received different type of radiotherapy. 2D, 3D-CRT, IGRT and IMRT was given to the patients.

Conception stage involved defining the research question. In this study the research question was 'Is the side effects of different types of radiotherapy used in head and neck cancer patients same or different and when they occur during the treatment?' clinical scan of research question was done by discussing the research question with expertise in radio oncology field.

A literature search and review is a primary requirement for any work/study to start. Extensive literature search was carried out to find out technical, historical and economic background to the work. Articles were searched from various accessible sites and databases to obtain the data related to study's area of focus. Various sites like Science Direct, Cochrane database and various books were also used for literature review. In addition to original articles, some review articles, correspondence and editorials were also included.

Sample size selected for retrospective analysis was 1010 patient files. In retrospective review sampling means method by which cases/ records were selected from available database. There are three methods of collecting data in retrospective review: Convenience, quota and systematic sampling. In convenience method suitable cases are taken over a specified period of time.

In this study convenience method was used to collect the data. In patients having head and neck cancer and undergone radiotherapy were taken for the analysis. Patients' data recorded between years 2006 to 2013 were evaluated.

Before starting data collection, some useful documents were prepared like study synopsis, protocol outline and case report form to get clear understanding of the study. These documents were discussed with seniors to validate and approve them.

Protocol included information about the Title of the study, rationale behind the study, study type, methodology, study duration, study center, aim and objectives, main inclusion criteria and statistical test if applied any. Data were collected in CRF. Sr no. name of patient, age, gender, type of cancer, type of radiation therapy given to the patient, dose of radiation, acute and chronic side effects seen after radiotherapy were recorded in CRF.

Study was presented before the members of ethics committee. Ethics committee members reviewed the study carefully. After valuable feedback and careful consideration the ethics committee cleared the study. All the patients' data were kept confidential and were not shared with any third party without prior approval from the hospital

From the collected data percentage of different side effects observed with different radiotherapy was calculated. Side effects with different radiotherapy took place in different weeks. Percentages of acute and chronic side effects were calculated on basis of week.

#### IV. Results

##### PATIENT CHARACTERISTICS

Table 1 describes total 1010 patients' data were taken for evaluation. Out of these there were 940 (93%) males and 70 (7%) females. Average age was found to be 55.9 year (range 30-85 years).

[Table 1: Gender Distribution]

Gender	N	%	Total (n)
Male	940	93	1010
Female	70	7	

Table 2 summarizes no. of patients with different types of head and neck cancer. The largest group of patient data had tumor location in region of buccal mucosa (n = 200). Followed by tumors tongue (n = 150), base of tongue (n = 120), vocal cord (n = 100), hypopharynx (n = 70), nasopharynx (n = 70), hard palate and soft palate (n = 60), tonsil (n = 60), parotid (n = 50) and maxilla (n = 20). Other tumors location found were pharynx (n = 20), larynx (n = 10), lip (n = 10), and Supraglottis (n = 10), olfactory neuroblastoma (n = 10), floor of mouth (n = 10), vallecula with left neck node (n = 10) and MUO with secondaries in neck (n = 10).

[Table 2: primary tumor location and no. of patients]

Primary tumor location	Total (n)	%
Oral cavity Cancer		
• Tongue	150	14.8
• Buccal Mucosa	200	19.8
• Floor of Mouth	10	0.9
• Alveolus	10	0.9
• Lip	10	0.9
Oropharyngeal Cancer		
• Larynx	10	0.9
• Glottis	10	0.9
• Tonsils	60	5.9
• Vocal cord	100	9.9
• Base of tongue	120	11.8
• Soft palate	40	3.9
• Hard palate	10	0.9
• Soft+hard palate	10	0.9
• Pharynx	20	1.9
• hypopharynx	70	6.9
Nasopharynx	70	6.9
Salivary gland		
• parotid	50	4.9
Maxilla	20	1.9
MUO with secondaries in neck	10	0.9
Nasal cavity	10	0.9
Olfactory neuroblastoma	10	0.9
Vellicula with left neck node	10	0.9

##### TREATMENT CHARACTERISTICS

All the patients had been given radiotherapy. Four type of RT was given to patients of H&D cancer. The treatment being given was 2D, 3D CRT, IGRT and IMRT. 8.9% patients received 2D therapy (n = 90), 10.8% received 3D CRT (n = 110), 39.6% received IGRT (n = 400) and 40.5% received IMRT (n = 410). The mean dose to tumor was 64.5 Gy. Mean dose for 2D plan of the treatment to tumor was 64.1 gy, for 3D CRT it was 63.3 Gy, for IGRT it was 64.3 and in IMRT it was found to be 64.4 Gy. The range of treatment duration was 2-4 months.

Table 4 and 5 summarize the total number of patients affected with acute and chronic side effects during radiotherapy. Results from the data indicate those patients received 2D plans were highly affected with different acute and chronic side effects than with the 3D CRT, IGRT and IMRT planning.

[Table 3: Treatment characteristics]

Type of radiation	No. of patients	%	TOTAL (n)
2D	90	8.9	1010
3D CRT	110	10.8	
IGRT	400	39.6	
IMRT	410	40.5	

[Table 4: Total number of patients suffered from acute toxicities.]

Acute effect	Side	2D	3D CRT	IGRT	IMRT
Mucositis		90	110	400	390
Dysphagia		30	60	190	200
Skin darkening		90	110	400	190
Loss of taste		90	100	310	300
Decreased salivation		30	20	70	50
Localised hair loss		90	110	400	410
Pain		90	110	400	410

[Table 5: Total number of patients suffered from chronic toxicities]

Chronic effect	side	2D	3D CRT	IGRT	IMRT
Dryness of mouth		90	100	20	40
Cough		20	30	-	-
Hoarseness of voice		10	-	40	10
Subcutaneous fibrosis		40	30	10	20
Dental problems		10	10	-	10
Ear problems		-	-	10	-
hypothyroidism		-	-	-	10

**PROPORTION OF SIDE EFFECTS SEEN WITH DIFFERENT RT**

Table 6, 7, 8 and 9 shows week wise proportion of side effects seen with four different kinds of radiotherapy.

Table 6 indicates that with 2D treatment mucositis appeared in 3rd, 4th and 5th week of the therapy. Cases of mucositis were seen in 90 patient data (100%) with 2D therapy. In third week incidence of mucositis was 11.2%. It increased in 4th and 5th week which was found to be 44.4%. Dysphagia was seen in 30 patients (33.3%). Dysphagia was observed in 3rd week of the therapy. Incidence of skin darkening, loss of taste was 100% in 4th week. Pain was observed during 3rd and 4th week in 66.6 (n=60) and 33.3 % (n=30) patients respectively.

[Table 6: week wise proportion of side effect with 2D therapy.]

Radiot herapy	Side effect	week							
		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>	7 <sup>th</sup>	8 <sup>th</sup>
2D	Mucositis	-	-	11.2 %	44.4 %	44.4 %	-	-	-
	Dysphagia	-	-	33.3 %	-	-	-	-	-
	Skin Darkening	-	-	-	100 %	-	-	-	-
	Loss of taste	-	-	-	100 %	-	-	-	-
	Decreased salivation	-	-	-	33.3 %	-	-	-	-
	Localized Hair loss	-	-	-	-	100 %	-	-	-
	Pain	-	-	66.6 %	33.3 %	-	-	-	-

Table 7 indicates that with 3D CRT treatment mucositis appeared in 4th and 5th week of the therapy. Cases of mucositis were seen in 100 patient data (90.9%) with 3D CRT therapy. In fourth week incidence of mucositis was 72.7% (n = 80). It decreased in 5th week which was found to be 18.1% (n = 20). Dysphagia was seen in 60 patients (54.5%). Dysphagia was observed in 3rd week of the therapy. Incidence of skin darkening, loss of taste was 100% (n = 110) and 90% (n = 100) respectively in 4th week. Localized hair loss was also observed in all the patients in 5th week of the therapy. Pain was observed during 3rd and 4th week in 63.6 (n=70) and 36.3 % (n=40) patients respectively.

**Table 8** summarizes the incidence of side effects seen with IGRT therapy. Mucositis was seen in third, fourth and fifth week of the therapy. Overall incidence of mucositis was 100% (n = 400) with IGRT therapy also. In third, fourth and fifth week it was seen 2.5% (n = 10), 60% (n = 240) and 37.5% (n = 150) respectively. Occurrence of dysphagia was 47.5% (n = 190) in fourth week. Skin darkening, loss of taste and pain was observed in all the patients. Skin darkening was observed 95% (n = 380) in 5<sup>th</sup> week and 5% (n = 20) in 6<sup>th</sup> week. In the same week 77.5% (n = 310) experienced loss of taste and 10% (n = 40) experienced localized

hair loss during the treatment. Salivation was decreased in 17.5% (n = 70) of patient in 5<sup>th</sup> week. With IGRT 90% (n = 360). Pain was observed in 53.5% (n = 210) and 47.5% (n = 190) in 3<sup>rd</sup> and 4<sup>th</sup> week respectively.

[Table 7: week wise proportion of side effect with 3D CRT therapy]

Radiot herapy	Side effect	week							
		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>	7 <sup>th</sup>	8 <sup>th</sup>
3D C R T	Mucositis	-	-	-	72.7%	18.1%	-	-	-
	Dysphagia	-	-	54.5%	-	-	-	-	-
	Skin Darkening	-	-	-	100 %	-	-	-	-
	Loss of taste	-	-	-	90.0%	-	-	-	-
	Decreased salivation	-	-	-	18.1%	-	-	-	-
	Localized Hair loss	-	-	-	-	100 %	-	-	-
	Pain	-	-	63.6%	36.3%	-	-	-	-

[Table 8: week wise proportion of side effect with IGRT therapy]

Radiot herapy	Side effect	week							
		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>	7 <sup>th</sup>	8 <sup>th</sup>
I G R T	Mucositis	-	-	2.5 %	60%	37.5 %	-	-	-
	Dysphagia	-	-	-	47.5 %	-	-	-	-
	Skin Darkening	-	-	-	-	95%	5%	-	-
	Loss of taste	-	-	-	-	77.5 %	-	-	-
	Decreased salivation	-	-	-	-	17.5 %	-	-	-
	Localised Hair loss	-	-	-	-	10%	90 %	-	-
	Pain	-	-	52.5 %	47.5 %	-	-	-	-

**Table 9** summarizes the incidence of side effects seen with IMRT therapy. Mucositis was seen in third, fourth, fifth and 6<sup>th</sup> week of the therapy. Overall incidence of mucositis was 95% (n = 390) with IMRT therapy. In third, fourth, fifth and sixth week it was seen 17.07% (n = 70), 56.09% (n = 230) and 17.07% (n = 70) and 4.87% (n = 20) respectively. Occurrence of dysphagia was 48.78% (n = 200) in fourth week. Localised hair loss and pain was observed in all the patients. Skin darkening was observed 36.58% (n = 150) in 5<sup>th</sup> week and 9.75% (n = 40) in 6<sup>th</sup> week. Loss of taste was observed in 73.27% (n = 300) in 5<sup>th</sup> week. Incidence of decreased salivation was 12.19% (n = 50) in

5<sup>th</sup> week. Localised hair loss was observed in 7.31% (n = 30) and 92.68% (n = 380) of patients during 5<sup>th</sup> and 6<sup>th</sup> week. Pain was observed in 36.58% (n = 150) and 63.41% (n = 260) in 3<sup>rd</sup> and 4<sup>th</sup> week respectively.

[Table 9: week wise proportion of side effect with IMRT therapy]

Radiotherapy	Side effect	week							
		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>	7 <sup>th</sup>	8 <sup>th</sup>
IMRT	Mucositis	-	-	17.0 7%	56.0 9%	17.0 7%	4.87 %	-	-
	Dysphagia	-	-	-	48.7 8%	-	-	-	-
	Skin Darkening	-	-	-	-	36.5 8%	9.75 %	-	-
	Loss of taste	-	-	-	-	73.1 7%	-	-	-
	Decreased salivation	-	-	-	-	12.1 9%	-	-	-
	Localised Hair loss	-	-	-	-	7.31 %	92.6 8%	-	-
	Pain	-	-	36.5 8%	63.4 1%	-	-	-	-

Table 10 summarizes the overall incidence of chronic toxicities observed. With 2D and 3D CRT incidence of dry mouth was 100%. It was 5% and 9.75% with IGRT and IMRT respectively. 22.2% and 27% of patients had cough with 2D and 3D CRT respectively. 11.1%, 10% and 2.43% patients experienced hoarseness of voice. Ear problem was seen with 2.5% patient in IGRT. 11.1% patients in 2D and 2.43% patients in IMRT had dental problems. Incidence of subcutaneous fibrosis was observed with all therapy but in small proportion.

[Table 10: Proportion of chronic side effects]

Toxicity	Therapy			
	2D	3D CRT	IGRT	IMRT
Dryness of mouth	100%	100%	5%	9.75%
Cough	22.2%	27%	-	-
Hoarseness of voice	11.1%	-	10%	2.43%
Subcutaneous fibrosis	44.4%	27%	2.5%	4.87%
Dental problems	11.1%	-	-	2.43%
Ear problems	-	-	2.5%	-
Hypothyroidism	-	-	-	0.9%

### Discussion

Radiation induced mucositis is one of the most common acute side effects. If we discuss about acute mucositis reaction in all types of RT it has been established that mucositis was seen in all

the patients (100%) with 2D, 3D CRT and IGRT. With IMRT (95%) incidence of mucositis was slightly less compared to all the other RT. It started in 4th week in case of 3D CRT and with remaining three RT it appeared in 3rd week after starting treatment. It confirms high incidence of mucositis after radiotherapy. Result of this study also supports one systematic review carried out to assess mucositis incidence in head and neck cancer patients. In that systematic review high incidence (100%) of mucositis has been observed. The overall incidence of mucositis was 98% in current study. Mean incidence of mucositis was found to be 80%, which is almost identical to present study, in one study carried out to evaluate the incidence and severity of mucositis after radiotherapy in head and neck cancer patient. Frequency of mucositis was higher in patients received altered fractionation affecting 100% patients. While with conventional radiotherapy incidence was found to be 90%. Result from these study and other published reports it reflects that mucositis is an unavoidable toxicity rather than preventable. Radiation causes death of basal keratinocytes. Death of the cells is thought to be due to mitotic arrest which may lead to loss of squamous epithelial cells (Sciubba and Berg 2006). Although not a part of this study recent investigation indicates that there is a statistical correlation between incidence of mucositis and weight loss and severity of mucositis and placement of feeding tube. Mucositis proves to be one of the causes of morbidity in head and neck cancer which greatly affect quality of life of the patient. [36, 41]

Another bothersome acute toxicity experienced by the patients in this retrospective study was dysphagia. Dysphagia could take place due to structural damage in pharyngeal and laryngeal muscles or muscles of base of tongue. Longitudinal and circular pharyngeal muscles, laryngeal adductor muscles of glottis and Supraglottis, suprahyoid muscle and muscle that pull backward the base of tongue may get damage due to radiation resulting in dysphagia (Eisbruch, Schwartz et al 2004). Number of patients showing dysphagia were nearly same in both IGRT and IMRT. The result obtained here is not supporting one literature in which most of the patient received IMRT experienced dysphagia during the second week of the treatment. Persistent dysphagia may lead to feeding tube dependence [26, 27]

Skin darkening is another side effect experienced by the patients undergoing radiation therapy. All the patients undergoing radiotherapy experienced skin darkening but the onset of the effect was different for different therapies. In 2D therapy and 3D CRT therapy, all patients showed this side effect in the 4th week. Onset was later in the IMRT and IGRT therapies as compared to the previous two therapies.

Loss of taste also occurred in a majority of patients in all therapies. Onset of the symptoms was different for different therapies. In 2D and 3D therapies, the symptoms were first seen in the 4th week whereas in IGRT and IMRT, they were seen first in the 5th week. All the patients in the 2D therapy group experienced loss of taste in the 4th week and 90% patients undergoing 3D CRT therapy showed this side-effect in the 4th week, suggesting that 3D CRT therapy is slightly safer as compared to 2D therapy. Only 77.5% of the patients in the IGRT group showed loss of taste in the 5th week whereas 73.17%

patients in the IMRT group showed this side effect in the 5th week, showing that IMRT is slightly safer than IGRT. Radiation therapy develops loss of taste by destroying cells of the taste receptors. [13, 19]

Decreased salivation was observed in very few patients in all therapies, onset of the effect being different for different therapies. The highest number of patients who experienced this side effect was present in the 2D therapy group. 33.3% patients of this group showed this side effect in the 4th week. In the 3D therapy group, only 18.1% patients showed decreased salivation during the 4th week, suggesting that for this side effect as well, 3D therapy is safer than 2D. 17.5% patients undergoing IGRT therapy were affected by this effect during the 5th week whereas only 12.19% patients in the IMRT group were symptomatic for decreased salivation showing that patients undergoing IMRT were the least affected by decreased salivation problems. [10, 36]

All patients undergoing any radiotherapy have suffered from localized hair loss. This is one of the major side effects of radiation therapy. For all therapies, this effect has been seen during the 5th week. All patients in the 2D and 3D therapy have shown localized hair loss during the 5th week whereas 10% and 7.31% patients in the IGRT and IMRT respectively, have shown hair loss during the 5th week. The other 90% in IGRT and 92.7% in IMRT experienced localized hair loss during the 6th week showing a later onset of this effect in the latter two therapies.

Pain was also experienced by all patients undergoing radiotherapy, some later than others. Onset of pain was either in the 3rd or 4th week for all patients in all therapies. 66% patients in the 2D therapy group experienced pain first during the 3rd week and the other 34% suffered during the 4th week. Similar results were seen in the 3D CRT group. 64% patients in the IGRT group suffered from pain in the 3rd week and the other 36% showed pain during the 4th week. 52.5% and 47.5% patients showed pain in the 3rd and 4th week respectively, whereas 63% and 37% patients showed pain in the 3rd and 4th week respectively, suggesting that IGRT and IMRT are safer than 2D and 3D with respect to pain as a side effect.

Dryness of mouth was seen in all the patients' data that were given 2D and 3D CRT. With IGRT it was observed 5% and with IMRT the result was 9.75% indicating that with IGRT and IMRT incidence of dryness of mouth was less. This finding is in line with the result obtained in one study in which only 14% patients experienced dryness of mouth after having been exposed to IMRT. In contrast dry mouth syndrome was reported in all the patients (100%) having nasopharyngeal, Oropharyngeal and laryngeal cancer. [35, 44]

Hypothyroidism may take place as a chronic side effect of radiotherapy due to altered function of thyroid gland. Irradiation to the larynx and neck region causes change in thyroid function. Past reports suggest that approximately 6 to 15% suffer from hypothyroidism after radiation therapy. While in this study it has been found that only 1% patient had hypothyroidism with cancer of larynx. In present investigation if we discuss about dental problems it was predominant with 2D therapy (11.1%). With

IMRT, only 2% patients experienced dental problems after radiation. Radiation induced dental problems are dental caries, periodontitis, soft tissue complications and even death of bone (osteonecrosis). The incidence of dental problems reported in other literature is in the range of 8.2 to 42% after radiotherapy. Subcutaneous fibrosis was observed in 8% patients in present evaluation with 44% incidence in 2D (conventional therapy) and 27% incidence in 3D CRT. Incidence of subcutaneous fibrosis was very less in IGRT (2.5%) and IMRT (4.8%), which do not support one literature showing 13% incidence of fibrosis with conventional radiotherapy. Hoarseness of voice was observed in high proportion with 2D therapy. It was less low with IMRT and IGRT. Another chronic effects Cough and Ear problems were also seen in fewer incidences. [9, 26, 31]

### Conclusion

The results of this study point to the fact that intensity of side effects of radiotherapy depend not only on the dosage of the therapy but also on the type of radiotherapy being given to the patients. Also, it can be seen that the onset of the side effects also depends on the type of radiotherapy. Mucositis is the unavoidable side effect of radiotherapy and occurs in all the patients undergoing any form of radiotherapy. Other acute toxic effects seen were dysphagia, skin darkening, loss of taste, localized hair loss, dryness of mouth and pain. Decreased salivation was a minor side effect also seen in all therapies. Though all these side effects were seen in all therapies, the onset of the effects and also the percentage of patients suffering was different and for almost all effects, IGRT and IMRT proved to be the better treatment options as almost all side-effects occurred relatively later than 2D and 3D therapy and the number of patients suffering was smaller as compared to 2D and 3D. The major chronic toxic effects seen were hypothyroidism, subcutaneous fibrosis and dental problems, which were all more prevalent in patients receiving 2D and 3D therapies, showing that these two therapies are less safe as compared to the more sophisticated IGRT and IMRT therapies.

### Limitation

In this study it was not possible to analyze degree of seriousness (measured in grade) of all side effects, but the relationship of RT and onset of acute toxicities and appearance of chronic toxicities were evaluated.

As this retrospective study was conducted in only one Centre, the result cannot be generalized.

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# The Lumber Room: Ideal artifact for prose analysis + an epistle on child rearing

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**Abstract:** *The Lumber Room* by Saki has undergone multiple analyses as a short story. This study firstly examines its socio-pedagogic suitability for a target population of fifteen year old students who are embarking on the path of appreciating literature in Sri Lanka as the short story is contained in their anthology. It is rich in analytical excellence. The tightness of plot, multiple themes, dramatic dialogue, economy and dexterity in the use of language make it an ideal artifact for analysis of the short story genre. There is an omnipresence of humour, especially satire and wit. Secondly this study utilizes the short story as an analytical cameo on development psychology of a child and adult-child relationships. Its autobiographical nuances enhance the realistic value in this context. At present within the institution of family in the Sri Lankan society a transition from the traditional extended family structure to an accelerated creation of nuclear families is witnessed. The short story generates awareness on the need in a child for strong emotional attachments with positive reinforcement from care givers who unlike in the past very often is restricted to the two parents at present. Additionally it affirms the right of children to engage in and experience creativity. Thus the thematic multiplicity of the short story targets a reader population of children who are given an occasion to evaluate the relationship they have with their own parents.

**Index Terms:** Appreciating literature, fifteen year old students, *The Lumber Room*, child rearing, adult-child relationships, Development psychology.

## I. INTRODUCTION

### 1.1 Background of the author: H. H. Munro

The British author Hector Hugh Munro (1870 - 1916) published under the pen name Saki. Munro was born in Burma (Myanmar) in 1870. His father was an inspector general of the Burma police. His mother died in 1872 when Munro was only two years old. After her death he with his two older siblings a brother and sister were sent to England. Their childhood in England was not happy as their two maiden aunts, Charlotte and Augusta, were very strict disciplinarians who resorted not only to physical punishment but also cruelty which resulted in psychological trauma. Religion too played a strong role in the household. A fear of God and individual self-discipline was to be instilled in the children at a young age. Munro's sister, E.M. Munro, who wrote the *Biography of Saki* (1924)<sup>[1]</sup> states:

'One of Munro's aunts, Augusta, was a woman of ungovernable temper, of fierce likes and dislikes,

imperious, a moral coward, possessing no brains worth speaking of, and a primitive disposition.'

Ethel Munro further states that the aunts 'imposed a regime of seclusion, restraint, and arbitrary rules enforced in the case of Charlie [Saki's brother] by corporal punishment and in the case of Hector [Saki] and Ethel by coldness, removal of privileges, and guilt' (cited in Byrne, 2007, 17)<sup>[2]</sup>. According to Saki's sister their aunts and grandmother 'tried to instill the fear of God into their charges'. Thus it could be stated that *The Lumber Room* is a near-autobiographical depiction of Munro's unhappy childhood experiences under his guardians. The Aunt in the short story is not entirely fictional. She had a real life equal in one of Munro's aunts: Augusta making the background of author an important facet the short story.

### 1.2 Social aptness to the Sri Lankan student population

Globalization, westernization and socioeconomic factors have led to endorsement of nucleation of the majority of family units especially in urban Sri Lanka. Furthermore the Sri Lankan society is, at its core, still patriarchal. The role of the mother as the primary caregiver is still unchanged. But at micro-economic level most family units in our society at present have moved away from a single wage earner entity. Thus difficulties of child rearing arise due to the need for employment of the primary caregiver. The balancing of a professional life along with the responsibilities of a home maker while providing quality time to a child levies a heavy psychological tax on the working mother. Thus with the diminishing status of the extended family child rearing is a delicate process and is a challenging responsibility. Sociologically the behavior patterns and beliefs of parents are guided by general cultural norms and value systems of a society. Being obedient is recognized to be a good trait in a parent-child relationship in most Asian societies. Thus one main cultural expectation from a child in Sri Lanka is obedience and respect towards parents and adults in general. This obedience when flouted tends to result in punishment. Nicholas in the short story *The Lumber Room* is a whimsical child with a great sense of humour who rebels against punitive punishment in a creative and innovative manner annoying and provoking the Aunt who is his caregiver. This questions her child rearing style which is authoritarian. Furthermore in most societies a child very often is forced to fulfil parental beliefs in diverse aspects of socialization including rigidity in the instilling of moral values. If an instiller of moral values, such as the Aunt in the short story, violates what

they preach it confuses a child's grasp of the difference between right and wrong.

Another main value of the short story is that it requests the attention of parents to one, very often neglected, aspect of child rearing: the need to experience creativity. According to a key recommendation of the National Child Protection Policy (2013)<sup>[3]</sup> of the National Child Protection Authority of Sri Lanka children should be subjected to creative experiences.

Allowing creativity to be nurtured at every stage in a child's life is crucial to enable the child to grow in different dimensions. This gives children the chance to process ideas, be creative, think flexibly, and use their imagination effectively and in different ways. Children can absorb the creative experience in different ways, ranging from emotional involvement to problem solving as well as the acquisition of knowledge. (National Child Protection Policy, 2013: 27)

What the short story depicts through its protagonist is a child who is denied the right to experience creativity. The lumber room is a barred territory and experiencing the creativity within it is denied to Nicholas. According to theories of child development experiencing creativity fosters free thinking, and experimentation. The short story illustrates that the few minutes of forbidden joy in the lumber room results in an emotional involvement with the story in the tapestry triggering the mind of Nicholas to enter a problem solution mode in the form of

experimentation on finding an ending to the hunting episode depicted on it.

Thus the authoritarian child rearing style, rigid instilling of moral values and the violation of the right of a child to experience creativity depicted in the character of the Aunt grants a high sociocultural requirement to analyze short stories as *The Lumber Room*. Such child rearing styles are not restricted to Edwardian England but might also be evidenced in the contemporary Sri Lankan society.

## II. AN ANALYSIS: THE LUMBER ROOM

### 2.1 The Plot

In *The Lumber Room* the plot is ordered chronologically. Other than the flashback at the beginning which goes back to events which happened in the morning each progressive episode occurs in chronological order during the time span of one day. The selection of title *The Lumber Room* is also significant as it carries a symbolic meaning for Nicholas the protagonist of the short story. The lumber room symbolizes the happy world of a child. The climax of the short story too takes place within the Lumber Room.

Figure 1 below summarized the plot of the short story.

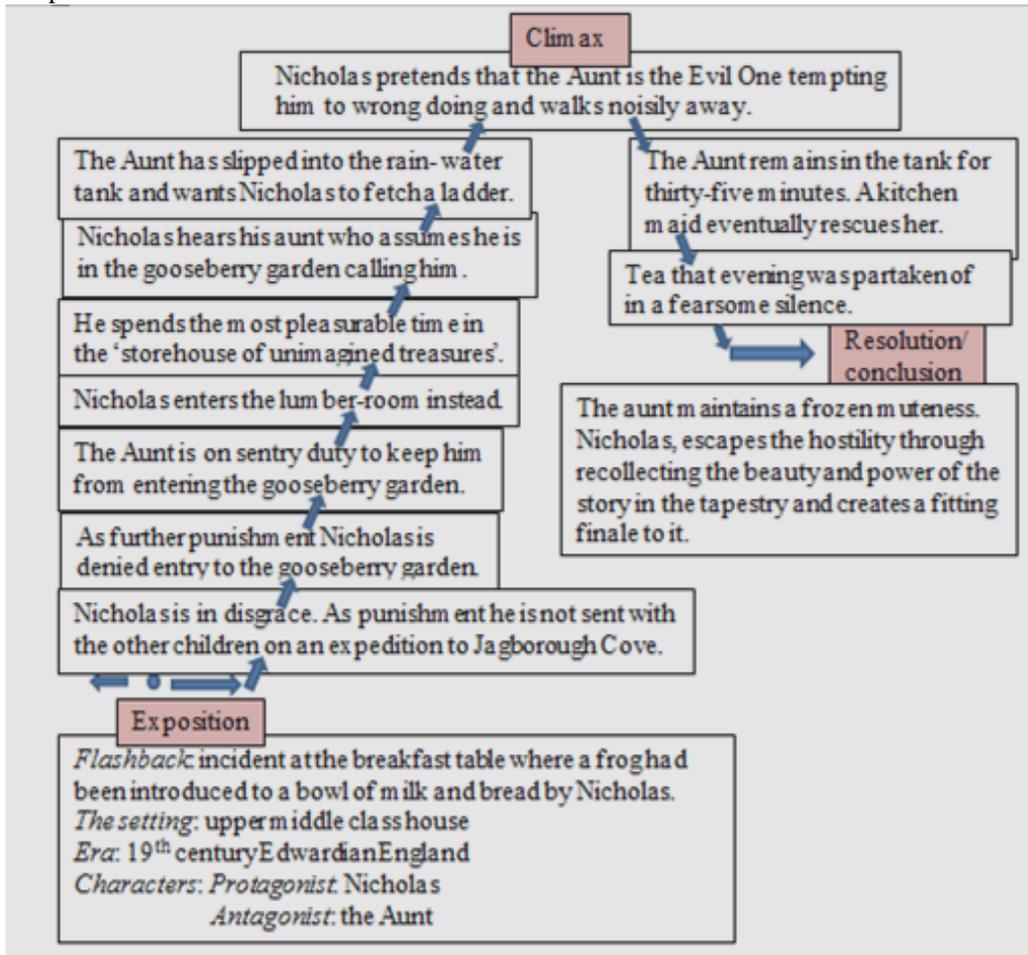


Figure 1: The plot structure of The Lumber Room

### 2.1.1 The exposition

During the exposition the author does not only describe the setting but also exposes the readers to his attitude towards characters through his tone and the mood he creates.

#### 2.1.1.1 The setting

The setting is in an upper middle class (suggested by the horse-drawn carriage, with a library and a lumber room with rare items) house in the 19<sup>th</sup> century Edwardian England. The action moves around different locations in the house: the dining room, the gooseberry garden and the lumber room.

#### 2.1.1.2 Point of view

The story is narrated from the 3<sup>rd</sup> person limited narrator position: The narrator can only see what Nicholas sees and experiences. Thus the reader is presented with a fairly biased and largely subjective view about the situations and the characters.

#### 2.1.1.3 The tone

The author's attitude towards characters, especially the Aunt, and incidents is full of satire and irony but as the narration is witty humour is generated in the reader. Though the tone is critical, especially toward the behavior of the Aunt, it is handled in a subtle manner.

#### 2.1.1.4 The Mood

The hostile atmosphere between the adult Aunt and Nicholas is vividly brought out during the first stages of the short story. The emotional effect or the feelings the author wants to create in the reader especially towards the Aunt and Nicholas is developed through words and descriptions. Nicholas is full of pranks and thus is fun and he is imaginative. Though the Aunt belonged to 'the older, wiser, and better people' her hypocritical manner and stupid actions clearly convey the negativity the author wants to create in the reader. Thus an atmosphere heavy with hostility is created in the exposition itself and built on at an increasing strength through the rest of the short story.

## 2.2 Characterization

The readers are introduced to the main characters: the Aunt and Nicholas and the minor characters: boy-cousin and girl-cousin and Bobby, Nicholas's brother. While the two main characters are used to develop the dramatic quality of the short story the minor characters are static.

### 2.2.1 Nicholas

Nicholas is the protagonist of the story. Though no physical description or age is given the powerful character description depicts an intelligent child with a very creative imagination. Some characteristics of Nicholas are as follows:

#### 2.2.1.1 Ability to create and control events

Nicholas is portrayed as a child who is capable of creating and controlling events. The shrewd way he does this depicts the intelligence of the character too. For example at the beginning of the story he creates a situation where the Aunt has 'been proved to be profoundly in error' in matters about which she had 'expressed the utmost assurance'. Further the dialogue which ensues after the children are sent on the hastily planned expedition conveys that Nicholas uses impromptu strategies to put the Aunt who does not have his quick, sharp brain into a difficult position as she is made aware of the truth, i. e. the children would not enjoy the expedition, by Nicholas. She loses control of the situation and changes the subject as she is confronted with loss of face.

Additionally the question and answer session between Nicholas and the Aunt when while she was in the rain-water tank not only conveys his shrewdness but also the maturity in strategic handling of the situation.

*"Now I know that you are the Evil One and not aunt," shouted Nicholas gleefully; "when we asked aunt for strawberry jam yesterday she said there wasn't any I know there are four jars of it in the store cupboard, because I looked, and of course you know it's there, but she doesn't, because she said there wasn't any. Oh, Devil, you have sold yourself!"*

Thus Nicholas excels in creating and controlling situations to his benefit during a very short period of time especially when pitted against his slow witted Aunt.

#### 2.2.1.2 Maturity

Nicholas's maturity is especially clear when compared with the juvenile behavior of the other children. Nicholas does not shed a tear when he is excluded from the expedition though it is expected from him. But in contrast his girl-cousin howls and weeps when she scraped her knee and 'the tightness of Bobby's boots had had disastrous effect on his temper'. The other children suffer without complaining but Nicholas is not afraid of the Aunt and is smart enough to point out her flaws. He criticizes her child rearing capabilities pointing out her lack of attention to the children's needs which is suggested through the following line.

*'You often don't listen when we tell you important things'.*

Thus it seems that he is the only child who rebels against the tyranny of the Aunt. But what is admirable in his personality is that he remains cool and composed in all situations. His maturity is shown yet again when his assessment of the outcome of the expedition is proven correct. The reader does not see happy children at the tea table describing the fun time they had at the Cove. The reasons pointed out by Nicholas and one thing overlooked by the Aunt: high tide had destroyed their enjoyment.

Yet we do not witness a gloating Nicholas as evidence around him was proof enough for the fact that the expedition had lost its main purpose: make Nicholas repent his deeds. Furthermore Nicholas has the mature ability of escaping from the depressing atmosphere around him to enter a fantasy world of his liking recollecting happy events.

#### 2.2.1.3 Vivid imagination

Another characteristic is the power of his vivid imagination which is shown through his response to beauty. In the Lumber room Nicholas sees a tapestry where *'a man, dressed in the hunting costume of some remote period, had just transfixed a stag with an arrow'*. The tapestry becomes a *'living-breathing story'* for Nicholas. His creative ability is brought out vividly as he builds the story and pictures the fate of the hunter.

*'Nicholas sat for many golden minutes revolving the possibilities of the scene; he was inclined to think that there were more than four wolves and that the man and his dogs were in a tight corner'.*

Later Nicholas recalls the scene on the tapestry during *'fearsome silence'* at the tea table. He creates the end to the story:

*'The huntsman would escape with his hounds while the wolves feasted on the stricken stag'.*

Furthermore his imagination is always ready to animate the inanimate. The sight of the colourful mandarin duck makes him commence on *'assigning a life-history to it'*.

All examples above convey and strengthen the idea that Nicholas is not a mere dreamer but has a vivid imagination and creative power which allows him to escape the hostile world outside.

#### 2.2.1.4 Strategist

Nicholas is a strategist. The lumber room was a *'region that was so carefully sealed from youthful eyes and concerning which no questions were ever answered'*. As entering the lumber room was prohibited Nicholas strategically plans a way of exploring its *'mysteries'*. He finds the place where the key is kept and practices unlocking doors waiting for an opportunity to put the practiced skill in to use by making his entry to the lumber room quick and smooth.

Yet again the strategic manner Nicholas convinces the Aunt that he was planning to enter the gooseberry garden not only creates humour but shows that he is able to outwit his aunt. Accordingly he is able to *'put into execution a plan of action that had long germinated in his brain'*. The Aunt is made to stay under *'self-imposed sentry-duty for the greater part of the afternoon'* leaving him enough time to explore the *'unimagined treasures'* hidden in the lumber room. Thus the strategist in Nicholas takes maximum advantage of all available opportunities not only to deride the Aunt but also to put his preplanned activities into operation.

#### 2.2.1.5 Observant

Nicholas is observant. The fact that Bobby has told the Aunt twice that the boots were hurting him because they were too tight but she was not listening had been noted down by the sharp-eyed Nicholas.

His observant capabilities are also evidenced in the lumber-room. Very methodically he goes through the items in it giving each one his unbroken attention. The fact that he spent more time with the more interesting items: framed tapestry and the book containing a portrait gallery of birds too suggests that he is not a random observer. Nicholas is a good judge of selecting what deserved careful scrutiny.

#### 2.2.1.6 Intelligent and smart

Nicholas is Intelligent and has a sharp, quick mind. The logical built up of the argument to prove that it is not the aunt but *'the Evil One tempting him to be disobedient'* conveys how quick thinking and intelligent he is.

- First he states *'when we asked aunt for strawberry jam yesterday she said there wasn't any'*.
- Then he states he knows that *'there are four jars of it in the store cupboard, because I looked'*.
- Next he argues stating that *'of course you know it's there, but she doesn't, because she said there wasn't any'*.
- Therefore, Nicholas convincingly concludes, *'Oh, Devil, you have sold yourself!'*

Nicholas is smart. According to Nicholas when compared with the lumber room,

*'The gooseberry garden was a stale delight, a mere material pleasure'.*

Thus he is smart enough to prioritize his sources of pleasure. He is able to discern between the sublime bliss gained through the beauty of the artifacts in the lumber-room over the *'material pleasure'* obtained through frolicking in the gooseberry garden. The gooseberry garden may provide fruit eat and he may be able to play in it. These would give him *'pleasure'* which is physical. But supreme aesthetic delight would come from the time spent in the lumber room. So he is smart and intelligent enough to decide and choose the lumber room over the gooseberry garden.

#### 2.2.1.7 Escapism

The world of Nicholas is a lonely one. Even his younger brother is *'quite uninteresting'*. But Nicholas when the surrounding becomes hostile and filled with fearsome silence escapes to his private world. There he *'has much to think about'*. His private world is a rich source of beauty triggering creativity and provides him much happiness which is lacking in the real world.

His ability to escape into a world of his own recollecting the beauty of the tapestry has strong parallels with a tenet set down by William Wordsworth (1802)<sup>[4]</sup> in relation to powerful feelings: *'Poetry is the spontaneous overflow of powerful feelings recollected in tranquility'*. In his poem *'I Wandered Lonely as a Cloud'* he describes the strength of the joy he receives when he witnesses the beauty of nature. Then in the last stanza in the poem given below he states that *solitude is bliss*

as it provides an opportunity to bring back your past experiences which have brought delight.

'They flash upon that inward eye  
Which is the bliss of solitude;  
Then my heart with pleasure fills  
And dances with the daffodils.'

Thus strong emotional pleasure received in the past can bring spontaneous present joy. This makes the beauty of the daffodils intransient to Wordsworth. It is permanent and everlasting as the poet can revive the same strong emotion he felt at the time he saw them when he is recollecting the scene later, in tranquility.

Similarly Nicholas has the power to escape his miserable atmosphere at the tea table through 'spontaneous overflow of powerful feelings recollected' in the midst of undesirable company. Thus using the character of Nicholas Saki suggests that not only adults but sensitive children too can transcend their loneliness through escaping into a world of imagination bringing back memories of pleasure experienced in the past.

#### 2.2.1.8 Mischievous rebel

Nicholas is not all good. Saki's realistic portrayal of his protagonist as a mischievous rebel shows the complexity of Nicholas' complex personality. The Aunt is the victim of his mischievous rebellious nature.

##### A. The rebel in Nicholas

Nicholas is a rebel as he does not follow the conventional standard behavior of a child.

- He mocks his aunt proving that she is wrong and is not truthful.

Example 1: the aunt was proved wrong about the presence of the frog in the breakfast bowl.

'You said there couldn't possibly be a frog in my bread-and-milk; there was a frog in my bread-and-milk.'

The simple hidden goal of this action would have been to avoid the hated tasteless meal.

Example 2: One lie of the aunt's is craftily exposed by Nicholas in the following conversation between the aunt who is in the rain-water tank and Nicholas.

"Will there be strawberry jam for tea?" asked Nicholas innocently.

"Certainly there will be," said the aunt.

But Nicholas joyfully states that previously she had said 'there wasn't any'. Thus Nicholas proves that though the Aunt tries to instill right behavior patterns in the children she herself does not set a good example.

- He answers back and knowingly provokes the Aunt.

Example 1: when the Aunt states that she has slipped into the rain- water tank and asks him to "Fetch the little ladder from under the cherry tree" Nicholas promptly says,

"I was told I wasn't to go into the gooseberry garden,"

Example 2: Nicholas points out two reasons why the Jagborough expedition is going to fail to annoy his aunt. Cheerfully Nicholas gives the first reason. Pointing out the fact that his girl-cousin, who scraped her knee rather painfully against the step of the carriage, will not enjoy the expedition he states, "How she did howl!"

Then with a grim chuckle Nicholas gives the second reason.

"Bobby won't enjoy himself much, and he won't race much either," as his boots "are hurting him. They're too tight."

Thus Nicholas grabs every opportunity to mock and provoke the Aunt. But the reader does not witness the rebel in Nicholas resorting to tantrums. As he is debarred from the expedition, though expected of him, he did not shed any tears. His sharp, quick mind already had a plan where he could enjoy his punishment especially in the absence of the other children.

Saki's development of the character of Nicholas makes the reader feel that the rebellion against the Aunt is justified. The Aunt seems to deserve such a reaction as she lacks psychological understanding of a child's natural reaction to an over strict upbringing.

##### B. Mischievousness in Nicholas

In contrast to the disobedient nature in Nicholas is his impishness. His mischievous behaviour is a continuous source of humour throughout the short story. All his pranks are psychological battles against the authoritarian behavior of the Aunt. His sharp mind works out methods to outsmart the Aunt and the success he gains makes the reader sympathize with rather than criticize his behavior.

Furthermore Nicholas is discerning. Thus he knows when to stop his pranks. After the short session of taunting the Aunt who was in the rain- water tank,

'Nicholas knew, with childish discernment, that such luxuries were not to be over-indulged in'.

But when he 'walked noisily away' the Aunt suffers 'undignified and unmerited detention in a rain-water tank for thirty-five minutes'. In this instance Nicholas's mischievousness in tinged with revenge and the author too seems to suggest that such a severe punishment is not deserved by the Aunt who is trying to manage four young children on her own.

But in the final assessment of Nicholas's character the reader sympathizes with his disobedience and admires his ability to survive through the hostility of the Aunt. Thus the author places the blame on the Aunt and her methods of bringing up children for Nicholas's mischievous behaviour.

#### 2.2.2 The Aunt

If Nicholas is the protagonist of the story the Aunt is the antagonist. Though slotted under the category "the older and wiser and better people" much criticism is aimed by the author at the Aunt's conventional upbringing methods and her inability in child-rearing. Some of her flaws are as follows:

### 2.2.2.1 Self-righteous and didactic

#### A. Self-righteous

The Aunt's self-righteousness is 'characterized by a certainty, especially an unfounded one, that one is totally correct'<sup>1</sup>.

Example 1: She assures Nicholas that, 'there could not possibly be a frog in his bread-and-milk and that he was not to talk nonsense.'

But Nicholas who has put a frog in his bread-and-milk proves that she is wrong.

Example 2: She always considers her actions as correct and punishment is deserved by every child for misbehavior. She has a punishment for every childish 'depravity' whether individual or collective.

It was her habit, whenever one of the children fell from grace, to improvise something of a festival nature from which the offender would be rigorously debarred; if all the children sinned collectively they were suddenly informed of a circus in a neighbouring town, a circus of unrivalled merit and uncounted elephants, to which, but for their depravity, they would have been taken that very day.

Example 3: She feels that it is correct to keep beautiful things under lock and key. 'A teapot fashioned like a china duck, out of whose open beak the tea was supposed to come' was in the lumber room while the children were given the 'dull and shapeless' nursery teapot.

#### B. Didactic

She is didactic and tries to 'teach proper or moral behavior in a way that is annoying or unwanted'<sup>2</sup>. Religion as represented in the short story consists of sinning by the children and the Evil One<sup>3</sup> tempting them to be disobedient. The word Devil (the supreme spirit of evil<sup>4</sup>) is in the vocabulary of Nicholas. Thus to teach proper behavior the Aunt uses religion in an unwanted manner.

Example 1: Not only does misbehavior get classified as 'sin' it generates a lot of moralistic discussion. "The *sin* of grabbing a frog from the garden and putting it into a bowl was enlarged on at great length"

Example 2: Nicholas states the following to the Aunt in the rain-water tank.

"You may be the **Evil One** tempting me to be disobedient. Aunt often tells me that the **Evil One** tempts me and that I always yield.

The repetitive use of the term 'the Evil One' shows how it is used to instill fear of sinning or misbehaving in the minds of the children.

But does it work? The Aunt's attempts to prevent improper behavior though the use of religion are shattered when Nicholas says,

"Oh, **Devil**, you have sold yourself!"

'Sold yourself' in the above line conveys that the Devil has betrayed his identity by revealing himself as tempting children to be disobedient. But note the way he addresses the Devil. It is full of delight not fear. Furthermore Nicholas states that he has been able to experience, 'an unusual sense of luxury in being able to talk to an aunt as though one was talking to the Evil One'.

### 2.2.2.2 Unimaginative

The Aunt is a 'woman of few ideas' though she thinks that she is wiser. Her weaknesses are indirectly conveyed to the reader through her of behaviour and thoughts. The most pleasurable outings for the children she devises consist of an expedition to the seaside or circus in a neighbouring town. These planned outings are so boring to Nicholas. His resourceful mind finds alternative ways of enjoying himself. She spent a long time in the gooseberry garden doing 'trivial gardening operations'. It took the whole period Nicholas spent in the lumber room for her to grow suspicious about his disappearance. Throughout that period she imagined that he was still trying to get in to the gooseberry garden.

For her 'wholesome' food for breakfast is the unappetizing 'bread-and-milk'. We can infer that bread-and-milk has been served continuously at breakfast as Nicholas rebels against the loathsome food by putting a frog in it. Within the limited scope of the Aunt's mind she could only picture the whitish, gooey, tasteless bread-and-milk as 'wholesome'. In contrast the author shows us what the children like: strawberry jam which is bright red, delicious and nutritious.

The lack of imagination in her resulted in failing to understand not only the psychological needs of children but also their behaviour.

### 2.2.2.3 Punishes through withholding enjoyment

Instead of giving love to Nicholas the Aunt took every opportunity to punish him. The other children too did not escape punishment. Her readiness to punish through withholding enjoyment turns her into an infuriating grown-up even in the eyes of the reader. For example after withholding the enjoyment of going on the expedition she punishes Nicholas further for being bold enough to point out that the other children would not enjoy the outing. Assuming that Nicholas would try to spend his time in the gooseberry garden she tries to withhold his enjoyment and commands Nicholas in an arrogant manner as seen in the following line.

"You are not to go into the gooseberry garden"  
"Because you are in disgrace," said the aunt loftily.

<sup>1</sup> Adapted from [https://www.google.lk/?gws\\_rd=ssl#q=Self-righteous](https://www.google.lk/?gws_rd=ssl#q=Self-righteous)

<sup>2</sup> Adapted from <http://www.merriam-webster.com/dictionary/didactic>

<sup>3</sup> The force in nature that governs and gives rise to wickedness and sin. <http://dictionary.reference.com/browse/evil+one>

<sup>4</sup> <http://www.oxforddictionaries.com/definition/english/devil>

But Nicholas artfully turns this punishment into a far better form of enjoyment in the lumber-room. The Aunt's form of punishment can be so petty as to deprive the children from having strawberry jam when there were four jars of it in the store cupboard.

These oppressive punishments are meant to make the children feel sorry for their childish pranks. She especially targets Nicholas as he seems to be the naughtiest and wants him to repent (regret and apologize) his 'sins'. But throughout the short story we do not see him regretting his actions which are often planned to provoke the aunt. Thus what the readers witness is that the Aunt's methods of making Nicholas stop his pranks and disobedience through fear of punishment is useless and impractical. Nicholas artfully turns punishment into enjoyment.

**2.2.2.4 Pretentious and obsessed with punishment**

Though the Aunt tries to instill moral values she is portrayed as a person who is devious. Though she considers herself and pretends to be a 'better' person she lies. While in the gooseberry garden she states '*I can see you all the time*' and Nicholas smiles as he is in the lumber-room. Thus not only does she lie, her lies are found out though her stupidity.

Her dishonesty is seen when she denies having strawberry jam in the store cupboard which is pointed out by Nicholas in the following extract.

*"When we asked aunt for strawberry jam yesterday she said there wasn't any".*

Then he goes on to say,

*"I looked, and of course you know it's there".*

Thus her lack of moral values in the form of deceit is proved by Nicholas.

Revenge is a negative characteristic we discover in the Aunt. She is obsessed with punishment. Her revengeful nature is conveyed when she is exposed as a liar. Her dishonesty too is shown again as she had decided not to give strawberry jam for tea when she tells Nicholas that they will get it as seen in the following conversation.

*"Will there be strawberry jam for tea?" asked Nicholas innocently.*

*"Certainly there will be," said the aunt, privately resolving that Nicholas should have none of it.*

In this instance too the Aunt does not set down the correct ethical values as she is proved as a liar by Nicholas. As she represents the older generation the author seems to convey that the moral pretentiousness in the Aunt could be extended as a characteristic of a majority in the adult world. Thus the adults are cautioned by Saki. Support comes from Weissbourd (2010)<sup>[5]</sup> who based on the conclusions drawn from his research states that children learn ethical values by watching the actions of adults.

**2.3 Stylistic devices**

Saki uses many stylistic devices to make the short story *The Lumber-room* a powerful study of human behavior. It is a 'prose poem' where many techniques are used to add to its beauty and creativity. Some stylistic devices used by Saki are discussed below.

**2.3.1 Juxtaposition**

One stylistic device is the juxtaposition of the Adult's world depicted through the Aunt and Child's world depicted through Nicholas throughout the short story as summarized in Table 1 below.

Table 1: Juxtaposition of Adult's world and the child's world

<b>Adult's world depicted through the Aunt</b>	<b>Child's world depicted through Nicholas</b>
Lacks understanding of the deep psychological needs of a child. Emotionally cold, lacks the ability to love and be compassionate.	Imaginative, intelligent with an abundant sense of fun.
Considers themselves to be superior as they are 'wiser, and better people'.	Restricted and oppressed by adult control.
Is full of criticism, contempt towards childish pranks and often makes disapproving remarks.	Has the ability to retaliate through careful originality of planning.
Neglects to listen when important information is conveyed.	Taunts at the lack of attention to child communication.
Has a shallow outlook towards childhood pranks. Inflicts cruelty through a system of rewards and punishments.	Retains the power to escape through into a world of private fantasy where they can transcend their loneliness.
Privileged to set down rules of behavior and to punish for disobedience. Authoritative. Do not like to be challenged by the children.	Children are expected be obedient and submissive. Subjected to constant punishment and denied forms of enjoyment when disobedient.
Infuriating behavior. Lacks communication with the children. Do not like to be challenged by the children. Though moralizing lacks good values thus cannot set a good example. Lacks sensitivity to a child's physical and psychological needs.	Not the conventional, innocent and obedient portrayal of a child's world. They are sharp and quick-witted enough to outsmart adults. They are also sensitive and creative and have the ability to generate humour and fun.

### 2.3.2 Figures of speech

Multiple figures of speech used by Saki gives the short story a poetic quality. These stylistic devices make the characterization realistic.

#### 2.3.2.1 Epithet<sup>5</sup>

The author uses many epithets to bring out the attitude of the Aunt especially towards Nicholas. According to his aunt Nicholas was trying to refuse breakfast on the *frivolous ground* that there is a frog in his bowl of bread-and-milk. The Aunt says that he was talking the '*veriest nonsense*'. Thus the aunt does not consider that Nicholas is serious about the claim. Later she finds out to be true. Thus true the use of the above epithets the author highlights a characteristic of the Aunt: she does not consider that listening to children is important. Epithets are used again to reveal not only the positive but also the negative characteristics of Nicholas. Inside the lumber room he is the sensitive dreamer conveyed by the epithets '*unimagined treasures, golden minutes, undreamed-of creatures*'. As Nicholas's reasoning states that he could be '*in disgrace and in a gooseberry garden at the same moment*' his face takes on an expression of *considerable obstinacy*. Thus the epithet suggests that stubbornness is weakness in the boy. The '*grim chuckle*' Nicholas gives after giving reasons for the expedition won't be a success conveys that he enjoys taunting the Aunt after outwitting her.

#### 2.3.2.2 Periphrases<sup>6</sup>

The periphrases *the Evil One* and *older wiser and better people* are repeated in the text. *The Evil One* talks about the Devil in a roundabout way which seems more suitable for the children. The periphrasis '*older wiser and better people*' is used in an ironical manner to talk about the older generation.

#### 2.3.2.3 Hyperbole

The hyperbole *the sin of taking a frog* is used by the author to illustrate the Aunt's stern methods of child rearing. The pranks of a child in her estimation are evil deeds.

#### 2.3.2.4 Metaphors

The Aunt spends a long time in '*self-imposed sentry-duty*' in the gooseberry garden. The term *sentry duty* creates a vivid imagery how seriously she fulfils her responsibility to prevent Nicholas from entering the gooseberry garden. The term has associations with strict military regulations which are transferred to the Aunt. The phrase '*self-imposed*' too conveys that she finds such duties her obligation.

In the metaphor '*had leapt to the conclusion*' the word *leapt* conveys how quickly she makes decisions.

<sup>5</sup> An adjective or phrase expressing a quality or attribute regarded as characteristic of the person or thing mentioned.

[https://www.google.lk/?gws\\_rd=ssl#q=epithets+definition](https://www.google.lk/?gws_rd=ssl#q=epithets+definition)

<sup>6</sup> A roundabout way of expressing something.

#### 2.3.2.5 Biblical allusion

To strengthen the ironic effect many biblical allusions are used by the author: paradise, the Evil One and the term Devil are references found in the Bible.

#### 2.3.2.6 Rhetorical question

The creative power of Nicholas is conveyed by the author through the following rhetorical questions.

*But did the huntsman see, what Nicholas saw, that four galloping wolves were coming in his direction through the wood? There might be more than four of them hidden behind the trees, and in any case would the man and his dogs be able to cope with the four wolves if they made an attack?*

To find answers to these questions '*Nicholas sat for many golden minutes revolving the possibilities of the scene*'. His powerful imagination continues to find the answers later in the evening at the tea table amidst a frozen silence.

#### 2.3.2.7 Repetition

Repetition is used by Saki to heighten the ironic effect created by him. The repetition of '*wholesome*' is ironic as the children do not find the food palatable. The term '*Older and wiser and better people*' is repeated but it creates irony as the Aunt who belongs to the older generation is stupid and is a habitual liar.

#### 2.3.2.8 Exclamatory sentences

Exclamatory sentences are used especially to depict the enjoyment Nicholas gets from beautiful things.

*'How dull and shapeless the nursery teapot seemed in comparison! And such birds!'*

Then again Saki uses an exclamatory sentence when Nicholas concludes gleefully the Aunt is the Evil One.

*'Oh, Devil, you have sold yourself!'*

The joy in outwitting the Aunt is conveyed through the use of exclamation.

#### 2.3.2.9 Symbolism

The title of the story is "The Lumber Room". It is not only a suitable title it also carries a powerful symbolic value. It symbolizes the inner self of a child. A child's need for beauty and sources which can trigger their imagination generating deep psychological pleasure is powerfully symbolized by the lumber room.

### 2.4 Language

Saki's use of language is very economic. There are no descriptions of the physical appearances of even the main characters: Nicholas and the Aunt. The language associated with brings out their inherent characteristics and is used as a device by the author to show his attitude towards them.

#### 2.4.1 Language associated with the Aunt

The Aunt uses imperatives very often in her speech as shown by the extracts below.

*You are to come out of this at once.  
Go and fetch the ladder.  
I told you not to, now I tell that you may.*

Thus her tone is always commanding showing that she enjoys having authority over the children. This commanding nature of the Aunt is heightened by the use of military words introduced to her vocabulary such as *expedition* and *sentry-duty*. The language associated with her denies her a gentle, maternal quality. Additionally as seen in the following extract her tone conveys her arrogance.

*'Because you are in disgrace,' said the aunt loftily.*

Her angry voice is raised in '*shrill vociferation*' lacking the control an adult should have when children disobey. The Aunt's speech is heavy with religious chastise. Nicholas says that the Aunt,

*'often tells me that the Evil One tempts me and that I always yield.'*

Thus the religious terms with negative connotations '*the Evil One*', yielding to his temptation and '*sin*' are found in The Aunt's speech. It seems that she is using religion as a weapon to make the children, especially Nicholas, obedient.

Language associated with the Aunt shows that the author's attitude towards grown-ups is cynical. He is critical and very often ironic in his description of the character of the aunt. Irony is generated as the older generation who should be mature enough to understand the physical and psychological needs of a child deprives these needs through their arrogance, narrow mindedness and lack of sympathy.

#### **2.4.2 Language associated with Nicholas**

The fact that he disliked and refused to bow down to her authority and wanted to distance himself from the Aunt is shown through the following extracts.

*'His cousins' aunt, who insisted, by an unwarranted stretch of imagination, in styling herself his aunt'  
'the aunt-by-assertion'  
'the soi-disant'<sup>7</sup> aunt*

The above extracts suggest that in Nicholas's view point the Aunt is a self-appointed to the position of caretaker and self-declares that she has authority over all children under her care. The resentment Nicholas feels towards the Aunt is strongly conveyed through language use of the author.

Language is also used to bring out the stubbornness and the rebel in Nicholas.

When Nicholas informs that Bobby won't enjoy himself at the expedition because his boots were too tight the Aunt sternly asks.

*"Why didn't he tell me they were hurting?"*

He points out her lack of attention to information given by children and stubbornly repeats.

*"He told you twice, but you weren't listening. You often don't listen when we tell you important things."*

The words the *cheerfully*, *gleefully* and *grim chuckle* shows that when Nicholas rebels against his aunt he obtains a large sense of satisfaction and even malicious contentment.

But the author powerfully uses language associated with Nicholas to bring out his impish quality making the reader empathize with him. The language is humourous and creates powerful imagery.

*'Nicholas made one or two sorties into the front garden, wriggling his way with obvious stealth of purpose towards one or other of the doors'.*

When the Aunt states that she can see Nicholas 'in the gooseberry garden,

*'It was probably the first time for twenty years that anyone had smiled in that lumber-room'.*

The reader shares his amusement at such an obvious lie coming from an adult. Furthermore the lyrical description of his experience in the lumber-room exposes his sensitivity and powerful reaction to beauty. We see the inner self of Nicholas and assume that his outer behaviour is a reaction to the harshness he has to encounter from the Aunt.

#### **2.5 Themes**

The short story carries multiple themes. Some of the main themes are discussed below.

##### **2.5.1 Generation gap**

This is the distancing of two generations due to inability to understand needs of each other and express their feelings. These needs and emotions are based on the values and preferences they have. The Aunt who represents the older generation is unable to understand a simple feeling as the food preference of a child. As a self-righteous and moralistic person she considers herself to be right in all her decisions and actions. She misuses the power she has over the young children. She loses her temper when she is ridiculed and outwitted. She lacks the aesthetic ability to respond to beauty. The older generation as represented by the Aunt assumes that a child's needs are all physical: food, expeditions etc. But what are missing are praise, smiles, love and attention.

On the other hand the younger generation represented by Nicholas is always out to find opportunities to make her angry. He has a remarkable insight into the Aunt's character, especially her weaknesses. All communication he has with his aunt is a not only a verbal but also a psychological battle of wills. The very things a sensitive child like Nicholas finds pleasurable are hidden in the lumber room forbidden to all children. The Aunt does not comprehend that the young value new experiences.

Through highlighting the tension between generations Saki raises doubts on whether they can have any harmony in their relationships. He seems to say that the adults have to understand and have more empathy towards the behavior of children. Furthermore Saki is critical of the superior attitude of the adults.

<sup>7</sup> Self-proclaiming, self-styled and supposedly

### 2.5.2 Innovativeness of children

Nicholas invents a situation where he avoids eating the 'wholesome bread-and-milk' and he does so knowing that he would not escape punishment. Nicholas is not saddened by his punishments. Instead the 'skilled tactician' in him finds a way of obtaining maximum pleasure through deceiving the Aunt.

The highest moment of Nicholas's inventiveness is exposed to the reader during his creation of the story in the tapestry. The ability to make the story come alive and the argument raised to arrive at the end bear evidence for his fertile mind. His innovative nature is yet again seen when the Aunt seeks his help to come out of the rain- water tank. The innovative manner he argues and proves why he should not help the Aunt is evidence of his intelligence.

The innovativeness of children is further heightened by the fact that Saki portrays adults as unimaginative.

### 2.5.3 Misuse of religion

Throughout the story we witness negative religious terminology such as *sin*, *Devil*, *the Evil One* recur. These words are used to instill a fear against misbehaviour in children. Nicholas, the most disobedient of the children, states that,

*'Aunt often tells me that the Evil One tempts me and that I always yield.'*

Nicholas uses a pretended fear of temptation by *the Evil One* when he says that,

*'This time I'm not going to yield.'*

Analyzing the statement the words 'this time' clearly suggest that he has been tempted by *the Evil One* in many prior instances. Though religion is used to instill fear what we witness is that it was not effective.

Additionally Saki ironically makes the adults violate one moral taught by religion: truthfulness. Within the short space of the story we find the Aunt lying thrice. Once about not having strawberry jam, the other when she says that she can see Nicholas in the gooseberry garden and thirdly when she says that '*Certainly there will be*' strawberry jam for tea as she privately resolves that '*Nicholas should have none of it*'.

Thus not only do adults use religion to instill fear in children they violate religious teachings setting a bad example.

## III. DEVELOPMENT PSYCHOLOGY OF A CHILD AND THE UPBRINGING OF NICHOLAS

### 3.1 Literature on child rearing

Many scholars (Baumrind, 1978<sup>[6]</sup>; McKay, 2006<sup>[7]</sup>; Spera, 2005<sup>[8]</sup>; Weissbourd, 2010<sup>[9]</sup>) based on the findings of their research state that there is a strong link between the way a child is raised or child rearing styles and the effects these styles have on children. Martin (ibid), claims that child rearing is the process of promoting and supporting the physical, emotional, social, financial, and intellectual development of a child from infancy to adulthood. Terry (2004)<sup>[10]</sup> posits that parenting styles can foretell a child's outcome in areas such as psychosocial development, social competence and academic performance.

A parenting style according to Kordi & Baharudin, (2010)<sup>[11]</sup> is the way parents rear their children through attempts to control

their behavior, discipline and influence them. Many researchers (Erden & Uredi, 2008<sup>[12]</sup>; Terry, 2004<sup>[13]</sup>) state that parenting styles can affect a variety of factors including self-esteem, academic performance, and mental health of a child.

Baumrind (1978)<sup>[14]</sup> and, more recently, McKay (2006)<sup>[15]</sup> have identified four main parenting styles in early child development: Authoritative, Authoritarian, Uninvolved and Permissive. Of the four this discussion is restricted to Authoritarian and Permissive which are at the positive and negative ends respectively in the continuum in styles of parenting; and Authoritative which is the optimal style of parenting.

### 3.2 Styles of child rearing

#### 3.2.1 Permissive child rearing

Sociologists distinguish that permissive or indulgent parenting which is low in control and high in responsiveness to the demands of the child is considered as more popular in middle-class families.

- i. The children are allowed to regulate their own behavior.
- ii. The parents can be exceptionally lenient and immediately fulfil a child's needs and requests. (Svenkerud, 2008)<sup>[16]</sup>
- iii. They are tolerant and give in to children's impulses and do not demand mature behavior in the process toward self-regulation. (Dornbusch et al., 1987)<sup>[17]</sup>
- iv. They use minimal punishment. (Buri, 1991)<sup>[18]</sup>
- v. As a result children who undergo permissive parenting evidence a lack of social responsibility and independence. (Dornbusch et al., 1987)<sup>[19]</sup>

#### 3.2.2 Authoritative child rearing

According to Baumrind (1978)<sup>[20]</sup> this is the 'just right' style of child rearing which exhibits the following characteristics.

- i. Parents are assertive but not intrusive or restrictive. They monitor their children and give clear standards of behaviour. (Baumrind, 1991)<sup>[21]</sup>
- ii. Recognition is given to the rights of parents as well as the children. (Dornbusch et al., 1987)<sup>[22]</sup>
- iii. This child rearing style uses positive reinforcement<sup>8</sup> and infrequent punishment.
- iv. They are sensitive to a child's feelings and capabilities.
- v. There is a give-and-take atmosphere involved in child rearer-child communication and both control and support are balanced.
- vi. The children form secure attachments and positive self-concepts.

<sup>8</sup> Positive reinforcement works by presenting a motivating/reinforcing stimulus to the child after the desired behavior is exhibited, making the behavior more likely to happen in the future.

The following is an example of positive reinforcement:

A mother gives her son praise (positive stimulus) for doing homework (behavior).

Source: <http://bcotb.com/the-difference-between-positiveneegative-reinforcement-and-positiveneegative-punishment/>

vii. Authoritative parenting styles were broadly associated with higher levels of children's school achievement. (Kordi & Baharudin, 2010)<sup>[23]</sup>

vii. Parents tend to be bitter or unresponsive toward children. (Svenkerud, 2008)<sup>[26]</sup>

viii. Children with Authoritarian parenting styles end up with behavioral problems. (Baumrind, 1991)<sup>[27]</sup>

**3.2.3 Authoritarian child rearing**

This is the most negative form of child rearing. Some features of the style are as follows.

- i. This style consists of a rigid set of rules and expectations that are strictly enforced and require rigid obedience.
- ii. Watchful intrusive monitoring of behavior is evidenced. (Baumrind, 1991)<sup>[24]</sup>
- iii. Corrective disciplinary styles are very often used to endorse future obedience. (Buri, 1991)<sup>[25]</sup>
- iv. There is usually no explanation of punishment except that the child is in trouble for breaking a rule.
- v. "Because I said so" is a typical response to a child's question of authority.
- vi. This child rearing style disregards children's feelings and emotions as important.

**3.3 The child rearing process of the Aunt**

Analyzing the child rearing process in the context of Nicholas and his aunt her style definitely falls under Authoritarian child rearing. In the absence of Nicholas's parents she is his guardian cum main caregiver and thus is responsible for his upbringing.

According to Weissbourd (ibid)<sup>[28]</sup> lack of self-awareness and confused priorities in the child rearer can dangerously undermine a child's development. Furthermore Spera (ibid)<sup>[29]</sup> posits that a parenting style is fundamentally dependent on the overall emotional climate in the home. Both of the above finding are applicable to the negativity evidenced in the child rearing process the readers witness in *The Lumber Room* by Saki.

Table 2: Analysis of the Aunt's mode of child rearing

The Aunt's mode of child rearing in the context of Nicholas	
Anti-Authoritative	Pro Authoritarian
No positive reinforcement is seems to be given by the Aunt but punishment seems to be frequent.	The Aunt has a rigid set of rules and expectations that are strictly enforced and require rigid obedience.
The Aunt is not sensitive to Nicholas's feelings and capabilities.	Punishment is very often used to endorse future obedience.
No give-and-take atmosphere is involved in the Nicholas - Aunt communication condition. The Aunt always wants to control Nicholas rather than support his needs.	No explanation of punishment except that the child is in trouble for breaking a rule.
Nicholas seems to be unable to form secure attachments with even the other members of the family.	When Nicholas questions the authority of the Aunt very often the response does not provide a reason but he has to obey because she 'said so'.

Table 2 above illustrates that the upbringing Nicholas receives is anti-Authoritative and pro Authoritarian.

Thus the one day exposure the readers get to Nicholas's life under the rule of the Aunt identifies many reasons for his behavior. Though the Aunt is careful to satisfy his physical needs she lacks insight into his psyche. Furthermore the normal psychological need of a child to form strong attachments too is unfulfilled in Nicholas.

**3.4 The Attachment Theory**

Theorists on childhood personal development, such as Ainsworth (1967)<sup>[30]</sup> and Bowlby (1969)<sup>[31]</sup>, state that forming strong attachments is an innate and instinctive need in any child. Bowlby (ibid) structured his Attachment Theory based on the findings of research conducted on the development psychology of children. Ainsworth (ibid) who conducted research on attachment behavior states that during childhood personal development a strong emotional and physical attachment to at least one primary caregiver is critical. She further states that attachment behavior very often is demonstrated by insecure children. This insecurity is generated due to a presently absent caregiver. The child hopes to establish or re-establish a similar attachment to a caregiver who is present in his current existence. She further claims that children with weak attachments to a

present caregiver exhibit particular behaviors that are effective in attracting the attention of their caregiver.

Applying the Attachment Theory to Nicholas's upbringing by the Aunt, though they are within the same physical environment there is no positive emotional attachment between them. Weak attachments according to Ainsworth (ibid) produce caregiver attention gaining behavior in children. Nicholas's connection with his aunt is more negative than a weak attachment. During one day the reader witnesses an ongoing battle of wills: Nicholas's will against the Aunt's. Thus it is clearly depicted that Nicholas is unable to find a substitute for his presently absent caregiver/s in his aunt. This makes him create situations not only to grab the attention of his aunt through mischievous deeds but also to enjoy his victory in the battle of wills.

Critics of Attachment Theory state that in non-Western societies the idea of a child being intimately attached to a single caregiver is rather alien and child-rearing duties are more evenly distributed among a broader group of people. In Sri Lanka, an Asian society, in the past the institution of family was an extended model. Within the locale of a household, members of the extended family such as grandparents provided a mechanism where child rearing was a shared responsibility. These extended members very often provide a broader group of people to form strong attachments. But at present within the institution of family

in Sri Lanka an accelerated creation of nuclear families is witnessed.

Thus attachment formation very often is restricted to parents. This makes the violation of emotional and attachment needs in the upbringing of Nicholas in *The Lumber Room* an eye opener for contemporary parents, most of them with busy professional life styles, who are bringing up children within nuclear families.

#### IV. CONCLUSION

*The Lumber Room* falls into the genre of social satire<sup>9</sup>. Saki uses satire to ridicule the actions of the adults in their role as caregivers to children through exposing, disapproving and scorning their weaknesses and stupidity. The modes of child rearing in the story are not only satirized but is also criticized. Though the children are provided with all physical comforts they are deprived of love and their psychological needs are not understood. The universal and all time theme of the generation gap is explored by the author and he who has undergone an Authoritarian style of upbringing himself suggests that the adults should change their attitude towards childish misbehavior.

But is the author unbiased in his depiction of character? Is the Aunt all bad? She is a woman who has the responsibility of taking care of four small kids who are not her own. One of them: Nicholas epitomizes a child who rises against adult authority. Very often he works hard to put the Aunt into humiliating situations. The other children or the servants witness her humiliation. Thus is Nicholas all fun and imaginative? Or does he enjoy the Aunt's humiliation. Note that he leaves her in the rain- water tank to be rescued after thirty-five minutes by a kitchen maid.

Thus in the truceless battle between the Aunt and Nicholas he comes out as the winner. What we witness is that the author strategically points out that all children are not the same. Bobby 'the quite uninteresting younger brother' of Nicholas continues to wear the 'too tight boots' in silence. He is classified as uninteresting due to his passive acceptance of adult authority. Nicholas on the other hand boldly uses differing tactics to fight against adult authority. The two brothers portray two different forms of child behavior. Saki seems suggests that when a child is sensitive, creative, intelligent and has a rebellious nature special care should be used by the adults to understand his deep psychological needs. Thus child rearing per se is a daunting challenge to care givers and the young readers, most of them from a middle class background, who are critically analyzing *The Lumber Room* will assess and most probably appreciate the child rearing they receive.

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<sup>9</sup> In this context social satire is a piece of literature that reflects on a (while criticizing or poking fun at a) specific group of people and certain lifestyles, morals, and beliefs of that group.

Adapted from [http://www.answers.com/Q/What\\_is\\_social\\_satire](http://www.answers.com/Q/What_is_social_satire)

# CONCEPT TO COMPLETION OF LEGAL ERROR IN PRACTICE MEDICINE

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**Abstract:** *This study aims to provide an overview of the concept of a legal settlement to errors in medical practice. This research was conducted by using research methods Normative, by abstracting of legal materials both primary, secondary and tertiary qualitative approach. Results of this study concluded that the concept of a legal settlement to errors in medical practice subject to all positive law justice system in both criminal law, civil law, the law of the State administration, consumer protection, code of conduct and discipline of medicine, thus potentially cause legal uncertainty for the medical profession as well as optimizing the impact on inhibition of improving the quality of public health services in general.*

**Keywords:** *the concept of the legal settlement, the error, the practice of medicine*

## 1. INTRODUCTION

Health services in Indonesia serves as a health care system for all Indonesian citizens without exception. This is very important because the right to health (right to health) is the norm of human rights are explicitly guaranteed in Article 12 of the International Covenant on Economic, Social and Cultural Muhtaj, ME 2008), which was ratified by Law No. 11 of 2005, which essentially recognize the right of everyone to the enjoyment of the highest attainable standards in terms of physical and mental health. Thus also have become constitutional rights of citizens. In addition, it is also stipulated in Article 28H paragraph (1) NRI Constitution in 1945. As such, the Government assumed the obligation to ensure the realization of the right to health for all citizens of Indonesia (Nasution, AB 2010)[1].

The world of medicine who once seemed unattainable by law, with the growing public awareness of the needs of legal protection, makes the world of medicine not only as a civil relationship, often develop into criminal matters. Many malpractice issues, on the legal consciousness of the patient, raised an issue of crime as an example the case of dr. Setianingrum in Pati. Likewise, cases of eye surgery patients in RSU named Muhidin Sukabumi in 1986 also had a lively discussion. (Isfandyarie, A. 2005.)[2].

Similarly, public statements to the Indonesian Doctors Association (IDI) from 1998 to 2004 there were 306 cases of complaints of alleged malpractice. (Macmud, S. 2008.)[3] Even death Sukma Ayu, Small soap opera starring the artist Small-So Manten also associated with the possibility of malpractice committed by the doctor in charge. The last case is a case of alleged malpractice that resulted in a caesarean section Siska Makatey patients died due to alleged mishandling conducted Ayu Sasiary Prawani Doctors, Physicians and Physician Hendy Hendry Simanjuntak Siagian. According Maryanti, examples of such cases suggestive of public awareness of the rights of health.

Based on the above, we need a thinking and prudent steps, so that each party, physicians and patients to obtain legal protection fairest. Let this issue drag on will be able to have a negative impact on medical care, which in turn will be able to harm society as a whole. It was realized by all parties, that the doctor is just an ordinary person who one day could be negligent and wrong, so that violations of the code of conduct can take place, perhaps even until the violation of legal norms. Soerjono Soekanto and Kartono Mohammad was quoted as saying Isfandyarie (Isfandyarie, 2005)[2] argues, that there is no strict parameters on boundary violations of the code of ethics and legal violations.

The absence of strict parameters between violations of the code of ethics and law violations in the actions of the doctor to the patient, indicating the need for a law that truly can be applied in solving medical problems, which can only be gained by trying to understand the phenomenon that is in the medical profession. According (Asshiddiqie, J. 2009)[4], the norm of law is difficult to enforce if ethics are not enforced.

Even patients and their families know that the quality of service it receives inadequate, often the patient or his family prefers silent because if they express dissatisfaction to the doctor, they worry that doctors will refuse to help themselves, which in turn could inhibit the recovery of the patient.

However, not all patients choose to remain silent when the doctor's services did not satisfy himself and his family, especially when one family member is no disability or death after medical procedures performed by a physician. Changing the phenomenon occurs because of changes in viewpoint on the pattern of the relationship between doctor and patient. Positions patients who initially just as the party depends on the physician in determining how to cure (therapy), now turned into equal with the doctor. Thus doctors no longer ignore the judgment and opinion of the patient in choosing the way of treatment, including those of the patient to determine which treatment with surgery or not. Consequently, if the patient feels aggrieved in the service of a doctor, the patient will file a lawsuit against the physician to provide compensation to treatment that is considered detrimental to him.

Doctors also reacted, the actions of the prosecution in the court, they perceive as a threat. Application of the law in the field of medicine is considered as a legal intervention. They argued that the Code of Ethics Indonesia (KODEKI) is sufficient to regulate and supervise doctors in the work, eliminating the need for legal intervention. Further than that, the most important concern is the medical profession would lose dignity when regulated by law. Doctors feel restless and not feel treated fairly, so that they demanded legal protection in order to carry out their profession in a peaceful atmosphere.

Until now they are arguing is the protection of the law and not on the issue of legal responsibility and legal consciousness profession. Case doctor in running this shows a lack of understanding of the Ethics and Law in the doctor (Isfandyarie, 2005)[2]. Likewise, there is confusion over the understanding of the problem of medical malpractice (medical professional error), still often regarded as a violation of the ethical norms of the profession are not supposed to be given the threat of criminal sanctions.

The fact is, that technological progress is able to improve the quality and range of diagnosis (determining the type of disease) and therapeutic (healing) up to the limit that was never imagined before. However, not always able to resolve medical problems a patient, sometimes even new problems emerging in which to perform the diagnosis doctors rely heavily on diagnostic tools.

Medical science is not an exact science as well as mathematics. Making the diagnosis is an art in itself, because it requires imagination after listening to the complaints of patients and make a detailed investigation against him. Hippocrates said that medicine is a combination of science and art (science and art), which must be mixed so as to produce a diagnosis that is closer to the truth.

As the profession in general, health care is a profession that is based confidentiality and trust as well as the profession of lawyers. According to Vander Mijl (D. Veronika Komalawati, 1989)[5], the principal characteristics of the health service are as follows:

**First**, everyone who seek professional help, in general, is in a position of dependence, meaning that he had to ask for some kind of specific help in order to achieve a specific goal. For example, for the purpose of increasing a person's health will ask for help to the medical profession, if someone has the purpose of doing a lawsuit comes to professional lawyers, was to declare the purpose of his will (make a will) ask for help to the profession of notary. **Secondly**, every person who asks for help from people who have a profession that is confidential, generally can not assess the professional expertise. **Third**, the relationship between people who ask for help and those who give aid confidential in the sense that the first party is willing to give particulars which he would not reveal to others, and the profession must be able to maintain such confidentiality. **Fourth**, Everyone who runs a profession which is confidential, is almost always holds a position that does not depend (free), also when he practiced privately. Even in such cases, there is autonomy profession and only a few possible only for the employer to carry out corrective measures. **Fifth**, the nature of this work also brings consequences that result can not always be guaranteed, but there is only an obligation to do their best. That obligation is not easy to test.

The characteristics of the basic health services that we can conclude that with trust, surrender to the doctor with the patient's belief that his knowledge of the physician, will be used to help him so that regardless of the misery. Therefore, the main condition for obtaining good results in treating patients is to trust the patient to the doctor. The medical profession is a profession that is filled with risk of permanent disability and even until his dying patient as a result of the actions of doctors. This risk is sometimes interpreted by people outside the medical profession as Medical malpractice as in the actual case examples as follows: (Isfandyarie, 2005)[2].

On Thursday, the 4th of January 1979 at 18:00 pm, a patient named Rusmini, come for treatment to a practice in the village and sub-district Setianingrum Wedarijaksa, Pati regency. After receiving an injection from a doctor Setianingrum Shock patients experience irreversible, at 18:15 pm, the patient was brought to RSUD Soewondo Starch in a state of unconsciousness, respiratory standstill, small irregular pulse, content and less stress. Because of this incident, the doctor Setianingrum filed as a defendant in Pati District Court on charges of: Doctor Setianingrum has violated Article 359 of the Criminal Code as a result of actions that have been giving injections to patients Rusmini, Rusmini death caused by the body's reaction is not resistant to the drug received. On the charges, Attorney / Prosecutor filed criminal principally as follows: a. Assign the defendant guilty of violating article 359 jo 361 of the Criminal Code; b. In order Pati District Court sentenced the accused to imprisonment for 1 year; c. Pay all court fees Pati, Central Java District Court in its decision No. 8/1980 /Pid.B /PN.PT. declare that the doctors Setianingrum bint Siswoko, aged 38 years old at the time of running a practice as a doctor, due to negligence or less carefully when treating a patient / female named Rusmini, by not carefully conducted research prior to the patient. And the patient has been given an injection of as much as 3 times in a row, the first form of Streptomycin 1 gram injected through the buttocks limbs left, then after the state of the patient (patient) visible signs of vomiting subsequent second injection is given in the form of cortisone 2 cc, the third time after it was given an injection of 0.5 cc delladryl in front of the left thigh.

As a result of successive injections before, because the patient can not tolerate these injections, finally died after it was brought to RSUD Pati. Because of his guilt, the accused doctor Setianingrum bint Siswoko convicted of a felony: "due to negligence causing other people died" and Pati District Court to punish the defendant for three months in jail and weigh on the defendant to pay for this case. And the defendant stipulated guilty of violating Article 359 of the Criminal Code 361 jo. Where verdict upheld by the High Court in Semarang with its decision on January 19, 1982 no. 203/1981 / Pid / PT.Smg. Based on the above mentioned decision, the defendant then filed the appeal on the grounds inter alia that the application of Article 359 of the Criminal Code in this case is not true, especially regarding the interpretation of omission (Schuld) in the aforementioned article and cause of death. That the District Court in its consideration of determining negligence and less carefully defendant based that before injecting the defendant was not examined by asking the patient's history related to allergies, the defendant also did not check the patient's blood pressure, do not perform skin tests, and does not try to do venesection for pharmaceuticals as drug delivery Another replication and cardiac massage to stimulate the motion.

According to the defendant, the notion of negligence here must be associated with professional negligence doctor. Definition (Schuld) in article 359 of the Criminal Code contains an element of inevitability result (vermijd baar Heid), can heckled

the creator (ver wijtbaar Heid). These elements did not get the spotlight in interpreting the term negligence (Schuld) by the District Court in Pati.

That in addition to establish the person's negligence must be determined normatively, that is to be set from the outside how should he do with taking the size of the inner attitude of people in general, if there are in the same situation as the creator of it. That in the trial turns out the work done by the defendant in order to help patients' lives is justified by witnesses Moch. Prihadi doctor and physician Luke Firdaus, and only blamed by Imam Parsudi expert witness doctor, so it can not be used to determine the defendant's negligence.

Pati District Court less attention to the standard of treatment by requiring venous section to provide per-infusion fluids, administration of oxygen (O<sub>2</sub>) and the provision of other drugs as a repeat cardiac massage to stimulate motion, whereas veins equipment section to provide infusion and administration of oxygen does not exist, if there is not adequate so it is not fair to demand too much on the defendant as a pioneer in combating diseases of the people. That causa of the death of the patient (Rusmini) can not be determined with certainty because of a post mortem are made by doctors Goesmoro Soeparno, dated 25 external examination without holding an autopsy, so the cause of death could not be determined if it is only based on the testimony of witnesses who stated because it does not hold up drugs.

On these objections, the Supreme Court argued among other things: That all the elements of negligence on the interpretation of this objection is justifiable, therefore judex facti less precise in setting benchmarks for determining whether there is an element of negligence in the actions of the defendant in terms of the extent to which the defendant seeks to maximum to save the lives of patients, according to the ability that is actually owned and facilities available.

That from the testimony of the six doctors, unless the witness testimony of Imam Parsudi doctor, the Supreme Court concluded that the actions of the defendant asks the patient if it is ever received injections of streptomycin, then successively give cortisone injections, delladryl, and adrenaline, having seen no sign -sign sufferers are allergic to streptomycin which is injected is an indication, that the defendant has made a reasonable effort can be prosecuted thereof as a doctor with experience working for 4 (four) years, and are performing their duties in health centers with very limited means.

That of the very limited means, it is not possible to hopefully be able to do things as a witness a doctor Imam Parsudi desired, eg to injections of adrenaline straight to the heart or intravenous fluids, administration of acidic substances and other actions that require a complete and elaborate facilities. Whereas, therefore, one of the elements desired negligence Article 359 of the Criminal Code is not evident in the actions of the defendant, so therefore the defendant must be acquitted of the charges against him. Free decision given by the Supreme Court is the right decision for the doctor Setianingrum, because as noted physician R. Darmanto Djojodibroto, streptomycin injections did can cause risk as experienced by the patient (Rusmini) of physicians Setianingrum. In addition, the handling of shock as a result of the reaction is not resistant to the drugs that the doctor performed, in accordance with the procedures of treatment that should be done, as presented by the doctor Bambang Wahjuprajitno in Shock Treatment Issues Symposium held in Surabaya on February 10, 1990.

The number of deaths that occurred after the treatment procedure that is often reported by various media and electronic media as alleged malpractice as expressed in a few cases above, the doctors felt quite alarming that could haunt them in carrying out his services to help the patient. Basically no one doctor who has the intention to murder intentionally to patients. In treating patients, doctors always remember ever uttered oath when he will begin to devote himself to his profession: "I will always put the health of patients". In fact, not infrequently, even though the doctors themselves in an unhealthy state, the condition of the body is tired, still have to go serve patients who need his help, because its mission. On the other hand, there may be a small part doctors in performing their duties or provide treatment to the patient, do not pay attention to signs of professional ethics and do not understand about the standard of care as determined by expertise. In such case, the right of people of course must also be considered.

With the understanding of the risks and medical malpractice law in terms of perspective, then the doctor will be able to provide health services better. Besides, if the doctor will understand the legal responsibility of the patient, the doctor will be quieter and a maximum of doing his job. Of all cases of suspected malpractice were reported, most likely not all of them actually malpractice. There is a risk of them as experienced medical doctor Setianingrum, if we can learn the status of these patients carefully one by one.

Based on the phenomena that occur as described above, then the issue has raised among doctors that today predicted a lot of action to criminalize the medical service, and on the other side of a relationship that can not be circumvented between doctor and patient in the context of health services to the community. Doctors as professionals in their field are obliged suggest to patients to choose medical treatment will be carried out against him, because of the decision (judgment) concerning medical action to be performed on the patient is the patient's right to self-determination, then the legal issue to be examined is of the essence accountable professional judgment of doctors in the legal perspective. Doctors are a law-abiding member of society in the countries priority rule of law and a part of the community of people who are educated and professional in carrying out the work of service to the public in the Republic of Indonesia (NKRI).

## 2. RESEARCH METHOD

This study uses a type of normative legal research, while in terms of the nature of the report is a descriptive study. Descriptive meaning through research results are expected to give a comprehensive picture of the qualifications accountable professional judgment and analytical because doctors will then do an analysis of it. This study uses two data, that is primary data obtained through interviews with respondents and speakers, as well as secondary data obtained by conducting library research by collecting and reviewing study materials document in the form of law to be primary, secondary and tertiary. The data were

obtained and analyzed qualitatively. The analysis technique used in this research is qualitative (normative) through reasoning and legal arguments for all materials.

### 3. RESULTS AND DISCUSSION

#### Dispute settlement concept Medicine

Operation of personal health services at the hospital involving physicians, patients and the hospital itself. All three are legal subjects involved in the field of health care and childbirth relation to medical and legal relations. (Wila Chandrawila Supriya, 2000)[6].

The relationship between doctor and patient is a relationship that has a special status. Namely Doctor or Hospital serves as the party providing health services (Health Care Provider) and patients as those who receive health care (Health Care Receiver). The relationship between doctor and patient is basically a contractual relationship. Contractual relationship between doctors and patients is called therapeutic contract. (Sofwan Dahlan, 2000)[7]

Basically position between doctors / hospitals with patients is a balanced position (horizontal), but in its development position began to shift towards vertical contractual position. Often the shifts that result in medical Disputes where Generally Patients are always disadvantaged. Medical disputes generally known as Medical malpractice. Doctors with its scientific devices have distinctive characteristics. This peculiar look of the justification provided by the law items, namely medical allowed to act on the human body in an effort to maintain and improve health.. Medical action is carried out on the human body rather than by a physician or a felony (Hendrojono Soewono, 2006)[8]. Basically medical action performed by doctors always lead to two possibilities, namely successful and unsuccessful (failed). Failure doctors in medical action can occur because it is caused by, among others:

- a. Because of intent (dolus);
- b. Due to negligence (Culva)
- c. Because of coercion (force majeure);
- d. Because Noodweer (emergency);
- e. because it does not conform with the standards of the medical profession (unprocedural).

This can lead to conflict between doctor and patient, so as to cause disputes. But actually many factors that can lead to disputes other than those mentioned above, including changes in the pattern of relationship between doctor and patient. Initially the relationship between doctor and patient paternalistic, in this connection the patient's participation is allowed only implicitly obedient to the healers. Patients were considered to have no idea and do not need to know about the causes of the disease because the disease is the manifestation of God's curse. (Veronica Komalawati. D, 1989)[5].

Pattern paternal relationship between doctor and patient gradually been transformed into a partner relationship patterns between doctor and patient. Legal relationships that occur are contractual and transactional relationship, so that doctors no longer have a higher position than the patient, but parallel to the rights and obligations of each are balanced and are subject to and comply with health care standards set by the government.

Various triggers a dispute between the doctor and patient are: the problem of communication between doctor and patient, with the differences in the level of knowledge among doctors and patients, as well as the time required for the communication. In addition, the problem of ignorance of patients regarding the object of the agreement he made with the doctor and the interpretation of the agreement between doctors and patients.

Commitments arising from transactions therapeutic (healing) was called inspanningsverbintenis namely an engagement should be done with caution and effort (meth zorg en inspanning) (Veronica Komalawati. D, 1989)[5]. Because of his achievements in the form of an attempt, the results clearly uncertain. Consequently, if the attempt failed in the sense that the patient does not become cured or died, it was a risk that should be borne by both physicians and patients. (Veronica Komalawati. D, 1989)[5].

Disputes between doctor and patient is the most prevalent of late this is a case of alleged medical malpractice. This is demonstrated by the many complaints of malpractice cases filed society in the medical profession. The increasing number of complaints is evidenced by the increasing number of people who use the services of a lawyer to sue the doctors accused of malpractice. Such conditions triggered by the increasing level of education and public awareness of the right care and health care (the right to health care) and the right to self-determination (the right of self determination) which they can use the services of a lawyer to obtain justice. (Hendrojono Soewono, 2006)[8].

To resolve medical malpractice disputes in Indonesia, can be reached via two paths, ie the path of litigation (judicial) and non-litigation or line (outside of court), but usually the case-the case of medical malpractice claims through litigation is always foundered middle of the road because the problem is the proof which is difficult given by the patient / lawyer. Therefore, the majority of medical malpractice cases settled amicably conducted outside the path of litigation because the doctor does not want his reputation damaged when posted negative.

#### a. Litigation

Settlement of disputes between doctors and patients, basically subject to the provisions of the legislation in force, both criminal provisions, civil and state administration. Therefore, the doctor-patient dispute is resolved through litigation either criminal prosecution through the criminal justice system, civil action through the civil courts, as well as the demands of the justice administration of the State through the State Administration.

Disputes between doctor and patient is a typical type of dispute because the transaction therapeutic and informed consent between the doctor and patient are marked with patient consent for the actions of doctors and an explanation of the actions and consequences of a doctor, in essence a legal relationship engagement on the one hand, but on the other hand the recovery efforts for the health of the patient is a human responsibility of doctors who require the physician must treat, whereas patients are the ones who are expecting a cure so that the approval given can be categorized as approval because of compulsion. Law enforcement in the field of health, especially if associated with the typical medical disputes, including structuring and enforcement (compliance and enforcement) in the areas of administrative law, the field of civil and criminal law. According to the authors that criminal sanctions are intended to give deterrent effect to the doctor as *ultimum remedium* used as a weapon of last resort, the end of a chain with a view to eliminating consequences to the detriment of patients and the public and the medical profession itself. It means that criminal sanctions in the practice of medicine is only a supporting course for other sanctions such as administrative sanctions and civil sanctions.

Legal responsibilities of physicians in terms of the burden of proof in general refers to the principle of responsibility (Liability Principle) who applied use of a certain principle of responsibility depending on the circumstances, there are at least three (3) principles or theories about the responsibility which is known, is: (Saefullah, HE 1999)[9]

### **1) The principle of responsibility based on the element of fault (fault liability, liability based on fault principle)**

In general, the law on civil liability still applies the principle of liability based on fault or "tort", as defined in Article 1365 BW. Thus everyone who suffered losses due to the actions of others can demand compensation or damages (compensation) from the person who caused the loss, so in principle responsibilities on the basis of this error, the burden of proof is on the party who suffered loss (burden of proof on the shoulder of the Plaintiff). If the person who suffered the loss (the plaintiff) can not prove the existence of an element of fault on the adverse party (defendant), then the people who suffer such losses can not obtain compensation or compensation.

### **2) The principle of responsibility based on the presumption (rebuttable presumption of liability principle)**

In the principle of "presumption of liability" the burden of proof shifted from the plaintiff (victim) to the defendant (the party harm). So, based on this principle the defendant is responsible for the losses incurred unless he can prove it has taken all necessary measures to avoid the damages or that it was impossible to do, so the plaintiff or victims can file claims to obtain compensation without having to prove the existence of an error on the part of the defendant. Thus the question that the responsibility of the defendant based on the "presumption" (presumption) means that the defendant's liability can be avoided if the defendant proves that it is not guilty (absence of fault).

Nevertheless, the position of the patient as well as consumers who are subject to consumer protection laws and based on the provisions of Article 22 of Law No. 8 of 1999 on Consumer Protection that the evidence against the existence of an element of fault in criminal cases is the burden and responsibility of businesses without the possibility for the prosecution to prove. Then the provisions of Article 28 of Law No. 8 of 1999 on Consumer Protection, that proof of the presence or absence of the element of fault in tort is a burden and responsibility of businesses.

### **3) The principle of absolute liability (no-fault liability, absolute or strict liability principle)**

The principle of absolute liability (no-fault liability or liability without fault) in the literature are usually known by the phrase strict liability or absolute liability. With the principle of strict liability for the purpose of responsibility without having to prove their guilt. The reason for applying the principle of absolute liability in today's modern society, with respect to activities or businesses that contain great harm to others, those who cause harm (defendant) may be held liable if the type of activities in society that can pose a great danger that could threaten the safety of others, especially if the hazard is so great even though the company carried out with caution. The basis of this responsibility is still the implementation of business / activity is realized true though that activity / business brings risks. Application of the principle of absolute liability is the price that must be paid to the public.

If peace were carried out outside the court have not produced an agreement, the parties still have a chance to make peace in court. Because the positive law was (especially civil law), this way is recognized and for now this precedence by taking the way of peace. In the civil case, the decision could be null and void if not preceded by peace. Judges will give time for forty days to mediate in order to achieve peace, and it still reaffirmed at any time will be a trial by asking to what extent the peace efforts made by the parties. And this peace can be made throughout the trial before the case is decided by a judge.

Likewise with, including the civil judicial process to dispute the patient's physician, then in accordance with the Appellate Court of the Republic of Indonesia No. 1 of 2002 on the Empowerment Institute of Peace, the judge granted an obligation to provide the opportunity for both parties to resolve their case through mediation unless it has been do not see the process of mediation and settlement solutions, the proceedings were resumed. This indicates that the litigation should be placed as the last weapon *ultimum remedium* of all the efforts undertaken settlement.

If the trial court also peace can not be achieved, then inevitably doctor litigants must prepare everything to stand trial. The need to be prepared are: collect all the written evidence, prepare witnesses, prepare expert witnesses, preparing all medical scientific material related to the case and appoint a reliable advocate and legal understanding of medicine.

## **b. Non litigation**

In hospital medical disputes or doctor or patient self-righteousness and the other should be responsible. This position does not benefit all parties because it will provoke an outside party involved in the dispute. So wise if any dispute resolved. Basically settling disputes (especially civil matters) through peace will be better and satisfy a sense of justice for the litigants, because the relationship between the parties can still be established well when compared with the case resolved in court. In addition, the dispute can be completed entirely without leaving resentment among litigants, with low cost and relatively fast completion.

In the provisions of Law No. 29 Year 2004 regarding Medical Practice, unregulated alternatives regarding the settlement of problems between doctor and patient, but merely regulates the criminal and disciplinary sanctions in the form of administrative sanction. Alternative problem resolution are set out in Chapter XI of dispute settlement in particular Article 77, Article 78 and Article 79 of Law No. 36 Year 2014 on Health Workers namely:

Article 77 that: "Any Recipient Health Services harmed by errors or omissions Health Workers can ask for compensation in accordance with the provisions of legislation". Furthermore, the provisions of Article 78 that: "In terms of health personnel suspected of negligence in carrying out his profession that cause harm to recipients of health services, disputes arising from the negligence should be resolved first through dispute resolution outside the court in accordance with the provisions of legislation. "Then the provisions of Article 79 states that:" Settlement of disputes between health personnel and health facilities conducted in accordance with the provisions of legislation. "

The provision follows the principle of *ultimum remedium* that the criminal proceedings and other litigation process is placed as the last weapon in the settlement of disputes between doctors, health professionals, and the hospital with the patient. It is based on the consideration that the medical profession and health workers are integrated with the hospital as a container, having primary responsibility for humanitarian obligation to help the soul and human safety, health care standards therefore need to be truly prepared.

Dispute resolution mechanisms through the non-litigation basically refers to the concept of Alternative Dispute Resolution as defined in the provisions of Law No. 30 of 1999 on Arbitration and Alternative Dispute Resolution. Methods of settling disputes in the legislation is a method that is built on the concept of civil, with reference to the principle of *pacta sunt servanda*, by applying the method of conferences, mediation, conciliation, and arbitration.

Arbitration Law No. 30 of 1999 on Arbitration and Alternative Dispute Resolution emphasizes the form of alternative dispute resolution mediation (and the use of experts). Not even rule out the possibility of dispute settlement through other alternatives. Regarding the completion of this alternative Arbitration Law and Alternative Dispute Resolution Law 30 of 1999 determines as follows: (Munir Fuady, 2000)[10]

Article 6:

- (1) Disputes or differences of opinion can be resolved by the parties through alternative dispute resolution based on good faith to waive settlement of litigation in state court.
- (2) Settlement of disputes or differences of opinion through alternative dispute resolution as in paragraph (1) resolved in the meeting directly by the parties within a period of fourteen (14) days and the results are set forth in a written agreements.
- (3) In the event of a dispute or difference of opinion referred to in paragraph (2) can not be resolved, then on written agreement of the parties, disputes or differences of opinion resolved through one or more advisory expert or through a mediator.
- (4) If the parties are in no later than 14 (fourteen) days with the help of one or more advisory expert or through a mediator fail to reach an agreement, the parties can reach an arbitration institution or agency of alternative dispute resolution to appoints the mediator.
- (5) Upon the appointment of a mediator by the institution of arbitration or alternative dispute resolution institutions, within a period of seven days of mediation efforts should already be started.
- (6) The business of settling disputes or differences of opinion through a mediator referred to in paragraph (5) to uphold confidentiality, within a period of 30 days should be achieved in the form of a written agreement signed by all parties concerned.
- (7) The agreement settlement of disputes or differences of opinion in writing is final and binding on the parties to implement in good faith and shall be registered in the District Court within a period of 30 days of signing.
- (8) The agreement settlement of disputes or differences of opinion referred to in paragraph (7) shall be completed within a period of 30 days after registration.
- (9) If the peace effort as referred to in paragraph (1) through (6) can not be achieved, then the parties pursuant to a written agreement may apply for the business settlement through arbitration institution or ad hoc arbitration.

As for alternative dispute resolution outside of court medical can be reached between the patients with medical personnel as follows: ([http / Kesimpulan.com.News.dugaan-malpractice-kedokteran.html](http://Kesimpulan.com.News.dugaan-malpractice-kedokteran.html), accessed on January 11, 2015)

- a) Lumping it, ie let the dispute does not need to be extended.
- b) Avoidance, chose not to make contact again with the adverse party.
- c) coercion, one party to force the other party through a third person.
- d) Negotiation, the negotiating parties to take a decision.
- e) Mediation, the parties negotiate with the services of a third person as an educator, resource person, catalisator, translator.
- f) Arbitration, the disputing parties submit to a third party / arbitrator for a decision.
- g) Adjudication, involving a third party that the court has the authority to give a verdict and execution.

Medical dispute resolution through legal channels, there are three logic presupposes that the logic of the patient, the doctor logic and legal logic. The logic of the law can be neutral or sided with the doctor or the patient shifts, depending on which one is most true logic. Advantages of dispute resolution through legal channels was objectively, more certain, highlight the

external side, sanctions can be imposed on the guilty party such as a cage or compensation. The disadvantage is the completion of the legal system is often at odds with moral values, it takes a long, exhausting labor, the mind, not the least cost, and can end up with a win-loss, loss-loss, is rigid, do not touch the conscience. (<http://Kesimpulan.com> News, accessed on September 26, 2010)

The form of settlement out of court, among others:

**a) Arbitration**

Dispute resolution through arbitration body is a settlement with the way the parties appoint arbitrators with an odd number that serves as an impartial referee and has no interest other than for the purpose of reconciling to get things done According to policy matters, so that his case is not resolved by the courts. The weakness of this method because not all regions in Indonesia have arbitration institutions.

**b). Negotiation**

Settlement in this way is to seek to bargain with the aim of reaching mutual agreement. This method is popular because without involving others so that the problems being faced are not known by others and do not involve official bodies such as arbitration. So that it can be done anytime and anywhere.

**c). Mediation**

Settlement of disputes by mediation method that involves another person as a neutral mediator, but does not make decisions or conclusions to the parties, but support for the implementation of the dialogue between the parties with an atmosphere of openness, honesty and brainstorm for the purpose of achieving consensus. So the mediator function here only as a facilitator to bring the two sides in order to exchange ideas and dialogue. This happens if the parties are reluctant to meet each other or have a sense of fear that if the offer was rejected by the other party. This method is also popular in the community because it does not require an official body so it can be done anywhere and anytime.

**d) Conciliation**

Dispute settlement by conciliation method is by way of desire to bring the disputing parties to reach an agreement and settle disputes. Or also interpreted bring the disputing parties to resolve the problems between the two sides in the negotiations.

**c. Code of Ethics**

Code of Indonesian medical previously drafted in 2001 which was passed later IDI in 2002, yet accommodate the substance of the professionalism of doctors and patient safety, as implied in the arrangement of Law Number 29 Year 2004 regarding Medical Practice, Law Number 36 Year 2009 on Health and Law 44 Year 2009 on Hospitals, Law 40 of 2004 on National Social Security System (Navigation) and Law No. 24 of 2011 on the Social Security Agency (BPJS), as well as various other laws that regulate the medical profession.

Ethics is a reflection of the orderly conduct of business of the motion or moral intuition and moral choices that someone decided. Medical ethics can be interpreted as an obligation based on character / morality that determines the practice of medicine. Over the last few decades, issues of medical ethics is the most important issue rather than awareness, with concerns focused on several major issues. Today's society has been questioned aggressively about how and to whom health care is given. Public attention on the issue of medical ethics have brought the medical profession to the increasing need of the public view of this, not only with regard to the relationship between doctor and patient, but also on how advances in science and medical technology affect issues of human rights, the structure of society and government policies in terms of health care. (Indonesian Doctors Association, 2004)

Code of Medical Ethics Indonesia based on the principles of social life that is Pancasila which has equally recognized by the Indonesian people as a philosophy of life of the nation. Majesty and glory is demonstrated by six (6) the nature of which must be presented by each physician, namely: (Indonesian Doctors Association, 2004)

- 1) The divinity,
- 2) Virtue cultivation,
- 3) The purity of intention,
- 4) The seriousness of the work,
- 5) Humility, as well as
- 6) Integrity and social science

Doctors have a great responsibility, not only to other human beings and the law, but the important thing is to his own inner conviction, and ultimately to God Almighty. Patients and their families will receive the results of operations of a doctor, if he believes that physician specialty and sincerity, so that they do not consider to be a problem when the recovery efforts have failed. It should be noted that the actions of every doctor, affecting many people's opinion on the whole "corps" doctor (Indonesian Doctors Association, 2004).

Services provided to patients who should be treated are all over the ability of the physician in the field of science and humanity. Under the provisions of Article 8 of Law No. Letter f 29 Year 2004 regarding Medical Practice that: the Indonesian Medical Council has the authority to conduct joint guidance of doctors and dentists on the implementation of professional ethics established by professional organizations; and Furthermore, the provisions of Article 24 of Law No. 36 Year 2009 on Health that :

- (1) Health workers must comply with a code of ethics, professional standards, the right health service users, service standards, and standard operating procedures.
- (2) The provisions of the code of ethics and professional standards as referred to in paragraph (1) shall be governed by professional organizations.
- (3) The provisions concerning the rights of health service users, service standards, and standard operating procedures as described in paragraph (1) shall be regulated by the Regulation of the Minister.

In medical practice, there are at least three (3) norms namely:

- 1). Discipline, as a rule the application of medical science;
- 2). Ethics, as a rule the application of medical ethics (KODEKI); and
- 3) The law, as the rule of law medicine.

Enforcement of the medical profession's ethics conducted by the Honorary Council of Ethics (MKEK) as mentioned in Article 1 paragraph 3 Guidelines for the Organization and Work Management Honorary Council of Indonesian Medical Ethics, that: "Honorary Council of Ethics (MKEK) is one of the autonomous bodies Doctors Association Indonesian (IDI), which was formed specifically in the Central, Regional and Branch to perform tasks to court profession, coaching and professional ethics or institutional duties and other ad hoc in each level. "

MKEK is the enforcement agency ethics of the medical profession (KODEKI), in addition to MKDKI (Indonesian Medical Disciplinary Council) the competent authority to determine whether there is a mistake made doctors and dentists in the application of the disciplines of medicine and dentistry, and establish penalties (see Article 1 point 14 of Law No. 29 of 2004 on Medical Practice).

Enforcement of codes of medical ethics through MKEK an internal enforcement mechanisms in the field of medicine that does not rule out other positive law enforcement. MKEK determine an act violating the ethics of the medical profession or not, so that when an act is sufficient evidence to otherwise violate the ethics of the medical profession it will be processed through the trial MKEK.

Coaching discipline for doctors conducted by Indonesian Medical Disciplinary Council (MKDKI), as defined in Article 55 of Law No. 29 of 2004 on Medicine that:

- (1) To enforce discipline doctors and dentists in the administration of medical practice, was formed Indonesian Medical Disciplinary Council.
- (2) The Indonesian Medical Disciplinary Council is an autonomous institution of the Indonesian Medical Council.
- (3) The Indonesian Medical Disciplinary Council in carrying out its duties are independent. Article 64 of Law No. 29 Year 2004 regarding Medical Practice that Indonesian Medical Disciplinary Panel of charge:
  - 1) Accepting the complaint, examine and decide cases of violation of discipline doctors and dentists are submitted; and
  - 2) Developing guidelines and procedures for handling cases of violation of discipline doctor or dentist.

## CONCLUSION

Results of this study concluded that the concept of a legal settlement to errors in medical practice subject to all positive law justice system in both criminal law, civil law, the law of the State administration, consumer protection, code of conduct and discipline of medicine, thus potentially cause legal uncertainty for the medical profession as well as optimizing the impact on inhibition of improving the quality of public health services in general.

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# Model Implementation City Government Policy of the Use to Location Arrangement Advertisement Room in the City Makassar

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**Abstract :** This study in the wake of irregular installation of billboards in the city of Makassar is caused due to the absence of regulation or regulations on spatial planning billboards in the city of Makassar, resulting in the installation of billboards in arbitrary locations / places anywhere can be mounted billboard, by him Makassar City Government really needs to make a policy that is the regulation of billboard space arrangement so as not to spoil the aesthetics and beauty of the city of Makassar. Assuming the theory of George C. Edward III. This study aims to explain and describe the location of the billboard space arrangement in order to become a leading Makassar city of the world and not "rangtassa", hence the need for the installation of billboards is not on indiscriminate place / location. This research was conducted in the city of Makassar to find some point of the installation of billboards exist in indiscriminate location / place, the unit of analysis in this study is of spatial location of the billboard. This research using qualitative research method of naturalistic qualitative or phenomenological. Sources of data obtained from the informant on several agency related and include: Office Opinion area of Makassar, chairman of the team, 2) the Department of Public Works Makassar, 3) Department of Spatial Planning and Building of Makassar, 4) Beauty and Health Department of the Environment, 5 ) Department of Transportation, 6) municipal police, 7) the installer billboard companies, 8) Aspri (Association of Indonesian Advertising businessmen, 9) Citizen. The results showed that the location of billboards in the city spatial planning Makassar no provision about the regulation or legislation / regulations, so that any employers who advertise or advertisement where she wants that important still pay advertisement tax on Dipenda Makassar, suggested the need for Makassar city government, give or make place / location of the billboard space arrangement models, but so far there has been no regulation / spatial planning regulations on billboards and also the ineffectiveness is due to the coordination of multiple departments or related agencies regarding the arrangement of the billboard space.

**Index Term:** government policy, planning billboards, makassar city

## 1. INTRODUCTION

In the study of public policy, said that the implementation is not just concerned with the elaboration of a mechanism of political decisions into routine procedures through the channels of bureaucracy, but more than that the implementation of a matter of conflict, decisions and who gets what from a policy. Therefore it is not entirely wrong to say that the implementation of the policy is a very important aspect in the overall policy process. A very simple understanding of the implementation are as disclosed by Jones (1980)[1], where the implementation is defined as "getting a job done" and "doing a". But behind the simplicity of such a formulation means that the implementation of the policy is a policy process that can be done easily. However its implementation, demanding conditions, among others: the people or executive, money and organizational abilities or often called resources. Furthermore Jones formulate implementation constraints as the process of receiving additional resources, so it can consider what to do. Meter and Horn (1979)[2] defines the implementation of the following policies: Policy implementation encompasses Reviews those actions by public and private individuals (and groups) that are directed at the achievement of goals and objectives set forth in the prior policy decisions ". it gave a meaning that is policy implementation actions undertaken by individuals - individuals (and groups) private and government directed at achieving the goals and objectives that have been set. These actions, at a time trying to transform decisions into operational patterns, as well as the continuing efforts to achieve changes, both large and small, which is mandated by policy decisions. With reference to the opinion can be taken understanding that the resources to achieve the goals that have been set previously by policy makers, it includes human, financial and organizational ability by both public and private (individual or group). In the process of policy implementation, in fact concerns not only the behavior of implementing agencies, more than it concerns the power network of political, economic and social directly or indirectly, can affect the behavior of all parties involved, which in the next turn affect the expected impact (intended impact) or unexpected (spillover / negative effect).

Policy formulation to policy implementation, they are not considered as a separate thing, although it may be analytical can be distinguished. At a certain level, the administrator not only be as a manager only. However, they are directly or indirectly, formally or informally, with a persuasive manner, control information, or by any means set the policy decisions (Christopher Hodgkinson, 1978)[3]. Assumptions in adaptive or interactive approach that "in emphasizing the implementation of adjustments to the objectives and strategies performed by the actors during the implementation process takes place. Urban space has a potential benefit to the community media, namely advertising. Advertisement or billboard is a formidable tool for the dissemination of information for marketing purposes.

According Danisworo (2005)[4] strategic placement of billboards that can provide opportunities for the public to get a good visual access to the resources. The existence of diverse billboard shapes, sizes, and colors will be able to draw striking when seen at a certain distance. In the arrangement of advertisement, there are several concepts, among others, the concept of a safe, orderly concept, the concept of a regular, obedient concept, design concept, the concept of the determination, and the concept of the point. Then the Regional Regulation (Perda) Makassar Number 13 Year 2005 regarding the permission granted on installation of billboards in the city of Makassar. Therefore, then that becomes the focus of attention of policy implementation is to understand what actual happens after a program, declared valid. Various Regional Regulation (Perda) and the wind seemed to be fine for the citizens of Makassar. Billboards are often referred to like "*simalakama fruit*". Rejected would be very unfortunate, however, because income to revenue (PAD) of the sector indeed great. When accepted, if it is not regulated or properly managed feared would ruin the beauty of the city. We'll see how chaotic installation of billboards and banners in Makassar Billboards installed haphazardly eyesore and urban planning. Why many city billboards standing, is clear in this case because the company needs to advertise and advertise on a billboard outside the room also had a hand effective than advertising on television. The impact then, more and more advertisers billboards, plus the lack of supervision and regulation, causing damage to the aesthetics of the city. So that the Government of Makassar have endeavored to regulate the installation of billboards and banners.

Based on the description of the problems in the background of the problem of research, then drafted formulation of the problem of this research as follows :1) How is the implementation of government policies on the use of spatial location of the billboards in the city of Makassar ?; 2) What are the factors that support and hinder the implementation of the policy on the use of spatial location of the billboards in the city of Makassar ?; 3) How to model the implementation of policy on the use of spatial location of the billboards in the city of Makassar?

## 2. RESEARCH METHODS

Types of research and research design using qualitative approach, qualitative research as part of a natural paradigm conducted by researchers with the assumption that any context related to the research are critical so that each contributes contextually of the data field (Moleong, 1993: 165 ) [5]. Qualitative research is also concerned to encompass the social complexities that are common in everyday social interaction and opportunities to the participants. Research informant to give meaning to the interaction based on experience or "habits of mind heart" informants (Rossman and Rallis, 1998, Marshall and Rossman, 1989: 2) [6,7].

### Location and Time Research:

This study was conducted in Makassar, South Sulawesi Province and the research is expected to provide an overview of the utilization of locations in the arrangement of billboards in the city of Makassar. This research was conducted by using a qualitative approach.

### Focus Research and Analysis Unit:

The focus of this research is the location of the billboard space arrangement that became the main focus of this research are: 1) Assess the implementation of the government policy of Makassar in the arrangement of advertisement locations to program / activity through the location of the installation of billboards; 2) Identify and interpret the supporting factors and inhibitors which are all factors that can affect the implementation of government policies Makassar as a technical institute that is managing and servicing; 3) Make use of policy implementation model of spatial location of the billboards in the city of Makassar is more effective.

### Types and Sources of Data:

The type of data is divided into two kinds of data primary and secondary data. Data collection is done in order to answer the central question as posed in the formulation of the problem. Secondary data was collected via tracking and analysis of documents, while primary data was collected through observation, interview and discussion. The fourth step or the preferred method of data collection is in itself form a model of triangulation method (methodological triangulation) useful for reducing the risk of limited information based on method or a particular data source, as well as to improve the validation of information to arrive at a conclusion. Further data collection form was used to survey land arrangement billboard, then the survey was also conducted by collecting data. Executing services include: a) Regional Revenue Office of Makassar, b) Makassar City Public Works Department; c) Department of Spatial Planning and Building of Makassar; d) Department of Health and Environment beauty; e) Pamong Praja Police Unit (Satpol PP); f) Community; g) Advertising Indonesian Employers Association (Aspri) Makassar.

## 3. RESULTS AND DISCUSSION

### Policy Implementation Model

In studying the model of public policy implementation processes are six (6) variables that make up the association (linkage) between the policy and the achievement (performance). These variables are independent variables and related variables that relate to each other, while the six variables are: (1) basic measures and objectives, (2) sources, (3) communication between the organization and activities of implementers, (4) the characteristics of the implementing agencies, (5) the economic, social and political, and (6) the tendency executors ". Implementation of policies there are variables that are interconnected to form the link

between public policy and the achievement of the expected. Studying issues of policy implementation means trying to understand what happened in fact declared valid after a program or formulated the events and activities that arise after the passing of a policy, either in relation to efforts to administrates and attempts to give a certain impact on society. The concept of implementation is derived from the word "to implement" (implements) which also means providing the means to implement something and have an impact or effect on anything, including the measures chosen by the government to be implemented or not implemented. In line with previous opinions, that the implementers organizational variables will affect the existing policies, the policy implementation actually realized that not all alternatives can comprehensively address all problems that arise.

The fact is that not every policy formulated by the government can be run well and yielded the expected results. It is also mentioned about the pressure from various parties, in this case it can be said also about the importance of monitoring conducted in policy implementation. In any oversight efforts consisted of measures to examine whether everything is achieved or run in accordance with a predetermined plan based on instructions, instructions that have been issued, the Principles have been set. Supervision aims to find weaknesses and to find out if something went according to plan activities that have been outlined, find out if everything is done with the instructions and principles that have been determined, knowing the difficulties and weaknesses in the work, to determine whether activities run efficiently, to determine the necessary policies and measures concerning the implementation of the tasks or find a way out, if it encountered difficulties and failures in the direction of improvement.

### **Makassar City Government Policy Implementation**

Implementation of the policy on the installation location and arrangement of the billboard at each location for now is free to enter the installation of billboards or advertisements, however, must still follow the procedures and policies so long as no violation of the installation of billboards or advertisements, while the policy of the Regional Revenue Office on installing namely Makassar the tax which point the installation of billboards entrepreneurs who put the brand or the product according to the location where the billboard mounted on the tax policy During entrepreneurs put on a billboard bias or the location where you want to install because the mayor has not yet decree or regulation that would like to install anywhere because one of the opinion that it is expected that the area is on Dipenda Makassar, namely the installation of billboards. Therefore, for installation can be at any location because there is no discretion so that the installation of billboards put up ads at any point or location of placement for ads are placed so that young people in view by the public / community products that are installed by the company that set it up, which is important and foremost by Makassar city government in this case the city of Makassar service revenue was an increase in the opinion (PAD) so that the city of Makassar yet on the location of the billboard advertisement spatial arrangement, however, the city of Makassar is necessary for the location of the arrangement of advertisement space and it is no longer appropriate with the symbol Makassar to the city's, is based findings as a researcher in the city of Makassar, so the businessmen looking for a location for the installation of billboards advertising yet government policy Makassar advertisement tax only in priority as one of the largest regional income tax revenues were the highest advertisement it is in priority, so the location of the installation of billboards can be in arbitrary locations or places where entrepreneurs want to advertise their products.

### **Factors Supporting and Inhibiting Policy Implementation**

Installation billboard dots on one side of the role of the community as an object of consumption of the contents of the billboard, but it is also often the placement of dots is expanded billboard area of urban public space (public space) that impact the disruption of the function of public space itself the which is where the interaction of its community in an urban space. On the other side of the billboard as Foreign Media Griya (MLG) marketing of goods and services both local and foreign companies increasingly important role as a marketing medium in addition to conventional media such as TV, Radio and Newspapers. Company advertising (advertising agency) as workers billboard mounting points are often only concerned with its clients from the aspect of safety, effectiveness and aesthetics of the city, another one advertising agency sometimes scramble dots installation of billboards in every corner of the city with no doubt waive legal aspects No, that will ultimately have an impact on urban areas such as forest advertisement. As for the other factors in the implementation of the policy beneficiary of spatial location of billboards factors that may affect the implementation of the policy and the end result, which is deduced from the review of the academics who examined various cases of failure of implementation.

### **Policy Implementation Obstacles**

The factors inhibiting the implementation of policy on the use of spatial locations in the advertisement has some inhibiting factors, namely: a). First of policy content, policy implementation failure is still vague because the contents of the policy, that is what the objectives are not sufficiently detailed, the means and the implementation of priorities, policies or programs are too general or absolutely nothing. Secondly, due to the lack of internal and external provision of policies to be implemented. Third, the policy will be implemented may also indicate the presence of flaws very meaningful. Fourth, other causes of the emergence of a public policy implementation failure can occur because of deficiencies related to the resource-resource aide, for example relating to time, cost / funding and manpower; b) Information on public policy implementation assumes that all the stakeholders directly involved or has information that needs to be closely related to be able to play its role properly. This information does not actually exist, for example due to a breakdown of communication; c) Support implementation of a public policy would be very difficult if the implementation is not enough support for the implementation of such policies d) Distribution of the potential origination related to the implementation of a public policy failure also determined aspects of the potential division between the actors involved in implementation. In this case related to the differentiation of tasks and authority of the

implementing organization. The implementation of the organizational structure can cause problems if the division of authority and responsibility are less adapted to the division of tasks or marked by restrictions that are less obvious.

#### 4. CONCLUSION

Based on the results of the discussion has explained the model of implementation of government policies in the city on the utilization of spatial location of billboards in the city of Makassar as well as the response of the citizens of the billboard arrangement implemented by the government of Makassar, the proposed conclusion of the research: 1) Implementation of Government policy the city of Makassar on the use of the location of the billboard space needs to be created for the regulation or the rules on the location of the installation of billboards in order not to put up billboards that snafu existence of the concept of non-compliance with the law selectively against one's membership in an association or group wishes to make a profit quickly because of the legal uncertainty because of the location of roads billboards dot the strategic value that is based on the location of the installation of billboards is in the same road determination based on the location of the road in the classroom or placement so as to cause the value of the installation of billboards strategy at all in the road space; 2) factors that support the implementation of the policy on the use of spatial locations advertisement Makassar is a view in the arrangement of advertisement space on the right path so that more residents can look and see the products that are installed by the employer. Dimensions, namely the impact of state policy: the expected impact of this policy (intended consequences) or unexpected (unintended consequences), Dimensions impact externalities / spillover effects, namely waste policy on the situation or the people (groups) outside the target group of influential policy impact on conditions current or future condition. Impact of policy on direct or indirect costs; 3) The proposed model of billboard space utilization Policy Implementation in Makassar in the Implementation of the advertisement essentially government policy can be influenced by the environment, where the system is affected by the environment so that the measures taken as a result of environmental influences on a political system. which is about the height of the installation of billboards which were divided into three groups. Based on the factors of the view that the high installation of billboards is a strategy point and the location of the installation of billboards on the road.

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# Prevalence of Deliberate Self-Harm in Alcohol Dependence Syndrome Patients

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**Abstract-** Deliberate self-harm (DSH) is common in people with Alcohol use disorders. Individuals who engage in deliberate self-harm (DSH) report using problematic coping mechanisms one of which is alcohol consumption. An observational, cross-sectional, clinical study was carried out to study the prevalence and methods of deliberate self-harm in patients with alcohol dependence syndrome.

Participants included 30 cases admitted in psychiatry ward and deaddiction ward. Tools used were Deliberate Self-Harm Inventory (DSHI), Mini Mental State examination (MMSE) and additional questionnaires for assessment of alcohol use pattern and socio-demographic data. Prevalence of deliberate self-harm in patients with alcohol dependence syndrome was found to be 30%. The commonest methods of deliberate self-harm in patients with alcohol dependence syndrome were severely scratching (33.3%) followed by carving pictures / designs in to the skin (22.2%). Majority of the patients with ADS had their age of onset of DSH in the age group of 26-35 years (44.4%), one past attempt (44.4%), duration of DSH lasting for more than one year (66.7%), last attempt 1-6 months back (33.3%) and need for hospitalisation for 11.1%.

**Index Terms-** Deliberate self-harm, Alcohol dependence syndrome.

## I. INTRODUCTION

Deliberate self-harm (DSH) is common in people with Alcohol use disorders. Individuals who engage in deliberate self-harm (DSH) report using problematic coping mechanisms. One potential problematic coping mechanism is alcohol consumption. It is well established that alcohol consumption is a major risk factor for deliberate self-harm. Research on alcohol involvement and deliberate self-harm is conflicting.<sup>1</sup> In a study of a sample of 150 DSH patients, compared with other DSH patients, those with an alcohol diagnosis were older and more often male, living alone, unemployed, sick, disabled, or with a past history of DSH. They also had higher scores on measures of anger, aggression, and impulsivity. Comorbid psychiatric disorder was present in 37 (92.5%) patients, in which majority (75%) had depressive disorders. Fourteen (35.0%) patients were receiving treatment from the psychiatric services prior to DSH, and 33 (82.5%) were subsequently offered treatment. Of the patients who were followed up, 37.9% remained in contact with

psychiatric services, 55.2% showed poor compliance with treatment and 44.8% reported a further episode of DSH. Deliberate self-harm (DSH) patients with alcohol dependence present a considerable challenge for clinical services.<sup>2</sup> There are only a very few published studies from India on this subject. The aims of our study were (a). To study the prevalence of deliberate self-harm in patients with alcohol dependence syndrome and (b) To study the methods of deliberate self-harm in patients with alcohol dependence syndrome.

## II. METHODOLOGY

This is an observational, cross sectional, clinical study. Participants were recruited by purposive sampling based on the inclusion and exclusion criteria. Cases for this study included 30 participants, aged 18 years-65 years, who met the ICD 10 DCR diagnostic criteria for alcohol dependence syndrome, willing to participate in the study and given written informed consent. Cases were recruited from patients admitted in psychiatry and deaddiction wards under the department of psychiatry in a tertiary care general hospital located in Mangalore, Karnataka, India.

Patients with comorbid organic mental disorders, schizophrenia spectrum disorders, bipolar affective disorder, those in delirium or those having severe cognitive impairment and those who were unable to give written consent were excluded from the study. Informed written consent was taken from the participants & confidentiality was assured. Participants were interviewed by the authors and DSH was assessed using the Deliberate Self-Harm Inventory (DSHI) and cognitive impairment using Mini Mental State examination (MMSE).

Socio-demographic data was assessed using the Modified Kuppaswamy Socioeconomic Status Scale. Other relevant clinical history and pattern of alcohol use was assessed using an additional semi structured questionnaire.

Statistical analysis was carried out using SPSS software. This study was ethically approved by the institutional ethics committee.

## III. RESULTS

Majority of the cases hailed from rural areas (53.3%) and nuclear families (80%) with occupation of an unskilled labourer

(33.3%) . Most of the participants belonged to the lower middle (33.3%) and middle socio economic categories (26.7%). Majority of the cases were in the age bracket of 31-40 yrs (40 %). Cases comprised of 66.7 % Hindus, 30 % Christians and 3.3% Muslims. On an average, most of the cases (46.7%) were educated up to high school.

Marital status of the cases varied with 70% being married, 30% being unmarried.

From amongst the sample, 63.3% cases had comorbid nicotine dependence. 70% had comorbid medical comorbidities and 16.7% had psychiatric comorbidities. In the study group, gastritis and alcoholic liver disease were the most common

medical comorbidity and anxiety disorders was the most common psychiatric comorbidity encountered.

Majority of the cases had onset of alcohol dependence syndrome before the age of 25 years (86.7%) , total duration of alcohol dependence for a period of 5-10 years (40%). Majority of the patients scored between 25-30 on MMSE (96.7%) .

30% of the patients had deliberate self- harm.(fig 1) The commonest methods of deliberate self-harm were severely scratching (33.3%) , carving pictures / designs into skin (22.2%), burning with lighter or match (11.1%) , carving wounds into skin (11.1%) , cutting (11.1%) and burning with cigarette (11.1%). (fig 2)

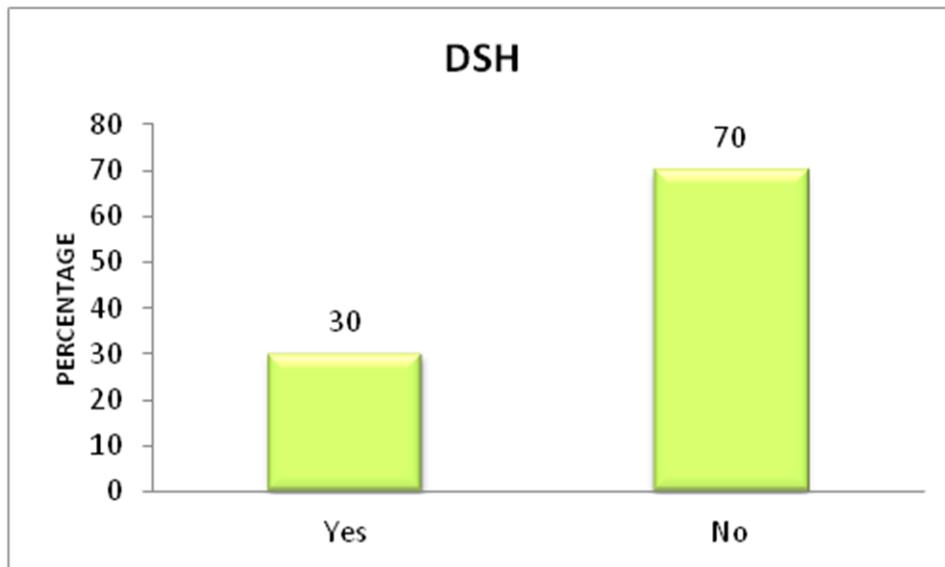


FIGURE 1 : PREVALENCE OF DSH IN ADS PATIENTS

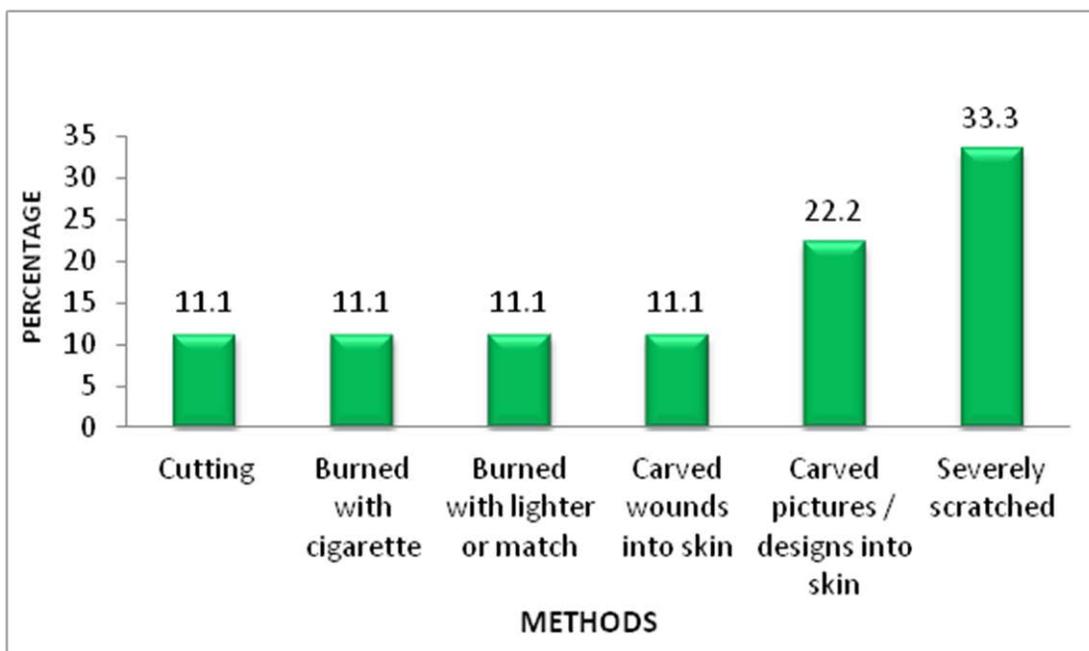


FIGURE 2 : METHODS USED FOR DSH IN ADS PATIENTS

Majority of the patients with ADS had their onset of DSH in the age group of 26-35 years (44.4%) (fig3) , one past attempt (44.4%) (fig 4), duration of DSH behaviour lasting for more than

one year (66.7%) (fig 5), last attempt 1-6 months back (33.3%) (fig 6) and need for hospitalisation for 11.1% (fig 7).

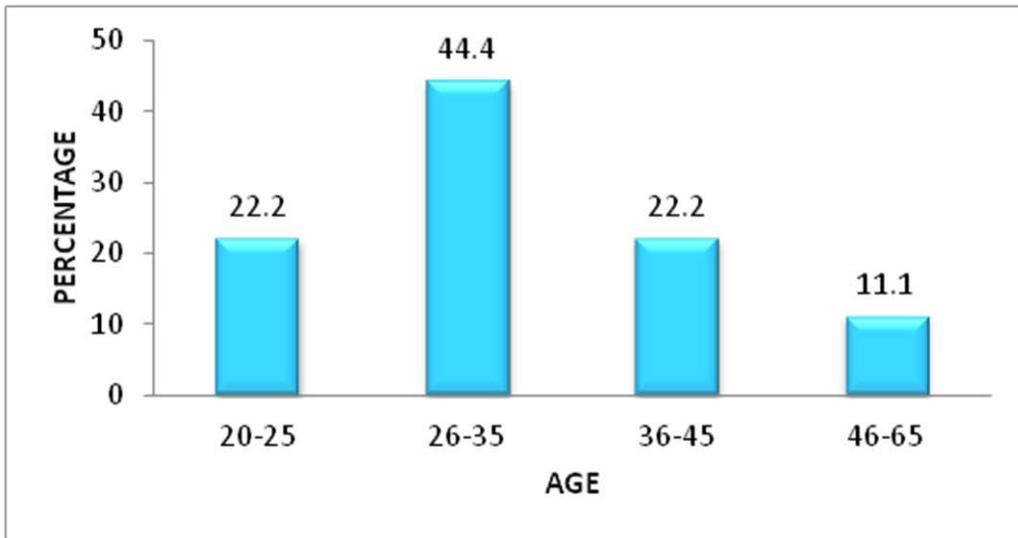


FIGURE 3 : AGE OF ONSET OF DSH

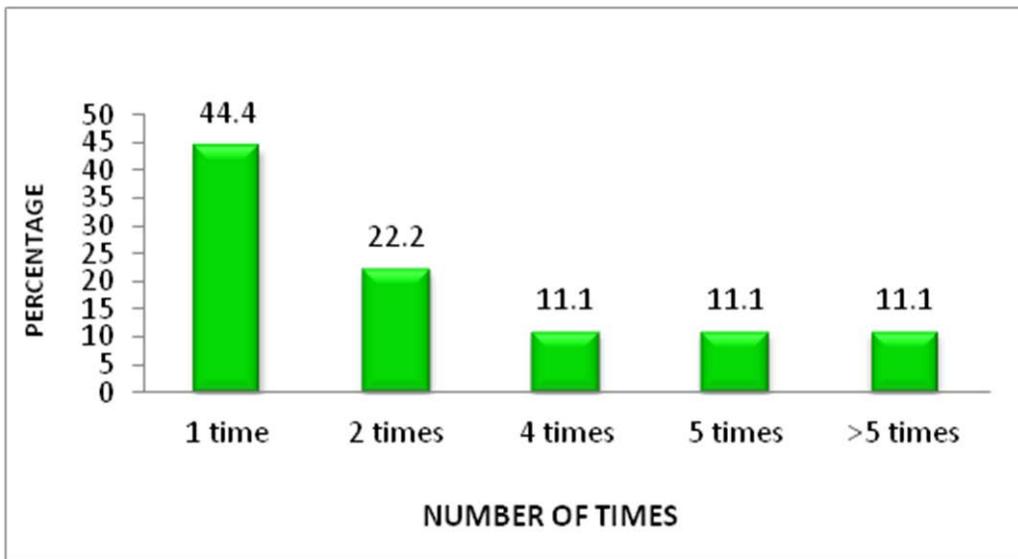
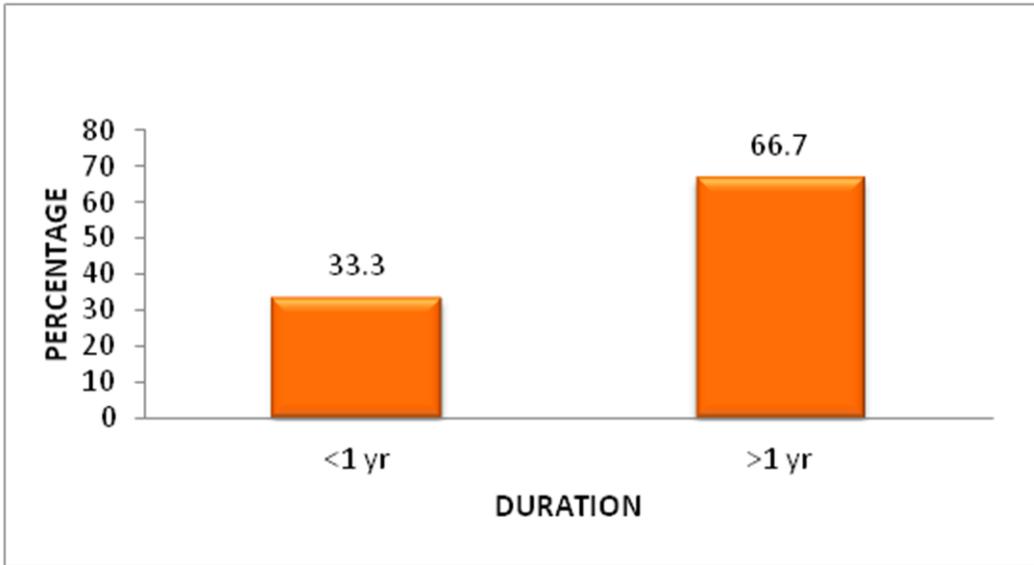
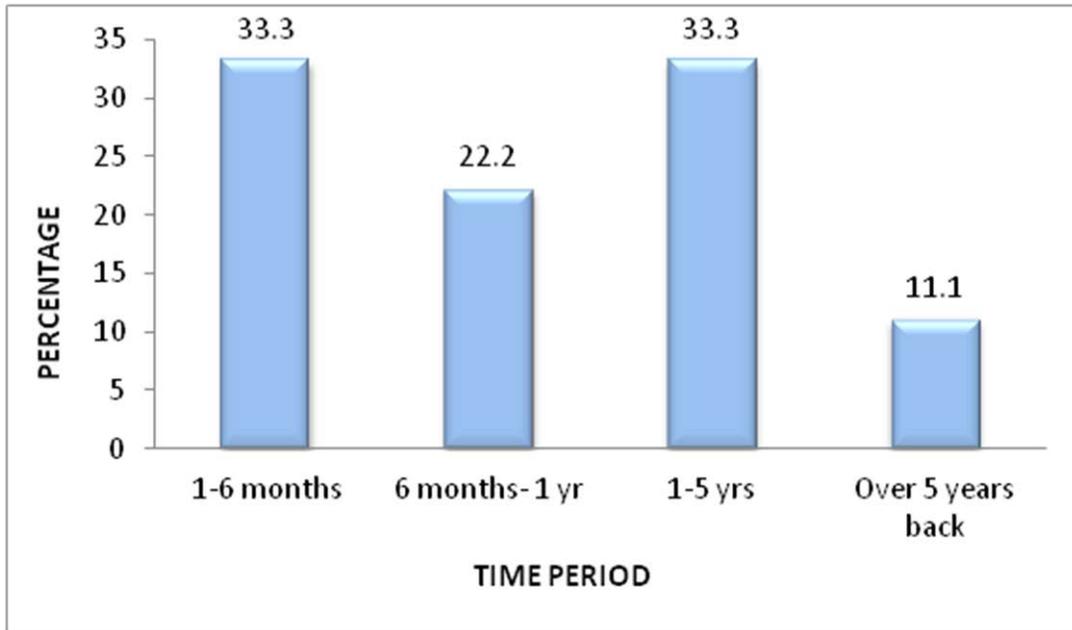


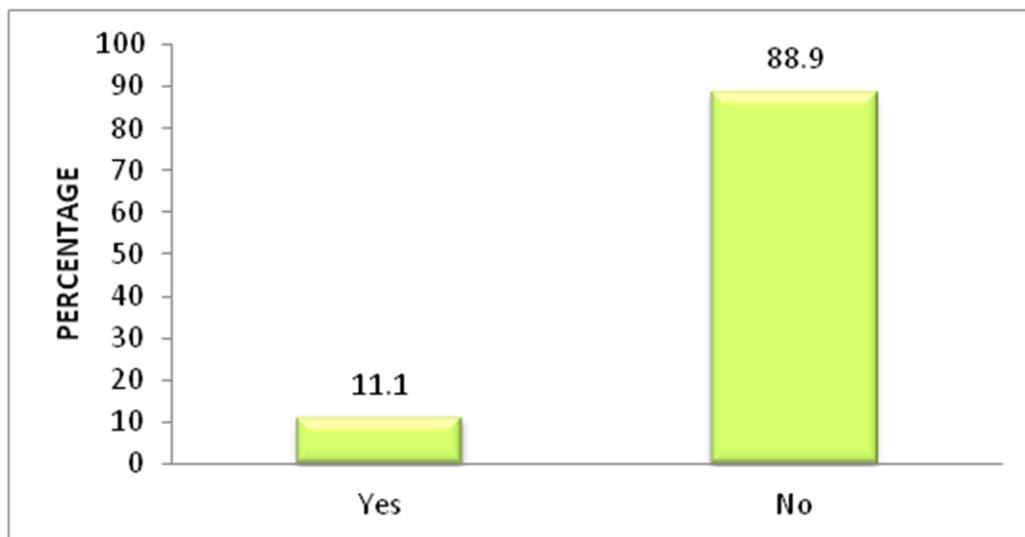
FIGURE 4 : NO :OF PAST ATTEMPTS OF DSH



**FIGURE 5 : DURATION OF DSH**



**FIGURE 6 : DURATION OF PAST ATTEMPTS**



**FIGURE 7 : NEED FOR HOSPITALISATION**

#### IV. DISCUSSION

Deliberate self-harm (DSH) is the intentional destruction of healthy body tissue without conscious suicidal intent.<sup>3</sup> It includes behaviours such as cutting, burning, scratching, carving and head banging. DSH may include a range of self harming behaviours which may range between those with no immediate physical tissue damage (i.e. self-starvation or alcohol abuse) to those that include suicide-related behaviours (i.e. self poisoning). Genital self mutilation which is a rare and a severe form of self-injurious behaviour can also be seen.<sup>4</sup>

There are a number of theories explaining DSH which includes affect regulation, depersonalization and behavioural / environmental but there remains a lack of consensus on the aetiology of DSH. There are strong evidences for a self-punishment function, and modest evidence for anti-dissociation, interpersonal-influence, anti-suicide, sensation-seeking, and interpersonal boundaries functions.<sup>5</sup>

The prevalence rates of DSH ranges between 4% to 20% in adult inpatients and up to 40% in adolescent inpatients. In non-clinical populations, the estimates range between 12% and 38% in college / university students. The highest risk age group for DSH is 18 to 34 years with a female to male ratio estimated at 8:1 for adolescents and at 1.6:1 for the 20-50 age group.<sup>6</sup> The prevalence rates of the current investigation (30%) are consistent with the study, however, the study sample consisted of only male patients.

There has been a significant increase in excessive drinking and consumption of alcohol around the time of DSH by females than males. These changes may relate to increased rates in the affordability and availability of alcohol and to social changes in drinking patterns. They have implications for services for DSH patients and may have an impact on future patterns of suicidal behaviour.<sup>7</sup> Characteristics of suicide victims with positive blood alcohol concentration are suggestive of Deliberate Self-Harm Syndrome (low lethality methods, substance misuse). These being at high risk of repeated suicide attempts, previous self-harm involving alcohol may represent a warning sign and access

to medication should be limited to prevent recidivism.<sup>8</sup> There is a strong association between alcohol consumption and suicide/poisoning/deliberate self-harm.<sup>9</sup>

Alcohol dependent patients were more likely than other attempters to be male, have histories of personality disorder and criminal offences and to make repeat attempts, and the drug misusers were more likely to be living alone and unemployed. These are characteristics associated with high risk of suicide.<sup>10</sup> Alcohol-related deaths were associated with unemployed/sick/disabled status, alcohol use during self-harm, referral to drug/alcohol services and lack of psychosocial assessment following self-harm was observed.<sup>11</sup> In a prospective cohort study, high alcohol use and psychological distress were significant risk factors for repeat DSH in both males and females.<sup>12</sup>

This study attempted to assess prevalence rates of DSH in ADS. Few studies are available for the same. However, this study has the limitations of a small sample size and the results may not be generalizable to the general population as the population of the present study is a selected one attending a private teaching medical charitable institution in Mangalore. Hence the samples are not representative of the general population. Some of the limitations are due to natural constraints of an investigation which is a study work undertaken in a stipulated period of time. Some others could be attributed to the innate research problems in the area of assessment of DSH in ADS. The subjects are assessed at the time of admission. The assessment is not blind due to constraints of the study. Therefore, rater bias is possible. Comorbid personality disorders were not excluded. This study is a cross-sectional one, and throws light upon the association between DSH and ADS. However, it does not establish a clear causality between the same. A longitudinal study with a larger sample group, with both male and female patients, taking into account the family members report along with the patients report, may perhaps yield more accurate results. Further research need to compare the prevalence rates between ADS and ADS with comorbid anxiety disorders.

## V. CONCLUSION

This study highlights the need for assessment of DSH in ADS patients.

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# Incidence of Anencephaly in a tertiary care hospital in North West India

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**Abstract- Background:** Anencephaly is a neural tube defect (NTD) which is due to defective closure of cranial neuropore. This NTD is associated with other congenital anomalies in most of the cases. This study was undertaken to determine the incidence of anencephaly among congenital malformations seen at autopsy. The study aims to identify the risk factors associated with anencephaly in our population. Attempt was made to correlate the incidence with associated systemic anomalies, maternal age, birth order and sex of the fetus.

**Material & method:** Data was tabulated on 520 foetal autopsies obtained out of 18744 births in a tertiary care hospital for a period of 3years from August 2011 to July 2014.

**Results:** Out of the total 520 autopsies, congenital malformations (CMF) were observed in 187 (36%) fetuses obtained from spontaneous /therapeutic abortions. 115 (61.4%) cases showed neural tube defects. NTD's accounted to 22.11% of all fetal autopsies. Anencephaly was the most prevalent anomaly observed in 69 cases (60% of NTD's), 13.3% of total autopsies. In 40 cases (58%) anencephaly was associated with other systemic anomalies such as cardiac defects, GIT defects and polycystic kidneys. No significant statistical correlation could be established regarding the sex of the anencephalic fetus. However mothers in the age group of 20-25 years reported highest number (54.4%) of anencephalic fetuses. Maximum anencephalic fetuses were born to primigravida mothers (38.2%). Regarding their socio-economic status 48% cases were from upper lower class and in 35% cases mothers were high school drop outs.

**Conclusion:** Prenatal screening of the fetus is of utmost importance to rule out the presence of any CMF. To prevent NTD's, peri-conceptional folic acid supplementation should be provided to low socio-economic females. Pathological examination of the abortus is essential to document associated anomalies.

**Index Terms-** Anencephaly, Fetal autopsy, Neural tube defects, Systemic anomalies.

## I. INTRODUCTION

Anencephaly is a neural tube defect that is incompatible with life.<sup>[1]</sup> Anencephaly (*Gr. An*, without+ *enkephalos*, brain) is an anomaly caused by the failure of the rostral end of the neural tube to develop. Failure of closure of the cranial neuropore between the third and fourth week of gestation (23rd and 26th embryonic day; 18-20 somite stage)<sup>[2]</sup> results in major portion of the brain, skull, and scalp being absent, though brain stem is

intact.<sup>[3]</sup> Although the eyes are present, the optic nerves are absent.<sup>[2]</sup> Other names like acrania (absence of skull), acephaly (absence of head) merocrania, exencephaly and meroanencephaly are also used instead of anencephaly.<sup>[4]</sup> In anencephaly, the influence of the expanding brain is removed, and secondary adaptive alterations in the cranial base occur. The squamo-occipital bones are under developed compared with the normal standards. In anencephaly the bones derived from chondrocranium are not as severely affected morphologically as those derived from the neurocranium.<sup>[5]</sup> In some cases closure defect of neural tube extends caudally into spinal cord, and the abnormality is called craniorachischisis. Anencephalic fetuses lack a swallowing reflex, the last 2 months of pregnancy are characterised with polyhydramnios.<sup>[6]</sup>

The birth prevalence of NTD's including anencephaly, is highly variable and is dependent upon geographical location, race and sex. According to standard textbooks, anencephaly occurs in 1/5000 births.<sup>[6]</sup> It is twice or four times more common in female fetuses.<sup>[7]</sup> A wide range of frequency has been quoted from different parts of India. Its about 1.8 to 7 per 1000 live births.<sup>[8,10,11]</sup>

The cause of anencephaly is disputed. Anencephaly can be induced experimentally in rats by using teratogenic agents and abortuses suggest that the process is similar in humans. Genetic factors are certainly involved because of well-established familial incidence of these defects.<sup>[7]</sup> The rates of chromosomal abnormalities range from 7-16%. It is more likely to find chromosomal abnormality if anencephaly is associated with other malformations. Trisomy 18 is a common abnormality found at mid-trimester in an anencephalic fetus whereas triploidies are more common in first trimester.<sup>[12,13,14]</sup> Several candidate genes (more than 100) are now associated with the risk of NTD's. These genes are related to folate, glucose, retinoid, inositol metabolism. Also others are related to apoptosis or developmental pathways such as Sonic Hedgehog, Planar Cell Polarity pathway. There is also evidence that genes related to structure and function of actin cytoskeleton when mutated impedes the elevation of neural folds causing these malformations.<sup>[15]</sup> Thus the most accepted inheritance of anencephaly is multifactorial inheritance.<sup>[7]</sup>

A study now confirms a suspected epidemiological link between parents' occupation and anencephaly. A nearly five fold increase in risk of anencephaly for mothers exposed to pesticides resulted while working in agriculture during the acute risk period. Fathers who were exposed to pesticides at any time while working in agriculture had twice the risk of having an anencephalic child. Chlorpyrifos and methyl parathion, have

also been previously linked with possible reproductive ill effects.<sup>[16]</sup>

Recurrence rate after one affected pregnancy is two to three percent for any open neural tube defect. Rare families have reported with X-linked inheritance. Women taking certain medications for epilepsy like valproic acid, folic acid antagonists (such as methotrexate), women with insulin-dependent diabetes mellitus, hyperthermia and folic acid deficiency are associated with increase risk of NTDs. Radiation, infectious agents like CMV, rubella, toxoplasma gondii, certain drugs like aminopterin and maternal alcohol abuse especially are known teratogens causing anencephaly.<sup>[7]</sup> Hibbard and Smithells (1965), were first to suggest a possible link between folate deficiency and NTD's.<sup>[17]</sup> The birth prevalence of NTDs in the United States has decreased by approximately 25%, to 1/1500 births after fortification of flour with folic acid was instituted in 1998.<sup>[2]</sup> Advanced maternal age is a stronger risk factor for spina-bifida than for anencephaly.<sup>[18]</sup>

Anencephaly can be diagnosed by ultrasound examination (USG), MRI, fetoscopy and radiography as extensive parts of brain and calvaria are absent.<sup>[7]</sup> This anomaly can be diagnosed by 11-12 weeks of pregnancy (by application of alpha protein screening). A study conducted in India, during the antenatal period detected 27 (1.55%) cases of anomalies whereas only 8.48% anomalies were diagnosed by USG.<sup>[19]</sup> Pathological examination of the abortus is essential, as in most of the cases anencephaly is associated with systemic anomalies.<sup>[5]</sup>

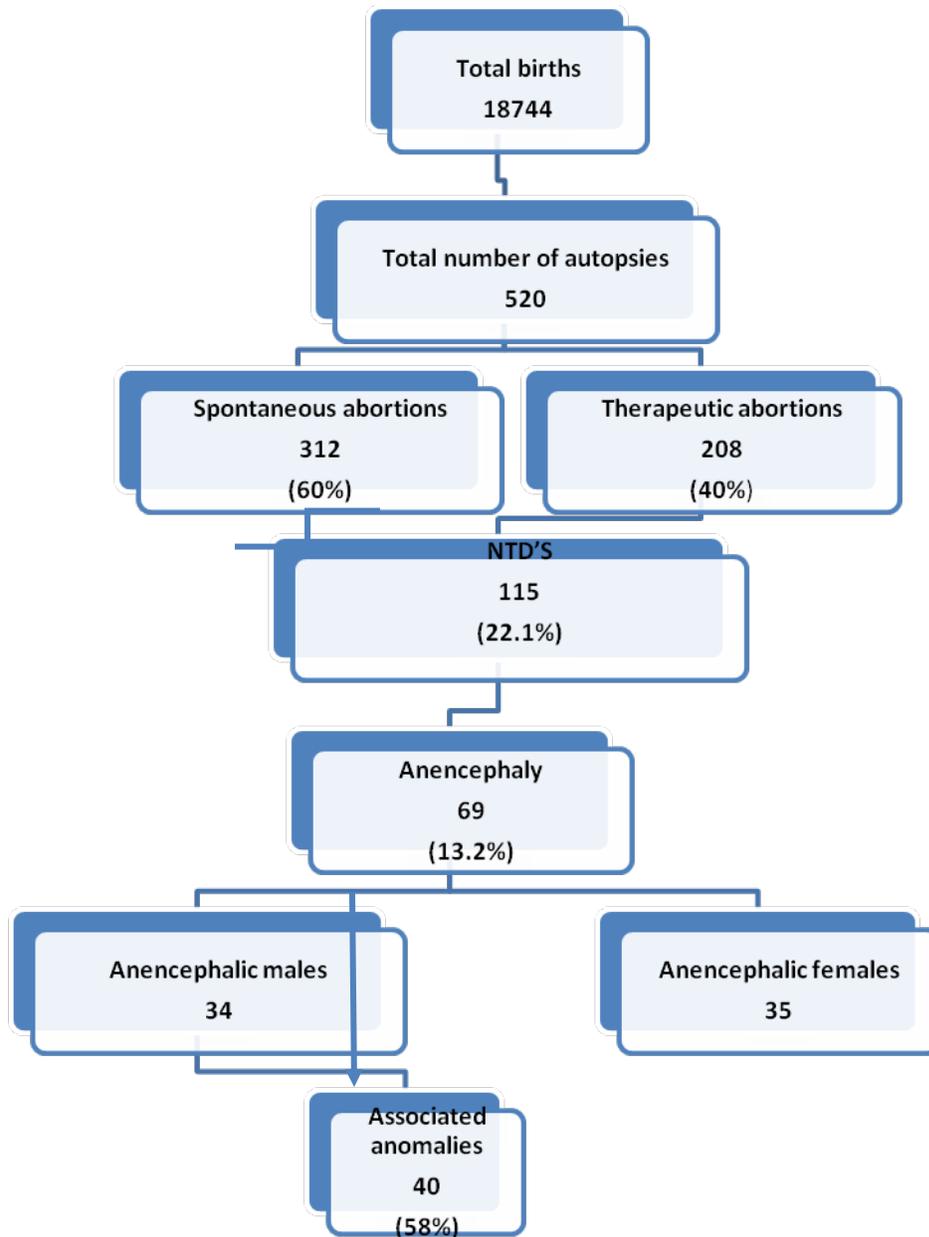
## II. MATERIAL AND METHODS

This study was conducted on 18744 births in a tertiary care centre for a period of 3 years from August 2011 to July 2014. 520 fetal autopsies were performed in this institute in the department of anatomy during this period. These cases originated

from spontaneous or therapeutic abortions received from the obstetrics and gynaecological department of the institute. Prior to autopsy, prenatal investigations such as ultra sound and radiographs were procured and a brief maternal and family history regarding socioeconomic status, maternal education level & addiction of father to alcohol and tobacco was noted. The updated Kuppaswamy's socioeconomic scale for 2012<sup>[20]</sup> was used to assess the family and education status. Consent for autopsy was taken from parents/relatives on a Proforma prepared in accordance with guidelines provided by the ethics committee which conforms to the provisions of the Declaration of Helsinki in 1995. Autopsies were performed as per guidelines provided by fetal autopsy protocol (Siebert and Kapur, 2001; WHO, 2007).<sup>[21]</sup> The autopsies included reading of the clinical findings, external examination, photography and internal examination. All the observations were recorded paying more attention to associated systemic anomalies. Other parameters registered were Gestational age (supplied by the clinical records), sex of fetus, incidence, frequency in relation to parity, maternal age and isolated or as a part of syndrome. The statistical analysis was performed by using frequency and percentage.

## III. RESULTS

Fig. 1 shows the profile of all autopsy cases. 60% fetuses were the result of spontaneous abortions while rest of the fetuses were clinically aborted after manifestation of CMF. 187(36%) fetuses were found to be congenitally malformed; out of these neural tube defects were present in 115(61.4%) fetuses. The overall percentage of NTD was 22.1% in 520 autopsies. The most prevalent NTD was anencephaly observed in 69 (60%) fetuses. The overall percentage of anencephaly was 13.3% in 520 autopsied fetuses.



**Figure1: .Profile of all autopsy cases.**

On a larger scale; when total numbers of hospital births were calculated (table 1) the incidence of anencephaly turned out to be 0.4%.

The incidence of anencephaly was correlated with various maternal and other factors.

**Table 1: Annual Incidence of anencephalic births in hospital**

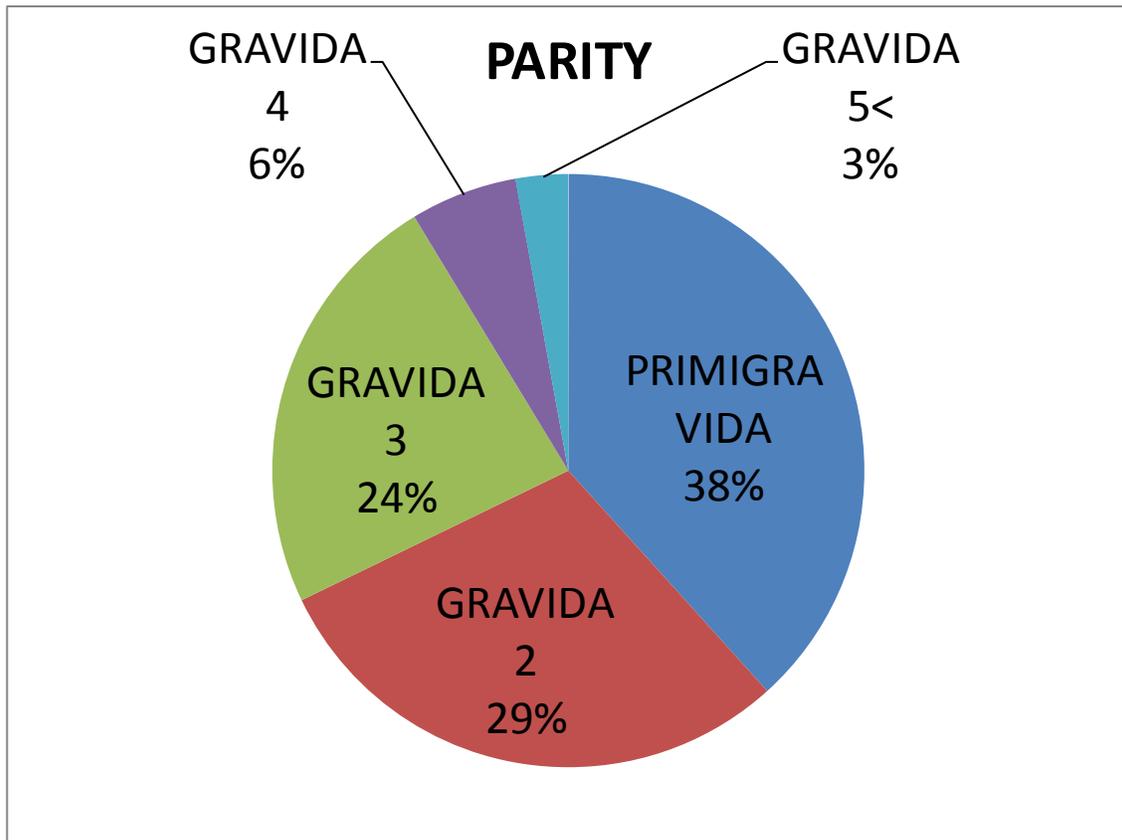
Year	Total no. of births	No. of fetal autopsies	Total CMF	Total NTD'S	Anencephalic births
2011 ( Aug-Dec)	2386	54	25	12	5
2012	5728	179	77	45	23
2013	6200	198	50	32	25
2014	4430	88	35	26	16
Total	18744	520(2.77%)	187(1%)	115(0.6%)	69(0.4%)

- a) **Maternal Age:** minimum age of mother observed was 19 years and maximum was 35years. The maternal age for 54.4% fetuses was between 20-25 years followed by 35% in 26-30 years (Table 2)

**Table 2: Frequency of anencephaly in relation to maternal age**

Maternal age	NO. Of cases
<20 yrs	1(1.4%)
20-25yrs	37(54.4%)
26-30yrs	24(35.2%)
31-35yrs	6(8.8%)
>35yrs	zero

- b) **Parity:** Out of 68 mothers 26 were primigravida (38.2%), Twenty were gravida 2 (29.4%), sixteen were gravida 3(23.5%) and four cases were gravida 4(5.8 %) , one was gravida 5(1.4%) and one was gravida 6(1.4%). As seen in Fig.2, anencephaly was more prevalent in primigravida (37.6%), the incidence decreased with the increase in parity.



**Figure 2: Frequency of anencephaly in relation to parity**

- c) **Sex:** No sexual preponderance was noticed. Out of 69 fetuses, 34 were males(49.2%), 35 were females(50.7%)and none of the fetuses had ambiguous genitalia
- d) **Gestational age:** Gestational age ranged from 12 to 29 weeks with mean of 19 weeks. Spontaneous abortions were seen in 10 cases of anencephaly with minimum gestational age of 19 weeks and maximum of 26<sup>+6</sup> weeks

**Table 3: Frequency of anencephaly in relation to Gestational age**

Gestational age	Total No. (%)
11-15 wks	11(15.9%)
16-20 wks	46(66.6%)
21-25wks	9(13%)
26-30 wks	3(4.3%)

The manifestation of anencephaly was maximum (66.6%) in the 16-20 weeks of gestation. In very few cases (4.3%), the anencephaly becomes symptomatic after 6 months of intrauterine life.

The recent National Family Health Survey (NFHS-3) revealed that about 44% of pregnant women sought antenatal care after 16 weeks of gestation as observed in our study also. Most of the mothers were from rural area and they were agricultural labours. The cases were diagnosed at the time of ultrasound examination during their visit to our hospital and they were advised medical termination of pregnancy

**Associated anomalies:** Anencephaly is not the only malformation present in a fetus, which was proved by the fact that 58% anencephalic fetuses also had some other systemic anomaly (Table 4) 36.23% anencephalic fetuses exhibited other neural tube disorders including rachischisis, meningomyelocele and encephalocele. In all anencephalic cases the fetus presented a toad face with protruding eyes, flattened nasal bridge, a very short neck and absence of cerebral hemispheres and skull. (Fig 6) Other Central nervous system (CNS) anomalies observed in association were cranio-spinalrachischisis in twenty cases (Fig 4) out of which in five cases it extended to the lumbar region & in three cases to whole of the vertebral column thereby exposing the spinal cord (Fig 5). Spina bifida was observed in four anencephalic fetuses. One case of anencephaly had a meningomyelocele in thoracic region and another with encephalocele of occipital region.

In nine fetuses (11.5%), anencephaly was associated with dysmorphic facial features, including cleft lip in two cases. One fetus presented with micrognathia, webbed neck, bilobed right lung, absent scrotum with inverted foot and a dysmorphic pinna. Low set ears were observed in five cases & in one anencephalic fetus a single nostril was seen. (Fig 6).

In 17.3% anencephalic fetuses respiratory anomalies were also present as hypoplasia of lung (bilateral-2, unilateral -2). In

one case no fissure was present in both right and left lungs. Bilobed right lung was present in eight cases.

Anencephalic fetuses also exhibited cardiovascular anomalies (CVS) in 13.4% cases, GIT anomalies in 18.8%, urogenital defects in 18.8%, and skeletal anomalies in 10% fetuses.

The CVS anomalies were presence of single umbilical artery in six cases. Dextrocardia as a part of situs inverses was observed in one case (Fig 7) and non development of diaphragm in another case (Fig 8). Position of heart chambers were reversed in one case.

The GIT anomalies observed were diaphragmatic hernias in five cases. In one fetus it was combined with ascites and ectopic position of appendix. In another case the ascending colon along with transverse colon pushed into midline and a diaphragmatic hernia was present. Sub hepatic appendix was observed in three anencephalic fetuses reflecting delay in development of other systems.

Malrotation of gut was spotted in four anencephalic fetuses. Anencephaly along with omphalocele was observed in two cases, out of which in one case the ascending colon was present in the left hypogastric region. Another case showing imperforate anus with common opening of ureter and anus was spotted.

The skeletal anomalies were observed in 10% of anencephalic fetuses. Polydactyly was present in (bilateral -2 ,unilateral-1) three fetuses, in one case associated skeletal anomalies were cleft palate with cleft lip. Other skeletal anomalies were in the form of scoliosis and fusion of lower limbs (Fig 9).

Genito- urinary abnormalities were present in 18.8% of anencephalic fetuses. Bladder with dilated left ureter was detected as a part of Prune Belly syndrome. Unilateral absence of kidney was noted in one case and horse shoe kidney in another. Two anencephalic fetuses had both their ureters dilated .Bilateral polycystic kidneys were present in three cases.

**Table 4: Systemic anomalies associated with anencephaly**

SYSTEM	Associated anomalies (No. of cases )
C.N.S	cranio-spinalrachischisis (20) , Spina bifida (4), meningomyelocele (1)
Head and Neck	cleft lip (2), Micrognathia with webbed neck, dysmorphic pinna (1), low set ears(5), single nostril (1)
Respiratory	B/L Hypoplastic lungs (2), right lung hypoplasia (8), Bilobed right lung (2)

Cardiovascular	single umbilical artery (6), dextrocardia (2), reversal of heart chambers (1)
GIT	Diaphragmatic hernia (4), malrotation of gut (4), Omphalocele (2), Imperforate anus (1), sigmoid colon opening in ureter (1), common opening of ureter & anus (1)
Skeletal	club foot (3), bilateral polydactyly (2), fused lower limbs (1), scoliosis (1), Simian crease (2)
Genitor-urinary	Absent scrotum (1), unilateral kidney (1), horse shoe kidney (1), dilated ureters (bilateral-2, unilateral-1), B/L polycystic kidneys (3)

In two instances Anencephaly was part of a well defined syndrome such as Meckel Gruber syndrome and OEIS complex. Two cases of Meckel Gruber syndrome (Polycystic kidneys, polydactyly, liver fibrosis hypoplastic lungs) were discovered. OEIS complex (Omphalocele, cloacal exstrophy, imperforate anus, spinal defects) was spotted in one fetus.

**Social factors**

The families were divided into five socioeconomic stratas according to Kuppuswamy's socioeconomic status scale (2012).<sup>[20]</sup> Almost half of the families (48%) were grouped in the upper lower status followed by lower middle in 17.3% instances.

**Table 5: Frequency of Anencephaly in relation to the socioeconomic status and the mother's education status (Kuppuswamy's socio-economic status scale)<sup>[20]</sup>**

Status	No of cases (%)	Mothers Education	No. of cases (%)
Lower <5	9 (13%)	Illiterate	12(17.4%)
Upper lower (5-10)	34 (49.2%)	Primary	16(23.2%)
Lower middle (11-15)	12 (17.3%)	Middle	5(7.2%)
Upper middle (16-25)	11 (15.9%)	High	24(34.8%)
Upper (26-29)	3 (4.3%)	Graduate & above	12(17.4%)

**Mother's education status:-**

Mother's education and thereby awareness did not prove to be deciding factor as in 35% anencephalic fetuses, mothers were educated upto high school.

**Family History** revealed that out of 69, 10 cases reported previous unhealthy pregnancy. In three cases, parents reported aborting previous anencephalic fetus. Recurrence rate after one affected pregnancy is 2-3% for any open neural tube defect.

**Substance abuses**

In the matter of substance abuse, none of the mothers confirmed the intake of alcohol or any tobacco product. Whereas 22(31.8%) fathers admitted intake of alcohol while 17(24.6%) fathers were addicted to tobacco products in form of ghutkas, bidis and cigarettes.

**Discussion**

NTDs are considered to be polygenic, multifactorial condition wherein many genes, nutrients, environmental factors including infections, drugs and maternal disease like diabetes individually or in combination play a role.<sup>[7]</sup> The maternal risk factors that are associated with anencephaly are illiteracy, increasing gravidity, history of previous miscarriages, positive history of birth defects, high or low age of mothers during pregnancy.<sup>[1,5,22]</sup> Other factors include increased stress, women employed in industry or agriculture,<sup>[16]</sup> low socioeconomic status and maternal antipyretic consumption,<sup>[4]</sup> and consanguineous marriages.<sup>[1,8]</sup>

This study provides detailed information on the incidence of NTD's, anencephaly with its associated anomalies in the northwest population of India. In the present study frequency of neural tube defect was 6.1/1000 live births in the period 2011-2014 comparable to previous study of Mahadeven et al (5.7/1000

births)<sup>[8]</sup> in South India . A wide range of frequency has been quoted from different parts of India and it was 3.9/1000 in Lucknow, 7/1000 in East Delhi<sup>[10]</sup> and 11.4/1000 births in Davangere; Karnataka.<sup>[8]</sup>

Study by Gopalipour et al , 2010<sup>[1]</sup> reported that NTD's accounted for 21.7% of all notified congenital birth defects, with an incidence of 28/10000 live births in northern Iran.<sup>[1]</sup>

Some studies (Chinara & Singh, 1982; Kara basi et al, 2009; Dutta et al, 2010) have reported the incidence of GIT and genitourinary defects to be the highest of all the CMF.<sup>[25]</sup> The present study confirms the existing view that neural tube defects are most prevalent congenital malformations as compared to defects in other systems i.e (61%) of all the CMF. This observation is in agreement with the other two fetal studies of the same region (Mohan et al; 2004 and Sankar, et al, 2006, Kapoor et al; 2013)<sup>[25]</sup>.

**Anencephaly** is the most prevalent neural tube defect observed in western and some Indian studies.<sup>[1,8,11,17]</sup> Study in South India reported a frequency of 1.8/1000 in Pondicherry as compared to 3/1000 in Delhi.<sup>[8,10]</sup> Outside India, the incidence of anencephaly was observed as 1.2/ 1000 in Iran, 1.04/ 1000 in China, 0.54/1000 in Singapore, and 5.9/1000 in Dublin.<sup>[1]</sup> The present study reports the incidence as 3.68/1000 births which is comparable to the eastern countries. The prevalence of anencephaly is higher in India. The cause of this discrepancy can be attributed to maternal malnutrition, low education and lack of social awareness.

The association between anencephaly and maternal age is disputable. While some authors are of the opinion that risk of anencephaly increases with advancing age, other studies advocate that it is more prevalent in younger women. The present observations corroborate with the later; i.e 54.4% anencephalic

babies were born to mothers between 20-25 years. Commonest child bearing age of women in India is 20- 28 year.<sup>[4]</sup> Mean age of the mother observed in our study was 26.9 years (range from 19-35 years). Our findings are consistent with published literature.<sup>[4,5]</sup> In contrast, (Caffey & Jessop ,1957; Golalipour et al,2010) observed the prevalence of anencephaly to be more in women over30 and above 35 years respectively.

The association between anencephaly and birth order has been described as U-shaped by Elwood et.al ,1978 , in contrast no association of parity with the aetiology and outcome in neural tube defects have been shown by Paduranga et al;2012<sup>[4]</sup> According to other studies anencephaly was common in primigravida.<sup>[8,17]</sup> Similarly in our study anencephaly was more prevalent in primigravida (37.6%), and the incidence decreased with parity in contrast to the study by Paduranga et al;2012.

The present analysis showed equal preponderance of anencephaly in both the sexes with 34 males and 35 females. On

the contrary some authors have noted female preponderance in the occurrence of anencephaly.<sup>[4,5,22]</sup>

The occurrence of anencephaly could be genetic as is suggested by the presence of associated anomalies. Nielson et al; 2006<sup>[23]</sup> have mentioned the chromosomal abnormalities in 16% of anencephalic cases.<sup>[23]</sup> The associated anomaly could be some other neural tube defect, or systemic anomaly. Table 7 shows the system wise occurrence of associated anomaly in comparison to available literature.

The most prevalent associated anomaly was neural tube disorders (13%) including rachischisis, spina bifida and meningomyelocele. This observation is in concurrence with other authors.<sup>[5,23]</sup> The other associated anomalies include hypoplasia of lungs(5.8%), single umbilical artery(8.7%), diaphragmatic hernia(5.8), malrotation of gut(5.8%),and musculoskeletal defects(11.5%). The present findings are consistent with literature( Table 6).

**Table 6: Comparison of associated anomalies with anencephaly**

System	Tan et al (1984) <sup>[17]</sup>	Vare et al (1971) <sup>[11]</sup>	Nielson et al(2006) <sup>[23]</sup>	Golali pour et al (2010) <sup>[1]</sup>	Panduranga et al (2012) <sup>[4]</sup>	Eslavath et al (2013) <sup>[5]</sup>	Present study(2015)
Total incidence of CMF	9.4	-	43	42.9	73	77.7	58
Head & neck	No	7.5	14	3.5	2.5	11.1	13
Respiratory System	3	NAD	NAD	NAD	2.5	NAD	17.3
CVS	3	7.5	4.75	1.7	14.5	33.3	13
GIT	29	32	NAD	5.3	14.5	22.2	13
Renal	3	27	12	3.5	NAD	NAD	11.5
Musculo-skeletal	20	14.5	16.5	8.9	14.5	11.1	10.1
Genital	NAD	5	NAD	NAD	12	NAD	1.4
Diaphragmatic hernia	NAD	5 2cases	2.3	NAD	1	NAD	5.7 4cases

NAD= No anomaly detected

In USA, the prevalence of anencephaly was highest among Hispanic births, followed by non-Hispanic white births, with the lowest prevalence among non- Hispanic black births. Considering the parental ethnicity, the prevalence of anencephaly was 12, 16, and 7 per 10000 in Fars, Turkman, and Sistani ethnicity in Northern Iran.<sup>[1]</sup> The race specific incidence of anencephaly was 7.6/10000 live births in Malaya population , higher than 5.5/10000 in the Chinese . The difference in races

and ethnicities could possibly suggest role of dietary factors and a genetic disposition.

In support of dietary deficiency, it was noticed that , there was a decline in anencephaly after starting the fortification program in South Africa, USA, Canada and Iran .<sup>[1]</sup> In Singapore, the decline was from 0.54/1000 in 1993 to 0.32/1000 in 2002.<sup>[17]</sup> Significant decline in anencephaly was observed among Hispanic births and non-Hispanic white births after fortification.<sup>[1]</sup>

Therefore the major thrust of primary prevention of NTDs has been on nutritional supplementation with folic acid apart from controlling the maternal diseases like diabetes and avoiding medications. Role of 0.4 mg of periconceptual folic acid leading to reduction in NTDs was demonstrated by Medical Research Council Vitamin study,<sup>[24]</sup> and also by Kulkarni *et al.* in India.<sup>[9]</sup> Currently there is no national program for primary prevention of NTD in India. National anemia prevention program provides 0.5 mg of folic acid along with 100mg of elemental iron from third month of pregnancy. The recent National Family Health Survey (NFHS-3) <sup>[26]</sup> revealed that about 44% of pregnant women sought antenatal care after 16 weeks of gestation as observed in our study as well. Thus only a small percentage of women receive Periconceptual folic acid supplementation.<sup>[4]</sup> Fortification of flour in India is not uniform; it varies from state to state with highest percentage in Gujarat. The benefit of fortification of flour still needs to be established in India.

In the present study also anencephaly was more commonly seen in mothers belonging to low socioeconomic class (62.2 %.) as compared to 4.3% in upper class estimated according to Kuppaswamy's socioeconomic scale 2012. However illiteracy could not be diagnosed as a relevant parameter as anencephaly was present with equal incidence of 17.4% in illiterates and graduates respectively. No association with consanguinity could be noted as consanguineous marriages are not common in India.

Anencephaly can be diagnosed as early as 11-14 weeks of gestation by USG and by measuring the values of serum alpha feto protein level in maternal blood. A high prenatal detection rate (100%) for anencephaly was reported from the Czech republic for anencephaly.<sup>[1]</sup> However in a developing country like India, sensitization is required for pregnant females to get antenatal check-up as soon as possible.

**Conclusions**

Better knowledge of unexpected fetal loss is the promise for better parental counselling and for prevention of recurrences. Understanding and identifying the risk factors associated with anencephaly in our population, allows approaches to avoid them and thereby lower the incidence of anencephaly in our population. Prenatal screening in a tertiary care hospital is of utmost importance to rule out CMF. 1<sup>st</sup> trimester antenatal check up of mothers should be made mandatory. To prevent NTD, dietary supplements should be provided to low socioeconomic pregnant females. Peri-conceptual and 1st trimester folic acid supplementation is of prime importance.. There should be obligatory reporting of all CMF all over the country to assess the incidence accurately. Autopsy is the gold standard to document the incidence, possible causes and associated systemic anomalies.

**Table 7: Comparison of anencephaly & its various parameters with available literature**

Authors	Live Births	Fetal Autopsy	Incidence Of CMF	Incidence of NTD	Incidence of anencephaly	Mothers age	Parity	Sexual difference (M/F)
Eslavath et al (2013)		103	34cases 33%	17cases 50% of CMF	9cases 13.8%	20-29yrs	P(55.5%) G2(33.3%) G3(11%)	5:4
Paduranga et al (2012)		41	-	-		19-28yrs	P(48.5%) G2(10%) G3(31.5%) G4(10%)	27:9:A
Golailipour Et al (2010)	49534		-	2.8/1000	1.2/1000 Prevalence 12/10000	1.31/1000 >35yrs Not significant		27:29
Nielsen et al (2006)		1984	-	4.9%	2.1%	-	-	51:46
Mahadevan et al (2005)	54738			5.7/1000	1.8/1000	80% in 21-30 yrs	P-40.6%	0.6:1

Tan et al (1984)	171773				0.54/1000	25-29yrs	P(41%) G2(24.7%) G3(21.5%) G4<(13%)	1.38:1
Coffey et al (1957)	23000				5.9/1000	30-34yrs	>Primigravida	1:4.2
Present Study	18744	520	36% of autopsy	22.1% Of autopsy	6.1/1000	20-25yrs	P(37.6%) G2(28.9%) G3(23%) G4<(8.6%)	34:35

P=Primigravida;,G=Gravida, M=male, F=female, A:=ambiguous

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**Table 1: Annual Incidence of anencephalic births in hospital**

Year	Total no. Of births	No. of fetal autopsies	Total CMF	Total NTD'S	Anencephalic births
2011 Aug-Dec	2386	54	25	12	5
2012	5728	179	77	45	23
2013	6200	198	50	32	25
2014	4430	88	35	26	16
Total	18744	520(2.77%)	187(1%)	115(0.6%)	69(0.4%)

**Table 2: Frequency of anencephaly in relation to maternal age**

Maternal age	No. of cases (%)
<20 yrs	1(1.4%)
20-25yrs	37(54.4%)
26-30yrs	24(35.2%)
31-35yrs	6(8.8%)
>35yrs	zero

**Table 3: Frequency of anencephaly in relation to Gestational age**

Gestational age	Total No(%)
11-15 wks	11(15.9%)
16-20 wks	46(66.6%)
21-25wks	9(13%)
26-30 wks	3(4.3%)

**Table 4: Systemic anomalies associated with anencephaly**

SYSTEM	Associated anomalies (No. of cases )
C.N.S	craniorachischisis (20) , Spina bifida (4), meningomylocoele (1)
Head and Neck	cleft lip (2), Micrognathia with webbed neck, dysmorphic pinna (1), low set ears(5), single nostril (1)
Respiratory	B/L Hypoplastic lungs (2), right lung hypoplasia (8), Bilobed right lung (2)
Cardiovascular	single umbilical artery (6), dextrocardia (2), reversal of heart chambers (1)
GIT	Diaphragmatic hernia (4),malrotation of gut (4), Omphalocele (2), Imperforate anus (1), sigmoid colon opening in ureter (1), common opening of ureter & anus(1)
Skeletal	club foot(3), bilateral polydactyly (2), fused lower limbs (1), scoliosis (1), Simian crease (2)
Genitor-urinary	Absent scortum (1), unilateral kidney(1),horse shoe kidney (1), dilated ureters (bilateral-2, unilateral-1), B/L polycystic kidneys (3)

**Table 5 : Frequency of Anencephaly in relation to the socioeconomic status and the mother's education status (Kuppuswamy 's socio-economic status scale)**

Status	No of cases (%)	Mothers Education	No. of cases (%)
Lower <5	9 (13%)	Illiterate	12(17.4%)
Upper lower (5-10)	34 (49.2%)	Primary	16(23.2%)
Lower middle (11-15)	12 (17.3%)	Middle	5(7.2%)
Upper middle (16-25)	11 (15.9%)	High	24(34.8%)
Upper (26-29)	3 (4.3%)	Graduate & above	12(17.4%)

**Table 6 : Comparison of associated anomalies with anencephaly**

System	Tan et al (1984) <sup>[17]</sup>	Vare et al(1971) <sup>[11]</sup>	Nielson et al(2006) <sup>[23]</sup>	Golali pur et al (2010) <sup>[1]</sup>	Panduranga et al (2012) <sup>[4]</sup>	Eslavath et al (2013) <sup>[5]</sup>	Present study (2015)
Total incidence of CMF	9.4	-	43	42.9	73	77.7	58
Head & neck	No	7.5	14	3.5	2.5	11.1	13
Respiratory System	3	NAD	NAD	NAD	2.5	NAD	17.3
CVS	3	7.5	4.75	1.7	14.5	33.3	13
GIT	29	32	NAD	5.3	14.5	22.2	13
Renal	3	27	12	3.5	NAD	NAD	11.5
Musculo-skeletal	20	14.5	16.5	8.9	14.5	11.1	10.1
Genital	NAD	5	NAD	NAD	12	NAD	1.4
Diaphragmatic hernia	NAD	5 2cases	2.3	NAD	1	NAD	5.7 4cases

NAD = No anomaly detected

**Table 7: Comparison of anencephaly & its various parameters with available literature**

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P= Primigravida, G=gravid, M=male, F=female, A= ambiguous

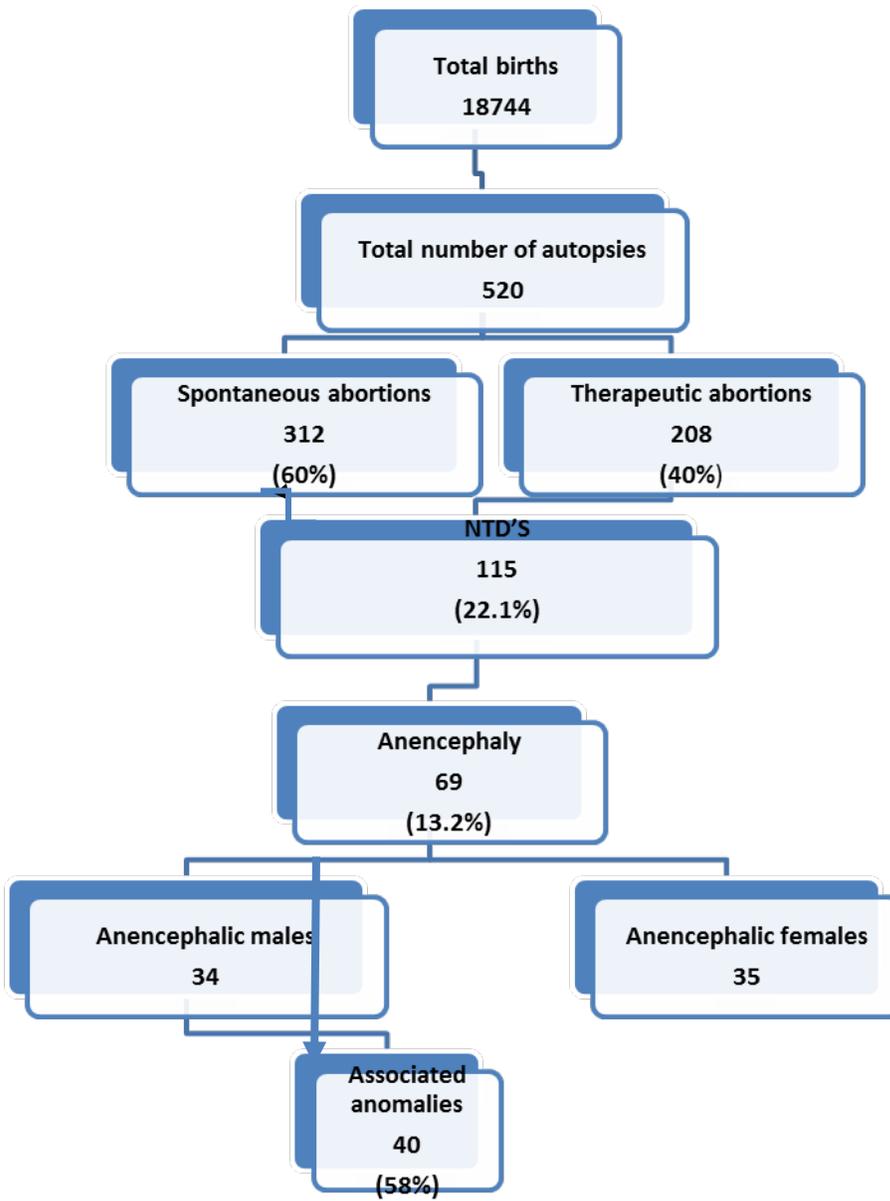


Fig 1:Profile of all autopsy cases

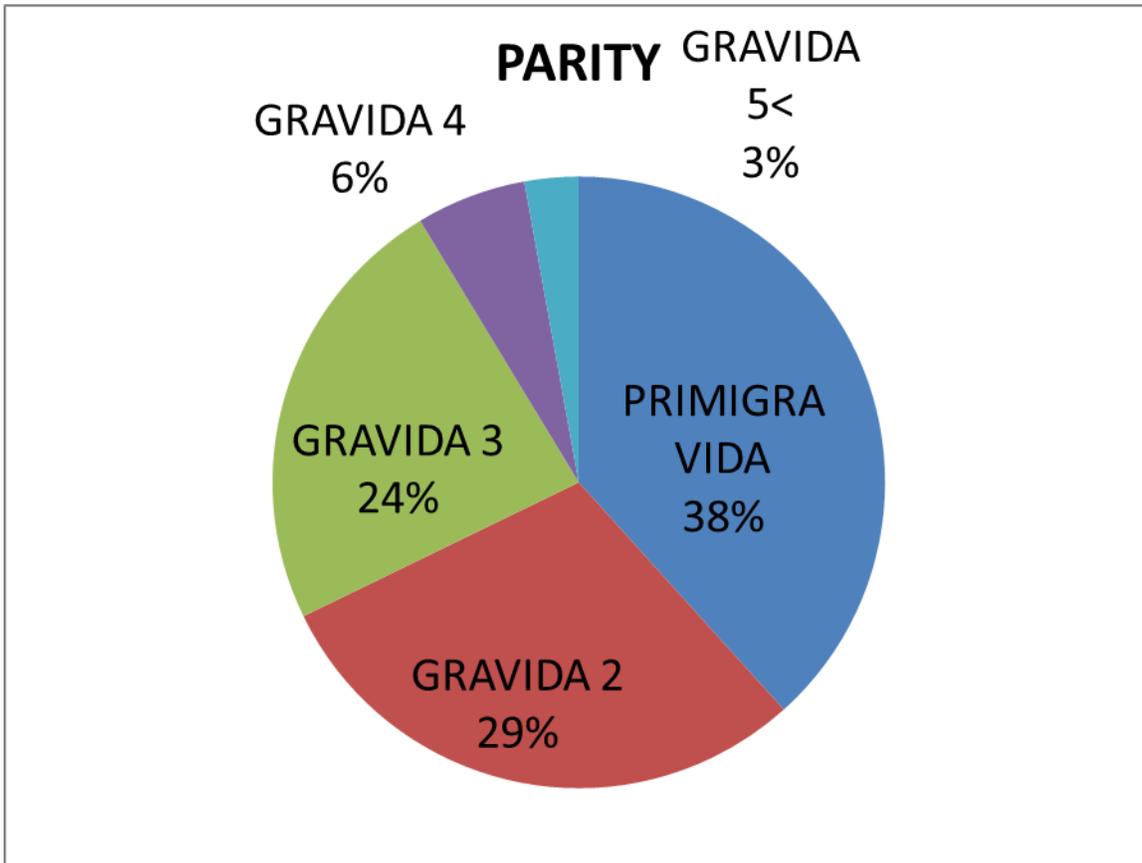


Fig. 2: Frequency of anencephaly in relation to parity

**Figures with legends**



**Figure 3: Anencephaly with uro-genital disorders (Horse shoe kidney, bilateral dilated ureters and sigmoid colon opening in urinary bladder)**



**Figure 4: Anencephaly and craniorachischisis**



**Figure 5: Anencephaly with open spinal cord**

**Figures with legends**



**Figure 6: Anencephalic fetus with toad face and single nostril (Proboscis)**



**Figure 7: Anencephaly with situs inversus**



**Fig 8: Anencephaly with dextrocardia and diaphragmatic hernia**



**Figure 9: Anencephaly with fused lower limbs**



# Performance Improvement of QoS Routing In WSN System

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**Abstract-** Due to the restricted communication range and high density of sensor nodes, packet forwarding in sensor networks is usually performed through multi-hop data transmission. Therefore, routing in wireless sensor networks has been considered an important field of research over the past decade. Nowadays, multipath routing approach is widely used in wireless sensor networks to improve network performance through efficient utilization of available network resources.

The field of wireless networking emerges from the integration of personal computing, cellular technology, and the Internet. This is due to the increasing interactions between communication and computing, which is changing information access from "anytime anywhere" into "all the time, everywhere". With the increased application of wireless sensor networks (WSNs) to military and civilian environments, securing the data in the network has become a critical issue. The severe resource constraints of sensor nodes and the broadcast nature of the wireless links as well as the challenging deployment environments of wireless sensor networks pose challenges for the quality and security of data transmission for these networks. In order to ensure data security and quality of service required by an application in an energy efficient way, we propose a mechanism for QoS routing with coding and selective encryption scheme for WSNs.

**Index Terms-** Wireless sensor network, Quality of service , Routing techniques ,coding.

## 1. INTRODUCTION

Wireless sensor network (WSN) is the collection of these homogenous, self-organized nodes called sensor nodes. These nodes have the capabilities of sensing, processing and communication of data with each other wirelessly using radio frequency channel. WSNs are resource constrained distributed systems with low energy, low bandwidth and short communication range. The basic features which make WSNs different from the traditional networks are; self-organizing capabilities, short range communication, multi-hop routing, dense deployment, limitation in energy and memory, and also frequently changing topology due to fading and failures. The constrained resource nature and unpredictable network structure (sensor nodes are scattered densely in an environment) poses numerous design and communication challenges for WSNs. All nodes in a network communicate with each other via wireless communication. Moreover, the energy required to transmit a

message is about twice as great as the energy needed to receive the same message. The route of each message destined to the base station is really crucial in terms network lifetime: e.g., using short routes to the base station that contains nodes with depleted batteries may yield decreased network lifetime. Always selecting the shortest route towards the base station causes the intermediate nodes to deplete faster, this results in a decreased network lifetime & also result in lowest energy consumption and lowest network delay.

Basically, each sensor node comprises sensing, processing, transmission, mobilize, position finding system, and power units. Sensor nodes are usually scattered in a sensor field, which is an area where the sensor nodes are deployed. Sensor nodes coordinate among themselves to produce high-quality information about the physical environment. Each sensor node bases its decisions on its mission, the information it currently has, and its knowledge of its computing, communication, and energy resources. Each of these scattered sensor nodes has the capability to collect and route data either to other sensors or back to an external base station. A base-station may be a fixed node or a mobile node capable of connecting the sensor network to an existing communications infrastructure or to the Internet where a user can have access to the reported data.

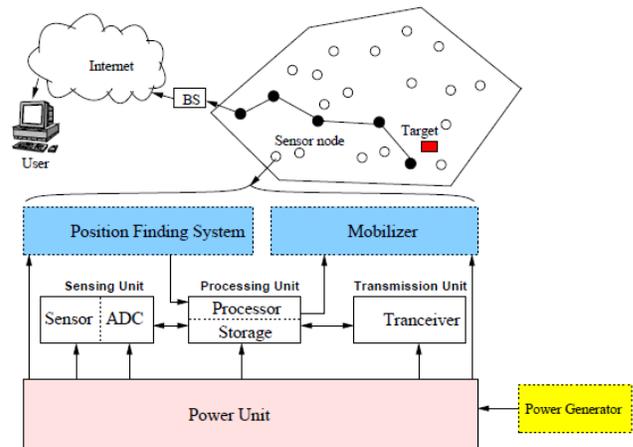


Fig 1: component of sensor node

Finally, the routing objectives are tailored by the application; e.g., real-time applications require minimal network delay, while applications performing statistical computations may require

maximized network lifetime. Hence, different routing mechanisms have been proposed for different applications. These routing mechanisms primarily differ in terms of routing objectives and routing techniques, where the techniques are mainly influenced by the network characteristics.

Resource constraints apply to both sensors and actuators, notwithstanding. In the presence of resource constraints, the network QoS may suffer from the unavailability of computing and/or communication resources. For instance, a number of nodes that want to transmit messages over the same WSN have to compete for the limited bandwidth that the network is able to provide. As a consequence, some data transmissions will possibly experience large delays, resulting in low level of QoS. Due to the limited memory size, data packets may be dropped before the nodes successfully send them to the destination. Therefore, it is of critical importance to use the available resources in WSNs in a very efficient way. WSNs must be adaptive and flexible at runtime with respect to changes in available resources. For example, when an intermediate node dies, the network should still be able to guarantee real-time and reliable communication by exploiting appropriate protocols and algorithms.

The remaining section of the paper are as follows: In section 2 we describe routing and routing objectives in WSN, taxonomy of routing protocols and routing challenges. In section 3 QoS model of WSN and challenges support for QoS. In section 4 coding in WSN. Finally, conclusion is outlined in section 5.

## 2. ROUTING IN WSN

Routing is an essential problem in any type of networks. Compared with existing routing protocols, secure routing or WSNs is a very challenging task due to the severe resource constraints of sensor nodes; the broadcast nature of the wireless links makes the WSNs vulnerable to link attacks that include passive eavesdropping, active impersonation, message replay and message distortion, dynamically changing in the size and density of the network, as well as the high risk of physical attacks to sensors.

The design of routing protocols for WSNs is challenging because of several network constraints. WSNs suffer from the limitations of several network resources, for example, energy, bandwidth, central processing unit, and storage .

The performance demands of the wireless sensor networks are application specific, routing protocols should be able to satisfy the QoS demands of the application for which the network is being deployed[3].

### Routing Objectives:-

**Non-real time delivery:** The assurance of message delivery is indispensable for all routing protocols. It means that the protocol should always find the route between the communicating nodes, if it really exists. This correctness property can be proven in a formal way, while the average-case performance can be evaluated by measuring the message delivery ratio.

**Real-time delivery:** Some applications require that a message must be delivered within a specified time, otherwise the message becomes useless or its information content is decreasing after the time bound. Therefore, the main objective of these protocols is to completely control the network delay. The average-case

performance of these protocols can be evaluated by measuring the message delivery ratio with time constraints.

**Network lifetime:** This protocol objective is crucial for those networks, where the application must run on sensor nodes as long as possible. The protocols aiming this concern try to balance the energy consumption equally among nodes considering their residual energy levels. However, the metric used to determine the network lifetime is also application dependent. Most protocols assume that every node is equally important and they use the time until the first node dies as a metric, or the average energy consumption of the nodes as another metric. If nodes are not equally important, then the time until the last or high-priority nodes die can be a reasonable metric.

### The Taxonomy of Routing Protocols:-

Many routing solutions that have been specifically designed for WSNs[5]. These routing techniques can be classified according to the protocol operation as negotiation based, query based, QoS based, and multi-path based, as depicted in Fig. 1.

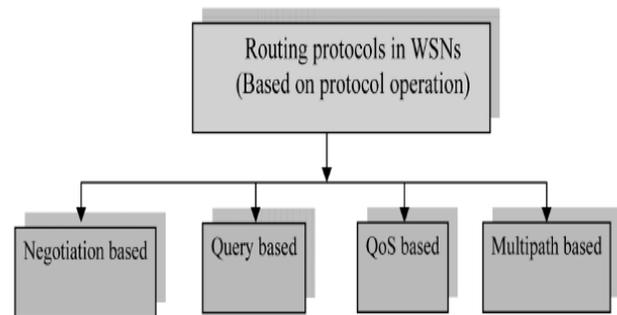


Fig 1: Classification of routing protocol based on protocol Operation

The negotiation based protocols have the objective to eliminate the redundant data by including high level data descriptors in the message exchange. In query based protocols, the sink node initiates the communication by broadcasting a query for data over the network. The multipath based protocols were initiated with objectives to provide reliability and to balance the traffic load in the network. These protocols use multipath in order to achieve better energy efficiency and network robustness in case of node failures. Multi-path routing protocols have been discussed in WSN literature for several years now.

QoS based protocols allow sensor nodes to balance between the energy consumption and certain pre-determined QoS metrics, such as delay, energy, reliability, bandwidth, etc., before they deliver the data to the sink node.

## 3. ROUTING CHALLENGES IN WSN

**Limited energy capacity:** Since sensor nodes are battery powered, they have limited energy capacity. Energy poses a big challenge for network designers in hostile environments, for example, a battlefield, where it is impossible to access the sensors and recharge their batteries. Thus, routing protocols designed for sensors should be as energy efficient as possible to extend their lifetime.

**Sensor locations:** Most of the proposed protocols assume that the sensors either are equipped with global positioning system (GPS)

receivers or use some localization technique to learn about their locations.

**Limited hardware resources:** These hardware constraints present many challenges in software development and network protocol design for sensor networks, which must consider not only the energy constraint in sensor nodes, but also the processing and storage capacities of sensor nodes.

**Massive and random node deployment:** In most applications, sensor nodes can be scattered randomly in an intended area or dropped massively over an inaccessible or hostile region. If the resultant distribution of nodes is not uniform, optimal clustering becomes necessary to allow connectivity and enable energy efficient network operation.

**Network characteristics and unreliable environment:** A sensor network usually operates in a dynamic and unreliable environment. The topology of a network changes frequently due to sensor addition, deletion, node failures, damages, or energy depletion. Also, the sensor nodes are linked by a wireless medium, which is noisy, error prone, and time varying. Therefore, routing paths should consider network topology dynamics due to limited energy and sensor mobility as well as increasing the size of the network to maintain specific application requirements in terms of coverage and connectivity.

**Data Aggregation:** Data aggregation technique has been used to achieve energy efficiency and data transfer optimization in a number of routing protocols.

**Diverse sensing application requirements:** Sensor networks have a wide range of diverse applications. No network protocol can meet the requirements of all applications. Therefore, the routing protocols should guarantee data delivery and its accuracy so that the sink can gather the required knowledge about the physical phenomenon on time.

**Scalability:** Routing protocols should be able to scale with the network size. Also, sensors may not necessarily have the same capabilities in terms of energy, processing, sensing, and particularly communication.

#### 4. QoS MODEL OF WSN

A common approach to satisfy some QoS requirements in Wireless Sensor Networks (WSNs) is to use forward error correction (FEC) technique as a replication mechanism in multipath routing to increase data transmission reliability, decrease energy consumption and increase network lifetime while avoiding the costly or impossible data retransmission due to the severe resource constraints of sensor nodes. Routing is an essential problem in any type of networks. Compared with existing routing protocols, secure routing for WSNs is a very challenging task due to the severe resource constraints of sensor nodes; the broadcast nature of the wireless links makes the WSNs vulnerable to link attacks that include passive eavesdropping, active impersonation, message replay and message distortion, dynamically changing in the size and density of the network, as well as the high risk of physical attacks to sensors.

**General QoS model for WSN:**

In recent years, Wireless Sensor Network (WSN) has become one of the cutting edge technologies for low power wireless communication. The fast development of low power wireless

communication devices, the significant development of distributed signal processing, adhoc network protocols and pervasive computing have collectively set a new vision for wireless sensor networks. In majority of WSN applications, a large number of sensor nodes are deployed to gather data based on application domains. This data collection process can be continuous, event driven and query based. Lot of research works have been done on various aspects of WSNs including protocol and architecture, routing, power conservation etc.

Quality of Service (QoS) support in WSNs is still remained as an open field of research from various perspectives. QoS is interpreted by different technical communities by different ways. In general, QoS refers to quality as perceived by the user or application. In networking community, QoS is interpreted as a measure of service quality that the network offers to the end user or application. Figure 2 shows a general QoS model for network.

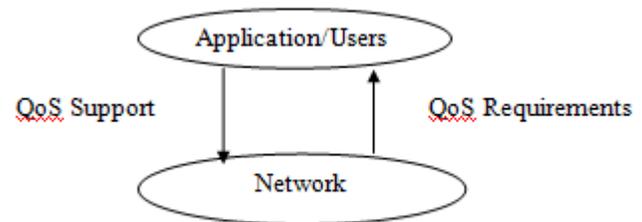


Fig 2: A Simlified QoS model

In traditional data network, QoS defines certain parameters such as packet loss, delay, jitter, bandwidth etc. However, the QoS requirements in WSNs such as data accuracy, aggregation delay, coverage, fault tolerance and network lifetime etc. are application specific and they are different from the traditional end-to-end QoS requirements due to the difference in application domains and network properties. Although some QoS solutions (like IntServ, DiffServ etc) are developed for traditional networks, these cannot be easily ported in WSNs due to

- 1) severe resource constraints in sensors nodes,
- 2) large-scale and random deployment of sensors nodes and
- 3) application specific and data-centric communication protocols in WSNs.

**Challenges for QoS Support in WSNs :**

QoS provisioning in WSN has some significant challenges. Some of such challenges are as follows.

**Extreme Resource Constraint:** Some of the very significant resource constraints in WSN are energy, bandwidth, buffer size and transmission capacity of the sensor nodes. Among these, efficient energy utilization of sensor nodes is a crucial issue as in most of the cases the batteries of the sensor nodes are not rechargeable or replaceable. Efficient bandwidth utilization is also a significant challenge in WSN. The traffics in WSNs can be mixture of real time and non real time. So there should be balanced allocation of bandwidth between real time and non real time traffic.

**Redundant Data:** Since the sensor nodes are densely deployed in a terrain of interest, therefore most of the data generated by sensor nodes are redundant. While this redundancy helps in

reliability and fault tolerance of the WSNs, it also causes a significant amount of energy wastage. Data aggregation or data fusion is a solution to remove this redundancy. For example image data generated by sensors pointing to the same direction can be aggregated as those data are less variant. However, data aggregation or data fusion techniques complicate QoS design in WSNs.

**Heterogeneity of the Sensor Nodes:** Handling heterogeneous data generated by different types of sensor nodes is another challenge in WSNs. For instance, there are some applications which require different types of sensors to monitor temperature, pressure and humidity of the surrounding environment, capturing image or video of moving objects. Data generated from these sensors at different rates based on different QoS constraint and delivery models. Therefore, these types of diversified sensor network may impose significant challenges to provide QoS.

**Dynamic Network Topology and Size:** Due to mobility of sensor nodes, link failure and node failure, the topology of the network may get changed. Self reorganizing and making this network adaptable to such changes is a challenging issue in Wireless Sensor Networks. A typical WSN may consist of hundreds to thousands of densely deployed nodes in a terrain of interest. The number of such sensor nodes may increase even after the initial deployment of the network due to the newly added nodes. Though these nodes are subjected to failure, the QoS should not be affected drastically due to increase or decrease of sensor nodes.

**Less Reliable Medium:** The communication medium in WSN is radio. This wireless medium is inherently less reliable. The wireless links are also very much affected by different environmental factors such as noise and cross signal interference.

**Mixed Data Arrival Pattern:** In a typical WSN application some sensory data may be created periodically and these are mainly due to the detection of some critical events at unpredictable times. Again there can be some sensory data which are created at a regular interval of time e.g., continuous real time monitoring of some environmental parameters. Moreover the period of periodic data may or may not be known a priori and this may depend on the kind of application. Therefore data to be handled in a typical WSN may be a mixture of periodic and a periodic type. This mix nature of data poses significant challenges in designing QoS based schemes (i.e., for guaranteeing timely and reliable delivery) for WSN.

**Multiple Sinks or Base Stations:** Even though most of the sensor networks have only single sink or base station, there can be multiple sink nodes depending on the application's requirements. Wireless Sensor Networks should be able to maintain diversified level of QoS support associated with multiple of sinks or base stations.

## 5. CODING

our {encryption technique} proposed approach encrypts only a certain fraction of Reed-Solomon codewords and the remaining portion is transmitted unprotected. Some other encryption techniques have also been used in the area for secure multipath routing protocols.

One of them is MVMP i.e. multi- version multi-path protocol. This protocol gives the secure and reliable data communication. MVMP consists of four steps-

1. The original data packet is divided into different groups.
2. Each group is encrypted using different cryptographic algorithms.
3. Using Reed-Solomon encrypted packets gets coded
4. Before transmitting the data packets it has been established on the multiple disjoint paths.

To transfer the data on correct path, node-disjoint path routing protocol is used. It is also used to minimize the worst case security risk and to maximize the packet delivery ratio under attacks.

In this paper, new mechanism is used that adapts to the resource constraints of WSNs by combing FEC technique and few selective cryptographic algorithms to achieve reliable and secure data transmission.

## 6. SYSTEM MODEL

**A. Replication and erasure coding-** Erasure coding has been used in distributed systems to obtain load balancing and fault tolerance. In early years it can also be used for WSNs as a replication mechanism in multipath routing to achieve reliable and secure data transmission. The advantage of data replication is to avoid the data retransmission in WSNs caused by severe resource constraints of sensor nodes which is very costly.

The one of the most simplest and widely used FEC codes is Reed-Solomon (RS) coding.

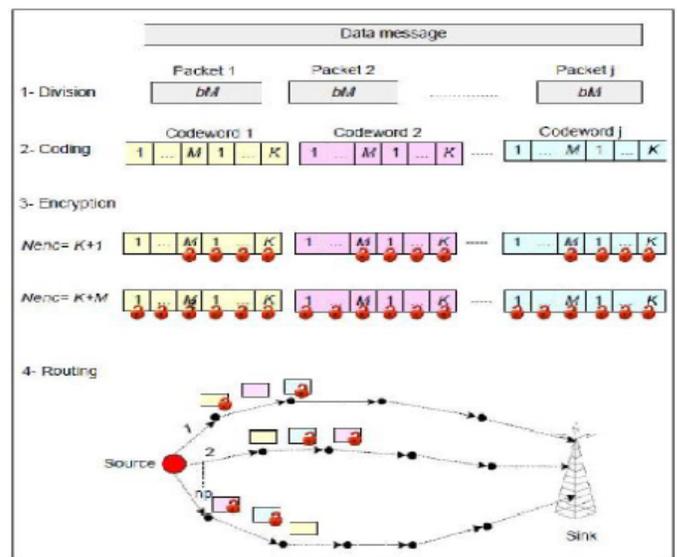


Fig 3:-The proposed mechanism

An Efficient Coded Based QoS Routing Mechanism In Wireless Sensor Networks.

**B. Replication and erasure coding-** Erasure coding has been used in distributed systems to obtain load balancing and fault tolerance. In early years it can also be used for WSNs as a replication mechanism in multipath routing to achieve reliable and secure data transmission. The advantage of data replication is to avoid the data retransmission in WSNs caused by severe resource constraints of sensor nodes which is very costly.

The one of the most simplest and widely used FEC codes is Reed-Solomon (RS) coding.

Reed-Solomon coding- Reed-Solomon codes are block-based error correcting codes. The Reed-Solomon encoder takes a block of digital data and adds extra "redundant" bits. Errors occur during transmission or storage for a number of reasons (for example noise or interference, scratches on a CD, etc). The Reed-Solomon decoder processes each block and attempts to correct errors and recover the original data. The number and type of errors that can be corrected depends on the characteristics of the Reed-Solomon code.

A. Multipath Routing Protocols- Data routing is an essential topic because distributed network Has many nodes and they services many messages. In short each node is a shared node since they have to make many decisions. This is very complicating. That is why routing is a very important topic in WSNs. Routing can be fixed, adaptive, centralized, distributed, etc.

The multipath routing technique which has demonstrated its efficiency to improve wireless sensor performance is efficiently used to find alternate paths between sources and sink.

Ad-hoc On-Demand Distance Vector Routing Protocol(AODV) has been used to route the data towards the appropriate node.

Ad-hoc On-Demand Distance Vector Routing Protocol- Ad hoc On-Demand Distance Vector (AODV) Routing is a routing protocol for mobile ad hoc networks (MANETs) and other wireless ad hoc networks. In AODV. The network has been silent until needed connection. At that time, network node which needs the connection sends a request for connection. Other node forwards that message and records it that they heard it from. The receiver sends back the temporary route. The needy node then starts using the route which has the least number of counts. When link fails, routing error is passed back to a transmitting node and the process repeats. The main advantage of this protocol is having routes established on demand and that destination sequence numbers are applied find the latest route to the destination. The connection setup delay is lower. It uses the shortest path algorithm.

## 7. MATH

Figure 3 shows the steps included in this mechanism. System model involves following steps.

1 .Divide the data message into packets such as each packet is of size

$$K=bM \quad (1)$$

2. Encode the data packet by using FEC technique which includes the Reed-Solomon coding in such a way that each codeword having the set of total M+K fragments. Where M is the number of fragments and K is the number of encoded fragments.

3. Depending on the security level required, the number of fragments to be encrypted ,

$$N_{enc}=K+E \quad (2)$$

Where  $N_{enc}$  is the total number of fragments encrypted and E is determined according to the required security level and

$$1 \leq E \leq M. \quad (3)$$

4. Route all the fragments on the  $n_p$  disjoint paths to the node and in order to enhance the security the encrypted fragments from the same codeword are transmitted on different paths.

5. At the receiving node, the encrypted fragments are first decrypted and then all the fragments are encoded to reconstruct the original data packet.

## CONCLUSION

This research indicated that in order to ensure data security and quality of service required by an application in an energy efficient way, we propose a mechanism for QoS routing with coding and selective encryption scheme for WSNs. In this project, we presented a new routing mechanism, which integrates FEC codes and selective encryption scheme for providing both QoS and secure data transmission in WSN.

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# Effectuality of relative advantage of Assistive Technology on teaching and learning of integrated English among the visually impaired learners in special secondary schools in Kenya

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**Abstract-** The purpose of the study was to examine the extent to which relative advantage of Assistive Technology affect effective teaching and learning of integrated English among the visually impaired learners. The research design was descriptive research design. The target population was 4 principals, 48 teachers and 480 students while the sample size was 4 principals, 218 students and 48 teachers. The sampling techniques were simple random sampling and purposive sampling. The data was collected using questionnaires, observation schedule and focus group interview.

The hypothesis was not rejected meaning that there was no significant relationship between relative advantage of assistive technology and effective teaching and learning of integrated English among visually impaired learners. The hypothesis test indicated that there was no significant relationship between relative advantage of AT and effective teaching and learning of VI. The researcher recommends that though not significant it would be important to consider whether an AT would make a difference to the students.

**Index Terms-** assistive technology, Relative advantage ,visually impaired

## I. INTRODUCTION

Relative advantage is the degree to which an idea is perceived better than the idea it supersedes (Rogers, 2003).

The United Nations defines assistive technology as “technology adapted or specially designed to improve the functioning of people with disabilities” (Borg, Lindstrom, & Larsson, 2009, p. 1863). Assistive Technology (AT) is a broad concept, covering anything that might be used to compensate for lack of certain abilities (Reed & Bowser, 2005). This range from low-tech devices like special grip for a pen, to more advanced items like hearing aids and glasses, to high-tech devices such as braille and computers with specialized software for helping persons to read (WHO, 2009; Petty, 2012). Kapperman, Sticken and Heinze (2002) demonstrated that approximately 60 percent of the academic students with visual disability in Illinois who could have benefited from the use of special technology for individuals with visual disability were not receiving that opportunity.

The increase in assistive technology use may be attributed to the federal laws passed which support funding for assistive technology devices and services. Although these laws increase

the accessibility of assistive technology, many recipients are dissatisfied with devices and services. Dissatisfaction typically results in [discontinuance](#) of assistive technology devices. A national survey on technology abandonment found that 29.3% of all devices obtained were abandoned (Phillips & Zhao, 1993). Discontinuance of assistive technology represents a [waste](#) of time and money. There is however, limited research documenting factors related to assistive technology discontinuance from consumers' perspectives. It is important to gain an understanding of these factors to aid professionals in designing assistive technology service delivery techniques. Assistive technology can improve teaching and learning in inclusive classrooms in various ways (Kleiman, 2010).

Rogers' Diffusion of Innovation theory has been the main starting point for much research into technology innovation and adoption domains, and still provides a widely used framework for forecasting purposes, service and infrastructure requirements, business modeling and policy measurements (De Marez, Evens, & Stragier, 2011). Rogers model is based on five aspects; compatibility, complexity, trialability, relative advantage and observability.

Rogers (2003) argued that innovations offering more relative advantage, compatibility, simplicity (less complex), trialability, and observability will be adopted faster than other innovations. Rogers does caution, “getting a new idea adopted, even when it has obvious advantages, is difficult” (p.1), so the availability of all of these variables of innovations speed up the innovation-diffusion process.

Diffusion theorists claimed that innovations that are perceived by individuals as having greater relative advantage, compatibility, trialability and re-invention will be rapidly adopted and slowly discontinued (Rogers, 1995). Relative advantage is examined in the present study to determine if they is applicable to continuance/discontinuance of assistive technology devices by students who are visually impaired.

The Kenyan government's education policies and goals are geared towards achieving Education for All (EFA) by 2015 in tandem with national and international standards. In an effort to achieve these goals, the government launched a special needs education policy framework in 2010 (Republic of Kenya, 2010).

## II. RELATIVE ADVANTAGE

For a person to choose to use a technology for a specified task, it should provide some form of benefit for the task concerned. To be more specific, the innovation should demonstrate a relative advantage over other options, ideally including the technology currently used for the task. Better technologies will be adopted, plain and simple. However, what defines “better” is rarely a single, simple statistic. Increased performance, cheaper costs, increased social standing, or even a wow factor may all contribute to the sense of relative advantage (Jacobsen, 1998).

Rogers categorized innovations into two types: preventive and incremental (non-preventive) innovations. “A preventive innovation is a new idea that an individual adopts now in order to lower the probability of some unwanted future. Preventive innovations usually have a slow rate of adoption so their relative advantage is highly uncertain. However, incremental innovations provide beneficial outcomes in a short period (Surendra, 2001). When faculty members face the new demands placed on them, they will adopt technology (Casmar, 2001). If teachers see that technology has value in their instruction, then they will use it (Finley, 2003; McKenzie, 2001; Parisot, 1995; Spotts, 1999). To integrate technology successfully into teacher education courses, teacher education faculty should see the need providing helpful experiences for themselves and their students (Schmidt, 1995). To increase the rate of adopting innovations and to make relative advantage more effective, direct or indirect financial payment incentives may be used to support the individuals of a social system in adopting an innovation. Incentives are part of support and motivation factors.

Rogers’ theory was helpful in categorizing and understanding. Internal where faculty members were in terms of instructional computer technologies and in suggesting directions for faculty change in these technologies. Faculty members’ low levels of instructional computer use and expertise, the majority of the faculty members’ self-placement in the last three adopter categories (Finley, 2003).

## III. STATEMENT OF THE PROBLEM

In 2009, the Ministry of Education (MOE) released a report which indicated that only 21 percent of visual disability children were attending school. This indicates that the majority 79 percent of visually impaired children do not have access to education. It is estimated that there are approximately 15,500 visually disabled children in Kenya. The MOE report (2009) shows that 1527 children were attending special schools and 1637 were attending integrated /inclusive schools in Kenya.

KISE has assistive technology such as Duxbury Braille Translator, dolphin pen and jaws for windows (Ministry of Education, 2012). These technologies are too expensive and are not available in all schools. This indicates there is a problem of teaching and learning of visual disability students due to inadequacy or unavailability of AT. KISE has assisted in facilitating availability of AT devices in some schools but have not been effectively utilized to enhance teaching and learning among visually disabled students. According to Bisi (2013) assistive technologies such as talk book were available but

inadequate. Therefore there was need to determine the effect of relative advantage of AT in effective teaching and learning of integrated English among visually impaired learners in special secondary school in Kenya.

## IV. PURPOSE OF THE STUDY

The purpose of the study was to investigate the effect relative advantage of assistive technology on effectiveness of teaching and learning of integrated English amongst visually impaired learners in special secondary schools in Kenya.

## V. OBJECTIVES OF THE STUDY

The study sought to achieve the following objective:

To examine the extent to which relative advantage affect Assistive Technology affect effective teaching and learning of integrated English among the visually impaired learners.

## VI. RESEARCH HYPOTHESIS

The study sought to test the following hypothesis.

HO: There is no significant relationship between relative advantage of Assistive Technology and effective teaching and learning of integrated English among the visually impaired learners

## VII. METHODOLOGY

This study used mixed-methods research design, quantitative and qualitative method for example the focus group discussion. Descriptive survey design is a method of collecting information concerning the current status of the phenomena to describe "what exists" with respect to variables or conditions in a situation (Orodho, 2003). According to Ministry of Education (2012) there are 4 public high schools for the blind in Kenya; Thika School for the Blind, St. Lucy’s High School for the Blind (Meru), Kibos High School for the Blind (Western Region ) and St Francis Kapenguria (Rift valley Region). This study target population was 4 principals, 48 teachers and 480 students. A sample of 218 students was used while the principals and teachers were purposively selected.

## VIII. FINDINGS AND DISCUSSIONS

### Relative Advantage and Gender Cross tabulation

This section presents the cross tabulation of relative advantage of AT and gender. The key used was as follows: 1) Not at all (2) to a less extent (3) To moderate extent ( 4) to a large extent (5) to a very large extent. This as shown in Table 1

**Table 1 Relative Advantage and Gender Cross tabulation**

	Scale Gender		Total
	Male %	Female %	
Relative Advantage	2.60	4.5	4.5
	2.80	4.5	4.5

3.00	4.5	4.5	9.0
3.20	6.8	4.5	11.3
3.40	6.8	2.3	9.1
3.60	4.5	11.4	15.9
3.80	2.3	9.1	11.4
4.00		2.3	2.3
4.20	9.1	2.3	11.4
4.40	2.3	4.5	6.8
4.60	4.5	2.3	6.8
4.80			4.5
5.00	2.3		2.3
Total	43.2	56.8	100.0

Table 1 shows the cross tabulation of relative advantage and gender. Nine point one percent of male rated relative advantage at high extent while 11.4 percent of female rated relative advantage at moderate extent. Both gender (15.9 percent) rated relative advantage at moderate extent. This is contrary to Petty (2012) study.

**Relative Advantage of AT and School Cross tabulation**

The researcher determined relative advantage by doing a cross tabulation with the school. The key used was as follows: 1) Not at all (2) to a less extent (3) To moderate extent (4) to a large extent (5) to a very large extent .Table 2 shows cross tabulation of relative advantage and school.

**Table 2: Relative Advantage and School Cross tabulation**

	Total
Scale	
2.60	4.5
2.80	4.5
3.00	9.1
3.20	11.4
3.40	9.1
3.60	15.9
3.80	11.4
4.00	2.3
4.20	11.4
4.40	6.8
4.60	6.8
4.80	4.5
5.00	2.3
Total	100.0

Overall 15.9 percent rated relative advantage at to a moderate extent and the lowest percentage 2.3 percent to high extent and very high extent. This results similar to Bennett & Bennett, 2003) and Casmar (2001).

**Influence of Relative Advantage of AT on Learners Achievement**

The objective was to examine the extent to which relative advantage of Assistive Technology affects effective teaching and learning of literature among the visual disability learners. To test

the objective the null hypothesis HO: there is no significant relationship between relative advantage of Assistive Technology and effective teaching and learning of integrated English among the visual disability learners was tested at 0.05 significance level.

Table 3. Indicates the relationship between relative advantage and learners achievement.

**Table 3: Relationship between relative advantage and learners achievement**

Model	R	R Square	Adjusted Square	R	Std. Error of the Estimate	
1	.053 <sup>a</sup>	.003	-.021		1.05349	
a. Predictors: (Constant), Relative Advantage						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.131	1	.131	.118	.733 <sup>b</sup>
	Residual	46.614	42	1.110		
	Total	46.744	43			
a. Dependent Variable: Learners Achievement						
b. Predictors: (Constant), Relative Advantage						
Model		Unstandardized Coefficients		Standardized Coefficients		Sig.
		B	Std. Error	Beta		
1	(Constant)	6.336	.959		6.608	.000
	Relative Advantage	-.088	.255	-.053	-.343	.733
a. Dependent Variable: Learners Achievement						

The coefficient of determination was 0.003 indicating that relative advantage of AT explained 0.3 percent of variation in learners' achievement among the visual disability learners.

The remaining 99.7 percent is explained by other variables not within the study. The overall test of significance using F-value statistic was 0.118 which was not significant because p-value (0.733) is more than 0.05 level of significance and the null hypothesis that there is no significant relationship between relative advantage of Assistive Technology and effective teaching and learning of integrated English among the visual impaired learners was not rejected.

Alper and Vaharhinna (2006) asserted that AT may not be fully beneficial to the users. Finley (2003) indicated that relative advantage of an AT has no significant effect on its usability by VI learners.

Table 3 indicates that the constant was significant (0.000) while relative advantage coefficient was not significant (0.733). From the principals data the overall test of significance using F-value statistic was 2.980 which was not significant because p-value (0.226) is more than 0.05 level of significance and the null hypothesis that there is no significant relationship between relative advantage of Assistive Technology and effective teaching and learning of integrated English among the visually impaired learners was not rejected. This implies relative

advantage of AT device has no significant effect on learners achievement.

#### IX. CONCLUSION AND RECOMMENDATIONS

The null hypothesis that there is no significant relationship between relative advantage of Assistive Technology and effective teaching and learning of integrated English among the visually impaired learners was accepted. This means the relative advantage of AT does not significantly affect teaching and learning in special secondary schools in Kenya.

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# Effectiveness of the antenatal pelvic floor exercise for stress urinary incontinence among the postpartum women

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**Abstract-** Postnatal stress urinary incontinence (SUI) is an important social and hygienic health problem affecting between 3% and 24% of adult women. This study was conducted to determine the effectiveness of antenatal exercise on postpartum women who were identified with SUI during their third trimester pregnancy. Among 103 women attending antenatal clinic of Dhulikhel Hospital, 34 women were identified with SUI during their third trimester pregnancy. They were treated by physiotherapist with antenatal exercise including education and home exercises. After 6 months, a telephone survey was conducted to find out the results of the treatment given during the antenatal period. Only 27 respondents answered the telephone survey. From these respondents, only 37% women had continued exercises whereas 63 % of the women did not continue to do exercises even after identifying the problem. All women who continued the recommended exercises were found to have no SUI whereas SUI had reoccurred in 70% women who discontinued exercises. A very significant ( $p=0.00$ ) association was found between antenatal pelvic floor muscle exercise, prevention and treatment of SUI indicating that pelvic floor exercise helps prevent SUI during antenatal period. Awareness of the importance of Pelvic floor exercise should be promoted especially in developing countries like Nepal which offers a cost effective management and improve the quality of life.

**Index Terms-** Pelvic floor exercise, antenatal, stress urinary incontinence, postpartum.

## I. INTRODUCTION

The International Continence Society (ICS) defines urinary incontinence (UI) as a condition in which involuntary urine loss occurs. The most common form is stress urinary incontinence (SUI), defined as any urine loss resulting from physical exertion such as jumping, running and coughing. The most commonly seen problem among pregnant women is SUI<sup>1</sup>. SUI occurs due to anatomical defects in the structures that support the bladder and urethra, resulting in suboptimal positioning of these structures at rest or on exertion. UI that is experienced during pregnancy seems to become worse as the pregnancy progresses<sup>2-4</sup>. Many studies have reported that pregnant women who had UI during pregnancy are at higher risk for postpartum UI than those without UI during pregnancy.

Urinary Incontinence is known to have detrimental effects on quality of life (QOL) in approximately 54.3 % of all pregnant women in four domains: physical activity, travel, social

relationships, and emotional health. Pelvic floor muscle exercise (PFME) is an effective treatment for SUI during pregnancy and has no significant adverse effects<sup>2</sup>. Continence can be improved when incontinent pregnant women adequately perform PFME. Studies from developed countries such as Turkey and New Zealand demonstrated that PFME performed for at least 6 weeks reduced the risk of the UI in the postpartum period<sup>5-6</sup>. This study aimed to evaluate the effectiveness of PFME in the treatment of SUI among the third trimester pregnant women in their postpartum in a least developed country like Nepal where alternative treatment is unaffordable by a majority of population, especially rural women are accustomed to severe hardship even immediately after delivery.

## II. RESEARCH METHODOLOGY

103 third trimester pregnant women who attended antenatal clinic in Dhulikhel Hospital were screened for SUI. Among them 34 women were identified with SUI through expanded paper towel test. Ethical approval was taken from the institutional review committee for identifying SUI among pregnant women with positive expanded paper towel test. Informed verbal and written consent was obtained for further study from the participants. They were treated by physiotherapist individually with education about the physiological, anatomical and hormonal changes that occur during pregnancy and postpartum. During the education the possibilities and complications that could occur during postnatal phase were clearly explained with PFME was administered and Knack maneuver training was recommended for home exercise. After 6 months, the subjects were followed up through a telephone survey to learn about their PFME behavior and continence status and the effectiveness of the treatment. Out of 34 women only 27 subjects participated in the survey and other 7 could not be reached. The questions asked during the telephone survey are presented in appendix. The study analyzed the association between the variables like age, BMI, occupation, parity and mode of previous delivery and SUI with Chi-square test.

## III. WRITE DOWN YOUR STUDIES AND FINDINGS

Only 37% of subjects continued exercise (among 27 respondents) who received exercise during their pregnancy and 63 % discontinued exercise even after identifying the problem. All women who continued exercise reported no problem of SUI in their postnatal phase till the time of conducting the survey.

Among women who discontinued exercise, 70% reported of SUI even in their postnatal period, 66.66% of experienced problem during coughing / sneezing, 16.66% had problem only during bending, and 16.66% had a strong uncomfortable urge to rush to urinate. 16.66% of the subjects had mixed symptoms, they had problem both during coughing/sneezing and also during bending or while performing other activities as well. But the subjects did not complain of any leakage during undressing or walking briskly. SUI was seen among the postnatal mothers soon after 1 month of delivery to 6 month period of time. The study showed a very strong association ( $p=0.00$ ) between antenatal pelvic floor exercise and the prevention of SUI in the postnatal phase as calculated in table (1). Mode of previous delivery ( $p=0.002$ ) and parity ( $P=0.006$ ) were found to be associating factors for SUI whereas BMI ( $p=0.055$ ) may be considered as an associating factor for influencing SUI. Age and occupation of the subjects appeared to have no association with SUI, as indicated by the results presented in Table (2).

**Table 1. Association between antenatal PFME and SUI.**

PFME	SUI		Chi-Sq value	P value	Df
	Yes	No			
Yes	0	10	12.7	0.00	1
No	12	5			
<b>Total</b>	12	15			

**Table 3 showing association between different variables and SUI.**

Variables	Chi-square	P-value
Age group	5.435	0.143
BMI	7.590	0.055
Occupation	5.419	0.367
Parity	10.403	0.006
Mode of previous delivery	12.322	0.002

#### IV. DISCUSSION

Urinary Incontinence is known to have detrimental effects on quality of life (QOL) in approximately 54.3 % of all pregnant women in four domains: physical activity, travel, social relationships, and emotional health.<sup>4</sup> PFME have very good evidence for prevention and treatment of the SUI during and after the delivery<sup>6-8</sup>. Studies have shown that SUI developed during pregnancy or puerperium without remission 3 months after delivery have a very high risk of symptom persistence 5 years later.<sup>7-9</sup> This study's findings is consistent with Cochrane review done by Hay smith<sup>12</sup> that showed women who leak urine while pregnant can reduce urine leakage for the first six months after childbirth by doing the exercises during and after pregnancy. All women who continued the prescribed exercises in this study did not have urine leakage after postpartum to the date of survey. PFME can be administered as a preventive measure too even women who do not leak urine during pregnancy.

This study demonstrated that antenatal PFME is effective as a treatment for the prevention of SUI after delivery in postpartum

women. The third trimester pregnant ladies were surveyed and only 34 % were found to have SUI. Among them also only 29.10% of who had SUI admitted that it affects their quality of life. Although the trials produce the good results, the dropout rates were high. 63% of the women who were administered physiotherapy classes and home exercises did not continue their exercise. Most of them said they forgot the exercise, whereas others said it was difficult to take out time from daily life to continue exercise, a scenario similar to the study conducted by Wilson and Herbison's which had a 52% drop out rate<sup>11</sup> Another study<sup>12</sup> reported only 6% dropout rate in study where treatment time was much shorter and was under supervision indicating that dropout rate can be controlled through supervised treatment. Here as in our study we taught the exercise once to the patient and told them to continue at home. However, the result of this study matches with results of previous studies as the women who continued exercise did not face SUI in their postpartum period .

Various Studies have shown that supervised antenatal and postnatal pelvic floor muscle training are protective against UI particularly in high-risk groups. However, this beneficial effect did not continue on the long term and novel interventions to improve motivation and adherence are required to achieve better long-term outcome. This study evaluated the benefits of unsupervised PFME only due to limited scope of providing long term supervised PFME and such a study could be the focus of further research.

Therefore, the supervised PFME may be helpful to maximize the adherence among the women but it cannot stop preventing the dropout. Even in previous studies withdrawal from exercise is one of the risks for postnatal complication.<sup>14-15</sup> They reported majority of women experience one or more barriers to regular PFM exercise, with the most common being trouble remembering to exercise and difficulty finding time which is similar finding we got in this study as well. There is little in the characterization of the patient that predicts how well she will adhere to an individualized program of practice and exercise, but trouble remembering appears to be associated with lower adherence.

#### V. CONCLUSION

Pelvic floor exercise during antenatal phases prevents SUI and improves quality of life. Awareness of the importance of Pelvic floor exercise should be promoted among health professionals, especially in least developed countries like Nepal. It offers an economic treatment and improve quality of life.

#### APPENDIX

Question asked during Telephone survey

1. Age of Baby
2. Exercise done/not
3. Urine leakage
4. Urine leakage during Cough/Sneeze
5. Urine leakage during Bent down/lifting
6. Urine leakage during Walk quickly/ exercise
7. Urine leakage during undressing

- |                              |
|------------------------------|
| 8. Strong uncomfortable need |
| 9. Need to rush to bathroom  |

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# Multidrug Resistant and Extended Spectrum beta-lactamase(ESBL) Isolates from different clinical specimens

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**Abstract- Background:** Multi drug resistant(MDR) and Extended Spectrum beta-lactamase(ESBL) producing strain are tremendously increasing and becoming worldwide problem. Therefore, detection of ESBL producing multidrug resistant pathogens has a great importance. This study was carried out with an objective to determine the status of MDR isolates and underlying ESBL from different clinical samples.

**Materials and Methods:** Clinical samples, which consists of pus, urine, blood, sputum, swabs, body fluids and stools, were included in the study. Samples were processed and identified as per routine laboratory protocol. ESBL screening and confirmation along with antimicrobial susceptibility was done according to the Clinical Laboratory Standards Institute(CLSI) guidelines.

**Result:** Of the 245 total isolates, 37.55% were MDR. The ESBL producing isolates were 22.04%. *Klebsiella pneumoniae* was major ESBL producer.

**Conclusion:** This type of study should be continued and necessary to prevent the spread and emergence of resistance should be taken.

**Index Terms-** MDR, ESBL, Combined Disk Assay, Nepal.

determinants including altered expression of outer membrane proteins and efflux pumps, along with an increasing arsenal of  $\beta$ -lactamases.<sup>15</sup>

Gram negative bacteria have  $\beta$ -lactamases as a major defense against beta-lactam antibiotics. Bacteria respond with a plethora of "new"  $\beta$ -lactamases including Extended spectrum beta-lactamases(ESBLs) that, with variable success, confer resistance to newer  $\beta$ -lactam antibiotics.<sup>9</sup> ESBLs are plasmid mediated bacterial enzymes that confer resistance to penicillins(except temocillin), second and third generation Cephalosporins and Aztreonam(but not the Cephamycins or Carbapenems) by hydrolysis of these antibiotics, and are inhibited by  $\beta$ -lactamase inhibitors such as clavulanic acid.<sup>9</sup>

ESBL producing bacteria are typically associated with multidrug resistance thus resulting complicated antibacterial choice. Thus, infection due to ESBL producing bacteria can result in inevitable failure of treatment and increased cost in patients those receiving inappropriate antibiotic treatment.<sup>14</sup> The present study was conducted with an objective to find out prevalence of ESBL producing isolates and its antimicrobial resistance profile which could be helpful to plan a proper hospital infection control strategy to prevent the spread of these strains.

## I. INTRODUCTION

One of the major medical advances of last century was the development of effective antibiotics. Antibiotics have always been considered as one of the wonder discoveries of 20<sup>th</sup> century but the real wonder is the rise of antibiotic resistance. The overuse of antibiotics have benefited extraordinary genetic capacities of microbes to develop multiple mechanism of resistant.

Most national and international organizations including WHO have recognized that systematic monitoring of resistance at local, national and international level is integral part of control strategy.<sup>10</sup> Use of broad spectrum antibiotics, in particular the third generation Cephalosporin in nosocomial infections have been linked to the emergence of antibiotic resistance and increase in treatment costs.<sup>2</sup>

Beta-lactam antibiotics are the cornerstone of the antibiotic treatment which act effectively against both gram positive and gram negative bacteria by inhibiting bacterial cell wall synthesis. However, bacteria have evolved sophisticated resistance mechanisms to combat the lethal effects of  $\beta$ -lactams and are all able to evade killing by Penicillins, Cephalosporins and Carbapenems and is often caused by an array of resistance

## II. MATERIALS AND METHODS

This study was carried out in Janamaitri Hospital, Balaju, Kathmandu between April 2014 to September 2014.

**Specimen size and Specimen types:** A total of 1416 different samples including Urine(748), Blood(350), Sputum(127), HVS(80), Pus(56), Body fluids(34), Stool(14) and others(7) sent for routine culture and antibiotic susceptibility tests were processed during the study period.

**Culture of the Specimens:** Urine specimens were cultured by semi-quantitative culture technique. A loopful of well mixed uncentrifuged urine sample was inoculated onto Blood Agar(BA) and MacConkey Agar(MA) using sterile calibrated loop. The plates were incubated in ambient atmosphere at 37°C for 24 hours. Pus, Sputum, Body fluids, HVS and swabs were inoculated on BA and CA plates and were incubated at 5-10% CO<sub>2</sub> enriched atmosphere whereas MA in ambient atmosphere at 37°C for 24 hours<sup>5</sup>.

**Identification and Antibiotic Susceptibility Test:** Identification of significant isolates was done by standard microbiological techniques. Antibiotic susceptibility test was done by Kirby-Bauer disc diffusion method as recommended by Clinical and Laboratory Standard Institute(CLSI)<sup>6</sup>. The zone of

inhibition was measured and interpreted using the standard chart and organisms reported as sensitive, intermediate and resistant accordingly.

**Criterion for Multidrug Resistance:** In the present study, the defining criterion for an isolate to be Multidrug Resistant(MDR) was set as resistance to three or more drugs of different structural classes.<sup>8</sup>

**Screening and Confirmatory test for ESBL production:** The test inoculum matching Mc Farland tube No. 0.5 turbidity was prepared and carpet cultured on Mueller Hinton Agar. The screening agents viz. Aztreonam(30mcg), Ceftriaxone(30mcg), Ceftazidime(30mcg) and Cefotaxime (30mcg) (Hi-media, India ) were placed onto the inoculated media and incubated at 37°C for 18-24 hours. Isolates showing Ceftazidime  $\leq 22$ mm, Aztreonam  $\leq 27$ mm, Cefotaxime  $\leq 27$ mm and Ceftriaxone  $\leq 25$ mm were suspected as possible ESBL producers<sup>6</sup>.

For the suspected isolates, Cefotaxime(30mcg) or Ceftazidime(30mcg) with or without clavulanate(10mcg) was used for phenotypic confirmation of the presence of ESBL as recommended by CLSI 2014 guidelines. A lawn culture of organism was made on MHA plate and discs were placed at an appropriate distance from each other and incubated aerobically overnight at 37°C. A difference in zone of inhibition of  $\geq 5$ mm of either of Cephalosporin disks and their clavulanate containing disks indicate production of ESBL.

**Data Analysis:** All the information were entered in the worksheet of Statistical Package for Social Science(SPSS) Software (16.0) and analyzed accordingly.

### III. RESULTS

Of the total 1416 specimens, the highest growth was contributed by Pus(58.93%), followed by Sputum(22.83%), Body fluids(20.59%) and Urine(19.12%). Among the total isolates, 59(24.08%) were resistant to >3 drugs.

**Table 1: Distribution of Samples along with Bacterial Growth**

Specimen	Total	Growth	No growth	Positivity
Urine	748	143	605	19.12%
Blood	350	25	325	7.14%
Sputum	127	29	98	22.83%
High Vaginal Swab	80	7	73	8.75%
Body Fluids	34	7	27	20.59%
Pus	56	33	23	58.93%
Stool	14	0	14	0%
Others	7	1	6	14.29%
<b>Total</b>	<b>1416</b>	<b>245</b>	<b>1171</b>	<b>17.30%</b>

The highest degree of MDR pattern was observed in isolates from Urine(46.2%), HVS(42.9%) and Pus(33.3%) (p= 0.03).(Table 2)

Altogether, 16 different bacterial species were isolates from different specimens processed with *E.coli*, 99(40.41%), *S.aureus* 31(12.65%), *K.pneumoniae*(10.20%) and *S.enterica*(9.80%) being the most frequently isolated species. Forty eight *E.coli*, 11 *K.pneumoniae* and 10 *S.aureus* were the major contributor of MDR bacterial strains

**Table 2: Status of Antibiotic resistance among MDR isolates**

Organism	Total Isolates	Resistant to						
		0 Drug	1 Drug	2 Drug	MDR Isolates			
					3 Drugs	>3 Drugs	Total	%
<i>E.coli</i>	99	13	22	16	19	29	48	48.48
<i>K.pneumoniae</i>	25	2	9	3	6	5	11	44.00
<i>Proteus spp.</i>	11	3	1	3	0	4	4	36.36
<i>M.morganii</i>	6	0	0	2	2	2	4	<b>66.67</b>
<i>P.aeruginosa</i>	11	1	3	0	2	5	7	63.64
<i>S.aureus</i>	31	9	7	4	4	6	10	32.26
<i>S.enterica</i>	24	6	2	12	0	4	4	16.67
<i>Alcaligenes spp</i>	4	0	2	1	0	1	1	25.00
<i>Enterobacter spp.</i>	3	1	0	1	0	1	1	33.33
<i>spp.</i>	10	3	4	1	1	1	2	20.00
<i>C.freundii</i>	4	0	0	2	0	1	2	50.00
<i>Providencia spp.</i>	3	1	1	0	1	0	1	33.33
CoNS	1	0	1	0	0	0	0	00.00
<i>S.saprophyticus</i>	1	1	0	0	0	0	0	00.00
<i>S.saprophyticus</i>	10	10	0	0	0	0	0	00.00

<i>S.pneumoniae</i>	2	1	1	0	0	0	0	00.00
<i>S.pyogenes</i>								
<i>K.oxytoca</i>								
Total	245	51	53	45	35	59	95	40.25

A hundred and eleven isolates were subjected to ESBL screening using Ceftriaxone(30mcg), Aztreonam(30mcg), Ceftazidime(30mcg) and Cefotaxime(30mcg). Out of these isolates, 54(22.04%) bacterial isolates were ESBL positive. Among the 54 ESBL positive isolates, *K.pneumoniae* i.e. 10/11(90.91%),*M.morganii* i.e. 4/6(66.67%) and *E.coli* i.e. 27 /53 (50.94%) were predominant.(Table 4) Antimicrobial Susceptibility pattern of ESBL producing isolates showed 94.74% susceptibility to Imipenem but they were highly resistant towards third generation Cephalosporins.

**Table 3: Distribution of MDR in different Clinical Specimens**

Specimens	Total	Mdr No.	%	p-value
Urine	143	66	46.2	0.029
Blood	25	5	20	
Sputum	29	5	17.2	
Pus	33	11	33.3	
Body fluids	7	2	28.6	
HVS	7	3	42.9	
Others	1	0	0.00	
Total	245	92	37.55	

**Table 4 :Distribution of ESBL positive isolates**

Organisms	Total	ESBL Susceptible Isolates	ESBL Confirmatory Test Positive result			Negative case among suspected isolates
			Total	Among Suspected Isolates(%)	Among Total Isolates(%)	
<i>E.coli</i>	99	53	27	50.94	27.27	26
<i>K.pneumoniae</i>	25	11	10	<b>90.91</b>	40	1
<i>K.oxytoca</i>	2	1	1	100	50	0
<i>Proteus spp.</i>	11	7	2	28.57	18.18	2
<i>M.morganii</i>	6	6	4	80	66.67	3
<i>P.aeruginosa</i>	11	5	2	40	18.18	3
<i>S.enterica</i>	24	6	3	50	12.50	11
<i>C.freundii</i>	10	4	3	75	30	0
<i>Enterobacter spp.</i>	3	1	1	100	33.33	2
<i>Providencia spp.</i>	4	3	1	33.33	25	0
<b>Total</b>	<b>226</b>	<b>111</b>	<b>54</b>	<b>48.65</b>	<b>23.29</b>	<b>57</b>

**IV. DISCUSSION**

Emerging antimicrobial resistance is being major cause to failure of empirical therapy, therefore, knowledge of the local prevalence of pathogens and their antimicrobial sensitivity patterns is essential to support clinicians in their routine work. The infection due to ESBL producing bacteria can result in inevitable failure of treatment and increased cost in patients receiving inappropriate antibiotic treatment. In the present study, an attempt was made to understand the prevalence of multidrug resistant and ESBLs isolates. The study was based on laboratory findings and includes the patients attending outpatient and inpatient departments of Janamaitri Hospital during a period from April 2014 to September 2014.

Out of total samples, only 17.50% showed growth whereas growth rate was high among females. MDR was shown by 24.08% isolates. Higher prevalence of MDR isolates was from urine and pus whereas majorly outpatients were involved. MDR might be the result of irrational use of antibiotics. Self-prescription by patients and incomplete course of treatment are probable contributing factors.

Generally, Imipenem and Amikacin were found to be effective whereas Amoxycillin was least effective. Out of 111 suspected isolates, 54(22.04%) were ESBL producers by phenotypic confirmatory method. MDR isolates were mostly found to be ESBL producers i.e. 83.33% whereas only 16.67% of

non MDR isolates were positive. *K.pneumoniae* was major ESBL producer followed by *M.morganii* and *E.coli*.(Table 4).

The prevalence of ESBL producing isolates varies geographically. Although the prevalence of ESBL is not known, it is clearly increasing. In many parts of world, 10-40% of strains of *K.pneumoniae* and *E.coli* express ESBLs<sup>7</sup>.

Among different clinical specimens, 30.07% of ESBL isolates were from urine. Similarly, female showed more ESBL isolates. Agegroup of 0-15 and 75 above was found to be more susceptible to ESBL. This may be due to low immunity of this age group. Prevalence of ESBL among outpatients and inpatients were 75.9% and 24.1% respectively. This indicates the ESBL to be common in communities. ESBL producers may have spread through communities, especially those with poor hygienic and

sanitation condition, through fecal contamination of soil and water, since most patients with ESBL producers may have had their gastrointestinal tracts colonized for a long period of time by these organisms as was reported by Paterson and Bonomo(2005)<sup>12</sup>.

Antibiotic susceptibility tests of ESBL producing isolates demonstrated high drug resistance. Analysis showed leading susceptibility rates to Imipenem (94.44%), Amikacin(72.22%), Ciprofloxacin(40.74%) and Cotrimoxazole(38.89%). High resistance rates were observed to Amoxycillin, Aztreonam, Cephalosporins and Gentamicin Table 5). Al -Zarouni et al demonstrated high resistance rates to Fluoroquinolones and Cephalosporins and higher susceptibility rates to Carbapenems and Amikacin<sup>1</sup>.

**Table 5: Distribution of Antibiotic Resistivity of ESBL positive Isolates**

Antibiotics	Total	Sensitive		Resistant	
		N	%	N	%
Amikacin	54	39	72.22	15	27.78
Amoxycillin	54	4	7.41	50	92.59
Cefixime	54	3	5.56	51	94.44
Ceftriaxone	54	0	0.00	54	100
Ceftazidime	54	1	1.85	53	98.15
Aztreonam	54	3	5.56	51	94.44
Ciprofloxacin	54	22	40.74	32	59.26
Cotrimoxazole	54	21	38.89	33	61.22
Gentamicin	54	15	27.78	39	72.22
Nalidixic Acid	54	18	33.33	36	66.67
Nitrofurantoin	54	20	37.04	34	62.96
Imipenem	54	51	94.44	3	5.56
Cefotaxime	54	2	3.70	52	96.30

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# Ethical Issues in Public Procurement in Kenya

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## I. INTRODUCTION

In the past decades, the public procurement system in Kenya has undergone significant developments. From being a system with no regulations in the 1960s, and a system regulated by Treasury Circulars in the 1970s, 1980s and 1990s, the introduction of the Public Procurement and Disposal Act (PPDA) of 2005 and the Procurement Regulations of 2006 has introduced new standards for public procurement in Kenya. As a result, ethical supply chain management is becoming a mainstream business practice in public sector in Kenya. Ethics in Public procurement provide advice and guidance to buying organizations on how to develop ethical purchasing practices in their supply chains (Arkingstall 1994). Although intended primarily for buyers, this guidance applies equally to anyone who has responsibility for managing the supply of goods or services from an external source. It has become essential for public organizations to have an ethical policy or code of conduct in procurement functions (Amstrong and Sweeney 2004). The Chartered Institute of Purchasing and Supply (CIPS) believes that public entities should universally apply the practice set out (as laws, regulations, policies and procedures) and should encourage all cadre of organizations to include good ethical business practices in all areas of their work. In this case, organizations should also involve all stakeholders in this process. It is vital that organization's management visibly endorses procurement ethical policy.

As ethical supply chain issues become more widely known, stakeholders are starting to question organizations about their compliance. There has been rapid growth in ethical investment funds that encourage organizations to look at issues of corporate social responsibility (Budenhorst 2006). However, although some companies started work on these issues in the 1980s, ethical sourcing is still a comparatively new concept for most organizations, especially government owned. Most of empirical research in Supply Chain Management (SCM) associated with unethical practices or behaviors in the buyer-supplier relationship is concerned to the opportunism, generally under the theoretical lens of transaction costs economics. Although opportunism is considered an unethical behavior, it is not the only one. According to Carter (2000) there are other unethical practices which may benefit the firm and/or the professional involved in the transaction. Apparently, there are few empirical studies addressing unethical conducts or behaviors in SCM, excepting the opportunism, despite supply chain professionals are probably more vulnerable to unethical choices because there are simply plenty of opportunities to abuse. Facing increasing demands for cost reductions and unattainable goals, supply chain personnel may succumb under such pressure, engaging in unethical practices (Rottig, Koufteros, & Umphress, 2011).

With the enactment of the PPDA and other Regulations, Kenya today has in place a sound and comprehensive legal framework for public procurement with a clear hierarchical distinction. The PPDA clearly establishes the procurement methods to be applied, advertising rules and time limits, the content of tender documents and technical specifications, tender evaluation and award criteria, procedures for submission, receipt and opening of tenders, and the complaints system structure and sequence. The PPDA and Regulations cover goods, works and services for all procurement using national funds. Both documents are published and widely distributed within government. However, this increased professionalism has not, however, proved to be an adequate defence against the temptation to act unethically by purchasing and sales people. Bribery, gift-giving and entertainment have been and are being used to induce purchasing personnel to favour particular suppliers rather than be guided solely by factors such as price, quality and delivery. This paper will look at ethics in public procurement and how its role in procurement performance in public sector in Kenya.

## II. PURPOSE OF THE STUDY

The purpose of this paper was to analyze ethical issues in public procurement in Kenya. This paper was guided by the following research questions: What ethical issues are incorporated in public procurement in public institutions in Kenya? What is the role of; procurement standards, policies and regulations on procurement functions of public institutions in Kenya?

## III. METHODOLOGICAL APPROACH

A literature review was conducted aiming to collect and analyze all relevant papers (by content analysis) complying with empirical studies that address the specific issue of ethics in the buyer-supplier relationship and along the supply chain. As a result of this review, a discussion on ethical issues in supply chain in public procurement was presented and finally, credible results, conclusion and recommendations also given.

## IV. DISCUSSION

Ethics are the guidelines or rules of conduct by which we aim to live on. Organizations like individuals have ethical standards and frequently ethical codes (Peter and Bailey 2005). The ethical standards of an organization are judged by its actions and the actions of its employees, not by pious statements of intent put out in its name. The pressures which the marketplace

exerts on purchasing departments and on individual buyers make it essential that top management, purchasing and supply managers, buyers and all other members of the procurement system recognize and understand both professional and ethical standards required in performance of their duties. According to Kothari (2004) emphasizes on procurement ethics being important in procurement for the following reasons: procurement staffs are the representatives of their organization in dealing with suppliers, sound ethical conduct in dealing with suppliers is essential to the creation of long-term relationships and the establishment of supplier good will, it is impossible to claim professional status for procurement without reference to a consideration of its ethical aspects.

The theoretical background underlying this review comprises three different fields of knowledge: *supply chain management*, *business ethics*, and *behavioral ethics*. In this study, the definition of supply chain management (Procurement) is that offered by Mentzer, DeWitt, Keebler, & Min (2001): 'Supply chain management is defined as the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across business within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as whole'. With this definition, the focus of SCM is on the different levels of analysis and the business operations within the channel from the point-of-origin to the point-of-consumption. Business ethics pertains to the conceptual field of social responsibility, which has been centered a real debate for decades, showing very different philosophical positions. For example, Friedman (1992) argued that the doctrine of social responsibility is "fundamentally subversive", asserting: "Few trends could so thoroughly undermine the very foundations of our free society as the acceptance by corporate officials of a social responsibility other than to make as much money for their stockholders as possible" (Friedman, 1992). Acknowledging the primacy of economic concerns, (McGuire, 1993) accommodates a broader view of the firm's social responsibility: "The idea of social responsibilities supposes that the corporation has not only economic and legal obligations, but also certain responsibilities to society which extend beyond these obligations" (McGuire, 1993).

In a slightly different path, Sethi (1975) proposes a set of three dimensions to corporate social responsibility: (1) social obligation, (2) social responsibility, and (3) social responsiveness. Social obligation involves corporate behavior in response to market forces or legal constraints. Social responsibility "implies bringing corporate behavior up to a level where it is congruent with the prevailing social norms, values and expectations" (Sethi, 1975). Finally, Carrol (1979) proposed a definition of social responsibility that fully address the entire range of obligations business has to society: "social responsibility must embody the economic, legal, ethical, and discretionary expectations that society has of organizations at a given point in time" (Carrol, 1979). These four categories are not mutually exclusive, nor are they intended to represent a continuum. According to Carrol (1979), these categories are neither cumulative nor additive. Although all these responsibilities have always simultaneously existed for business organizations, the history suggests an early emphasis on the

economic and then legal aspects and a later concern for the ethical and discretionary aspects.

For this review purposes, the framework proposed by Carrol (1979) comprises the concept of ethical responsibility to be used going forward: although the economics and legal responsibilities embody ethical norms, there are additional behaviors and activities that are not codified into law but nevertheless are expected of business by society's members. Important to note that the discretionary responsibilities, as described by Carrol (1979), are those purely voluntary, and the decision to assume them is guided only by a business's desire to engage in social roles not mandated, not required by law, and not even generally expected of businesses in an ethical sense.

Unethical behavior conceptualization is often found in the decision-making literature. For some authors, unethical intention is used as a proxy of unethical behavior (Kish-Gephart, Harrison, & Trevino, 2010). Unethical intention is defined as the expression of one's willingness or commitment to engage in an unethical behavior. Unethical behavior is defined as any organizational member action that violates widely accepted (societal) moral norms. These definitions are convergent with recent behavioral ethics literature (Kaptein, 2008; Trevino, Weaver, & Reynolds, 2006). Despite research that address individual-level determinants of ethical and unethical decision making at work has grown significantly in the past few years, a recent meta-analysis on the topic concludes that still little is known about how and under what circumstances individuals make unethical choices. The most studied ethical decision-making framework was proposed by Rest (1986) and comprises a sequence of elements considered antecedents of an ethical/unethical behavior/decision: moral awareness, moral judgment and moral motivation. Recognizing an ethical issue and solving it means determining whether a specific behavior or decision is right or wrong (Treviño, Weaver, & Reynolds, 2006). In this sense, formal communication of organizational values and principles, by the establishment of codes of conduct and codes of ethics, have been allowed firms express expectations or guidelines for employees regarding a variety of issues (Rottig, et al., 2011).

In relation to this, Public procurement means the process of acquiring goods, works and services by government procuring entities. The process includes purchasing, hiring, leasing or any other contractual means of engaging suppliers in provision of public services to the public. The public procurement goals include; satisfying the customer in terms of cost, quality and in timely manner, minimizing administrative operating costs, conducting business with integrity, fairness and openness and fulfilling public objectives. Rwti (2005) noted that effective application of procurement ethics is a major challenge facing many organizations around the globe. The level of application of procurement ethics has been used as a measure of the state of organization corporate image and corporate social responsibility practices hence supply chain management ethics is nowadays considered a core factor for business success. Low level of procurement regulations compliance by government ministries and lack of effective enforcement of regulations implementation by the government encourages cases of unethical procurement practices in Kenya (GoK 2006).

The rise of supply chain management and procurement in Kenya is associated to a number of unethical business practices that violates codes of conduct. For instance when tendering processes is not executed in a transparent manner, then suppliers may have chances and vantages to solicit for consideration by advancing bribes and other forms of corruption. Transparency, fair treatment in bidding and awards of tenders, accountability and responsible purchasing and supply have a positive implication on procurement processes in any organization and could thus result into increased performance and delivery. This is not possible without employing ethical theories. According to Rwoti (2005) compliance with the formal elements gives an indication of knowledge of the rules. Procurement managers will comply with the rules if they perceive them as clear. Lack of clarity increases the possibilities for procurement regulations noncompliance. Lack of familiarity with procurement rules results into poor compliance levels and this leads to inefficiency which negatively affects organizations performance.

In this case, public procurement is the main process through which the government operates and spends public money. It is estimated that in Kenya public procurement accounts for over 10% of Gross Domestic Product (GDP), making it a large market for suppliers and contractors (GoK 2006). With this amount of resource public procurement tops the list of sectors with high opportunities for corruption. This therefore means that every effort should be made to erect safeguards to check against corrupt malpractices in public procurement. It is against this background that Kenya Anti-Corruption Commission has partnered with the Public Procurement Oversight Authority (PPOA) to issues corruption prevention guidelines in public procurement as part of its corruption prevention strategies and in line with the wider public financial management reforms that Kenyan government has been initiating. The issuance of these guidelines is further anchored in Section 9(c) (i) and (iv) of the Public Procurement and Disposal Act, 2005 read together with regulation 30 of the Public procurement and Disposal regulations, 2006. These guidelines are aimed at assisting public procuring entities in checking corruption in the procurement processes and instilling ethics as well in public procurement. This guideline highlights procurement methods, the procurement processes and various manifestations of corruption and corruption prevention strategies.

## V. CONCLUSION

Public sector has become highly competitive, and the industry therefore focuses a lot on principles of efficiency of procurement process. But this paper shows that for long term efficiency and effectiveness, competency need to be built on the ethical code of conduct in public procurement. The paper brings us to the conclusion that the more ethical practices are adhered in public organization, the better the effectiveness of the procurement process and hence the more customers will be satisfied. Furthermore this paper asserts that the more public organizations adhere to a strong ethics policy, the more likeliness to enjoy a long-term competitive advantage. Despite the government implementation of policies in procurement, its full adoption is still a challenge since the organizations lacks the capacity to do so. Lack of a procurement ethics training policy is

enough proof since all the ethical practices are just mere guess work.

This article has reviewed the ethics at the interface between purchasing and supplier/contractor from an international perspective and provided evidence of the degree to which their interaction is marked by unethical behaviour. Bribery is seen as being the most significant problem, particularly, though not exclusively, in public procurement in Kenya. Many public organizations operate lower ethical standards, and that corruption is endemic in their procurement functions. However, there are positive movements to improve the situation by; for example, introducing codes of ethics which, although they have limitations, can influence the climate within which procurement processes are conducted.

## VI. RECOMMENDATIONS

Efforts foster ethics in public procurement ought to be seen as the responsibility of both public entities (employee and employers) and bidders/contractors. Prevention of corruption deals; collusion and malpractices are essential elements of risk management in procurement. The purchasing unit should not be solely responsible for making the organizations purchase decisions. Instead, it should involve individuals from entire organization. In various committees, organization personnel can work together in order to achieve the larger goals of the organization's strategy. Ethical procedures should comprise clear and transparent rules as well as clear behavioral rules for all the parties in the procurement process. The corruption Prevention Guidelines in public procurement need frequent review to cope with changing trends in procurements procedures. This paper recommends that there is need for establishment a procurement training policy and code of ethics. This will provide the staff involved in the process with the much needed knowledge and guidance. The state of procurement professional in public sector in Kenya need to be improved especially now when the public sector is facing accusations of procurement malpractices and procurement in efficiencies at high levels.

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# FREEDOM ACT (*Discretionary Power*) AND ITS IMPLEMENTATION AS OBJECT CORRUPTION ANALYSIS OF THE DECISION NUMBER 2420.K / SPECIAL CRIMES / 2013 SPECIAL CRIMINAL CASSATION CASES

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**Abstract :** Freedom acting in the administration of government affairs known two kinds namely freedom of discretion and freedom of interpretation. freedom of discretion or freedom to decide independently occur in the case of a norm of giving freedom to the agency or official of the state administration to take an action according to the considerations to do or not do something that is stated in the basic rules. While freedom of interpretation is more focused on the formulation of norms which disguised (*vage norm*), in which case the entity or state administrative official has the freedom to interpret the intent (meaning) of the norm *vage*. Forms of discretion in the administration of government affairs, according **Kreveld** like; *beleidslijnen* (*stripes wisdom*), *het beleid* (*wisdom*), *voorschriften* (*regulations*), *richtlijnen* (*guidelines*), *regelingen* (*instructions*), *circulaires* (*surat circulars*), *resoluties* (*resolutions*), *aanschrijvingen* (*instructions*), *beleidsnotas* (*memorandum of wisdom*), *reglemen* (*ministriele*) (*ministerial regulations*), *beschikkingen* (*decisions*), *en bekenmakingen* (*announcements*). Based a nalysis freedom of action (*discretionary power*) and its implementation as an object of corruption to Decision Number 2420.K / Special Crimes / 2013 Case Special Criminal Appeal and analysis of the reasons a weld Type of Cassation, it was concluded that: 1) The act of law committed by the defendant is corruption, 2) Measure the abuse of authority in the in casu let by basing on the principles of specialties in budget management.

**Keywords:** *Discretionary Power, Corruption,*

## I. INTRODUCTION

In government *Freies Ermessen* give meaning as one of the means that provide space for administrative official bodies or countries are to commit an (Marcus Lukman, 1996) [1]. Space motion to perform the intended action is still unclear from these opinions, so it is important considering the views **Phlipus M. Hadjon** (Philip M. Hadjon, et al (2002) [2], Philip M. Hadjon and Tatiek Sri Djatmiati, 2005, [3] which states that, freedom of action in the implementation of government affairs known two kinds. It is declares, as follows : "Freedom of action which is commonly known from the principle of" *Freies Ermessen* "(*discretionary power*). There are two kinds of freedom, namely freedom of discretion and freedom of interpretation. Example : 1. the permit holder does not meet the provisions of Article II, permission *can be* revoked. 2. Governors authorized prohibit billboards in a foreign language for the sake of public order. In the two examples above, Example 1 allows a freedom of action in terms of policy freedom (freedom to decide independently). In a word *can be* implied the freedom to use the authority revoke licenses and the freedom to not use this authority. Freedom here does not mean *he pleases*. Liberty here to give an opportunity to consider carefully whether the permit is revoked or not. In the example of two in the words "*public order*" there is a vague formulation (*vage norm*), ie whether the interpreted with public order. Natural D example above, the governor is to interpret the meaning of the public order. "Thus, the freedom of discretion or freedom to decide independently occur in the case of a norm of giving freedom to the agency or official of the state administration to take an action according to the considerations to do or not do something that is stated in the basic rules. While freedom of interpretation is more focused on the formulation of norms which disguised (*vage norm*), in which case the entity or state administrative official has the freedom to interpret the intent (meaning) of the *norm vage*.

Relating granting freedom of action (free reign) set forth in the foregoing, **Philip M. Hadjon** (Philip M. Hadjon, et al (2002) [2] states: Against the free power (*vrij bestuur*) principle "*wetmatigheid*" not sufficient . The power of free is not intended as an unlimited power. The power of free is still a power that is subject to the law, at least the unwritten law in the form of legal principles. The principles of the law of the Dutch administrative law is defined as "*alegemene beginselen van behoorlijk bestuur*". In literature Indonesian administrative law principles were originally popularly known as" general principles of good governance "that until today the word" *behoorlijk* "means" good ", although they were aware that" *behoorlijk* "means worthy or appropriate (in terms UK: *behoorlijk* = *proper*; *beginselen van Algemene behoorlijk bestuur* - *principles of proper administration or principles of due administration*).

Decision of the Supreme Court on Decision No. 2420.K / Pidsus / 2013 on special criminal appeal cases on behalf of Defendants Lodewyk Bremer, S. Sos, in essence, the public prosecutor in the indictment states that:

"The act of the defendant is a criminal offense and punishable as provided in Article 3 in conjunction with Article 18 of Law No. 31 of 1999 on Corruption Eradication, as amended and supplemented by Law No. 20 of 2001 on the Amendment of Law Number 31 Year 1999 on the Eradication of Corruption "

Furthermore, in the Corruption Court verdict on the Ambon District Court Number 27 / PID.TIPIKOR / 2012 / PN.AB, dated December 19, 2012, which amar Decision basically states that:

1. Declare the defendant Lodewyk Bremer, S.Sos not proven legally and convincingly guilty of committing a criminal offense as charged in the indictment Public Prosecutor primary;
2. Freeing the defendant from the primary charge (*vrijspraak*)
3. Removing the defendant Lodewyk Bremer, S.Sos therefore from any lawsuits over subsidiary charges (*onstlaag van alle rechtsvervolging*)

Given the deed of the appeal submitted by prosecutors *Public Prosecutor No. 10 / Akta.Pid.Tipikor.K / 2012 / PN.AB, the Supreme Court, in its Decision No. 2420.K / Special Crimes / 2013* on special criminal appeal cases on behalf of Defendants Lodewyk Bremer, S. Sos, in essence states that:

"To grant the appeal of Cassation Attorney / Public Prosecutor at the Ambon District Court. Cancel the decision of the Corruption Court in Ambon District Court Number 27 / PID.TIPIKOR / 2012 / PN / AB, December 19, 2012. The defendant menamatkan Lodewyk Bremer, S.Sos proven legally and convincingly guilty of corruption. "

Based on the description above, the analysis will be directed to examine the *ratio decedenci* against the decision on the case *a qua*. From this aspect, the analysis also rests on aspects of constitutional law relating to the **First**, constitutional juridical act in this case in his capacity as Cash holders / Treasurer Maluku Provincial Secretariat FY 2006, which was appointed by the Governor of Maluku Decree No. 135 of 2006 on the Ratification Documents Unit Budget Work (DASK) Maluku Regional Secretariat of Fiscal Year 2006. **Second**, the act detrimental to state finance, either against the law or because of abuse of authority (see Article 2 and Article 3 of Law No. 31 of 1999 on Corruption Eradication, as amended and coupled with Act No. 20 of 2001 on the Amendment of Law No. 31 Year 1999 on Eradication of Corruption)

## II. ANALYSIS OF DECISION NUMBER 2420.K / SPECIAL CRIMES / 2013 SPECIAL CRIMINAL CASSATION CASES

The analysis focused on the consideration of the Supreme Court *in casu* the d apat described as follows : **Consideration of the Supreme Court** Considering that the reasons the Supreme Court opinion : That the Supreme Court as the body which has the task to foster da n keep all the laws and legislation in all regions of the country are applied properly and fairly, and with the Constitutional Court Decision number 114 / PPU-X / 2012 dated March 28, 2013 which states the phrase "except against the acquittal" in Article 244 of Law No. 8 of 1981 does not have binding legal force, the Supreme Court authority to examine the appeal against the acquittal "That goes the wheels of government and services to the public through **the provision of bias** by the defendant at **the discretion (discretion)** of the secretary of the areas where a single cent downpayment is not a legal obligation of the defendant, except admonition to regional work units. who made orally by it which is an advantage in a country where the provincial scale bias is not given, then the stagnation of the local government, directly or indirectly by will impact broadly to the central government, because if the local government services are not maximal, then the service to Central Government agencies in the area are also not optimal so that interfere with the performance of the central government;

Forms of discretion in the administration of government affairs, according to such **Kreveld ; Beleidslijnen** (stripes wisdom), *het beleid* (wisdom), *voorschriften* (regulations), *richtlijnen* (guidelines), *regelingen* (instructions), *circulaires* (email circulars), *resoluties* (resolutions), *aanschrijvingen* (instructions), *beleidsnotas* (memorandum of wisdom), *reglemen (ministriele)* (ministerial regulations), *beschikkingen* (decisions), *en bekenmakingen* (announcements) (JH van Kreveld, 1983) [4]. The same thing stated by other legal experts, among which was mentioned was **Bagir Manan** stating that in practice the various forms of policy decisions, instructions, circulars, announcements, etc. Another, even can be found in the form of *regulation* ( Bagir Manan, 1994) [5]. That if *Judex facti* have made mistakes as we have described above, it should *Judex facti* declare acts of which the accused defendant was **proven legally and convincingly guilty of corruption** as in the subsidiary charges **and is not a mal-administration**. That for these reasons the Supreme Court argued:

That the reason for cassation Attorney / Public Prosecutor described in cassation posterior 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 **can be justified**, because *Judex facti* was wrong in applying the rule of law in *a* case verdict *quo wrong in applying the law of evidence*. That in accordance with the provisions of article 4 of Law No. 31 of 1999 on Corruption Eradication, as amended and supplemented by Law No. 20 of 2001 on the Amendment of Law No. 31 of 1999 on Corruption Eradication, the return loss of state or state economy does not Eliminate convicted perpetrators of corruption as referred to in Article 2 and Article 3 of Law No. 31 of 1999 on Corruption Eradication, as amended and supplemented by Law No. 20 of 2001 on the Amendment of Law No. 31 Year 1999 on Corruption Eradication, anyway sesui with the provisions of Article 57 of Decree No. 29 of 2002 **returns the bias recently completed restored in October 2011**.

That berdas a rkan above considerations Corruption Court verdict on the Ambon District Court **can not be maintained and must be canceled** by the Supreme Court

Consideration of the Supreme Court *in casu* in principle **accept** the applicant's appeal to **reason to cancel the Corruption Court verdict on the Ambon District Court Number 27 / PID.TIPIKOR / 2012, dated December 19, 2012**. On that basis, the analysis will be conducted on the reasons for the appeal (point 1 through item 11) which can be explained as follows:

### III. ANALYSIS OF THE REASONS FOR APPLICATION CASSATION

The Supreme Court found the three (3) down-payment in 2007 of the Inspectorate / watchdog area not included in the indictment but was attached to the list of items of evidence because the data obtained after the indictment was made and transferred to the court. Referring to the reasons mentioned above, put forward legal question is "whether the difference in bias as stipulated in the indictment is a form of unlawful act or an act of mal administration". Against this, the administrative law distinguishes between **job responsibilities** and **personal responsibility**. The responsibility positions with regard to the legality of the (validity) *in* the form of legal acts *cause* in doing pa njar. Suppose there cac at juridical (eg log substance), remedies available at the time it was an effort cancellation Maluku Governor Decree No. 135 of 2006 on the Ratification of the Budget Unit (DASK) Secretariat Maluku 2006. Personal responsibility with regard to mal administration, especially **misuse of authority**. For example illustration his leadership elements with one or intimidation or the promise of a certain influence decision making, the act of intimidation or certain members i promise is mal administration and become a personal responsibility.

Under the provisions of Article 1 (1) of the Criminal Code would clearly that people can not be convicted based Decree of the Minister of the Interior. It is important to understand that the principle of **delictum crimen nulla poena sine praevia lege poenali** obvious that no crime without statutory provision as meaning *lex* legislation. In Dutch law known term *wet* which in Article 1 *Wethoek van Strafrecht* used **wettelijk voorschriften** formulation. Unfortunately, in many translations of the Criminal Code used formulas **provisions of legislation** or the **provisions of the legislation** giving rise to misinterpretation by reference to the meaning of the legislation of Law No. 11 of 2011. The misunderstanding occurred because the reference to the dictionary meaning of the word **wettelijk**. *Wet* or **wettelijk** have the same meaning, namely law (*lex*). The only difference in the type of words that is **wet wettelijk nouns** and **adjectives**. Translation **wettelijk** with legislation is erroneous translation (Note dictum weigh verdict of the Supreme Court in *casu*, yard 39). Ratio legis principle *delictum crimen nulla poena sine praevia lege poenali* relating to criminal nature. Essentially depriving criminal nature that (*life, liberty and property*). The essence is the natural right **inalinable** (can not be seized). In life built construction state law regarding deprivation of rights in the context of a criminal act. Construction is built on the argument of **natural rights can only be diram fitted with the approval of the people**.

Legal instrument which is made with the consent of the people is the **lex** (*wet, legislation*) on the basis of the spirit (soul) is formulated with the basic provisions of the criminal element **misuse of authority** (Article 3 of the Law on Corruption). Misuse of authority does not have the parameters of the law. It is clear from the examples of existing policy, not all can be qualified as regulatory policy (*beleidsregel*). Such *beschikkingen*, excluding regulatory policy. **Laica Marzuki** stated policy regulations ("*beleidsregel*") is not a decision (decree) procedures ha usa state (HM Laica Marzuki (1997) [6]. The legal experts agreed that regulatory policy administration, is the product of state administration carried out without having statutory authority but is made on the basis of *Freies Ermessen* (*discretionary power*), the substance of which contains general rules and binding indirectly. **Philip M. Hadjon** (Philip M. Hadjon, et al (2002) [2], claim : "A regulatory policy is essentially a product of the actions of the state administration aimed at" *naar buiten gebracht schriftelijk beleid* (reveal out a written policy) "but without the rulemaking authority of the agency or a state administrative official who created the policy rules. Regulations wisdom meant in fact been a part of the administration (*bestuuren*) today. "

From this view it can be seen that a policy rule is a consequence of the government's power in running the affairs of government through the creation of regulations. It can views further, as follows : Marcus Lukman, 1996) [1] "Rules of wisdom instead of legislation. The agency issued regulations wisdom, is *in casu* not have rule-making authority (*wetgevende bevoegdheid*). Regulations wisdom is not binding law directly, but have a legal relevance. The regulations provide opportunities discretion how an entity or state administrative official run of governmental authority (*beschikkingbevoegdheid*). That in itself should be associated with the use of governmental authority on the basis of *discretionare* because if it were not so, there would be no place for the rules of wisdom. "

From the above opinion, it is clear that regulatory policy is the written form of the use of *discretionary power* (*Freies Ermessen*), and because of regulatory discretion is not made by the legislature, the written form of the regulation in question is in the context of the implementation of governmental power. The opinion gives the same meaning despite the different wording proposed by **Indroharto**, (Indroharto (2004) [7] and **Laica Marzuki** (HM Laica Marzuki (1997) [6], The difference **Laica Marzuki** detailing policy rules into subjektum components, materials, and authority. He said that:

#### 1. Components Subjektum :

Regulation wisdom ("*beleidsregel*") made by the agency or official of the state administration as the embodiment of the use of *Freies Ermessen* ("*discretionary power*") in written form that was announced out and tied the residents.

#### 2. Component Materials :

Fill the policy regulations ("*beleidsregel*") contains a general rule ("*Algemene regel*") of its own.

#### 3. Component Authority ("*bevoegdheid*") :

Entity or state administrative officials who make policy regulations ("*beleidsregel*") does not have the statutory authority ("*geen bevoegdheid wetgeving tot*") but is not directly binding on the citizens as well as the rules of "*juridische regels*"

Through details like this make it easier to understand the concept of rules intended wisdom. One important thing is that the substance of the details norm regulatory policy is of a general nature. Before examining the similarities and differences in regulatory policy rather than as a legislative body with the legislation as a legislative product, needs to be seen **Kreveld** opinion about p eraturan wisdom that: (JH van Kreveld, 1983) [4]

**a. De regel is noch direct and indirect, op green gebasserd completely turning away in de formale wet of grondwet die uitdrukkelijk Regeling geeft tot een bevoegdheid, met andere worden, de regel heeft geen uitdrukkelijke grondslag in de wet.**

(Regulation it direct or indirect, based on the provisions of the law or the Constitution that gives formal authority to regulate, in other words, that rule is not found essentially in the legislation).

*b. De regal is, hetzij ongeschreven en and ontstaan door een reeks van individuele beslissingen Degen door de bestuursinstantie in de uitoefening van de vrije bestuurs bevoegdheid jegens individuele genomen burgers; hetzij uitdrukkelijk vastgesteld door deze bestuursinstantie.*

(That rule, *unwritten* and emerge through a series of decisions of government agencies in implementing government authority y ang free to citizens or specified *in writing* by the government agencies).

*c. De regal geeft in Algemene zin, zonder dat wil zeggen aanduiding van individuele, hoe de bestuursinstantie aan bij de uitoefening van de vrije bestuurbevoegdheid zal handelen jegens iedere individuele burger die zich bevint de situatie die in de regal in omschreven.*

(The regulations provide general guidance, in other words without the statement of the individual citizens on how public authorities carry out independent government authority to the individual citizens who are in a situation which is defined in the regulations).

One thing to receive a response from this opinion is about policy rules that are otherwise not found essentially in the legislation. This opinion was easily cause misunderstanding, that **as if the** policy rule that was born from the use of *Freies Ermessen* provides unlimited freedom law. As understood from the foregoing description, that the use of *Freies Ermessen* there is always an underlying rule because if not then what happens is arbitrary. Regulatory policy, according to **Hamid Attamimi** ( A. Hamid S. Attamimi, 1993) [8] has much in common with laws and regulations, namely (1) Both have subjects and setting behavioral norms or norms of the same object, namely general and abstract (*Algemene Regeling* or *Algemene regal*); (2) Both are valid out (Though the enactment outside to regulatory discretion does not occur directly, author); and (3) Both are determined by the institution / public official who has the authority / public for it.

As per differences of both, is : (A. Hamid S. Attamimi, 1993) [8]

1. The formation of policy carried out by government regulations aimed at further regulate government administration, so that always can be done by any government agency that has the power of government. As for the formation of legislation done legislature or minimal with the approval of the institution.
2. The substance of policy rules associated with the authority's decision in the sense *beschikkingen* form, in the field of private law, make plans (*plannen*) government agencies. The legislation regulates the life of society more basic, such as command and prohibition to do or not do.
3. Regulatory policy can simply load administrative sanctions for violations of the norm. As for the legislation, may contain criminal sanctions and coercive that could restrict the human rights of citizens. Rule lower than law may only include criminal charge of violation if it is expressly attributed by law.

In consideration of the Supreme Court *in casu* relating to the "elements unlawfully" (vide case 36-38), that refers to the considerations mentioned above, then the element of unlawful fulfilled according to the law.

#### IV. CONCLUSION

Based on the description above, it can be concluded that:

1. The legal action undertaken by the defendant constitute corruption
2. Measure the abuse of authority in the *in casu* let by basing on the principles of specialties in budget management.

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# Study on the Swelling Behaviour of Immobilized *Stereospermum Kunthianum* Plant Materials (Stem-Bark , Leaves, Root And Seed )

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**Abstract-** This paper studies the swelling behaviour of *Stereospermum kunthianum* plant parts (stem-bark, leaves, root, and seed) at various parameters (kinetics, temperature, pH and ionic strength). The plant parts were prepared by entrapping bio-sorbent with in a polymeric matrix of calcium alginate to produce immobilized bio-sorbents. Result shows that, in water, percentage water uptake increase with increase in time. The water absorbency for the immobilized plant samples in various salt solutions decrease with increasing ionic strength and temperature. The percentage water uptake for the plant parts were 363.6%, 330.6%, 263.6% and 240% for stem-bark, leaves, roots and seed respectively. The plant stem-bark and leaves has the highest percentage water uptake. These observations indicate that these plant samples have potentials in metal ions sorption from aqueous solution because in bioremediation process, the higher the water uptake by the sorbent, the higher metal ions it can remove from the aqueous medium.

**Index Terms-** *Stereospermum-kunthianum*, Immobilization, Water-uptake, Swelling.

## I. INTRODUCTION

Bioremediation is one of the remediation processes in the treatment of wastewater using low-cost biomass in the sorption of metals from aqueous medium. In this aspect, the ability of the sorbent to remove the metal ions is greatly influenced by the swelling behaviour of the sorbent. The higher the water uptake by the sorbent, the higher metal ions it can remove from the aqueous medium (Espert et al., 2002). This therefore necessitates the study of the swelling behaviour of *Stereospermum kunthianum* plant samples (stem-bark, leaves, root, and seed) before its application as sorbent. Due to environmental awareness and government policies, many industries are looking for new materials which are environmentally friendly (Ramedive et al, 2012). With enhancement of environmental protection consciousness of people, natural fibers have shown great promises in a variety of applications that were previously dominated by synthetic fibers. This is due to their biocompatibility, possible biodegradation, non-toxicity and abundance (Xue et al, 2012).

The world wide availability of natural fibers and other abundantly accessible plant-waste is a motivator towards achieving sustainable technology in this aspect of science. History shows that humans collected raw materials from the wild

to use as ropes or textiles and later, societies developed and learned how to cultivate such crops (Akil, 2011). The incorporation of fibers and fillers into composites affords a means of extending and improving the properties of the composites that meets the requirements of most engineering applications. Consequently these improvement are associated with economic advantages such as low production costs and resin consumption (Aziz et al., 2004).

In view of the above, Natural lignocellulose fibers have been receiving considerable attention as substitutes for synthetic ones. This is because the natural fibers among other benefits exhibit many advantageous properties such as low density, low cost, high stiffness, bio-degradability, reduced energy consumption, high degree of flexibility during processing and it is a renewable source (Ramedive, 2013). Some of the potential applications of natural fibers are in metal ion adsorption, textiles, packaging, paper manufacturing industries etc. Therefore, an understanding of the hygroscopic properties of natural fibers is very important to improve the long time performance of composites reinforced with these fibers and also its sorption capability (Saikia., 2010).

*Stereospermum kunthianum* belongs to the family *Bignoniaceae*. It is a deciduous shrub or tree 3-15 m high. The plant is found in dry areas of deciduous forest, rocky outcrops, termite mounds and margins of evergreen forests (Choudhury et al, 2011). The plant is used in treating water by communities where the plant is commonly found (Fori, 2013). Traditionally, the plant samples have medicinal values. Leaf infusion is used for treating wounds. Stem-bark decoction is used to cure bronchitis and pneumonia (Hanwa et al, 2009). Roots are used in treating venereal diseases and respiratory ailments. The pods are chewed with salt for coughs and are used in treatment of ulcers. (Falodun et al. 2012)

*Stereospermum Kunthianum* plant has come to interest due to its importance in innovative application in water treatment/purification and its medicinal values by communities where it is commonly found.

The objective of these work is to compare the water up-take of *Stereospermum kunthianum* plant materials (stem-bark, leaves, root and seed) under different parameters. (kinetics, pH, Ionic concentration and temperature to find out which part of the plant has highest water uptake ability so that attention will be given to it, to be converted into an industrial product to enhance its full potentials in water treatment/purification. The plant is been used by communities for water treatment in its natural form and creates problems of debris on the water and fouling (smelling) of

water if it stays for more than 24 hours. Hence attention will be given to the plant part that has the highest water uptake ability for bioremediation process.

## II. MATERIALS AND METHODS

### Materials

Sodium- alginate, Calcium- Chloride, Sodium- Chloride, Hydrochloric- acid, Sodium- hydroxide. These chemicals were of analytical grade and were used as supplied. *Stereospermum Kunthianum* plant samples used (stem, leaves, root and seed ) was obtained from Creek in Waka-Biu, Borno state, Nigeria.

### Methods

#### Preparation of samples

The stem bark, root, and leave samples were freed from sand particles and dead dried tissues by carefully scraping with spatula and were chopped to pieces, air dried for two weeks, and the pods were collected and left to stand for a week for complete drying. The pods were broken with hand to expose the winged and coated seeds. The seeds were left to stand for 24 hours followed by removal of seed coat using local mortar and pestle. The broken seed coat and wings were blown off with the aid of gravitational force and wind. The bear seeds obtained were milled into powder using pestle and mortar. The pulverized samples were stored in polyethylene bags for further analysis.

#### Dissolution of plant samples

The dissolution of the *Stereospermum kunthianum* plant sample was done by weighing 4.00g of the stem bark powder and dissolved in 100cm<sup>3</sup> of water and label mixture A, then the mixture poured into a separating funnel and allowed to stand for 12 hours for separation into various fraction. The process was repeated for root, leaves and seeds respectively.

#### Preparation of Sodium Alginate and Calcium Chloride to Immobilized Sample

Sodium alginate was prepared by weighing 4.00g and making it up to 100cm<sup>3</sup> mark with distilled water in a volumetric flask and left overnight for complete dissolution to give 4% w/w. 0.12M calcium chloride was prepared by weighing 26.28g into 1L volumetric flask and make up to the mark with distilled water (Wuyep et al,2007)

#### Synthesis of Immobilized Samples of *Stereospermum kunthianum*

25cm<sup>3</sup> viscous layers of dissolved *Stereospermum kunthianum* stem- bark sample was mixed with 25cm<sup>3</sup> of 4% stock solution of sodium alginate and stirred vigorously for even mixing in 250cm<sup>3</sup> beakers. The mixture was then transferred into another beaker containing 30cm<sup>3</sup> of 0.12M calcium chloride solution. The reaction was allowed retention time of 1hour for complete precipitation. The precipitated blend solid of the stem-bark sample was filtered and dried at room temperature (30<sup>0</sup>C) for 24hours. The dried solid were stored in polyethylene bag for further use, Wuyep (2007). The same procedure was repeated for the leaves, root and seed samples.

#### Determination of water uptake by the *Stereospermum kunthianum* Immobilized Samples.

The modified "Tea bag" method reported by Osemeahon et al, (2003) was employed in this study. This involves the insertion of 2g of clean dried immobilized sample of stem bark into a

transparent polyethylene bag, the assembly was weigh before adding 100ml of distilled water and was hermitically sealed and kept undisturbed for 24hours at 30<sup>0</sup>C to attain equilibrium. At the end of the equilibrium period, the excess solution was carefully sucked out using micro syringe, the polyethylene bag with the wet sample was reweighed. The percentage water uptake was determined using the following equation.

$$\text{Water uptake (\%)} = (W_x - W_y) / W_x \times 100/1$$

Where W<sub>x</sub> and W<sub>y</sub> represent weight of the dry and wet immobilized blend samples respectively (Barminas et al., 2005).

#### Determination of the Effect of Time on Water Uptake by *Stereospermum Kunthianum*

The effect of contact time on water uptake by *Stereospermum kunthianum* immobilized samples was determined at room temperature. 2 g of the immobilized stem was inserted in a polyethylene bag and weighed before adding 100ml of distilled water, using the modified tea bag method as reported earlier (Osemeahon, 2003). At the end of the equilibrium period, the excess water was sucked out using a micro syringe ,the polyethylene bag with the wet sample was reweighed, The percentage water uptake was determined at different time interval ranging from 60 minutes to 24hours. The process was repeated for the immobilized root, leaves and seed samples respectively.

#### Determination of the Effect of pH on Water Uptake by *Stereospermum Kunthianum*

The water uptake behaviour of *Stereospermum Kunthianum* immobilized stem at different pH values (pH 2 - 12) was investigated at 30<sup>0</sup>C for 4hours using the modified tea bag method. A standard of 1.0 M HCl and 1.0 M NaOH was used to adjust the solutions to the required pH as the case may be. At the end of the equilibrium period, the excess solution was sucked out using a micro syringe; the polyethylene bag with the wet sample was reweighed. The percentage water uptake was determined at different pH within the range stated above. The process was repeated for the immobilized root, leaves and seed samples respectively.

#### Determination of the Effect of Ionic Strength on Water Uptake by *Stereospermum Kunthianum*

2.0 g of the clean and dried *Stereospermum kunthianum* immobilized stem-bark was inserted into a polyethylene bag and weigh before adding 100 ml of sodium chloride solution of various concentrations (0.1 M – 1.0 M w/w) using the modified tea bag method. At the end of the equilibrium period of 4 hours at 30<sup>0</sup>C, the excess solution was sucked out using a micro stringe; the polyethylene bag with the wet sample was reweighed. The percentage water uptake was calculated using the formula reported earlier (Barminas et al., 2005). The process was repeated for the *Stereospermum kunthianum* immobilized root, leaves and seed samples respectively.

#### Determination of the Effect of Temperature on Water Uptake by *Stereospermum Kunthianum*

The effect of temperature on water uptake by *Stereospermum kunthianum* was determined. 2.0 g of the immobilized stem-bark was inserted in a polyethylene bag and weigh before adding 100ml of distilled water, the polyethylene bag was sealed and allowed to stay for 4hours. The assembly was

kept at a constant temperature using a regulated water bath. At the end of the equilibrium period, the excess water was sucked out using a micro string, the polyethylene bag with the wet sample were reweighed. The percentage water uptake was determined as reported earlier. The procedure was repeated for various temperatures ranging from 30° to 80°C. The process was also repeated for the immobilized root, leaves and seed samples respectively.

### III. RESULTS AND DISCUSSIONS

#### Sorption capacities of Different *Stereospermum Kunthianum* Samples

Figure 1 presents the sorption capacities of different *Stereospermum Kunthianum* plant samples at room temperature for the sorption period of 24 hours. The result shows that stem have the highest water-uptake ability, followed by leaves, root and seed respectively.

Plant natural fibers are made up of cellulose, hemicelluloses and lignin. The cellulose is held by amorphous hemicelluloses and fibers are cemented together in the plant by lignin. Lignocelluloses cell walls of plants contain hydroxyl and other oxygen containing groups that attract water through hydrogen bonding. The hemicelluloses are mainly responsible for water absorption. In view of the above, the stem-bark has the highest amount of hemicelluloses followed by leaves, root and seed respectively since it has the highest percentage absorption capacity.

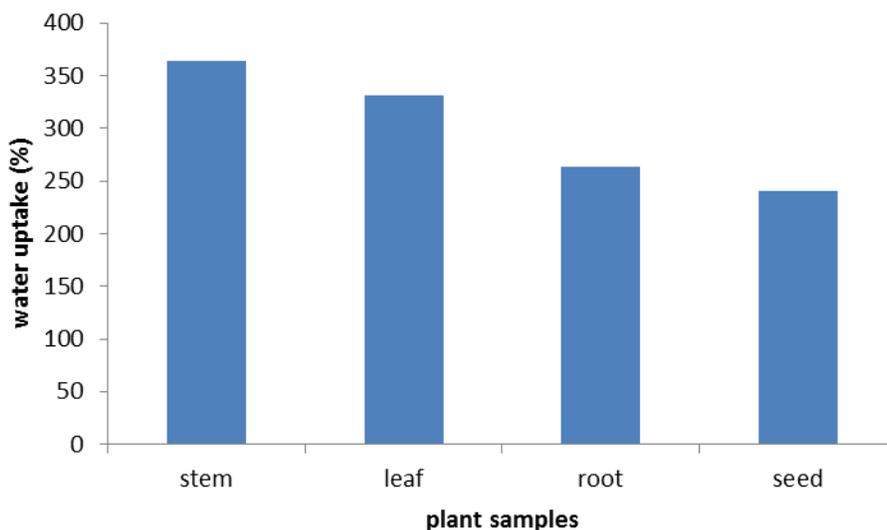


Figure 1: Absorption capacities of plant samples at 30°C

#### Effect of Time on Water uptake by *Stereospermum Kunthianum* Samples

Result on contact time on percent water uptake at 30°C is shown on Figure 2. It can be seen that the rate of uptake of water by immobilized plant samples increases steadily up to 7 hours then began to fall slightly. The swelling kinetics for sorbent is significantly influenced by the swelling capacity and apparent density of the polymer.(Lee and Lin.,2000). Previous studies by (Osemeahon et al., 2003, Toti et al., 2002), supports the increase in the rate of water uptake with in the first few hours of this experiment. The swelling ratio increases with increase in time because the structure of the polymers affects the swelling of the samples depending on the composition of polymeric matrix. The

water sorption is caused among other factors by the hydrophilic nature of the plant samples.

The swelling of plant samples in water is attributed to the interaction between the hydrophilic cellulose molecules of the plant samples fibers in water molecules .Cellulose which is the main constituents of plant fibers contain three hydroxyl (-OH) groups, these hydroxyl groups form hydrogen bonds between the cellulose molecules and exposing these bonds to water which causes them to be broken (Jayamol et al., 2001). The hydroxyl groups then form new hydrogen bonds with water molecules which cause swelling. When the plant samples are immersed in water, the hydrophilic fibers swell, and the high cellulose content in the plant fibers contributes to more water penetrating into the interface through the voids induced by swelling of fibers with time (Njoku and Obikwelu, 2008).

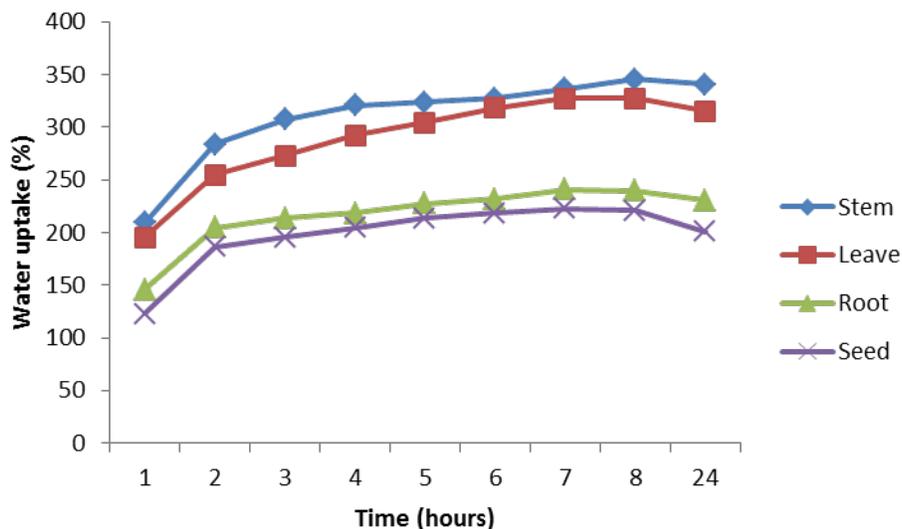


Figure 2: Effect of contact time on equilibrium mass % of uptake of water at 30°C

**Effect of Temperature on Water Uptake by *Stereospermum Kunthianum* Plant Samples**

Figure 3 is the effect of temperature on water uptake by *Stereospermum kunthianum* plant samples. The result showed that, water uptake decrease with increase in temperature. Decrease in water uptake by polymeric sorbents with increase in temperature was also reported by Osemeahon et al., 2003, Toti et al., 2002. Increase in temperature during water absorbency give more compacted form of membrane resulting in reduction of cross linking density of the membrane which causes the pore to be narrower and the suction sites be hidden or in accessible to the

water molecules. (Barminas and Osemeahon, 2005). When the temperature is increased, the moisture saturation time is greatly shortened; weight gain is higher for samples at lower temperature than higher temperature (Dhakal et al., 2006). This is attributed to the fact that the water sorption as the temperature increases is governed respectively by the wetting of fibres and the capillary sorption process because of the heat involved. This is due to the hydrophilic property of cellulosic fibres as more water molecules penetrate into the micro cracks present in these fibres, making the fibres swell faster and eventually leading to failure of water uptake at higher temperature (Sombastsompop et al., 2004).

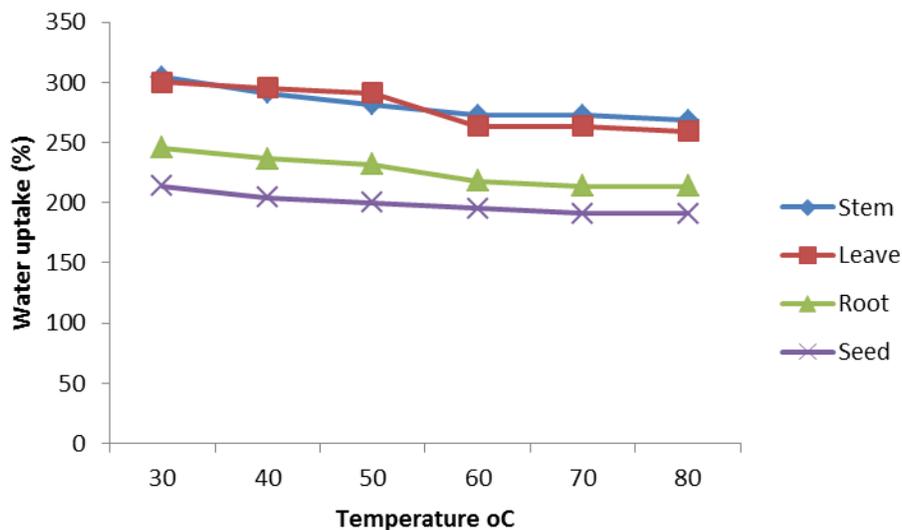


Figure 3: Effect of temperature on equilibrium mass % uptake of water at 30°C

**Effect of pH on water uptake by *Stereospermum kunthianum* plant Samples**

The effect of pH on *Stereospermum Kunthianum* plant samples on water uptake is presented on Figure 4. It can be observed that the plant samples absorbed less water in acidic solution than the alkaline solution. This is due to the change in

the surface topography of the plant fibers as a result of replacement of hydroxyl group by hydrophobic esters in which chemical modification takes place as the acid substitute the cell wall hydroxyl groups making the surface more hydrophobic. (Sampathkuma et al., 2012). In all the figures of the plant samples, it was observed that water up-take increases with

change of the pH of the swelling medium from pH 2 to pH 6 and remain static at pH 7. As the pH of the medium increases from pH 8 to pH 12, there is significant increase of water absorption by all the plant samples. This is due to the fact that, at lower pH values the  $-CONH_2$  groups do not ionize and keep the network at its collapse state. At high pH values it get partially ionizes and the charged  $-COOH$  groups repel each other leading to increase in swelling of the polymer .

Similar observation was reported by Nkafamiya , Barminas and Osemeahon (2011), that hydrogels are pH sensitive. Also, it was reported that the swelling of microgels, prepared with grafting of poly onto guar gum, increases when the pH of the medium changes from acid to alkaline because of the saponification of the  $-CONH_2$  to the  $-COOH$  group (Soppimath et al.,2001).

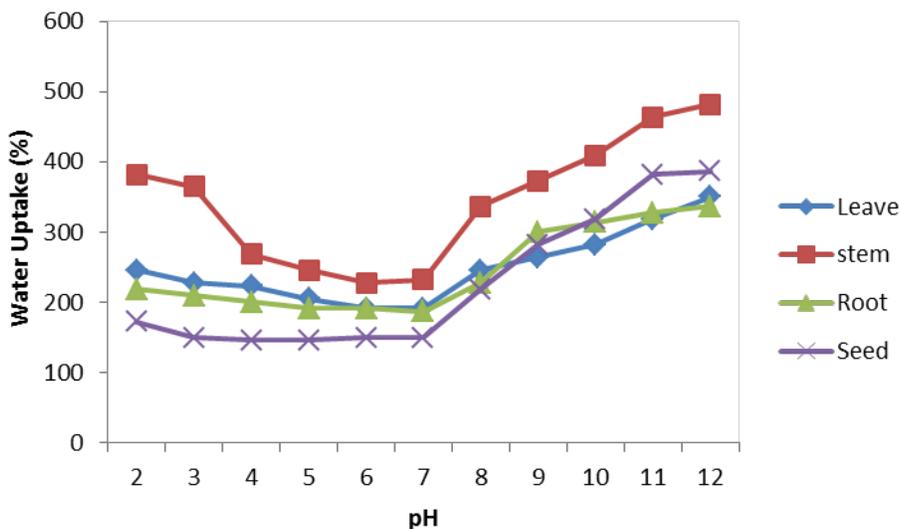


Figure 4: Effect of pH on equilibrium mass % of uptake of water at 30°

**Effect of Ionic Strength on Water uptake by *Stereospermum kunthianum* plant Samples**

Figure 5 is the percentage water uptake by *Stereospermum kunthianum* plant samples at various Ionic concentrations from 0.1 M to 1.0 M. The result shown on this figure indicate that the water absorbency for the immobilised plant samples in various salt solutions decrease with increasing ionic strength of salt solution. This result is attributed to the decrease in the expansion

of the polymer network which was caused by repulsive forces of the counter ions on the polymeric chain shielded by the ionic charge .Therefore, the difference of the osmotic pressure between the polymer network and the external solution increased with increased in the ionic strength of the saline concentration. This is possible due to the difference in the ionic osmotic pressure between the plant samples and the external solution (Lee and Lin, 2000 ).

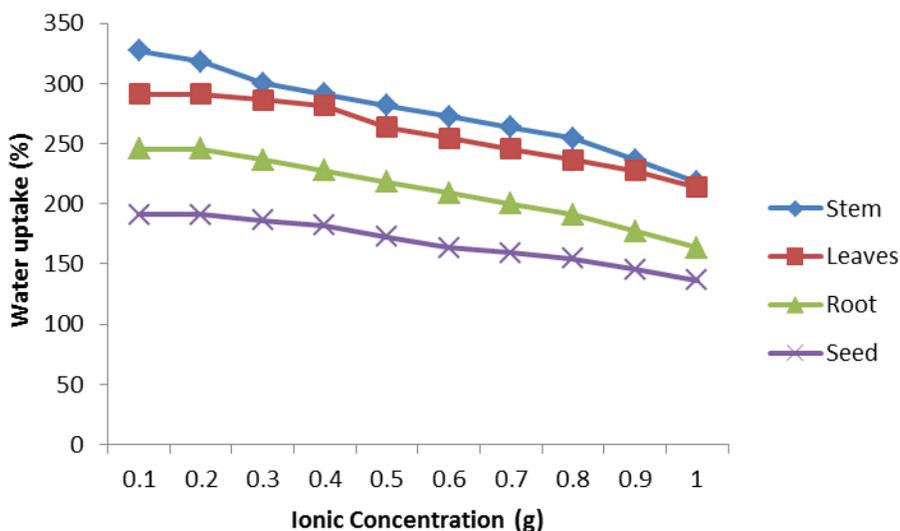


Figure 5: Effect of ionic strength on equilibrium mass % of uptake of water at 30°C

#### IV. CONCLUSION

The effect of water uptake by *Stereospermum kunthianum* plant samples has been studied at room temperature under various conditions of concentration, temperature, kinetics, ionic strength, and pH. Immobilization of *Stereospermum kunthianum* plant samples (stem-bark, Leaves, Root and Seed) was achieved by encaging them within stable polymeric matrix of calcium alginate. The results obtained from the water uptake were satisfactory. There was an increase in water uptake by the bio sorbents as contact time, pH of the medium and the concentration of *Stereospermum kunthianum* plant samples increases. While a decrease in water uptake was recorded as the temperature and ionic strength increases. Therefore, since *Stereospermum kunthianum* stem bark has high water uptake ability, it may be a good biomass in the sorption of heavy metals in aqueous solution.

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# Role of RRBs in the Promotion of Self Help Groups in India (An Analytical Study)

Dr. Anoop Kumar Singh

**Abstract-** No doubt, commercial banks and co-operative banks have achieved a great success in the area of financing during the post independence period, but there exists a wide gap between demand and supply of rural credit. In order to bridge this gap a new set of banks namely regional rural banks were introduced in banking sector of India. Their scope of rural financing has been expanding in terms of network of their branches as well as volume of financial transaction. Micro finance has tremendous strides in India over the last few years and it has become a household name in a view of multi prolonged benefits receivables from micro finance services by the poor in our country. Through this paper an attempt has been made to assess the role of RRBs in last few years focusing on their contribution in the field of micro financing. At the same time, the paper argues that in the economy as vast and varied as India, there is scope for diverse micro finance approach to co-exist in future.

**Index Terms-** SHGs, SHPIs, MFIs, RRBs, NABARD

## I. INTRODUCTION

In India where still 40% of the rural population is non-bankable and living in an acute shortage of employment opportunities, our rural poor are forced to borrow from the money lenders at exorbitant interest rate, which often exploit these poor for their own advantage. The main goal of establishing regional rural banks in India was to provide credit to the rural people who are not economically strong enough, especially the small and marginal farmers, artisans, agricultural labours, and even small entrepreneurs." RRBs are region based and rural oriented banks which have been set up to correct the regional imbalance and functional deficiencies in the institutional credit structure that is the weaker section of the rural economy".

Regional Rural Banks were established under the provisions of an Ordinance promulgated on 26th September, 1975 and the RRB Act, 1976 with an objective to ensure sufficient institutional credit for agriculture and other rural sectors. The RRBs mobilize financial resources from rural / semi-urban areas and grant loans and advances mostly to small and marginal farmers, agricultural laborers and rural artisans. RRBs are jointly owned by GOI, the concerned State Government and Sponsor Banks (27 scheduled commercial banks and one State Cooperative Bank); the issued capital of a RRB is shared by the owners in the proportion of 50%, 15% and 35% respectively. The GOI initiated the process of structural consolidation of RRBs by amalgamation RRBs sponsored by the same bank with a view to provide better customer service by having better infrastructure, computerization, experience work force, common publicity and marketing efforts etc. the amalgamated RRBs also benefited from large area of operation, enhance credit exposure limit for

high value and diverse banking activities. As a result of amalgamation, the no. of RRBs has been reduced from 196 to 57 as on 31 mar 2014. The number of branches of RRBs increased to 19082 districts as on 31 mar 2014, covering 642 notified districts of 26 states of India. A remarkable growth has been recorded in the growth parameters of RRBs in 2013-14. There is an evident of 13 percent growth in the aggregate deposits, 34 percent in borrowings, and 17 percent in outstanding loans and advances during this period.

Introduction of RRBs was an important step forward to fulfill the social development objective of specially the rural sector which was outreach of a rural economy. Development of RRBs was required for:

1. To take banking to the doorsteps of the rural masses, particularly in areas without banking facilities.
2. To make available cheaper institutional credit to the weaker sections of society, who were to be the only clients of these banks.
3. To mobilize rural savings and channelize them for supporting productive activities in the rural areas.

## II. RRBs SUPPORTING MICRO-FINANCE

The Indian micro finance sector has seen phenomenal growth in the last few years. Considering the world success on micro finance, GOI has taken initiatives to widen the outreach of RRBs all over India, especially in rural areas where commercial banks and other financial institution are outside the outreach of rural poor. Micro financing is one of the distinctive functional areas of RRBs.

Micro financing by definition refers to "the entire range of financial services rendered to poor and including skill up gradation entrepreneurial development that would enable them to overcome poverty." Micro finance has been recognized and accepted as one the new development paradigm for alleviating poverty through social and economic development of the poor with social emphasis on empowering poor. SHGs also known as self-help group is born out of micro-finance with the main objective of development of rural economy. SHGs or self-help group consist of group of 15-20 people who comes together with an objective of creating the financial cushion in the times of individual or collective exigencies. According to the review of financial performance of RRBs, besides financing SHGs, the RRBs also play a vital role of serving as SELF HELP PROMOTIONAL INSTITUTION (SHPIs), which entails these RRBs to provide the social mobilisation role at the local community level. This approach was necessitate as the no. of social intermediary like NGOs were limited and near to absent in the region which warranted their presence. This necessitated NABARD to start a pilot project in 1998 to support RRBs to

attempt functioning as social intermediary. An independent assessment of project indicated that RRBs staff could be selectively leverages to function as social intermediaries in mobilising poor communities into group like SHGs. The scheme envisages the RRBs to select 10 branches for the task of promoting and nurturing SHGs using the services of branch staff, involving the branch manager and the local sub-staff. In the year 2011-12, 203617 SHGs account has been sanctioned loan amount of Rs 356573.48 lakhs for the upliftment of SHGs under micro finance.

The need of micro financing arises because the rural India requires sources of finance for poverty alleviation, procurement of agriculture and farms unit, to pay its debt and maintain social and economic status in the village and to bring down the cost of providing credit in the rural areas.

As we know that India is an agriculture based economy, hence micro finance may be a tool to empower the farmers and rural people to make agriculture profitable. Therefore the researcher is interested to find out the scope of micro financing in rural India. This research paper is trying to trace out the importance of RRBs as well as their future prospects as a profitable segment through micro financing in rural India.

### III. REVIEW OF LITERATURE

Development of an Indian economy has been an outcome of revolution in the banking sector. The relationship between the financial system and economic growth has been scrutinized by a large number of studies in India and abroad. Financial development is considered as a cause of economic growth (Schumpeter 1911; Hicks 1969). Hicks (1969) argued that without financial innovation the industrial revolution would not have taken place.

Financial intermediaries make it possible for small savers to pool funds and allocate them to the highest return investment, and then to provide capital for investing in costly new technology (King and Levine 1993; Greenwood and Smith, 1997). According to Levine (1997) reported that a well-developed financial system reduces information and transaction costs and influence saving rates, investment decisions, technological innovation and long run growth rates. In this context, microfinance has emerged as a financial innovation tool to serve the millions of poor households that are out of reach of the formal banking and financial institutions. Microfinance is the result of financial service innovations which includes microcredit, micro savings, money transfer vehicles and micro insurance. It is a special kind of financial service designed to cater the needs of poor people who are unemployed, entrepreneurs or farmers who are not bankable. Microfinance has become, in recent years, a fulcrum for development initiatives for the poor, particularly in the Third World countries and is regarded as an important tool for poverty alleviation. The microfinance revolution, particularly the success stories of institutions like Grameen Bank in Bangladesh, Banco Sol in Bolivia, and Bank Rakyat in Indonesia, attracted several economists to study microfinance in the latter half of the 1990s. Some studies argue that microfinance has very beneficial economic and social impacts (Holcombe, 1995; Hossain, 1988; Otero and Rhyne, 1994; Remenyi, 1991; Schuler, Hashemi and

Riley, 1997). "Microcredit is a critical anti-poverty tool and a wise investment in human capital." The emerging microfinance revolution with appropriate designed financial products and services enable the poor to expand and diversify their economic activities, increase their incomes and improve their social wellbeing (Bennett and Cuevas, 1996; Ledgerwood, 1999). Past studies of many researchers found that microfinance has very beneficial economic and social impacts (Holcombe, 1995; Hossain, 1988; Otero and Rhyne, 1994; Remenyi, 1991; Schuler, Hashemi and Riley, 1997). A recent study by Emma Svensson examines microfinance movement for economic growth by exploring the linkages of microfinance, the financial system and economic growth. He found some evidence of the microfinance clients engaging in growth enhancing economic activities. There has been change in income and productivity in micro-enterprises and the economic sectors relevant to microfinance clients. He also found that the character of the informal sector seems to be inhibiting for micro-enterprise growth.

In India also many studies are conducted by various autonomous agencies like NABARD, SIDBI, BIRD etc. including RBI from time to time. These organizations practice microfinance. Most of the studies are on the impact assessment of the beneficiaries of microfinance. There have been various studies on growth of micro finance, growth of SHGs and growing empowerment through micro finance. Most of the studies focus on Self-Help Groups (Agarwal, Shalini 2007; Gopiseti, Rambabu 2007; Gaonkar, Maya Sairoba 2008; Sarkar, Soumitra 2008; Nagarajan, P.S 2009). Some studies are also conducted on poverty reduction and empowerment (Prakash, Jayasheela 2009). Some researchers have also worked on group based credit programmes (Sarangi, Niranjana 2008). There were many studies where the researcher has evaluated the performance of Regional Rural Banks (Abdul, Hadi (2005). Some studies were found to focus on the relationship between microfinance and microenterprises (Kanaskar, Mukesh Prabhakar 2008; Natarajan, Jeyaseelan 2007). In this paper the researcher has focussed on the performance of RRBs in the field of micro finance by showing the growth process in the loan disbursed to SHGs under micro finance, saving of SHGs under micro finance by RRBs, loan by RRBs to micro finance institution, loan outstanding of SHGs under micro finance.

### IV. OBJECTIVE OF STUDY

The present study aims at the following:

1. To have an understanding of the role of RRBs in micro financing.
2. To compare the growth trends of RRBs with respect to SHGs in the last eight years from 2006-07 to 2013-14.
3. To study the role of NABARD on maintaining and improving the quality of micro financing specially in self employment generation to ensure their sustainability and enabling their gradation.
4. To analyse the growth of self-help groups with the aid of MFIs.
5. To identify the main hindrances in the growth of the microfinance sector.

## V. RESEARCH METHODOLOGY

The present study has been made mainly to focus on the performance of regional rural banks in India in the field of micro financing.

This study is descriptive as well as analytical in nature and makes use of secondary data. The data have been found out by googling in different websites, research paper, and magazines. The quantitative data has been taken from the NABARD handbook which is published yearly. Percentage growth and averages have been used to analyse the data.

### GROWTH OF MICRO FINANCE BY REGIONAL RURAL BANKS IN INDIA

In the view of large outreach and pre-dominant position of this micro financing programme, it is very important to examine the status, progress, trends, qualitative and quantitative performance comprehensively. To achieve this objective, RBI and NABARD have issued guidelines to various financial institutions to furnish data on progress of micro finance. In present study we will focus on the increasing role of regional rural banks in micro financing like savings of SHGs with RRBs, loan disbursed to SHGs by RRBs, loan provided to micro finance institution by RRBs and RRBs loan outstanding against SHGs. This is a comparative study, based towards the performance of RRBs in the field of micro financing in the last six financial years.

### MODELS OF MICRO FINANCE

There are two models of micro finance involving credit linkage with banks. The present paper deals with these two credit linkage model of micro finance.

- **SHG- BANK LINKAGE MODEL:** this model involves SHG financed directly from banks viz, commercial banks (public and private sector), regional rural banks, Co-operative banks.
- **MFI- BANK LINKAGE MODEL:** this model covers financing of Micro Finance Institution (MFIs), by

banking agencies for lending to SHGs and other small borrowers covered under micro finance sector.

### Legal structure and regulation

SHG-Bank linkage model, under which Micro finance institutions are mainly working, is managed in India by NABARD. However there is a need of proper regulatory body which can fully monitor, supervise and promote the MFIs working in India. There are a mass of institutions with a variety of legal formalities due to this the regulation of all such institutions is not an easy target by a single regulatory body in the present system. Under micro financing structure, though NBFCs, which cover the major part of the outstanding loan portfolio, are regulated by Reserve Bank of India, other institutions like cooperative societies, trusts, companies constituted under Section-25 do not fall within the purview of RBI's regulation. The microfinance bill which was introduced in the year 2007 is still pending. The most recent and the strongest step taken by the government, The Micro Finance Institutions (Development and regulation) Bill, 2011 is a major step in the microfinance sector. The proposed bill clarifies all doubts pertaining to regulation of the MFIs by appointing RBI as the sole regulator for all MFIs.

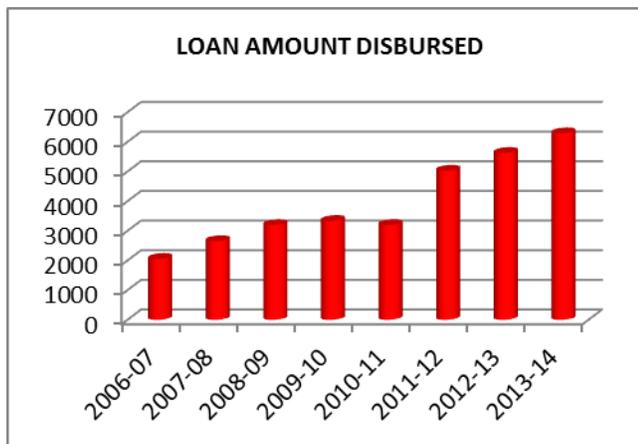
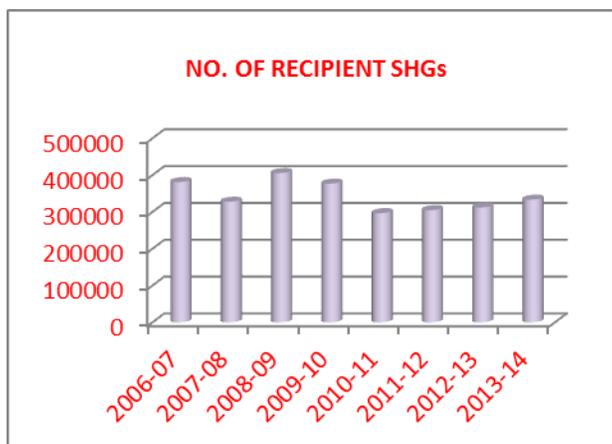
### REGIONAL RURAL BANKS- PROGRESS UNDER MICRO FINANCE

The progress of micro financing by RRBs especially through SHGs can be assessed by looking at the statistics pertaining to growth trends of various parameters such as number of SHGs getting loan, depositing their savings, outstanding bank loan of SHGs, loan disbursed to MFIs etc over a period of time. For this purpose pertinent data along with the percentage growth therein have been demonstrated in the tables presented below. Moreover, in order to have a pictorial view the data have been presented through graphs and diagrams too.

**LOAN DISBURSED TO SHGs BY RRBs Table -1**

YEARS	NO. OF SHGs	GROWTH %	AMOUNT (Rs. Cr.)	GROWTH %
2006-07	381199	-	2052.72	
2007-08	327650	-14.0475	2651.84	29.18664
2008-09	405569	23.78117	3193.49	20.42544
2009-10	376797	-7.09423	3333.20	4.374838
2010-11	296773	-21.238	3197.61	-4.06786
2011-12	304809	2.70779	5026.05	57.18146
2012-13	312010	2.362463	5626.52	11.94716
2013-14	333420	6.86196	6288.13	11.75878

Source: NABARD handbook- Source of Micro Finance in India.



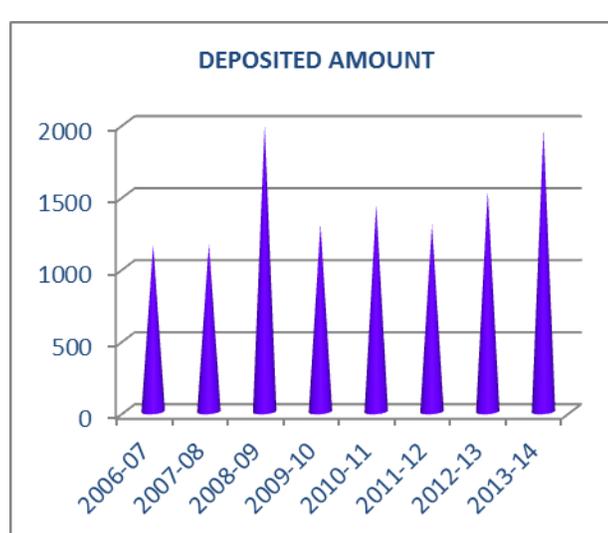
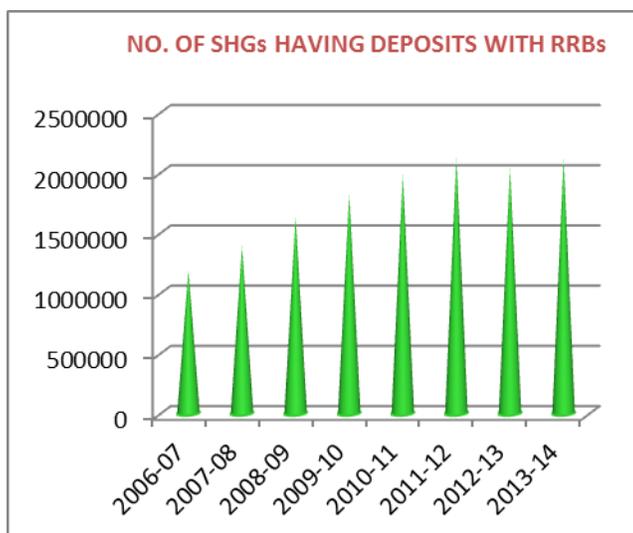
As per the data available on the website, RRBs line up second after commercial banks in terms of financing to SHGs. In the above section, loan disbursed to SHGs by RRBs under micro finance has been shown. The year 2008-09 saw an immense growth in the no. of SHGs with a loan amount of 3193.49 Cr, where as in the next year no. of SHGs has declined to 376797 but amount of loan disbursed saw a growth of 4.4%. The year 2011-12, witnessed an enormous growth in the amount of loan

disbursed to SHGs that is of 5026.05 Cr, which is more than 50% as compared to 2006-07. During the years 2012-13 and 2013-14 the loan amount was increased at almost same rate. As a whole the number of SHGs has decreased from 381199 in 2006-07 to 333420 in 2013-14. Despite that amount of loan disbursed to SHGs has increased to 6288.13Cr.in 2013-14 from 2052.72Cr. in 2006-07 registering a total growth of 206% during the period of eight years,.

**SAVING DEPOSITS OF SHGs WITH RRBs Table -2**

YEARS	NO. OF SHGs	GROWTH %	AMOUNT(Rs. CR)	GROWTH %
2006-07	1183065	-	1158.29	-
2007-08	1386838	17.22416	1166.49	0.70794
2008-09	1628588	17.43174	1989.75	70.57583
2009-10	1820870	11.80667	1299.37	-34.6968
2010-11	1983397	8.925788	1435.40	10.46892
2011-12	2127368	7.258809	1300.13	-9.42385
2012-13	2038008	-4.2005	1527.10	17.45749
2013-14	2111760	3.618828	1959.86	28.33868

Source: NABARD handbook, status of micro finance in India.



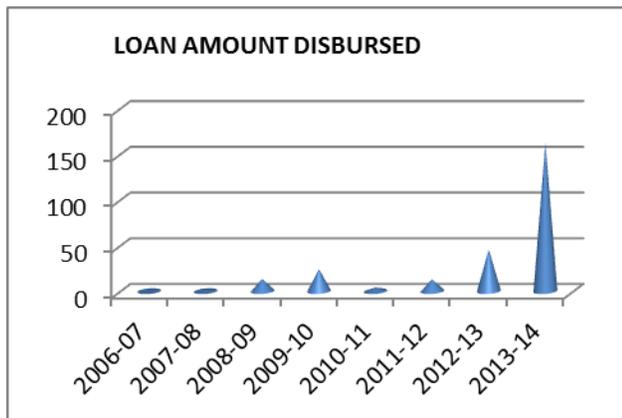
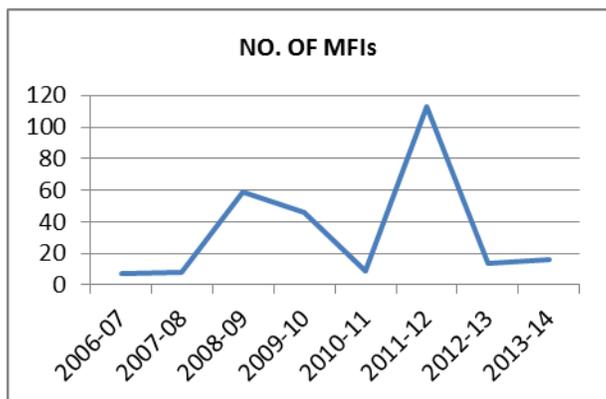
The saving accounts of SHGs with RRBs have increased with many folds in the last eight years, from 1183065 in the year 2006-07 to 2111760 in the year 2013-14. This clearly depicts the inclination of rural and marginalised people including members of SHGs towards banking transaction and saving habits. If we look at the saving amount of SHGs with RRBs, year 2008-09

recorded the maximum saving deposit amounts of 1989.75 Cr, which was highest until now. It was followed by the saving of Rs. 1959.86 Cr. in 2013-14. The growth pattern of the saving amount does not seem to be consistent over the study period evidencing a negative growth during 2009-10 and 2011-12.

**LOAN DISBURSED TO MICRO FINANCE INSTITUTION by RRBs Table - 3**

YEARS	NO. OF MFIS	GROWTH %	AMOUNT(Rs. Cr)	GROWTH %
2006-07	7		0.22	
2007-08	8	14.28571	1.51	586.3636
2008-09	59	637.5	13.50	794.0397
2009-10	46	-22.0339	24.14	78.81481
2010-11	9	-80.4348	4.16	-82.7672
2011-12	113	1155.556	13.28	219.2308
2012-13	14	-87.6106	45.82	245.03
2013-14	16	14.28571	163.17	256.11

Source: NABARD handbook, status of micro-finance in India.



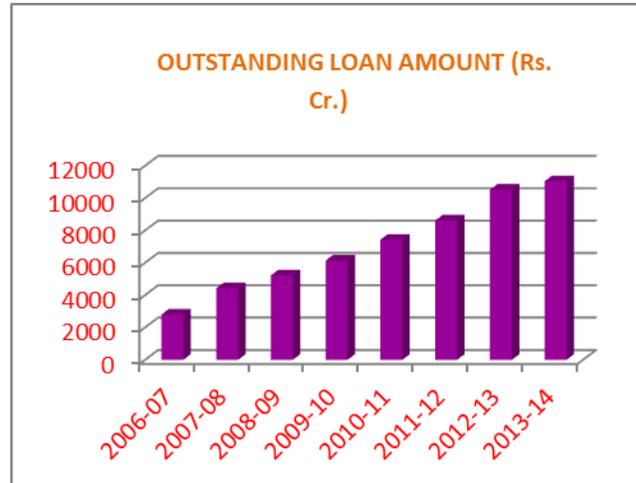
Under MFIs –bank linkage model, the year 2011-12 saw an enormous growth in loan disbursed to micro finance institution. No. of MFIs getting loan from RRBs was to 113 in India which further came down to 16 in 2013-14. These MFIs act as intermediaries between a bank and a borrower. While looking at the statistics relating to loan disbursed to MFIs we find that the year 2013-14 recorded a highest amount of loan disbursed to MFIs i.e. Rs 163.17Cr, which was all time highest by RRBs in this period. According to the report of progress under micro

finance 2011-12, commercial banks are losing their confidence in lending to MFIs and loan during the year declined by over 38% as compared to last year. There has been a marginal decline in no. of MFIs availing fresh loan from bank in spite of the fact that loan outstanding against MFIs has come down by almost 17% during the year. The regional rural banks on the other hand have increased their lending to MFIs during the year and also reducing their outstanding loan amount.

**BANK LOAN OUTSTANDING of RRBs AGAINST SHGs Table-4**

Years	NO. OF SHGs	GROWTH %	AMOUNT (Rs. Cr.)	GROWTH %
2006-07	729255	-	2801.76	-
2007-08	875716	20.08365	4421.04	57.7951
2008-09	977834	11.66109	5224.41	18.17152
2009-10	1103980	12.90055	6144.58	17.6129
2010-11	1281493	16.07937	7430.05	20.92039
2011-12	1293809	0.961067	8613.57	15.92883
2012-13	1327367	2.593737	10521.23	22.14715
2013-14	1227563	-7.51895	11048.95	5.015763

Source: NABARD handbook, status of micro-finance in India.



Through the numerical facts shown in the Table No. 4, researcher has tried to show the outstanding loan amount of RRBs against SHGs. Though there has been a growth in the no. of SHGs in the study period, a marginal decline has been recorded in 2013-14. On the other hand the loan outstanding has also increased, but the % growth in outstanding loan amount is decreasing year by year, which means that RRBs are presently in better position to recover their outstanding loan amount, and it has been concluded that RRBs will reduce their outstanding loan very fast in coming years.

#### Main hindrances in the growth of the Microfinance sector

1. A very basic and crucial problem of MFIs is a shortage of sufficient funds as well as improper utilisation of available funds. The main reason of this is the nature of MFIs being for-profit motive, and hence restricted from taking public deposits.

2. Another hindrance in the growth of the microfinance sector is the little or no knowledge of the common people about microfinance arrangement and it is more difficult to serve them as microfinance clients as loans are disbursed on group lending concept and a past record of the group plays an important role in getting new loans.

3. Because of increasing level of completion among the financial institutions serving in this sector, it has become mandatory for a MFI to make their pricing system quite transparent. Non-transparent pricing by MFIs restricts the borrowers to choose the loan products in a dilemma.

4. One of the major drawbacks of MFI sector is Multiple Lending and Over-Indebtedness. Though competition is assumed to be good for a healthy business environment but in this case it is going against both the parties. In order to increase the market share, some of the MFIs are giving multiple loans to same borrowers which in some cases is leading to over-indebtedness

5. In some of the areas it has been observed that mutual understanding of some large MFIs has resulted in cluster formation. This is one of the reasons for the dominance of the microfinance sector in the southern states.

6. Another important problem of the microfinance is that some of the members of the group either leave the group or move to another group. Since loans are disbursed on group basis, the

group plays an important role in getting new loans either through SHG-Bank linkage or through MFIs.

#### VI. STRATEGIC MICRO-FINANCE PLAN WITH NABARD SUPPORT

They are playing a major role in the SHG - Bank Linkage Programme especially also as SHPIs. It is significant that as an institution they have the expertise and potential to fulfill both the requirements of SHGs - formation plus nurturing and financial service provisions (credit plus). Their dual role has special meaning in areas which face severe financial exclusion and which do not have a sufficient presence of well performing NGOs. However, to upscale the programme to a level where it can really make a visible impact, RRBs need handholding particularly in the areas of training, promotion and development. NABARD may provide required assistance.

NABARD should prepare a strategic action plan RRB-wise, for promotion and credit linkage of SHGs. RRBs may be asked to form, nurture and credit link at least 3,000 SHGs in all districts covered by them in North-Eastern, Eastern and Central Regions. A Memorandum Of Understanding (MOU) may be signed by RRBs with NABARD for a period of 5 years - with NABARD providing the promotional and development assistance out of the "Financial Inclusion Promotion and Development Fund" and RRBs forming, nurturing and providing financial services to SHGs. RRBs may accomplish the task with the support of individual rural volunteers, BFs, their staff members, etc. NABARD may closely monitor the programme - with focus on qualitative aspects.

#### VII. CONCLUSION

For the last two decades, Indian economy has been growing at a faster rate but not all have benefited by this excellent growth. Liberalisation, privatisation and globalization have given a tremendous opportunity to develop but this development has been restricted to a certain group of people. This has resulted in an increasing gap between the haves and have-nots of the society. In this context, microfinance can help reduce this

disparity and lead to a more equitable growth of the country. Savings-driven microfinance environment is feasible in rural as well as urban areas. If properly regulated and supervised, they have great potential in poverty alleviation and development, both in rural and urban areas. Most of the world's poor lack access to basic financial services that would help them manage their assets and generate income.

Over the years, savings of SHGs with RRBs and loan borrowed by them have been increasing drastically because of various Schemes launched by the Government such as Rajiv Gandhi Project, SJGSY and NRLM etc. At the same time growth in outstanding loan amount is decreasing year by year, which means that RRBs are presently in better position to recover their outstanding loan amount. In order to make microfinance system more vibrant and smooth, there needs an enabling regulatory environment that protects interest of stakeholders as well as promotes growth. This could also be made possible through field visits as a medium for monitoring the conditions on ground and correcting the unfavourable conditions. Moreover in order to enhance their business and funding their loan portfolio, MFIs should look for other sources for funding such as raise their Equity through outside investors. The first and the most crucial step to receive equity investment are getting converted to for-profit NBFC. Through securitization, MFIs can tap new sources of investments because fund of certain types like mutual funds, which are barred from directly investing in MFIs, can invest through securitized loans. Encouraging MFIs should also be encouraged to establish their branches in those areas where no financial institution is there to provide the financial assistance. Priority to shift from promotion of SHGs to provide livelihood opportunities to the SHG members in a calibrated manner through skill building, production optimisation, value chain facilitation and market linkage. Priority to shift from promotion of SHGs to provide livelihood opportunities to the SHG members in a calibrated manner through skill building, production optimisation, value chain facilitation and market linkage. A uniform policy and practice with regard to criteria of loaning as well as rate of interest should be adopted by all MFIs so that the entire MFI sector can become more competitive and systematic.

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# Effect of Fluoride Concentration on Cattle of Nagaur District (Rajasthan)

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**Abstract-** Fluoride is highly toxic and corrosive gas, light yellow-green in colour and with a pungent smell. The excess fluoride intake is responsible for dental and skeletal fluorosis in cattle. The symptoms of excessive fluoride ingestion include lesions in the developing dentition, skeletal lesion and lameness. The immature animals are reported to be most susceptible to dental fluorosis. The milk production is indirectly affected by fluoride toxicosis. The excessive fluoride reduces the conception rates of cattles.

**Index Terms-** Fluoride, cattle, dentition, toxicosis.

## I. INTRODUCTION

Nagaur district is one of the 33 districts of the state of Rajasthan in western India. It falls almost in the central part of Rajasthan covering an area of 17,718 sq.km. High fluoride concentration in the ground water of different parts of the Nagaur district is responsible for widespread fluorosis. When fluoride intake is more than the permissible limit it becomes toxic and wants cause various metabolic disturbances in cattles including dental and skeletal fluorosis. The surface water has low fluoride content while ground water passes a huge concentration of fluoride. Groundwater is the single biggest contributing factor for the spread of fluoride and fluorosis. High concentration of fluoride causes adverse effect on the central nervous system and joints. The survey indicates that the degree of fluoride problem is very serious in Nagaur district.

## II. METHODOLOGY

The fluoride concentration in water was determined electrochemically using fluoride in selective electrode. This method is applicable to the measurement of fluoride in drinking water in the concentration range of 0.02-1000mg/l. The electrode was used as an Orion fluoride electrode, coupled to an Orion electrometer. House to house survey was done in the early morning and late evening when the animals were available at home. The herds in the field were also examined during the day time.

## OBSERVATIONS

Normal cattle have blood levels of up to 0.2 mg fluorine per deciliter of blood and 2-6 ppm in urine. The detoxification process takes place if intake is very high in the form of deposition of fluorine in association with phosphate before irruption of teeth. The deposition is greatest in long bones on periosteal surface and exostosis occurs due to excessive

mobilization of calcium and phosphorus at any age in life. The bone lesions like osteomalacia, osteoporosis, osteofluorosis, hip lameness and stiffness of limbs, painful gait, un-thriftiness are the characteristic clinical symptoms. Palpably and visibly enlarged bones particularly the mandible, sternum, metacarpal, and phalanges become short thicker, broader, porous, brittle, hence are prone to fracture.

Immature animals have relatively greater sensitivity and susceptibility and less tolerance to fluoride. A few of the immature camel (calves), goats (kids) and sheep (lambs) were found to be afflicted with either dental or skeletal fluorosis. The excessive intake of fluoride is usually observed as skeletal, abnormalities or damage. Many detailed medical investigations have confirmed that there is no adverse effect on the body from continuous long term consumption of 1 mg/l in drinking water. Ingestion of 20/30mg /day or more through water over all long period result in crippling fluorosis and severe osteosclerosis. Calcification of certain ligaments, rendering movement of joints difficult, is usually associated with at least 10 mg/l of fluoride in drinking water.

The bone structure was found to be burred and it becomes a diffuse structure less shadow with uneven contours. These changes were marked in the spine and ribs. The actual lethal dose in between 2.5 and 5.0 gm depending upon the solubility of the compound and susceptibility. Cattle have been the species most commonly affected, and the symptoms of excessive fluoride ingestion in the species include lesions in the developing dentition, skeletal lesions, lameness, chemical evidence of tissue fluoride ingestion in that species include: lesions in the developing teeth and decrease in production. Dental lesions occur when excessive amounts of fluoride are ingested during the period of tooth formation and calcification. Bone effects the incisor teeth of a 6 year and 8 month old cow drinking fluoridated water from birth. All teeth have severe brown discoloration, and the enamel of these areas is thinner and has receded from the surrounding less-disturbed enamel. The maxillary gingiva is recessed, and the exposed distal enamel exhibits extensive defects. The mandibular gingival has receded and is bulging. The entire masticatory surface of the mandibular teeth has a severe brown coloration.

The teeth of a camel that has been consuming fluoridated water from 21year has brown discoloration of the enamel and extensive defects of the distal enamel of the maxillary teeth are present. A severe loss and recession of apical alveolar bone resulted in exposure of the distal clinical crown and the upper part of the roots of the maxillary teeth along with recession and bulging of the gingiva of the mandibular teeth. In milk producing animals like cow, buffalo and goats etc., the milk production is indirectly affected by fluoride toxicosis. Due to poor mastication

of roughages by unevenly worn teeth results in poor digestion and utilization of feed. Lameness associated with fluoride toxicosis may limit feeding time. Prolonged ingestion of excessive fluoride reduces the conception rates of cattles. Some secondary factors like poor body condition etc. has also seen to decrease the rate of reproduction. Decline in fertility is observed in cows and buffaloes receiving 8-12 ppm. fluorine continuously.

### III. CONCLUSION

Nagaur district was observed to have 27.8% of villages with concentration range between 3.1 to 5.0 mg/l, 26.96% villages have between 1.6 to 3.0 mg/l, 15.64% have more than 5.0 mg/l, 14.56% between 1.0 to 1.5 mg/l. But only 14.64% villages have less than 1.0 mg/l fluoride concentration in their ground water. Skeletal fluorosis, skeletal deformities, bony exostosis, muscle wasting, poor body condition, reductions move stiffness were observed.

### IV. RECOMMENDATIONS

Prior to providing safe water, it is necessary to carry out a benchmark health survey of the community. The timing of the initial survey should be closer to the date of commissioning of the safe water source. It is equally important to carry out a second health survey among the same population, 2 or 3 weeks after providing safe or defluoridated water for impact assessment. When health complaints-especially early warning signs of fluoride poisoning-disappear, the community needs to be informed about it. The rainwater harvesting is the best possible option to make fluoride-free water available to both the human beings and domestic animals.

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# Music therapy - A scientific Approach

Madhavi Kaulgi

## I. INTRODUCTION

**M**

usic is an inseparable part from our lives. Who doesn't like music? We hear some or the other kind of music everyday in our daily life. It's rare to find a person who doesn't like music. The taste of music may vary from person to person. The genre also may vary, but we are hardwired to music. It can be from the ocean of varieties, various forms of music easily available for us like classical music, light music, folk or regional music, western music etc.

Each of us selects our choice of music. We listen to our favourite music. However, does it ever strike to us that this music can be one's physiological or psychological need? The answer is, yes. It has been proven by researchers all over the world.

## II. POWER OF MUSIC

It is a well known fact that music has the power to heal. To reduce stress, make one feel lighter, to enhance moods, etc. The tune or melody gives one peace of mind. Today we see people plugging in headphones, listening to music even while travelling. This gives the listeners a good feeling. This "feel good" factor plays a very important factor in our day-to-day activities and improves our way of working. To get a favourable frame of mind, we listen to the music of our choice. In short we unknowingly undergo "Music Therapy"!!

Further, I would like to add that music as therapy can be used on bodily diseases and disorders as well. I can make this bold statement as it has been proved by scientific research. Music is an Art, but Music is a Science too!!

How?

This scientific aspect of music as a therapy I would like to explain on the basis of Ayurveda, physics – sound waves and Neuroscience.

## III. PRINCIPLE OF SOUND WAVES

Sound travels through mediums like air as a series of periodic vibrations, measured in Hertz or cycles per second. Swaras or musical notes are sound waves of different frequencies. When we listen to music, these sound waves, enter the ears to be transmitted to the brain. Actually, the sound waves reach every cell of our body, creating a number of vibrations which correct the disturbed body rhythms. Here healing through music comes into the picture.

## IV. INDIAN CLASSICAL MUSIC

Raagas in Indian Classical Music are nothing but various combinations of various musical notes i.e. sound waves. By the law of interference, superimposition of these sound waves creates secondary vibrations and a spectrum of sound waves. The resultant waveform has power to heal, thereby becoming an effective wave form in music Therapy.

Also "ragas" balance the doshas of the physiological functioning. According to Ayurveda, the ancient medical science, human body works on 3 basic energy strings i.e. Vaat,Pitta,Kaph. When there is an imbalance of any one of the above, it's called as "doshas".

How does this happen?

For this we need to understand the working of a human brain.

## V. HOW MUSIC PROMOTES HEALTH

The brain is the most important and most complicated organ or CPU of the human body. Though complicated in structure and a subject of research to scientists, the way it responds to music is amazing. Under the influence of music, the brain works like magic, giving results useful for smooth functioning of body and mind.

## VI. THE STRUCTURE OF THE BRAIN

The working of the brain is through electrical impulses, called as brain waves. These brain waves are produced by communication between brain cells called as neurons. There are 1000,000,000,000 neurons in the brain. These neurons, while communicating secrete various chemicals, called neuro-chemicals or neuro-hormones. These hormones are responsible for the smooth functioning of the body. The brain sends signals to the various parts of the body to carry out their respective functions. These brain waves have different types classified as follows:

Delta 0 – 4 Hertz  
Theta 5 – 8 Hertz  
Alpha 8 – 12 Hertz  
Beta 12 – 30 Hertz

Different hormones are secreted at different brain wave levels. The imbalance in these hormones causes diseases or disorders of the body or mind. Research proves that various Mantras and Raagas in Classical Music can remove these imbalances.

When we hear, the sound waves enter the ear through the auditory canal and are transmitted to the hypothalamus. The hypothalamus in turn sends the signal to the pituitary gland which is the master gland controlling all the hormones. In short,

the musical notes, through the medium of various raagas help in restoring the balance of the rhythm and restoring the balance of the neuro-hormones. For this to happen, listening to music using headphones – as music therapy – for the sound waves to enter the brain flawlessly and bring about immediate vibrations in the auditory nerves, which actually initiates the process of healing.

Healing is nothing but regaining biorhythm which is disturbed. Music Therapist decides the type of music for healing. Music works as the best self healing therapy as the sound waves after entering the brain get converted into brain waves and the way brain processes music, balances the secretions of brain chemicals which are the messengers to various body

parts. Thus correct signals are sent all over the body by the nerves, balancing the doshas bringing about desired effect of healing.

Listening to given dose of music medicine, brings about brain workout for good health and also peace of mind as additional benefit without any side effects. That's the key to open the magic of healing.

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# Vegetational analysis and seasonal aspectation of tropical dry deciduous forest of Madhav National Park, Shivpuri.(M.P.) India

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**Abstract-** The present paper deals with the phytosociological diversity of Madhav National Park. During study 65 species, 59 genera belonging to 41 families were recorded. The results showed that Leguminaceae was the dominant family. Trees were dominant (50%) followed by shrubs (22.72%), Herbs (21.53%), Climbers (4.54%) respectively. Most of the plant species had flowering and fruiting in rainy season, followed by summer season and very few species in winter season. During the month of May maximum species showed no phenological activity while in the month of September maximum number of species showed phenological activity.

**Index Terms-** Madhav National Park, Seasonal Aspectation, Phanerogram.

## I. INTRODUCTION

India is unique and rich in biological diversity and ranked tenth in the world and fourth in Asia in plant diversity, (Bal Krishnamurthy- 2008), with around 45,000 species of plants of which approximately 15,000 are higher plants (Lal 1989). The state of Madhya Pradesh is situated in the central part of India and falls in two biogeographical zones, semi-arid and the Deccan peninsular. Studies from Forest Survey of India showed that an average of 54.7% of forest is affected by fire and 72.1% of the forest area is subjected to grazing. Approximately 3.73 million hectares of the forest area are burnt annually resulting in economic losses of approximately 440 crores (MOEF, 1999). As per official statistics the forests of Madhya Pradesh are broadly classified into Reserved Forests (80, 996 sq. kms. i.e., approx. 61.7%), Protected Forests (69, 083 sq. kms. i.e., 37.4% approx.) and Unclassified Forests (5, 335 sq. kms. i.e., 0.9%). The per capita forest area is 2400 m<sup>2</sup> as against the national average of 700 m<sup>2</sup>.

Madhav National Park is one of the oldest National park of Madhya Pradesh created in the year 1956. It is situated close to

Shivpuri town. Two national highways viz, (Agra-Bombay (NH-3) and Jhansi-Shivpuri (NH-25)) pass through the park. Physical and manmade features have divided the National Park into 3 zones, viz., North, Central and South.

Due to distinct variation in climate the district is very rich in plant diversity. Tropical dry deciduous forests are enriched with economically important species. Dry deciduous forests are among the most exploited and endangered ecosystem of the biosphere (Murphy and Lugo 1986, Janzen 1988, Gentry 1992).

The present work has been taken to study the vegetation and to prepare phanerogram to infer the existing phytoclimate of different sites along the climatic gradient in Madhav National Park, Shivpuri, India.

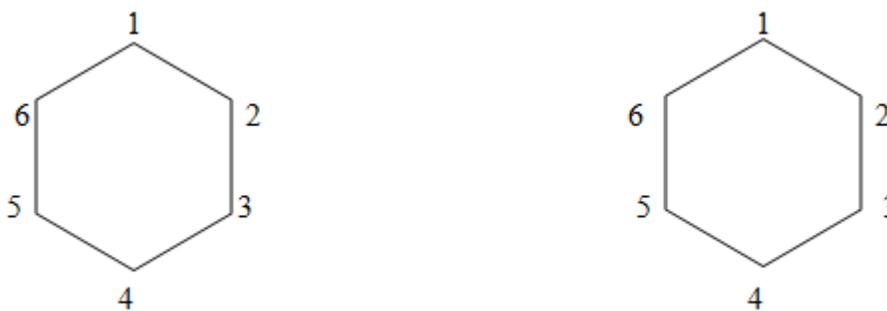
## II. MATERIALS AND METHODS

### Study Area

The study was conducted during 2010 and 2012 at Madhav National Park in Shivpuri District of State Madhya Pradesh (77°15' to 78°30' East longitudes and 24°50' to 25°55' North). The average temperature is 32°C-45°C in summer and 4°C-15°C in winter. The average rain fall is approximately 100 cm-125 cm/annum falling from July to October. The total area of National Park is approx 354.61 sq km at a height of 464 m above the msl.

### Data Collection

The Survey of (Madhav National Park) was done every two month of the year and the site was divided into 10 sampling zones randomly on the basis of altitude, physiognomy, hill, slope, dry place, water body, road side. In each sample zone point centre quarter method was used at five places to study each zone. Thus a total of 50 sample points were laid down with sampling intensity based on random sampling method. Phenological observation were made and accordingly phenograms of both trees and herbs were prepared as follows



**Fig. A Fig. B**

**A) Phenogram of woody plants (Trees)**

1. Incoming of new leaves
2. Vegetative phase
3. Flowering
4. Fruiting
5. Fruit fall
6. Leaf fall

**B) Phenogram of Annual plants (Herbs)**

1. Germination
2. Vegetative growth
3. Flowering
4. Fruiting
5. Fruit fall
6. Death

**III. RESULTS AND DISCUSSION**

The climatic study of the area clearly reveals that there is a monoxeric climate which shows dry phases followed by a wet phase. The dry phase extends for nearly eight months which projects that the climate is of semi- arid type. A total of 41 families, 59 genera and 65 species were recorded (**Table - 1**). Leguminaceae was observed to be dominant at all site with 7 species (**Table -2**). The floristic studies of adjoining areas of Shivpuri and Karera (Kaushik, 1973) and Kolaras (Verma, 1978) also show that Leguminaceae occupies the top position. Very

less plants have flowering during winter season. Majority of woody plants showed flowering in the month of July while in annual plants flowering occurs in the month of September.

Vegetation summary showed that the Dicot plant species are more dominant with 39 Family 54 genus and, 60 species while Monocot have 2 families, 5 genus and 5 species respectively (**Table 1**). The results also reveals that 33 plant species were trees (50% vegetation) and had dominance in the site followed by shrubs 15 species (22.72%), herbs 14 species (21.53%) and climbers 3 species (4.54%) respectively. No epiphyte has been found in the site. (**Table 3**)

**Table -1: Plant Species Summary of Madhav National Park, Shivpuri**

S.no.		No.	Dicot	Monocot
1	Family	41	39	2
2	Genus	59	54	5
3	Species	65	60	5

**Table.2. Family distribution with no. of species and percentage at Madhav National Park, Shivpuri**

S.NO.	FAMILIES	NO.OFSPECIES	% OF SPECIES
1	Leguminaceae	7	10.60 %
2	Moraceae	3	4.54 %
3	Anacardiaceae	3	4.54%
4	Combretaceae	3	4.54 %
5	Acanthaceae	3	4.54 %
6	Euphorbiaceae	3	4.54 %
7	Asteraceae	3	4.54 %

**Table 3. Vegetation diversity of plant species at Madhav National Park, Shivpuri**

S.no.	Habit	No. of species	% of species
1	Herb	14	21.53%
2	Shrub	15	22.72%
3	Tree	33	50.0 %
4	Climber	3	4.54%
5	Epiphyte	0	0

**Table 4: Phenograms of various species in Madhav National Park, Shivpuri.**

Species Name	Jan	Mar	May	July	Sep	Nov
<i>Acacia catechu</i>						
<i>Acacia nilotica</i>						
<i>Buteamonosperma</i>						
<i>Bauhinia racemosa</i>						
<i>Bauhinia variegata</i>						
<i>Cassia fistula</i>						
<i>Albzzialebeck</i>						
<i>Thespesiapopulnea</i>						
<i>Ficusglomerata</i>						
<i>Anonasquamosa</i>						
<i>Saccopetalumtomentosum</i>						
<i>Mangiferaindica</i>						
<i>Lanneacoromandelica</i>						
<i>Buchanialanzan</i>						
<i>Anogeissuspendula</i>						
<i>Terminalia bellerica</i>						
<i>Terminalia arjuna</i>						
<i>Emblicaofficinalis</i>						

<i>Brideliaretusa</i>						
<i>Mitragynaparvifolia</i>						
<i>Cephaluscadamba</i>						
<i>Eugenia jambolanum</i>						
<i>Balanitis roxburghii</i>						
<i>Grewiatiliifolia</i>						
<i>Diospyrosmelanoxyton</i>						
<i>Sterculiaurens</i>						
<i>Manilkarahexandra</i>						
<i>Ziziphusxylopyra</i>						
<i>Phoenix sylvestris</i>						
<i>Boswelliaserrata</i>						
<i>Madhucaindica</i>						
<i>Elaeodendronroxburghii</i>						
<i>Mimosa duteii</i>						
<i>Caricaindicus</i>						
<i>Lantana camara</i>						
<i>Vitexnegundo</i>						
<i>Myrtuscommunis</i>						
<i>Syzygiumheyneanum</i>						
<i>Neriumindicum</i>						
<i>Helicteresisora</i>						
<i>Ziziphusoenoplia</i>						
<i>Adhatodavastica</i>						

<i>Solanumnigrum</i>						
<i>Ziziphusnummularia</i>						
<i>Aloe vera</i>						
<i>Barleriaprionitis</i>						
<i>Myrsineafricana</i>						
<i>Ipomeacarnea</i>						
<i>Gymnemasylvestre</i>						
<i>Abruspreicatorius</i>						
<i>Opuntiasp</i>						
<i>Achyranthesaspera</i>						
<i>Oscimumbasilicum</i>						
<i>Convolvulus pluricaulis</i>						
<i>Eclipta alba</i>						
<i>Sphaeranthusindicus</i>						
<i>Trigonellasp</i>						
<i>Sidacordifolia</i>						
<i>Euphorbia thymifolia</i>						
<i>Partheniumsp</i>						
<i>Marsileasp</i>						
<i>Cynodondactylon</i>						
<i>Saccharummunja</i>						
<i>Cassia tora</i>						
<i>Peristrophecalyculata</i>						

**Table 5: Phenological Behaviour of Woody Plant (Trees) at Madhav National Park, Shivpuri**

S. No.	Events	Number of species					
		Jan	Mar	May	July	Sep	Nov
1	Emerging of New Leaves	1	17	21	11	1	-
2	Vegetative phase	19	11	26	42	46	43
3	Flowering	3	20	19	21	10	5
4	Fruiting	18	7	15	19	23	22
5	Fruit fall	8	8	2	9	11	10
6	Leaf fall	10	25	5	-	-	3

**Table 6: Phenological Behaviour of Annual Plant (Herbs) Madhav National Park, Shivpuri**

S. No.	Events	Number of species					
		Jan	Mar	May	July	Sep	Nov
1	Germination	1	-	-	13	1	-
2	Vegetative Growth	4	-	-	13	7	4
3	Flowering	1	-	-	3	12	6
4	Fruiting	4	1	-	-	11	10
5	Fruit fall	5	3	-	-	2	8
6	Death	7	6	1	-	-	3

Ecological conditions witnesses the dry winter season followed by hot summer. The climate is marked by south west monsoon with rains from June to September. Such a climate affords a dry deciduous forest as climax. This forest type is dominated by *Anogeissus pendula* (Kardhai), *Boswellia serrata* (Salai), *Butea monosperma* (Palas), and *Lannea coromandelica* (Gurjan). From the standpoint of vegetational growth a smaller amount of rainfall distributed over larger period is more effective than the larger amount of rainfall within a very short period. Similarly number of rainy days is more important than the total rainfall.

The phenogramic results reveals that in the month of January *Saccharum munja* and *Lantana camara* showed maximum phenological activity followed by *Ipomea carnea*, *Emblia officinalis*, *Mimosa duteii*, *Solanum nigrum*, *Trigonella sp.*, *Cynodon dactylon* respectively. Species like *Bauhinia variegata*, *Cassia fistula*, *Thespesia populnea*, *Ficus glomerata*, *Saccopetalum tomentosum*, *Eugenia jambolanum*, *Manilkara hexandra*, *Phoenix sylvestris*, *Elaeodendron roxburghii*, *Carica indica*, *Myrtus communis*, *Nerium indicum*, *Aloevera*, *Myrsine Africana*, *Marsilea sp.*, *Abrus precatorius*, *Opuntia sp.*, *Sidacordifolia*, *Cassia tora*, *Peristrophe bicalyculata* showed no phenological activity during January. (Table - 4).

During the month of March *Syzygium heyneanum* showed maximum phenological activity followed by *Albizia lebeck*, *Thespesia populnea*, *Ficus glomerata*, *Ananas squamosa*, *Madhuca indica*, *Elaeodendron roxburghii*, *Nerium indicum*, *Helicteres isora*, *Solanum nigrum*, *Opuntia sp.* and *Saccharum munja*. The species with no phenological activity during the month of March are *Cassia fistula*, *Grewia tiliifolia*, *Barleria prionitis*, *Gynemasa sylvestre*, *Achyranthes aspera*,

*Oscimum basilicum*, *Euphorbia thymifolia*, *Marsilea sp.*, *Cassia tora*, *Peristrophe bicalyculata*. (Table - 4).

In the month of May *Bauhinia variegata*, *Balanitis roxburghii*, *Elaeodendron roxburghii*, *Carica indica* showed maximum phenological activity while species like *cassia fistula*, *Lantana camara*, *Adhatodavasic*, *Solanum nigrum*, *Barleria prionitis*, *Myrsine africana*, *Ipomea carnea*, *Achyranthes aspera*, *Oscimum basilicum*, *Convolvulus pluricaulis*, *Eclipta alba*, *Sphaeranthus indicus*, *Trigonella sp.*, *Sidacordifolia*, *Euphorbia thymifolia*, *Marsilea sp.*, *Cynodon dactylon*, *Saccharum munja*, *Cassia tora*, *Peristrophe bicalyculata* showed no phenological activity because of adverse climatic conditions like high temperature, high light intensity, dry climate etc. (Table - 4).

With the advent of July, plants like *Bauhinia racemosa*, *Cassia fistula*, *Buchanania lanzan*, *Mimosa duteii*, *Syzygium heyneanum*, *Euphorbia thymifolia*, *Cassia tora*, showed maximum phenological activity. Only one species *Sphaeranthus indicus* did not have any phenological activity. (Table - 4).

During the month of September maximum number of species showed phenological activity. The species are *Acacia nilotica*, *Cassia fistula*, *Buchanania lanzan*, *Anogeissus pendula*, *Lantana camara*, *Ipomea carnea*, *Convolvulus pluricaulis*, *Eclipta alba*, *Trigonella Sp.*, *Cynodon dactylon*, *Saccharum munja*, *Cassia tora*. No plant species during this period showed zero response regarding phenological activity due to favorable climatic conditions like moisture, low temperature, less light intensity, etc. (Table - 4).

Similarly, during November species like *Buchanania lanzan*, *Boswellia serrata*, *Mimosa duteii*, *Lantana camara*, *Adhatodavasic*, *Solanum nigrum*, *Myrsine africana*, *Ipomea carnea*, *Oscimum basilicum*, *Convolvulus pluricaulis*,

*Ecliptaalba*, *Trigonella Sp.* and *Saccharummunja* showed positive response regarding phenological activities. Only one species *Eugenia jambolanum* showed no phenological activity at all (**Table – 4**).

The optimum temperature and moisture conditions are obtained during rainy season (July and August) which in turn result in maximum canopy cover of the trees and causes a luxuriant growth of herbaceous vegetation. With onset of winter (December & January) there is an abrupt change in the face of vegetation due to low temperature. It is the time when some forest trees like *Sterculiaeurens* and *Lanneacoromandelic* show the sign of yellowing of their leaves and ground cover starts drying up. In March and April most of the tree species lose their leaves during summer season (May and June). During this period extremely high temperature and low humidity accompanied with acute shortage of soil moisture restrict growth of herbaceous layer. Khair occupies the open areas of the foothills in the park. It occurs at lower elevation and in pockets where soil is hard and shallow. Kardhai forests cover the western side of the park, on slopes facing the 'SakhyaSagar' the famous lake inside the park and towards Bhoorakho. Mixed forests is not very common in the park, but is found only in deep sheltered valleys or places where there is a permanent sources of water. Among woody plants the emerging of new leaves was found highest in the month of May followed by March, July, January and September respectively. The vegetative phase was found highest in September and lowest in month of March. While minimum was found during November. As far as leaf fall is concerned July and September showed no sign. (**Table- 5**). In case of annual plants, germination and vegetative growth occurs highest in the month of July because during this season moisture is available in the soil environment. Flowering and fruiting was found highest in the month of September. There was no fruiting and fruit fall during the month of May and July. With the onset of favourable climatic conditions no death of annual plants was observed during July and September. (**Table - 6**).

#### IV. CONCLUSION

Madhav National Park is rich in floral diversity and has the potential for conservation of ecosystem in its totality. Trees were dominated with maximum of dicot species. The phenological behaviour of plant species were good during monsoon season as it provides favourable climate for floral

diversity. The seasonal aspectation affects the plant diversity and phenological activity, in both trees and herbs. Because of the change in climate there is urgent need to address and correlate seasonal aspectation with phenological activity, on a recurring basis.

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# Appraisal of Accounting Information System and Internal Control Frameworks

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**Abstract-** The advancement in technology has enabled companies to generate and use accounting information systems. The qualitative characteristic of any Accounting Information System can be maintained if there is a sound internal control system. Internal control is run to ensure the achievement of operational goals and performance. When organizations adjust their computerized techniques of internal control mechanism according to accounting information systems they will be able to ensure the reliability of financial information processing. Also, developing an internal control system requires a thorough understanding of information technology, capabilities and risk as well as how to use IT to achieve organizational goals. Therefore the purpose of this study is to look at the accounting information system and the internal control frameworks amongst which was the Control Objective for Information and Related Technology (COBIT) which is a security measure that allows management to benchmark the security practices and IT environment, allow users of IT services to be assured that adequate security and control exist, allow the auditors to substantiate their internal control opinions and advice on its security and control matters. The Internal Control - Integrated Framework was also looked at, which is widely accepted as the authority of internal control and is incorporated into policies, rules, and regulations used to control business activities, which the five components are; looking at the control environment, risk assessment, control activities, information and communication, and monitoring the entire process. Therefore, I recommend that organizations should adopt the use of accounting information systems because adequate accounting information is essential for taking every effective decision-making process and adequate information is possible if the Accounting Information Systems are run efficiently. Also, a proper internal control measure should be adopted to ensure the reliability of information and achievement of organizational goals.

**Index Terms-** Accounting, Information System, Internal control, Organizations.

## I. INTRODUCTION

Modern world is the information world and every business organization makes it necessary to obtain proper information both for external and internal users for appropriate decision making. The Accounting Information System is a component of administrative management in business organizations, which handles the collection, tabulation, data processing, financial information communicating and the amount

needed to make decisions to users. This system provides accounting information on time to assist in preparing, monitoring and implementing the state or organization budget. It also helps in making decisions related to financing lending, making financial policies, that means Accounting Information Systems serves the government administration and organizations in planning control and decision making (Al-kasswina, 2012).

Wilkinson (2000) noted that effective AIS perform several key functions throughout these various stages such as data collection, data maintenance, data management, data control and information generation. The main function of AIS is to analyze the past, present and future economic events and its produces the financial statements namely income statement, balance sheet, owner's equity statement and cash flow statement. Management compares information about current performance to budgets, forecast, prior periods, or other benchmark to measure the extent to which goals and objectives are being achieved and to identify the unexpected results or unusual conditions that require follow up. The management has line responsibility for designing, implementing and monitoring internal control system for identifying the financial and compliance risk for their operations (www.ucop.edu).

Therefore, if companies are able to adjust their computerized techniques of internal control mechanism according to AIS, they will be able to ensure the reliability of financial information processing and boost the control measures of effectiveness of the financial information reliability. When the controls are used properly there will be better operating effectiveness and efficiency which will result in better financial information reliability. Managers at various levels need AIS to make decisions in internal controls (U. Hoitash and Bedard 2009)

## CONTROLS AND ACCOUNTING INFORMATION SYSTEM

Toposh K. (2014) asserted that qualitative characteristics of accounting information can also be maintained if there is sound internal control system in an organization. Internal controls are procedures set up to protect assets, ensure reliable accounting reports, promote efficiency and encourage adherence to company policies. Internal controls are essential to achieve some objectives like efficient and orderly conduct of accounting transactions, safeguarding the assets in adherence to management policy, prevention of error and detection of error, prevention of fraud and detection of fraud and ensuring accuracy, completeness, reliability and timely preparation of accounting data. If good internal control exists in any organization, management can use information with greater reliance to maintain their business activities properly which provide AIS.

(I.X Zhang 2007) Internal controls aim to ensure the reliability of financial information, the effectiveness and efficiency of operations and the compliance of laws and regulations. The validity of an internal control system affects the significance of internal controls. U.Hoitash et al (2009) stated that the value of internal control influences operational performance through information reliability operational effectiveness. Computerized internal controls have effects on the value of internal controls and performance of operations.

(H.Sajad,M.Dastgir and H.Hashem Nejad, 2008) alleged that implementation of accounting information systems caused the improvement of managers decision making process with internal controls, the quality of the financial reports and facilitated the companies transaction. Therefore, the adaptation of internal control techniques is a critical management issue that ensures the usefulness of internal controls and the achievement of operational objectives.

(I.X.Zhang 2007),Internal controls aim to ensure the reliability of financial information, the effectiveness and efficiency of operations and the compliance of laws and regulations. The validity of an internal control system affects the significance of internal controls. Effective internal control systems are essential for successful operation of business as well as accounting control and administrative control. It helps the Accounting Information Systems division to generate reliable and relevant information. (A.Masli G.F.,Peters,V.J.,Richard J.M, 2010) In the AIS environment the qualities of internal controls adaptation affects operations and management and in turn influence internal control. Internal controls are run to ensure the achievement of operational goals and performance.

Grande et al., (2011) outlined the advantages of integrating accounting information into business to include better adaptation of the business to a changing environment, better management of arm's length transactions and a high degree of competitiveness. The integration also helps to boost the dynamic nature of firms with a greater flow of information between different staff levels and the possibility of new business on the network and improved external relationships for the firm, mainly with foreign customers accessed through the firm's web. With the existence of more intercommunication, there are increased chances for diversification of traditional businesses. However, accounting information may be distorted when efficient and effective system of control is not in operation. A good system of internal control (means of ensuring reliability and completeness of accounting information for management use) therefore, will serve to ensure an adequate procedure for the recording of monetary and all other transactions of an organization. Al-Hantawi, (2001) has indicated that the most important characteristics that qualify accounting information systems as effective an efficient are the accuracy and speed of processing financial data into accounting information, therefore providing management with the necessary accounting information on time; providing management with the necessary information to perform functions of planning, control, evaluation, speed and accuracy in retrieving stored overall and descriptive information when it is needed; adequate flexibility; general acceptance of workers ;simplicity, and to be associated with other information systems in the entity.

Toposh K.(2014) asserted that other qualitative characteristics of accounting information can also be maintained if there is sound internal control system in an organization. Internal controls are procedures set up to protect assets, ensure reliable accounting reports, promote efficiency and encourage adherence to company policies. Internal controls are essential to achieve some objectives like efficient and orderly conduct of accounting transactions, safeguarding the assets in adherence to management policy, prevention of error and detection of error, prevention of fraud and detection of fraud and ensuring accuracy, completeness, reliability and timely preparation of accounting data. If good internal control exists in any organization, management can use information with greater reliance to maintain their business activities properly which provide AIS. But if internal control is not strong, management cannot achieve its goal

## **CONTROL FRAMEWORK**

### ***CONTROL OBJECTIVE FOR INFORMATION AND RELATED TECHNOLOGY(COBIT).***

(Marshal and Paul 2015) The Information System Audit and Control Association developed the Control Objective for Information and Related Technology (COBIT) framework. COBIT describes best practices for the effective governance and management of IT. It helps the organization build an effective governance and management framework that protects the stakeholders, investments and produces best information system. COBIT consolidates control standard from different sources into a single framework that allows:

- Management to benchmark the security and control practices of IT environment.
- Users of it services to be assured that adequate security and control exist.
- Auditors to substantiate their internal control opinions and advise on IT security and control matters.

### ***COSO'S INTERNAL CONTROL FRAMEWORK***

The committee of sponsoring organization (COSO) which consist of the American Accounting Association,the AICPA, the Institute of Internal Auditors ,the Institute of Management Accountant, and the Financial Executives Institute in 1992, COSO issued **Internal Control –Integrated framework (IC)**, which is widely accepted as the authority on internal controls and is incorporated into policies , rules and regulations used to control business activities. The IC framework also provides users with precise guidance on how to implement and document the framework. Below are the five component of the IC framework:

- **Control environment:** This is the foundation for all other components of internal control. The core of any business is its people –their individual attributes, including integrity, discipline, ethical values, the competence, and the environment in which they operate. They are engine that drives the organization and the foundation on which everything rest.
  - Commitment to integrity and ethics
  - Internal control oversight by the board of directors, independent of management.
  - Structures, reporting lines and appropriate responsibilities in the pursuit of objective

established by management and overseen by the board.

- A commitment to attract, develop, and retain competent individuals in alignment with objectives
- Holding individual accountable for their internal control responsibilities in pursuit of objectives.

➤ **Risk assessment:** the organization must identify, analyze, and manage its risks. Managing risk is a dynamic process. Management must consider changes in the external environment and within the business that may be obstacles to its objective.

- Specifying objectives clearly enough for risk to be identified and assessed
- Identifying and analyzing risks to determine how they should be managed.
- Considering the potential of fraud
- Identifying and assessing changes that could significantly impact the system of internal control.

➤ **Control activities:** control policies and procedures help ensure that the actions identified by management to address risks and achieve the organization's objectives are effectively carried out. Control activities are performed at all levels and at various stages within the business process and over technology.

- selecting and developing controls that might help mitigate risk to an acceptable level
- Selecting and developing general control activities over technology
- Deploying control activities as specified in policies and relevant procedures

➤ **Information and communication:** information and communication systems capture and exchange the information needed to conduct, manage and control the organization's operations. communication must occur internally and externally to provide information needed to carry out day to day internal control activities, all personnel must understand their responsibilities.

- Obtaining or generating relevant, high-quality information to support internal control.
- Internally communicating information, including objectives and responsibilities necessary to support the other components of internal control.
- Communicating relevant internal control matters to external parties.

➤ **Monitoring:** The entire process must be monitored, and modification made as necessary so that the system can change as conditions warrant. Evaluations ascertain whether each component of internal control is present and functioning. Deficiencies are communicated in

timely manner, with serious matters reported to senior management and the board..

- Selecting, developing and performing ongoing or separate evaluation of the component of internal control.
- Evaluating and communicating deficiencies to those responsible for corrective action, including senior management and the board of directors, where appropriate. (Marshal and Paul 2015).

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# Synthesis and Characterization of ZnO Nanotubes by Hydrothermal Method

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**Abstract-** zinc oxide nanotubes were prepared by a hydrothermal method using zinc nitrate as a precursor. The synthesized nanotubes were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Fourier transform infrared spectroscopy (FT-IR) and their optical properties were characterized using UV-visible spectroscopy. The XRD analysis confirmed that the ZnO nanotubes have the hexagonal wurtzite structure. UV-vis absorption spectrum showed a typical spectrum of pure ZnO nanotubes. According to TEM analysis, the mean length and average outer diameter of the ZnO NTs were about 2.4  $\mu\text{m}$  and 200 nm, respectively.

**Index terms-** ZnO nanotubes, Hydrothermal, TEM, SEM

## I. INTRODUCTION

Zinc oxide is an n-type semiconductor of hexagonal wurtzite structure with optical transparency in the visible range [1]. Zinc oxide (ZnO) is a self-activated crystal of hexagonal wurtzite structure with direct wide band gap energy of 3.37 eV at room temperature [2-4], and has strong excitonic emission in the ultraviolet range even at room temperature due to its larger excitonic binding energy of 60 meV which is significantly larger than other materials [5]. ZnO has attracted much interest as one of the multifunctional inorganic nanoparticles due to its unique combination of superior chemical, physical, optical, biological, electrical, long-term environmental stability, biocompatibility, low cost and non-toxic properties. Therefore, nano-ZnO can potentially be applied to photocatalyst for degradation of waste water pollutants, catalysts, gas sensors, semiconductors, varistors, piezoelectric devices, field-emission displays, ultraviolet (UV) photodiodes, surface acoustic wave (SAW) devices, UV-shielding materials, rubber, medical and dental, pigments and coatings, ceramic, concrete, antibacterial and bactericide, and composites [6-13]. Various morphology of ZnO nanostructures have been realized, such as nanoparticles, nanorods, nanowires, nanobelts, nanotubes, nanobridges, nanowalls, nanohelices, mesoporous single-crystal nanowires, and polyhedral cages [9, 14]. On the other hand, one-dimensional (1D) nanostructures such as rods, wires, belts and tubes have attracted much attention in recent years, due to their many unique properties and the possibility that may be used as building blocks for future electronics and photonics, as well as for life-science applications. 1D nanostructures are expected to play an important role as both interconnects and functional units in fabricating electronic, optoelectronic, electrochemical and electromechanical

nanodevices. Among the 1D nanostructures, ZnO rods (NRs) and nanotubes (NTs) have been widely studied because of their easy nanomaterials formation and device applications [15]. Recently different synthesis methods have been devised for ZnO nanostructures such as vapor transport process [16, 17], spray pyrolysis [18, 19], thermal decomposition [20], hydrothermal synthesis [21, 22], sol-gel processing [23], direct precipitation and co-precipitation [24-26]. Among these methods, vapor deposition (PVD) and chemical vapor deposition (CVD) have been developed to synthesize ZnO nanoparticles into complex structures such as flower-like and web-like agglomerates. However, in order to obtain the final structure these methods usually require multiple steps, sophisticated equipment and high temperature. In contrast, low-temperature wet chemical processes such as, hydrolysis, precipitation and hydrothermal process are cost-effective and scalable and have been used for preparation a wide variety of ZnO nanostructures [27]. Hydrothermal technique is a promising alternative synthetic method for nanostructure materials because of the low process temperature and very easy to control the particle size. The hydrothermal process have several advantage over other growth processes such as use of simple equipment, catalyst-free growth, low cost, large area uniform production, environmental friendliness and less hazardous. The low reaction temperatures make this method an attractive one for microelectronics and plastic electronics. This method has also been successfully employed to prepare nanoscale ZnO and other luminescent materials [28]. In brief, the particle properties such as morphology and size can be controlled via the hydrothermal process by adjusting the reaction temperature, time and concentration of precursors. The aim of this work was to find a simple route to prepare ZnO nanotubes (powder) via hydrothermal method and characterize the final product using several techniques.

## II. EXPERIMENTAL

### 2.1. Materials

Zinc nitrate hexahydrate ( $\text{Zn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ , 99% Sigma-Aldrich), sodium hydroxide pellets (NaOH, 99% Merck), Ethylene Diamine (EDA  $\text{C}_2\text{H}_8\text{N}_2$ ; 99%, Merck), Ethanol ( $\text{C}_2\text{H}_5\text{OH}$ , 95%, Pio chem) were used as received.

### 2.2. Preparation of ZnO NTs

ZnO NTs were synthesized according to the method proposed by Bin Liu *et al* [22]. Firstly, 40 g of NaOH pellets and 14.874 g of  $\text{Zn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$  were dissolved in 100 ml of deionized water to prepare a precursor clear solution with a

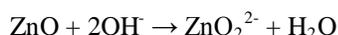
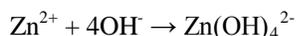
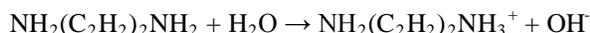
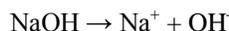
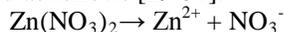
molar ratio of  $Zn^{2+}:OH^-$  of 1:20. Then 6 ml of this solution ( $Zn^{2+}:OH^- = 1:20$ ) was mixed with 10ml of distilled water. After that, 50 ml of pure ethanol was added, followed by 10 ml of ethylene diamine. The mixture was then kept in an ultrasonic water bath for 40 minutes and subsequently transferred to a Teflon-lined stainless steel autoclave. The autoclave was kept inside an electric oven set at 180 °C for 2 h and cooled. The precipitate (ZnO NTs) was separated by centrifugation and washed several times with deionized water and pure ethanol. The collected product was dried in a vacuum oven at room temperature for 24 h.

### 2.3. Characterization

Fourier transform infrared (FT-IR) spectra were measured by FTIR -4100 spectrometer, JASCO with a frequency range from 4000 to 400  $cm^{-1}$ , using KBr disks. The crystallinity and phases of the ZnO nanostructures were characterized by X-ray diffractometer, XRD-6000, Shimadzu, Japan with  $Cu-K\alpha$  radiation ( $\lambda = 1.5412 \text{ \AA}$ ), 40 Kv, 30 mA) in the  $2\theta$  range of 10-80° with 2°/min scanning rate. The crystallite size (D) of selected samples were estimated using the Scherer's equation,  $D = k\lambda / (B \cos\theta)$  where:  $k = \text{constant}$  ( $0.89 < k < 1$ ),  $\lambda = \text{wavelength}$  of the X-ray,  $B = \text{FWHM}$  (Full Width at Half Maximum) width of the diffraction peak,  $\theta = \text{diffraction angle}$ . The morphological feature of the nanostructures was observed by a scanning electron microscope SEM-EDS, JSM-6360 LA, JEOL, Japan and a high-resolution transmission electron microscope (HRTEM), JEM-2100, JEOL. The samples for SEM were coated with gold and the samples for TEM analysis were prepared by dropping dilute suspension of ZnO nanostructures onto copper grids. The optical properties of prepared ZnO NTs were analyzed via UV-visible Spectrophotometer (Shimadzu, UV-2450).

## III. RESULTS AND DISCUSSION

In general wet synthesis is more attractive compared to dry approaches, because it is able to produce high quality nanomaterials at low cost, and thus promises large-scale production of novel ZnO materials. The usages of a high basic condition and an alcoholic environment are the two crucial keys in ensuring the formation of  $ZnO_2^{2-}$  and a controlled release of this species from the alcohol-water mixture phase to the growing ZnO nanostructures. Ethylene diamine acts as chelating ligands to the  $Zn^{2+}$  cations in the precursor solution, inhibiting the radial enlargement of the rods. It is believed that the ultrasonic pretreatment of the solution mixture is an important step prior to the hydrothermal reactions at 180°C, which may generate a suitable amount of ZnO cluster nuclei for the subsequent hydrothermal growth [22]. The whole reaction process can be described as follows [29-31]:



### 3. 1. Fourier Transform infrared spectroscopic analysis

FT-IR spectrum of ZnO nanotubes, (Figure 1) shows the characteristic absorption bands at 508 and 404  $cm^{-1}$ . These two absorption peaks correlate with the bulk To-phonon frequency and the Lo-phonon frequency [32]. The absorption band at 3500  $cm^{-1}$  was assigned to the OH groups on the surface of ZnO.

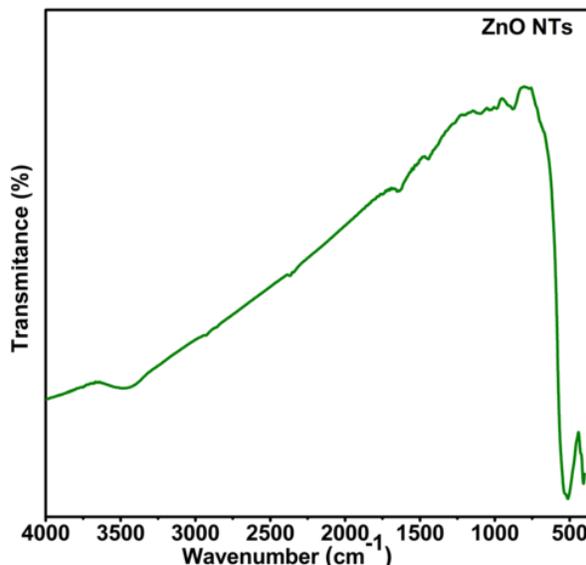


Figure 1 FT-IR spectrum of ZnO nanotubes.

### 3. 2. Powder X-ray diffraction (XRD) studies

Figure 2. Illustrates the XRD patterns of the as-prepared ZnO NTs. It is apparent that, the diffraction lines are consistent with the values reported in the database of ZnO (JCPDS) card no. PDF 2010: 01-071-6424, providing clear evidence for the formation of hexagonal wurtzite-type structure with cell constants of  $a=0.324 \text{ nm}$  and  $b=0.520 \text{ nm}$ , and no diffraction peaks of any other phases were detected [33]. The average crystalline size of ZnO NTs was calculated according to Scherer's equation and the result was found to be 209.4 nm.

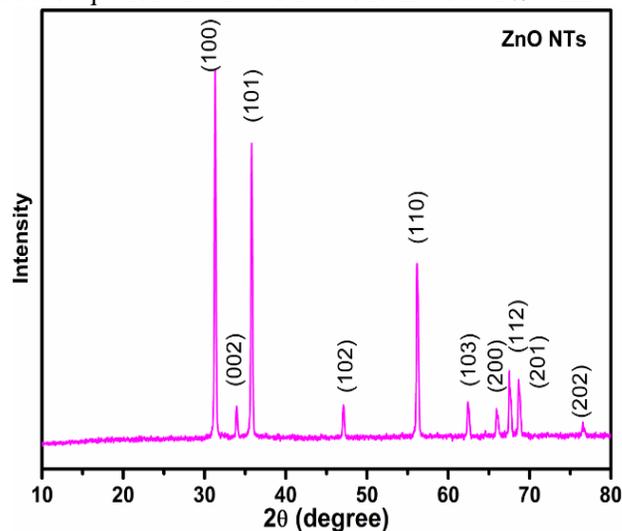


Figure 2. XRD patterns of ZnO nanotubes (ZnO NTs).

### 3.3. SEM analysis

Figure 3. Shows the SEM images of the ZnO NTs at different magnifications. The images clearly show that uniform ZnO NTs were obtained and most of the nanotubes are parallel to each other. The magnified image shows hollow core structure of the ZnO NTs with single-crystalline, densely packed, faceted hexagonal tabular shape. The average outer diameter and length of the ZnO NTs were about 200 nm and 3µm, respectively.

### 3.4. TEM analysis

Further studies on the structure of the ZnO NTs were done using transmission electron microscope. On the basis of high-resolution TEM the formation of ZnO NTs was further confirmed and the analysis shows that the hollow ZnO NTs grow with a single-crystalline structure and the axial direction is along the [001] as shown in Figure. 4. The mean length and wall thickness of the ZnO NTs were about 2.4 µm and 200 nm, respectively.

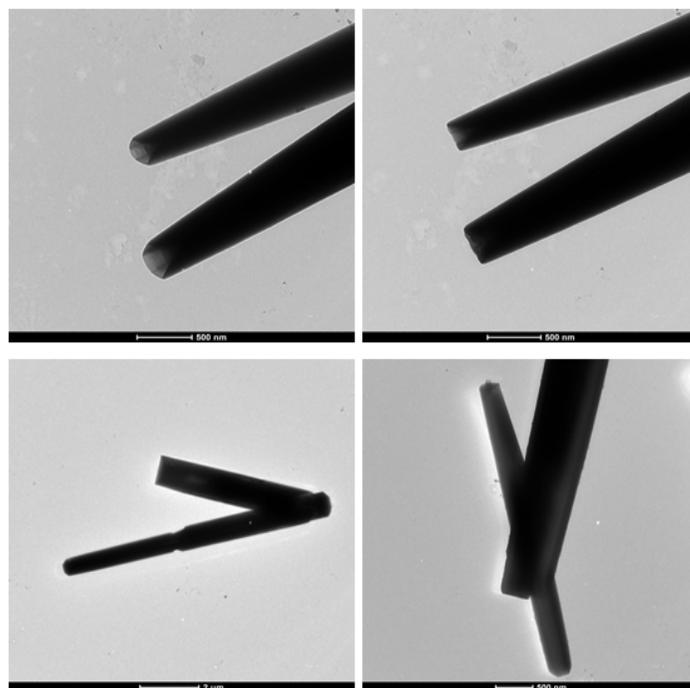


Figure 4 TEM images of ZnO NTs at different magnifications.

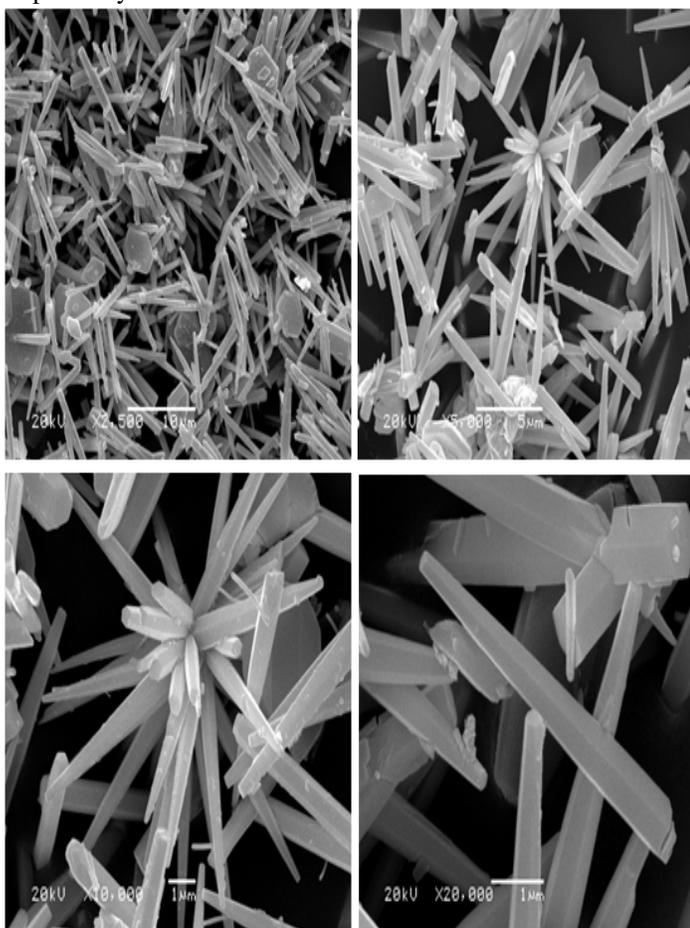


Figure 3 SEM Images of ZnO NTs at different magnifications.

### 3.5. UV analysis

Figure 5. shows the UV-vis spectra of ZnO NTs. A broad band at 367 nm is the characteristic band of pure ZnO nanotubes [34].

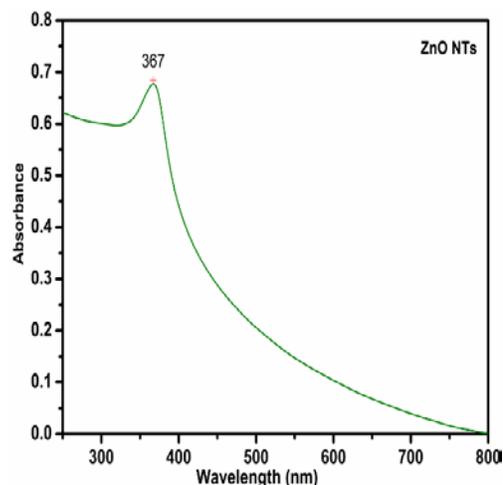


Figure 5 UV- absorption spectra of ZnO NTs.

## IV. CONCLUSION

ZnO NTs with an average outer diameter and length of 200 nm and 2.4 µm respectively were prepared by wet method (hydrothermal method). The FT-IR showed the characteristic absorption bands at 508 and 404 cm<sup>-1</sup>. These two absorption peaks correlate with the bulk To-phonon frequency and the Lo-phonon frequency. The morphology was evaluated using XRD, SEM and TEM. The XRD analysis confirmed that the ZnO nanotubes have the hexagonal wurtzite structure. The optical properties were measured by UV-vis spectroscopy.

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# Web Application Accessibility Testing

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**Abstract- Web Accessibility** is about making web accessible to users with impairments. More specifically, users with disabilities can understand and commune with web. Web page is accessible if it can be used efficaciously by users with and without disability.

The paper focuses on the tests carried to verify the accessibility of a Web Page.  
It discusses the underneath areas:

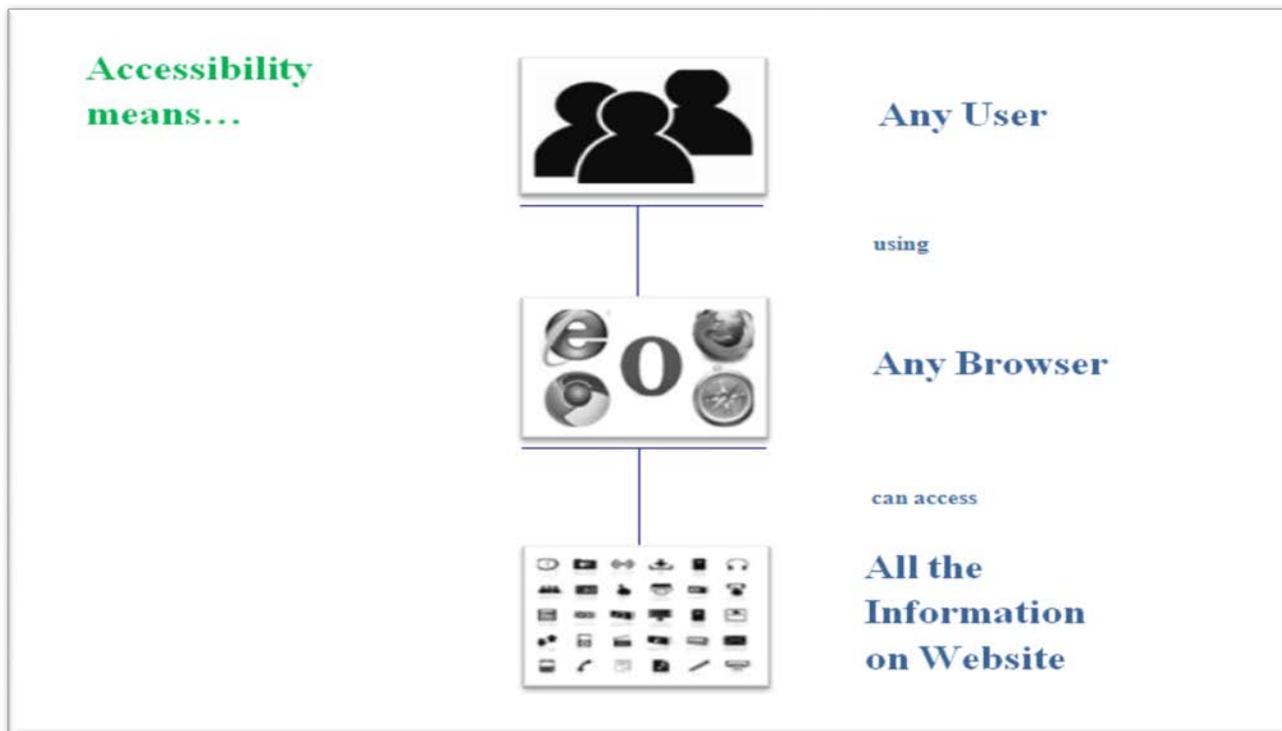
- Web Accessibility Testing Introduction
- Categories of Disabilities
- Web Accessibility Standards and Guidelines
- Web Accessibility Testing Techniques
- Web Accessibility Testing Tools

**Index Terms-** Web Accessibility Testing, Web Accessibility Standards and Guidelines, Web Accessibility Testing Techniques, Web Accessibility Testing Tools

## I. INTRODUCTION

**Accessibility Testing** ensures the accessibility of a Website.

Web Accessibility Testing makes web products usable & accessible to people who have any form of disability. It intends smooth access of web to people with disablements.



## II. CATEGORIES OF DISABILITIES

### Categories of Disabilities:

- **Visual**
- **Hearing/ Auditory**
- **Mobility**
- **Cognitive**

**Visual Disability** comprises blindness, weak vision, tunnel vision, Dimness, Extreme near- or far-sighted and color blindness.

**Auditory Disability** comprises deafness, hard of hearing and High/low frequency hearing loss.

**Mobility Disability** is a physical impairment that considerably limits movement such as lifting, walking, and typing. It comprises of Repetitive Stress Injuries (RSI), Arthritis, Stroke, Spinal Cord Injuries, ALS and Loss of limbs or digits.

**Cognitive Disability** is a category of mental health disorder that affects learning, memory, perception, and problem solving. It comprises dyslexia and short-term memory deficit.

## III. WEB ACCESSIBILITY STANDARDS AND GUIDELINES

- **WCAG 1.0 Web Content Accessibility Guidelines 1.0**
  - <http://w3.org/TR/WCAG10>
- **Section 508 Standards**
  - <http://www.access-board.gov/508.htm>
- **WCAG 2.0**
  - <http://w3.org/TR/WCAG20/>
- **IBM web guidelines**
  - <http://ibm.com/able/guidelines/web/accessweb.html>

## IV. WEB ACCESSIBILITY TESTING TECHNIQUE - MANUAL TEST

### Manual Tests

Manual test is usually actioned by an accessibility test expert who is technically cognizant of all the accessibility compliances and nitty-gritty. This approach helps to attain end-to-end testing of any website.

In addition, Assistive tools and technologies such as screen readers and magnifiers can help in interacting with the application in a realistic setup and real-time challenges.

Following is the list of manual tests which can be executed on different browsers (IE, Firefox, Chrome etc.) to test Accessibility:

#### 1. Validate HTML

Validate your code using the W3C HTML Validator.

- Open the [W3C HTML Validator](#) site.
- Enter the application URL in Address and click the Check button.



## 2. Headings

In the W3C HTML Validator under More Options, select the “Show Outline” option and validate that headings are in the right order in the Web Application.



## 3. Fonts

Verify the text size and form field text size by increasing the text.

Change the browser text size to ‘Largest’ to test the large fonts by performing the below action.

- Activate large fonts in Internet Explorer, open IE > navigate to the View menu >Text Size >Select “Largest”.

## 4. High Contrast

Verify that changing the color scheme to High Contrast intact the page contents display and page information is not lost.

Change the high contrast in windows by performing the below action

- Open the Control Panel> navigate to “Ease of Access Center”> click on “Make the computer easier to see”. Under “High Contrast” section, select a High Contrast color scheme.
- High Contrast can also be turned on or off using keyboard shortcut keys, press left ALT + left SHIFT + PRINT SCREEN> a pop up to turn on High Contrast is displayed>click on Yes button to enable High Contrast.

## 5. Alternate Text

Alternate text is the text associated with an Image. Images should include AltText to make these images accessible especially by people with visual disabilities.

Screen readers can read text associated with images for the people with disable impairment. In Internet Explorer, hover the mouse over each image; the Alt text will display the image tool tip.

## 6. Captions and Transcripts

Web audio and video content can be accessible to people who have hearing disabilities by allowing Captions and Transcripts. Check that your videos recordings have captions and transcripts with audio.

## 7. Skip Navigation

Web pages having Skip Navigation Links are easily accessible to people with mobility impairments.

Verify by pressing Ctrl+Home keys to move focuses to the top of the page. Use the Tab key to start moving through links. Make sure that “Skip to Content” link is visible near the top.

## 8. Tab Order & Link Text

Using Tab key in right order should access Fields and links. Text linked with each link should be unique and apprehensible.

## 9. Form Labels

Verify that -

- Form label is accessible, check by putting the mouse on label form field; flashing cursor should appear to the linked field.
- Form field has a label. If a field label is missing, hover the mouse over the field to verify valid title attribute, which will appear as a tool tip.

## 10. Keyboard Operations

Verify that all the dynamic elements (drop-down menus, tab pages, Flash interfaces, etc.) are accessible using keyboard. Check using the Tab key, up/down arrows, space bar, etc. to check the accessibility of all the dynamic elements.

## 11. PDF Documents

Open PDF document and click on File> Save as Text>Save the text file. Open the saved text file and check that all text of pdf file is present in text file in the correct order.

## 12. PDF Forms

Check that each form field is accessible through keyboard and contains label, verify that putting the mouse over each form field displays label as a tool tip.

## 13. Disable styles and linearize tables

Verify that contents without style are displayed in order and apprehensible. Check the styles using WAVE or with the “Web Developer toolbar” extension for Firefox.

## 14. Test content scaling

Check the test content scaling by increasing the font size in web browser to 200% and verify that page is readable and usable. In order to enlarge the images, zoom the web page and check text in image is readable.

## 15. Testing with Assistive Technology

### ➤ Screen Readers

Screen reader tests elements which cannot be checked in any other reporting tool. These include Flash objects, interactive elements and unique plugins and documents.

Common screen reader tools include

- JAWS– used by approximately 65% of blind users
- Voiceover – free on a Mac or iPhone/iPad
- NVDA – free for Windows

### ➤ Screen Magnifiers

Screen magnifiers allow the user to magnify the screen many times its usual size and test the accessibility for disabled.

## V. WEB ACCESSIBILITY TESTING TECHNIQUE - AUTOMATED TEST

### Automated Tests

Automatic testing validates much faster, and gives a good idea of the accessibility. However, there are certain issues which automated testing cannot detect. This depends on the standards or guidelines we are testing for.

Following is the list of automated tests which can be executed on different browsers (IE, Firefox, Chrome etc.) to test Accessibility

#### 1. aDesigner

This is a tool developed by IBM which simulates the experience of visually impaired individuals so that the designer can better understand the needs of disabled people and develop applications accordingly.

aDesigner can be accessed using URL <http://www.eclipse.org/actf/downloads/tools/aDesigner/>

#### 2. WebAnywhere

This is a browser based tool that works similarly to the screen readers like Jaws. It assists the readers how to read the web page.

WebAnywhere can be accessed using URL <http://webanywhere.cs.washington.edu/>

#### 3. Vischeck

This tool is used to simulate how a web page or an image will be viewed by people affected with color-blindness. This can be done by entering URL or uploading images.

Vischeck can be accessed using URL <http://www.vischeck.com/>

#### 4. Web accessibility toolbar

WAT is an extension of Internet explorer or Opera that offers web page designers with useful features in the analysis of web page. One best feature is Grey Scale feature which helps to find low contrast spots in the design.

Web accessibility toolbar can be accessed using URL <http://www.wat-c.org/tools/>

## VI. WEB ACCESSIBILITY TESTING TOOLS

### 1. AChecker (Accessibility Checker)

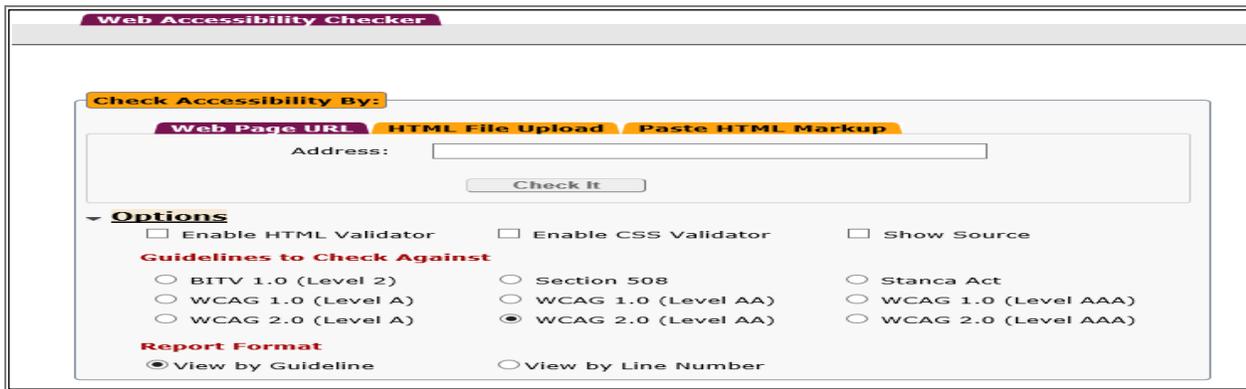
Accessibility Checker is an open source web accessibility evaluation tool. This tool tests web accessibility by entering web page URL or by uploading its HTML file at AChecker.

AChecker provides option to select an international accessibility guideline for accessibility check:

- WCAG 1.0 (International)
- WCAG 2.0 (International)
- BITV 1.0 (Germany)
- Section 508 (U.S.)
- Stanca Act (Italy)

It also gives the option to choose report format (View by Guideline and View by Line Number).

AChecker can be accessed using URL "<http://achecker.ca/checker/>"

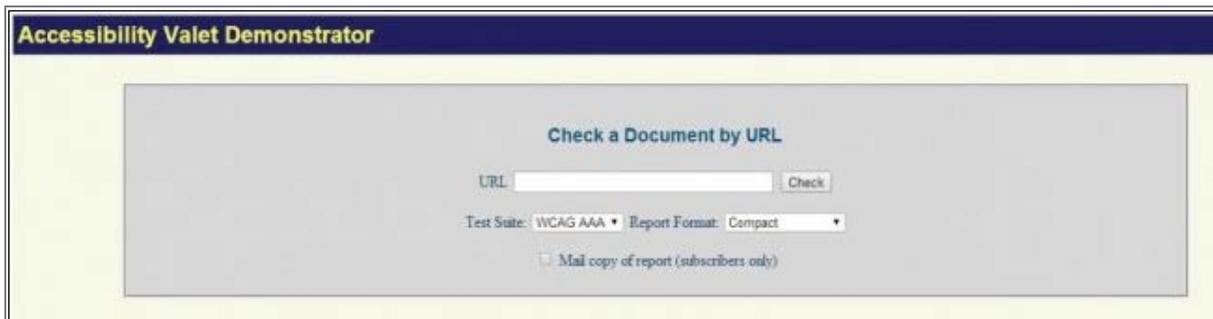


The screenshot shows the AChecker web interface. At the top, it says "Web Accessibility Checker". Below that, there are three tabs: "Web Page URL", "HTML File Upload", and "Paste HTML Markup". The "Web Page URL" tab is selected, and there is an "Address:" input field with a "Check It" button below it. Underneath, there is an "Options" section with several checkboxes: "Enable HTML Validator", "Enable CSS Validator", and "Show Source". Below these are "Guidelines to Check Against" with radio buttons for "BITV 1.0 (Level 2)", "WCAG 1.0 (Level A)", "WCAG 2.0 (Level A)", "Section 508", "WCAG 1.0 (Level AA)", "WCAG 2.0 (Level AA)", "Stanca Act", "WCAG 1.0 (Level AAA)", and "WCAG 2.0 (Level AAA)". The "WCAG 2.0 (Level AA)" option is selected. Finally, there is a "Report Format" section with radio buttons for "View by Guideline" (selected) and "View by Line Number".

### 2. Accessibility Valet

Accessibility Valet is a web accessibility test tool which tests the application accessibility compliance w.r.t.W3C Web Content Accessibility Guidelines (WCAG) or Section 508.

Accessibility Valet can be accessed using URL "<http://valet.webthing.com/access/url.html>"



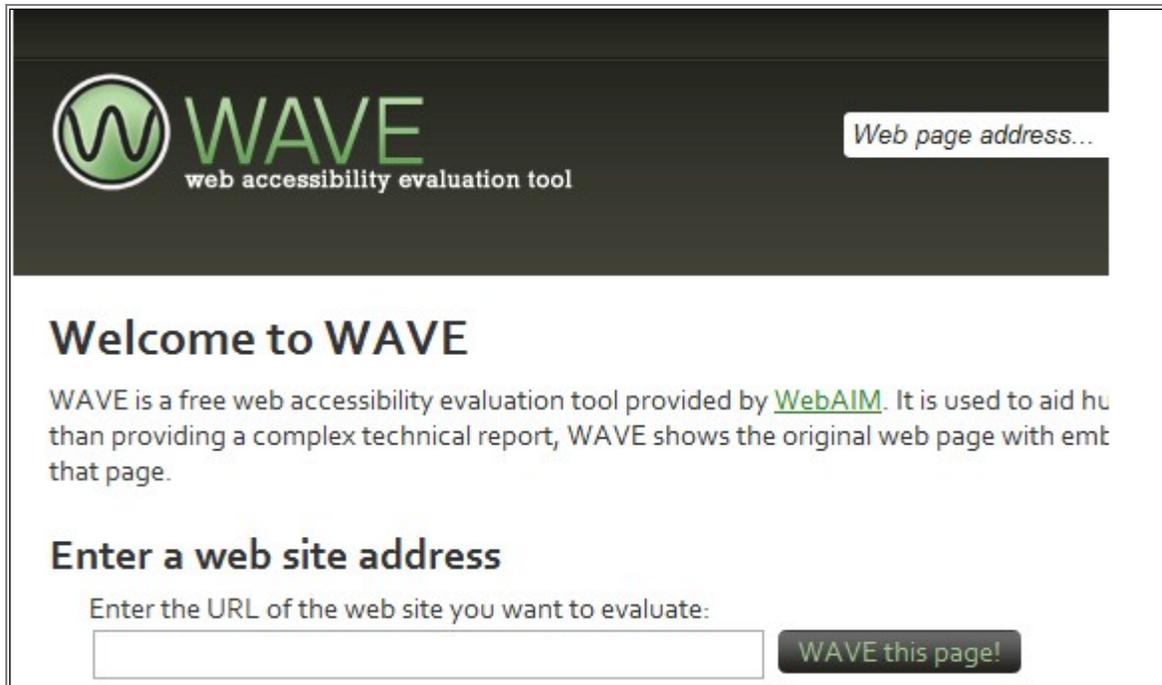
The screenshot shows the Accessibility Valet Demonstrator interface. At the top, it says "Accessibility Valet Demonstrator". Below that, there is a "Check a Document by URL" section. It features a "URL" input field with a "Check" button to its right. Below the input field, there are two dropdown menus: "Test Suite:" set to "WCAG AAA" and "Report Format:" set to "Compact". At the bottom, there is a checkbox labeled "Mail copy of report (subscribers only)".

### 3. WAVE

WAVE is very utile web accessibility tool. WebAIM has provided several options to use WAVE:

- URL can be entered on the WAVE webpage. WAVE will show the original web page with icons and indicators which reveals the accessibility of the page. URL can be entered in <http://wave.webaim.org/> or “<http://wave.webaim.org/report#/YOUR+URL+HERE>”.
- WAVE provide the option to upload a file can be uploaded or enter HTML code to check.
- WAVE toolbar is also available to run the WAVE reports in Firefox. WAVE toolbar can be downloaded from “<http://wave.webaim.org/toolbar/>”.

WCAG 1.0 and Section 508 guidelines are used by WAVE for the webpage evaluation.



The screenshot shows the WAVE web accessibility evaluation tool interface. At the top left is the WAVE logo, which consists of a green circle containing a white waveform, followed by the word "WAVE" in large green letters and "web accessibility evaluation tool" in smaller black letters below it. To the right of the logo is a text input field with the placeholder text "Web page address...". Below the logo and input field is a large heading "Welcome to WAVE". Underneath this heading is a paragraph of text: "WAVE is a free web accessibility evaluation tool provided by [WebAIM](#). It is used to aid hu than providing a complex technical report, WAVE shows the original web page with emt that page." Below this text is another heading "Enter a web site address". Underneath this heading is a text input field with the placeholder text "Enter the URL of the web site you want to evaluate:". To the right of this input field is a dark green button with the text "WAVE this page!" in white.

#### 4. Web Accessibility Toolbar for Internet Explorer

Web Accessibility Toolbar is used to validate accessibility manually. Tool bar has functionality:

- To identify components of a web page
- To Provide access to alternate views of page content
- To Facilitate the use of third party online applications

Web accessibility toolbar follow the WCAG 1.0, Section 508 and BITV guidelines.

#### 5. The Color Contrast Analyser

Color Contrast Analyser checks the color contrast (foreground/background color combinations) and color visibility. It checks the color contrast against WCAG 2.0 color contrast criteria. It also provides the feature to simulate some visual conditions such as color blindness and cataract. Tool helps to determine that contrast ratio between two colors can be read or not by visually challenged people.



## 6. EvalAccess 2.0

EvalAccess2.0 is developed by the University of the Basque Country in Spain. This tool can evaluate a single web page as well as an entire website for WCAG 1.0 and Section508 compliance.

EvalAccess provides the beneath ways to test web accessibility:

- Evaluate Single URL- To use this method user needs to enter the URL of every page and evaluate it.
- Evaluate Website- Using this method entire website can be evaluated.
- Evaluate HTML source- This method is used to evaluate the HTML source code. Enter the HTML source code and evaluate it.



## 7. FAE (Functionality Accessibility Evaluator)

FAE evaluates web page.

Evaluation results returns in following categories: Navigation and Orientation, Text Equivalents, Scripting, Styling and HTML Standards.

FAE can be accessed using URL "<http://fae20.cita.illinois.edu/>"



The screenshot shows a web form titled "Run FAE". The form contains the following elements: a heading "Run FAE", a paragraph "Use this form to evaluate the functional accessibility of a single web page.", a paragraph "Register for a free user account to gain access to these additional features:", a bulleted list of features: "Evaluate multiple pages via web crawling", "Generate a Sitewide Report that identifies problem pages", and "Save reports in an account-specific Archived Reports list". Below the list is a label "URL:" followed by a text input field containing "http://". There is a checkbox labeled "Include DHTML content" which is currently unchecked. At the bottom of the form is a button labeled "Evaluate".

## 8. AccessColor

AccessColor checks the color brightness, color combinations and color contrast between colors. It ensures that color contrast can be accessed by people with visual impairments.

AccessColor also helps in finding appropriate color combinations within HTML and CSS documents in order to test the contrast between each color combination. It provides the option to only errors and warnings in report or view full report with details.

AccessColor checks the color combinations against WCAG 1.0 guidelines.

AccessColor can be accessed using URL "<http://www.accesskeys.org/tools/color-contrast.html>".



The screenshot shows a web form titled "Check URL". The form contains the following elements: a label "Web Address" with a red asterisk, a text input field containing "http://", a "Show" dropdown menu with "Only Errors" selected and "Full report" as an option, a "Show Source" checkbox which is unchecked, and a "Check" button at the bottom.

## 9. Hera (Version 2)

Hera is a web-based system that performs the accessibility test as per the WCAG1.0 guidelines. It does some automation testing and guides users through tests which need to be done or confirmed manually.

Hera can be accessed using URL "<http://www.sidar.org/hera/>".

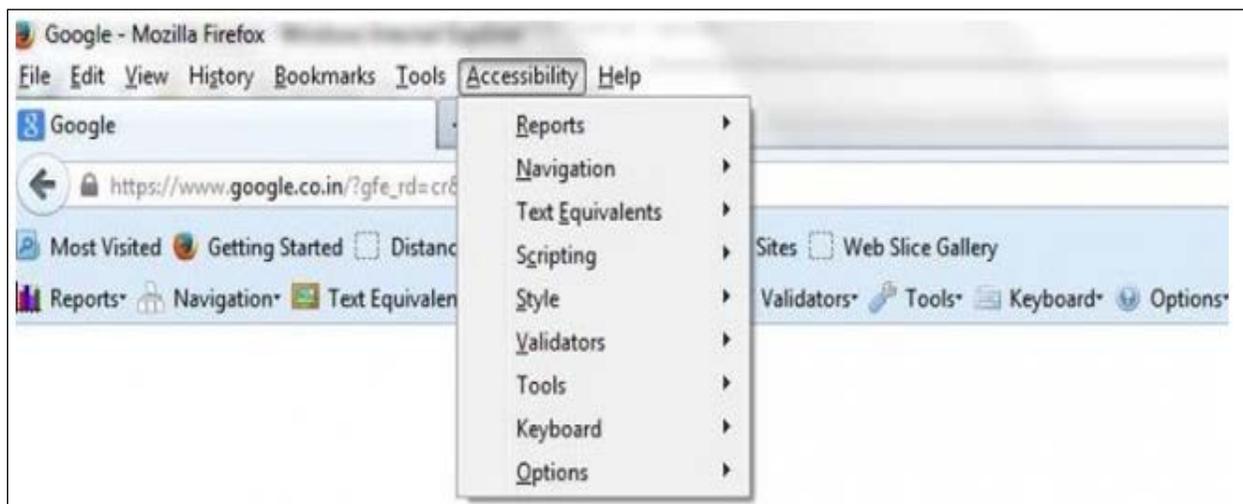


The screenshot shows a web form titled "HERA 2.1 Beta". The form has a green header bar with the text "HERA 2.1 Beta". Below the header is a blue background with the text "Testing Accessibility with Style" in a large, stylized font. On the right side, there is a cartoon owl logo and the word "HERA" in large, red, stylized letters. Below the text is a text input field containing "Page: http://designzzz.com" and a "Check" button.

## 10. Firefox Accessibility Extension

Firefox Accessibility Extension is an add-on available for Firefox which makes people with disabilities to view and navigate web page contents. To download the Accessibility Extension open Firefox and navigate to Tools>Add-ons>Accessibility Extension. A new menu bar “Accessibility” is displayed with number of features:

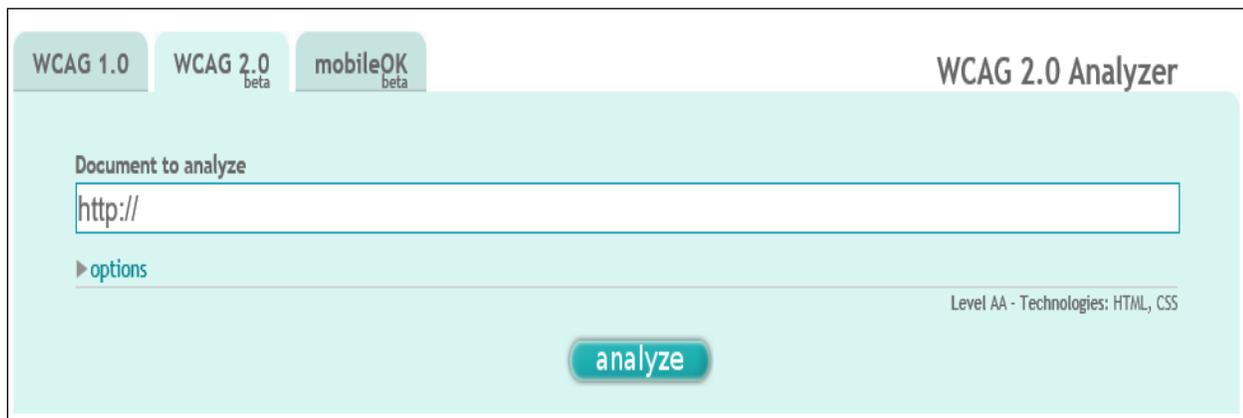
- Reports(Accessibility Issues)
- Navigation (Title, Headings, Links, Forms, Data Tables, Language Changes etc.)
- Text Equivalents (List of Images, List of Objects, List of Abbreviations etc.)
- Scripting (Focus Inspector, List of ARIA Widgets, Disable Scripting etc.)
- Style (Colour Contrast, Text Flow, Text Sizing, High Contrast View etc.)
- Validators (W3C Specifications, HTML Validator, CSS Validator, Link Checker etc.)
- Tools (FAE, WebAIM WAVE, Cynthia Says, WebXact, TAW etc.)
- Keyboard (Keyboard Shortcut Options, Disable Access Keys etc.)



## 11. TAW Online

TAW (Web Accessibility Test) is an online tool for the accessibility test of web sites based on the W3C Web Content Accessibility Guidelines. It gives the option to select a guideline WCAG1.0 or WCAG2.0. It also gives the option to select Level Analysis (Level A, Level AA and Level AAA). As per the selected WCAG guideline standard and level, it tests the web site.

TAW can be accessed using URL “<http://www.tawdis.net/ingles.html>”



## 12. PDF Accessibility Checker (PAC)

PDF Accessibility checker is a freeware windows tool to check the accessibility of PDF files. PAC is recommended by W3C for checking the accessibility of PDF files.

PAC can be used by opening the “PDF Accessibility Checker 2.0.exe”, PAC can be downloaded from “<http://www.access-for-all.ch/en/pdf-lab/pdf-accessibility-checker-pac.html>”.



## VII. CONCLUSION

Accessibility testing assists in making application disabled friendly. Accessibility testing may be challenging for testers because they are unfamiliar with disabilities. It is better to work with disabled people who have specific needs to understand their challenges.

In addition, it's a myth that creating accessible website and testing them is expensive. It is not limited to disabled; it also improves the usability of application which helps regular users as well.

#### ACKNOWLEDGMENT

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# “Endometrial Cells in Pap smears- Role in prediction of Endometrial Pathology- A three year study”

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**Abstract- Introduction:** Endometrial Carcinoma is one of the most common malignancy of female genital tract and third most common worldwide. No widely accepted screening test for endometrial carcinoma exists. However, cervical cytology has been found to be useful in detecting endometrial disease. The 2001 Bethesda system recommends the reporting of endometrial cells in women of 40 years and more, regardless of menstrual status or clinical history. **Aims & objectives:** The purpose of the current study is to identify the endometrial cells in Pap smears and correlate with the presence or absence of significant endometrial pathology. **Materials & methods:** A total of 29,736 conventional Pap smears, during a three year study period (July 2010 to June 2013) were studied and evaluated for presence of any significant endometrial pathology on histopathology. In all these patients, clinical information including age, menopausal status, use of hormonal replacement therapy, presence of abnormal bleeding were noted. **Results:** In the current study, 49 of 189 women had histopathological correlation. 85.7% cases of endometrial carcinoma on biopsy had abnormal cells in Pap smears except 1 case which showed benign EMCs. 1 of the 5 cases of endometrial hyperplasia had atypical endometrial cells. Other benign conditions had benign EMCs in Pap smears. Most of the women with significant endometrial pathology on biopsy had benign EMCs (13/20 cases) in Pap smears. However, abnormal EMCs were noted in 6 of 7 cases of endometrial carcinoma. Only 1 case with benign EMCs in Pap had endometrial carcinoma on follow up. No malignancy was noted in women aged <40 years of age. **Conclusion:** Underlying significant endometrial pathology is likely to be present in symptomatic women aged >40 years with benign EMCs on cytology, post-menopausal women with or without symptoms and in women with abnormal EMCs in Pap smears regardless of their age and necessitates further evaluation.

**Index Terms-** Endometrial cells, Endometrial carcinoma, Hyperplasia, Polyp, Pap smears.

## I. INTRODUCTION

Endometrial Carcinoma is one of the most common malignancy of female genital tract and third most common worldwide. It accounts for 97% of all uterine carcinoma and arise from glands in the endometrium<sup>1</sup>. Endometrial hyperplasia is a precursor lesion. It is most often diagnosed in post-menopausal age. No widely accepted screening test for endometrial carcinoma exists. The goal of cervical cytology is to detect cervical pre-cancer/ cancer; it is not a screening method for endometrial abnormalities. Over 60% of cervical smears obtained from women in the first few days of menstrual cycle may have endometrial cells (EMCs). Clusters of stromal, glandular or mixed origin can be observed<sup>2</sup>. However, if normal EMCs are observed in smears when physiological exfoliation is not expected; i.e. second half of menstrual cycle, pathological significance may be greater, although cell shedding at times can be associated with oral contraceptive pills (OCPs), Intrauterine devices (IUDs) and use of hormone replacement therapy (HRT)<sup>3</sup>.

The presence of benign appearing EMCs in Pap smears must be noted. Several studies have suggested that spontaneously exfoliated benign EMCs on Pap smears might indicate endometrial pathology in post-menopausal women, necessitating further investigations<sup>4, 5</sup>. The 1991 Bethesda system (TBS) recommended that the presence of benign EMCs in post-menopausal women, which may be harbinger of endometrial carcinoma or its precursors, should be reported in Pap smear report<sup>6</sup>. However, menopausal status often is not documented in test requisition forms. If clinical information is provided, it may be incorrect. A cut-off age of 40 years rather than the menopausal status was included in the TBS 2001 based on studies of the clinical significance of benign EMCs in Pap smears<sup>6</sup>.

Reporting a cytological diagnosis of benign EMCs in all women aged 40 years and older may create the potential for unnecessary clinical intervention because there is no recommended approach for managing women with benign EMCs. Setting an appropriate cut-off age of 40 years is an example of the question of sensitivity versus specificity of reporting benign EMCs in Pap smears. Presence of abnormal EMCs in Pap smear has been reported to be associated with higher rate of significant endometrial pathology<sup>7</sup>.

In the present study attempts have been made to identify EMCs in Pap smears and assess their role in prediction of endometrial pathology.

## II. AIMS & OBJECTIVES

### AIM:

To ascertain the relevance of endometrial cells detected in routine cervical Pap smears in predicting endometrial pathology.

### OBJECTIVES OF THE CURRENT STUDY:

- 1) To identify endometrial cells in conventional Pap smears.
- 2) To categorize endometrial cells into benign and abnormal (atypical/malignant) subtypes.
- 3) To correlate their presence with clinical, radiologic and histopathological findings whenever available.
- 4) Evaluate whether significant endometrial pathology exists in postmenopausal women with EMCs in their Pap smears
- 5) Correlate cases of abnormal EMCs in Pap smears with histopathological findings.

## III. MATERIALS & METHODS

A retrospective & prospective review was done of the archives of the Department of Pathology, Kasturba Medical College & Hospital, Manipal, from July 2010 to June 2013. Twenty-nine thousand seven hundred and thirty-six Pap smears were performed during this 3-year period. All of these smears were conventional Pap smears.

### Inclusion Criteria:

All cervical Pap smears performed on women attending Kasturba Hospital, Manipal from July 2010 to June 2013 that contained endometrial cells were included in the study.

### Exclusion Criteria:

All cervical Pap smears lacking endometrial cells and inadequate smears, performed on women attending Kasturba Hospital, Manipal from July 2010 to June 2013 were not part of the study.

One-hundred and eighty-nine of 29,736 Pap smears were identified to have endometrial cells. The patients were divided into two groups:

- 1) With presence of benign-appearing endometrial cells with or without stromal cells, necrotic debris, histiocytes, inflammatory cells in the smears.
- 2) Abnormal (atypical/malignant) endometrial cells.

Clinical information like age, menopausal status and use of hormone replacement therapy, use of tamoxifen and history of abnormal bleeding, ultrasound findings including endometrial thickness as assessed on transvaginal ultrasound was obtained from medical records department. These patients were subdivided into pre- and postmenopausal group, 44 of 189 being postmenopausal women. Endometrial biopsy/ curettage was performed in 49 of 189 cases and correlated with the cytological findings. Pathological findings from endometrial biopsy were documented for correlation.

## IV. RESULTS

In a three year study period (July 2010 to June 2013); 29,736 conventional cervical Pap smears received in Kasturba Hospital were analyzed.

- 1) One-hundred and eighty-nine (0.64%) smears showed presence of endometrial cells. Most of the women in the study were in the age group of 41-50 years.
- 2) Different patterns and cytological features of EMCs were observed and classified as benign appearing and abnormal EMCs. Presence of top-hat appearance (Fig 1) was noted in benign EMC clusters whereas stromal cells, histiocytes and debris were noted in both the groups i.e., benign appearing EMCs & abnormal EMCs (Fig 2).
- 3) One-hundred and sixty-nine women had benign EMCs in Pap smear; menorrhagia was common presenting symptom. Fifty-two women were asymptomatic. Significant endometrial pathology was noted in 13 of 41 biopsied cases in this group including one case of endometrial adenocarcinoma (Fig 3).
- 4) The mean age of 20 women with abnormal EMCs in Pap smear was 53.65 years; most common presenting symptom being post-menopausal bleeding. One of these 20 women was asymptomatic. Eight of these 20 cases had biopsy correlation; six

- showed endometrial adenocarcinoma. The other two biopsied cases showed one case each of endometrial hyperplasia and secretory endometrium.
- 5) Forty-seven women in the age group of <40 years with a mean age of 32.3 years showed endometrial cells on Pap smears. Dysfunctional uterine bleeding (23.3%) was the most common presenting symptom among symptomatic women (63.8%). Forty-six of these 47 smears showed benign EMCs. One case with abnormal EMCs had no follow up data. None of the cases with histopathological correlation had underlying malignancy.
  - 6) One-hundred and forty-two women were identified in the age group of  $\geq 40$  years with EMCs on Pap with a mean age of 49.2 years. Sixty-seven percent women were symptomatic; postmenopausal bleeding the common presenting symptom (Fig 4).
  - 7) Thirty-eight of 123 women aged  $\geq 40$  years with benign EMCs on Pap underwent histopathological examination. Significant pathology was observed in eleven cases ( $\approx 29\%$ ) including endometrial polyp (18.4%), endometrial hyperplasia (7.9%) and endometrial adenocarcinoma (2.6%) (Fig 5).
  - 8) Among 123 women aged  $\geq 40$  years, 20 women showed benign EMCs along with debris on Pap smears. Though 65% of these women underwent endometrial biopsy, significant pathology i.e., endometrial hyperplasia was identified in one of them.
  - 9) Nineteen women aged  $\geq 40$  years had abnormal EMCs on Pap smears; 42% of them had histopathological correlation (8 of the nineteen cases). Six of these 8 women i.e., 75% had underlying endometrial malignancy (Fig6,9-10).
  - 10) Forty-four women were postmenopausal. Six of 30 women with benign EMCs among postmenopausal women underwent endometrial biopsy; significant pathology being observed in 4 cases. However, no endometrial malignancy was noted. The positive and negative predictive value of benign EMCs in postmenopausal women in predicting significant endometrial pathology was 54.6% and 72.7% respectively.
  - 11) Fourteen postmenopausal women showed abnormal EMCs on Pap smears. Five of these 14 women who were biopsied showed endometrial adenocarcinoma (Fig7,8,11).
  - 12) Post-menopausal bleeding was the most common presenting symptom noted in the postmenopausal women (65.1%). Nine of 11 cases biopsied showed significant endometrial pathology; five being endometrial carcinoma. Further, 7 of the 9 cases with significant endometrial pathology were symptomatic.
  - 13) Seven of 30 postmenopausal women with benign EMCs had history of HRT. Two of them had endometrial biopsy that showed endometrial polyp and endometrial hyperplasia, one case each. Rest of the women in this group had no history of HRT. Four of these 23 underwent follow up histopathological examination; 2 showed significant endometrial pathology, i.e., one case each of endometrial polyp and hyperplasia.
  - 14) Eight of 14 postmenopausal women with abnormal EMCs on Pap had history of HRT use. Three of these 8 cases showed endometrial malignancy on biopsy. Six of 14 postmenopausal women had no history of HRT; 2 of them showed endometrial malignancy.
  - 15) History of intrauterine contraceptive device use was available in 6 of 189 cases. Two cases had biopsy for correlation with one case each of endometrial polyp and leiomyoma.

## V. DISCUSSION

The Pap test which was introduced nearly 80 years ago is now proven to be one of the best procedures for cervical cancer screening and prevention. In contrast, endometrial carcinoma, currently emerging as common malignancy of the female genital tract, has no cost-effective universal screening test.

It has been observed that the Pap test has low sensitivity & low positive predictive value in detection of endometrial cancer. Though there is discrepancy regarding the clinical significance of finding benign exfoliated endometrial cells in Pap test, it has been seen that significant endometrial pathology is present whenever abnormal endometrial cells are observed in Pap smear.

In the present study, an attempt was made to analyze the frequency of different types of endometrial cells in Pap smear and their role in predicting endometrial pathology in relation to age group (<40 years &  $\geq 40$  years), menopausal status, hormonal therapy and history of use of intrauterine contraceptive devices.

One-hundred and eighty nine Pap smears with endometrial cells were identified in the three year study period. These findings were correlated with clinical, radiological and histopathological findings whenever available.

Incidence of endometrial cells on Pap smears in the present study was 0.64%. Similar findings were observed by Karim et al<sup>1</sup> (1.71%). However, Voojjs & coworker<sup>2</sup> noted a much higher rate of EMCs in Pap smears in their study (12%).

In the current study, the presence of benign appearing EMCs accounted for 0.56% of all the conventional Pap smears studied. These findings are similar to the observations of Lai et al<sup>3</sup> (0.24%). However, Cherkis & coworker<sup>4</sup> noted a lower rate of benign EMCs (0.06%).

In the present study, 13 of 41 cases biopsied with benign EMCs on Pap showed significant endometrial pathology with endometrial polyp (19.51%), endometrial hyperplasia (9.76%) and one case (2.44%) of endometrioid adenocarcinoma. However, Cherkis et al<sup>4</sup>

noted higher rate of endometrial adenocarcinoma (11.2%) in their study. Rest of the cases observed by them was endometrial polyp (11.7%) and endometrial hyperplasia (12.84%). In contrast, Yancey et al<sup>5</sup> noted a lower rate of endometrial carcinoma (0.8%).

In the present study, twenty of the 189 women had abnormal EMCs on Pap smears of which atypical EMCs were noted in 14 (i.e. 7.4%) cases. The mean age of women with atypical EMCs was 53.3 years. Thrall et al<sup>6</sup> noted fewer cases of atypical EMCs [1.24% (48/3863)] and in younger women as compared to our study i.e., mean age was 44 years.

Six of 14 (43%) women with atypical EMCs had histopathological follow up. Significant pathology was noted in 5 cases (83.3%). Cherkis et al<sup>7</sup> and Yancey & coworkers<sup>5</sup> noted significant endometrial pathology in 41.8% and 29.2% respectively in women with atypical EMCs in their studies. In the present study, 66.7% cases with biopsy in this group of women showed endometrial carcinoma. However, lower rate of endometrial carcinoma was observed by Cherkis et al<sup>7</sup>(20%) and Yancey et al<sup>5</sup> (21%).

In the present study, the frequency of malignant endometrial cells was 3.2% [6 of 189 cases]; the mean age of women in this group was 54 years. However, Thrall et al<sup>6</sup> noted a lower prevalence rate (0.13%) and a higher mean age (62 years). In the study by Li & coworkers<sup>8</sup>, the incidence was 1.01% with a mean age of 64.3 years. In the present study, 2 of 6 cases with biopsy available for correlation showed endometrial adenocarcinoma. Li et al<sup>8</sup> had similar findings with endometrial adenocarcinoma on biopsy in all 21 cases with malignant EMCs on Pap smears in their study. However, Yancey et al<sup>5</sup>, noted malignancy in 75.8% of cases with suspicious/malignant EMCs in Pap.

In the present study, 142 women aged  $\geq 40$  years showed EMCs on Pap smears, with a mean age of 49.2 years. These findings are in concordance with those observed by Thrall et al<sup>6</sup> who noted a mean age of 46 years in their study.

In the current study, the prevalence rate of benign EMCs in women aged  $\geq 40$  years was 0.4%, a finding similar to the results of Beal et al<sup>9</sup> (0.9%) and Browne et al<sup>10</sup> (1.1%).

Presence of atypical EMCs was noted in 6.9% of our cases with a follow up biopsy in 46.2% of these cases. Li et al<sup>8</sup> however noted a higher frequency of atypical EMCs (21.9%) and biopsy rate of 81.7%. The mean age of women with atypical EMCs was 53.3 years in our study group. These findings are similar to those of Li et al<sup>8</sup>.

It was noted that 66.7% of our cases with atypical EMCs in Pap smears in women aged  $\geq 40$  years showed malignancy on follow up biopsy. Shin et al<sup>11</sup> noted abnormal endometrial cells in 38% of patients with endometrial carcinoma in their study. In contrast, a much lower rate was observed in study by Eddy & coworkers<sup>12</sup> (15%).

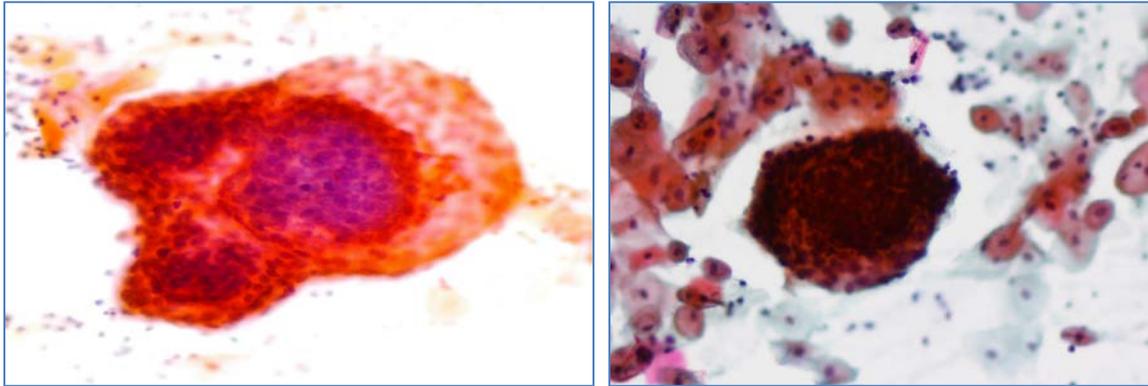
In the current study, it was observed that 6 (85.7%) of the 7 cases of endometrial carcinoma had abnormal EMCs in their Pap smears. DuBeshter et al<sup>13</sup> noted 77% cases of endometrial carcinoma with abnormal EMCs in their Pap smears.

It can be concluded from the present study that symptomatic women aged  $\geq 40$  years with benign EMCs in Pap smears and postmenopausal women irrespective of symptoms and history of HRT with normal or atypical EMCs on cervical cytology screening should be evaluated for any underlying endometrial pathology. All women with abnormal EMCs in their Pap smears should be subjected to further clinicoradiologic examination and close follow up irrespective of age, symptoms or history of HRT or IUD use.

## VI. CONCLUSION

It can be concluded from the current study that normal exfoliated endometrial cells in both the first half and second half of menstrual cycle in asymptomatic menstruating women are unlikely to be associated with significant endometrial pathology and need not be evaluated unless otherwise clinically indicated. Underlying significant endometrial pathology is likely to be present in symptomatic women aged  $\geq 40$  years with benign EMCs on cytology, postmenopausal women with or without symptoms and in women with abnormal endometrial cells in Pap smears regardless of their age and necessitates further evaluation. In the absence of demographic and clinical information including history of symptoms and menstrual status, age might be used to stratify the risk of underlying endometrial pathology.

**IMAGES AND TABLES:**



**Fig/Table 1: Clusters of Benign EMCs with “top-hat” appearance (A.Pap X200;B.Pap X100)**

**Fig/Table2: EMCs in PAP smears: Cytomorphological features [n=189]**

Features	Benign EMCs (n=169)	Abnormal EMCs (n=20)
1) Top-hat appearance of EMCs	21	0
2) Stromal cells	35	6
3) Histiocytes & necrotic debris	20	8
4) EMCs only	93	6
Total	169	20

**Fig/Table3 : Comparison of patient groups with benign and abnormal endometrial cell clusters [n=189]:**

Features	Benign EMCs (n=169)	Abnormal EMCs (n=20)
1) Age range	22-85 years	35-67 years
2) common age group (in years)	41-50	51-60
3) Number of cases symptomatic	111 (65.7%)	19 (95%)
4) Number of postmenopausal women	30 (17.8%)	14 (70%)
5) Number of cases with biopsy correlation	41	08
6) Significant endometrial pathology*	13	07
7) Number of cases of endometrial carcinoma on biopsy	01	06

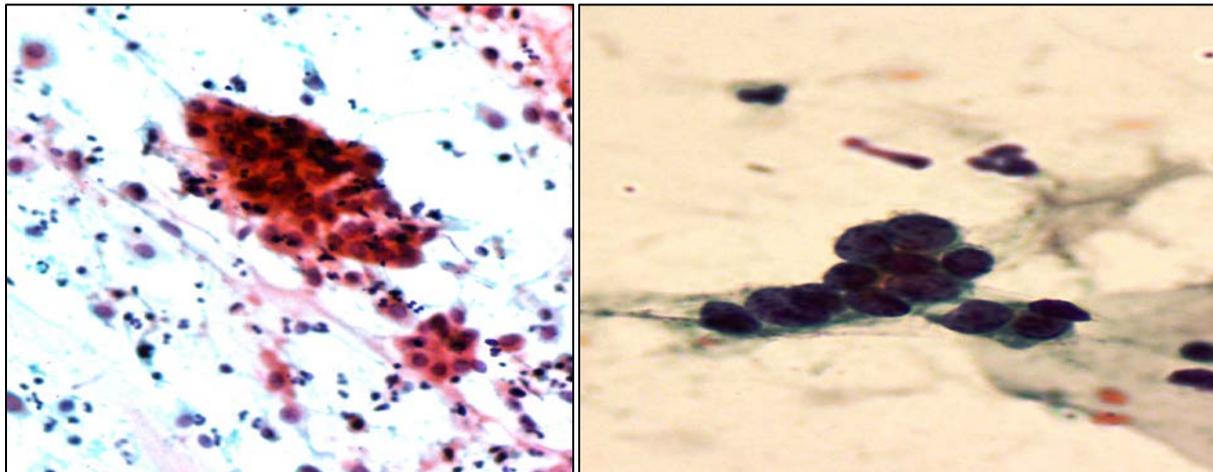
\*[“Significant endometrial pathology” includes: endometrial polyp, endometrial hyperplasia & endometrial carcinoma]

**Fig/Table no. 4: Comparison of patient groups with respect to age category [n=189]:**

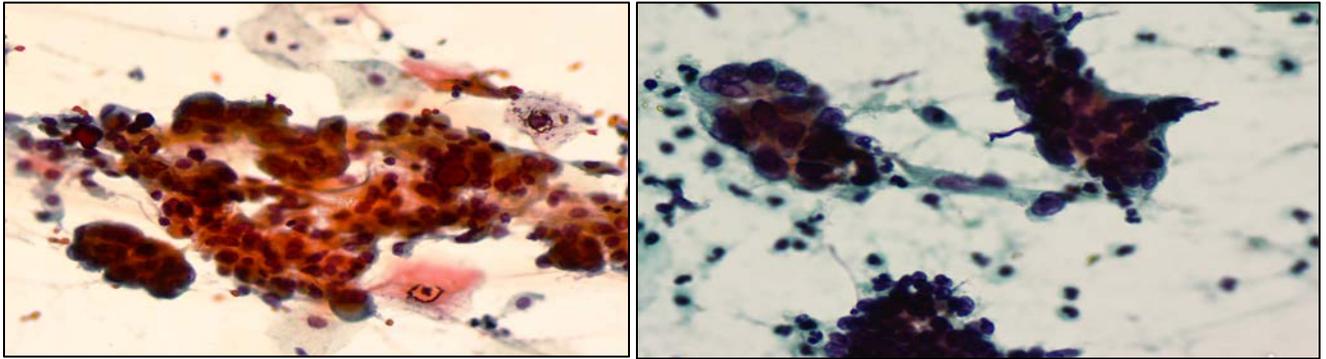
Features	<40 years (n=47)	≥40 years (n=142)
1) Mean age (in years)	32.3	49.2
2) Common presenting symptom	DUB (23.3%)	Postmenopausal bleeding (29.5%)
3) Benign EMCs only	35	67
4) Benign EMCs + stromal cells	9	36
5) Benign EMCs + debris	2	20
6) Abnormal EMCs	1	19

**Fig/Table No. 5: Biopsy correlation with types of EMCs in their Pap smears & age group. [n=49]**

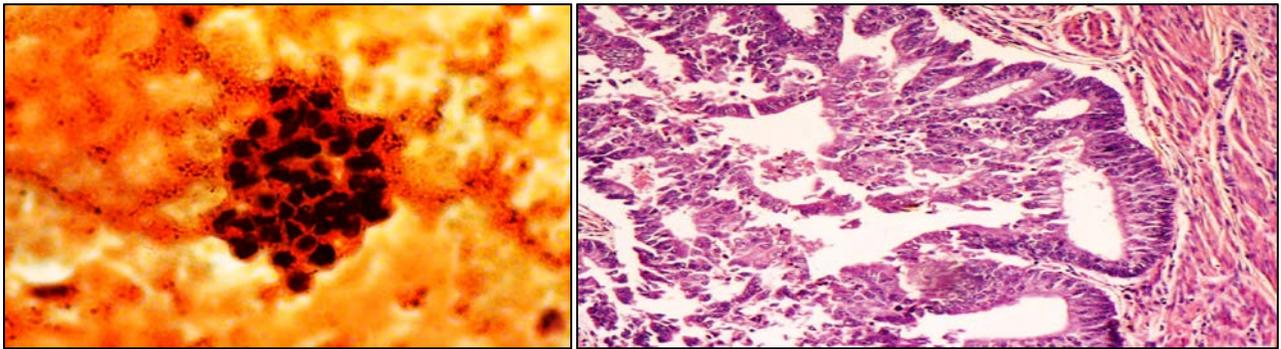
		Type of EMCs in Pap smears			Age group	
					<40 years	≥ 40 years
<b>Histopathological diagnosis</b>	Number of cases	Benign EMCs	Atypical EMCs	Malignant EMCs		
Leiomyoma	12	12	-	-	1	11
Proliferative endometrium	06	6	-	-	-	6
Secretory endometrium	10	9	1	-	-	10
Adenomyosis	1	1	-	-	-	1
Endometrial polyp	8	8	-	-	1	7
Endometrial Hyperplasia	5	4	1	-	1	4
Endometrial carcinoma	7	1	4	2	-	7



**Fig 6 :Clusters of atypical EMCs with neutrophils & debris (A: Pap X100; B: Pap X200)**

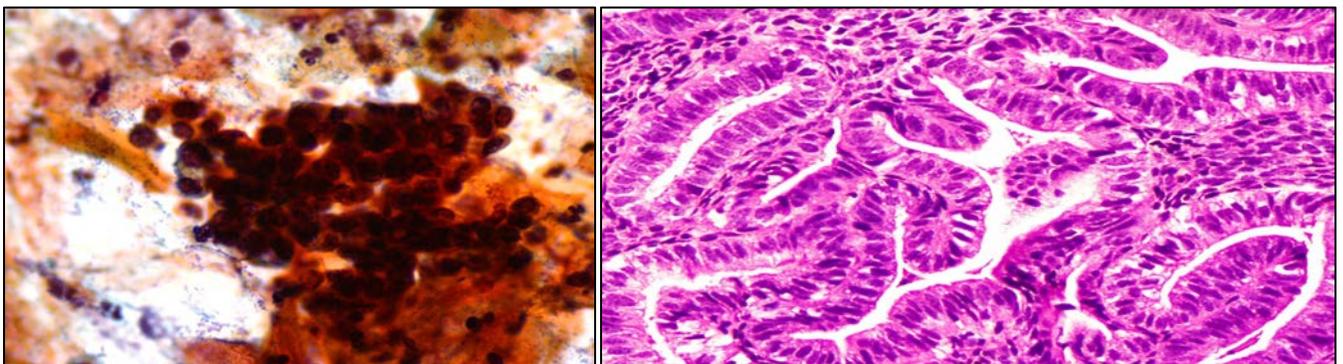


**Fig 7: cluster of malignant EMCs with neutrophils (A:Pap X100; B:Pap X200)**



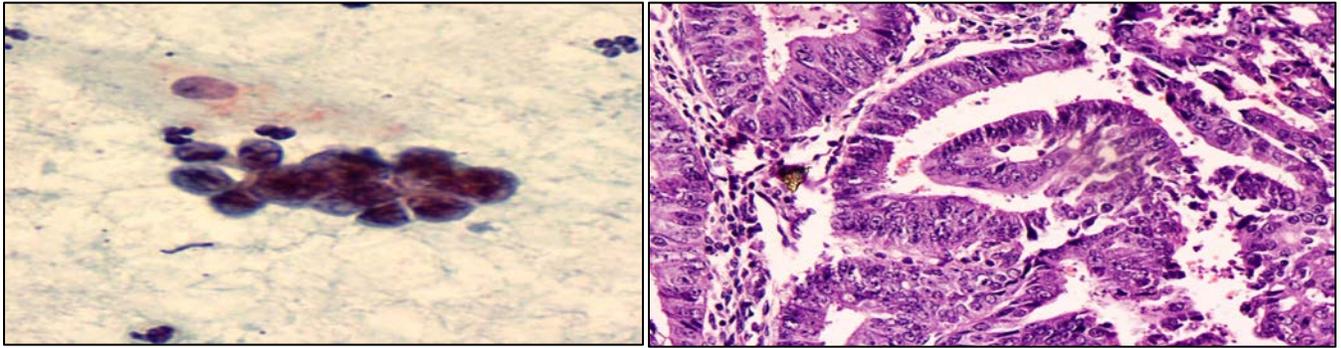
**Fig 8(A): Cluster of benign EMCs (Pap X200)**

**Fig 8(B): Corresponding histopathological image showing poorly differentiated endometrial carcinoma, grade III. (H&E X200)**



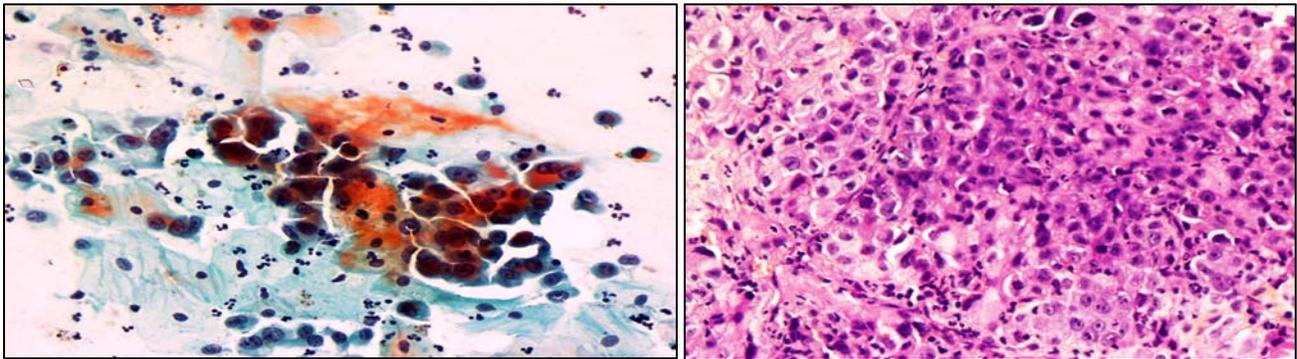
**Fig 9(A): Cluster of atypical EMCs with neutrophils & debris (Pap X200)**

**Fig 9(B): Corresponding histopathological image showing endometrial hyperplasia. (H&E X200)**



**Fig 10(A): Cluster of atypical EMCs with few neutrophils (Pap X200)**

**Fig 10(B): Corresponding histopathological image showing grade 1, villoglandular endometrial carcinoma. (H&E X200)**



**Fig 11(A): Cluster of malignant EMCs with neutrophils & debris (Pap X100)**

**Fig 11(B): Corresponding histopathological image showing poorly differentiated endometrial carcinoma, grade III. (H&E X200)**

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# Static and modal analysis of engine cover for different materials

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**Abstract-** The designed engine cover in this paper is made of different plastic materials, today's ever increasing demand for newer, lighter materials with higher strength, greater stiffness, and better reliability has led to wide research on development of thermo plastic materials. These materials offer a combination of strength and modulus that are either comparable to or better than many traditional materials such as metals. However, with the development need for materials with superior properties from the private sector, composites are now making their way into more common applications. However study on the static and dynamic mechanical behaviour, long term durability, and environmental stability of these materials are limited. Under-the-bonnet applications came later with the more widespread availability of high-performance thermoplastics (referred to as 'engineering plastics') and contributed significantly to cost and weight reduction in the engine compartment.

In the present work an attempt has been made to analyze the different composite materials for engine cover of vehicle with respect to static and modal analysis. Initially the engine cover model is prepared in catia software with actual dimensions. Analysis of engine cover model is done in ANSYS by importing the CATIA software model for 5 different materials and results for existing material are studied. The objective of present work is to suggest the best material for vehicle engine cover by comparing obtained results with present material. The various parameters of interest are natural frequency, total deformation and equivalent stress. Based on results obtained with the study of above parameters ideal material for engine cover is suggested.

The major objectives are outlined as follows:-

- Preparation of CAD model of engine cover using CATIA software.
- Carrying out static analysis and modal analysis using ANSYS for 5 different materials and to compare the obtained results with existing material.
- To obtain the mechanical properties viz equivalent stress, total deformation and modal frequencies of engine cover for different materials.
- To compare the various parameters of interest and draw conclusion.

**Index Terms-** Engine Cover, Deformation, Plastic Material.

## I. INTRODUCTION

Today's ever increasing demand for newer, lighter materials with higher strength, greater stiffness, and better reliability has led to wide research on development of thermo plastic materials. These materials offer a combination of strength and

modulus that are either comparable to or better than many traditional materials such as metals. Because of their low specific gravities, the strength-to-weight ratios as well as specific modulus make these materials more superior to those of metallic materials. In addition, fatigue strength-to-weight ratios as well as fatigue damage tolerances of many polymers are excellent and make them feasible candidates for many applications. The use of advanced materials has primarily been limited to high performance aerospace and sporting applications. However, with the development need for materials with superior properties from the private sector, composites are now making their way into more common applications. However study on the static and dynamic mechanical behaviour, long term durability, and environmental stability of these materials are limited.

Thermoplastics have been extensively used in automotive applications for the last few decades and are most visibly seen in automobile bumpers and interiors. Under-the-bonnet applications came later with the more widespread availability of high-performance thermoplastics (referred to as 'engineering plastics') and contributed significantly to cost and weight reduction in the engine compartment, initially in applications that could be regarded as less critical to performance and safety, such as cooling fans, shrouds and header tanks, fixations, radiator grills, etc.

Recently it has been seen engineering plastics are used in critical components on the vehicle itself as well as into safety critical components such as brakes, steering and air bag systems. The driving force behind this trend has been the growing confidence of automotive engineers in the capabilities of thermoplastics and engineering plastics. Engineering plastics have performed very well in each new demanding application. This successfully has raised awareness about plastic materials. Beyond this automotive engineers also studied different characters to judge the thermo plastic materials. They suggested that their characteristics are quite different to those of the metals that have been used for generations.

While this understanding has enabled innovation with thermoplastics, the drivers for change have been those familiar throughout the automotive industry: weight reduction, greater fuel economy and system cost reduction. The use of composite materials in various parts of automobile chassis component are shown in Fig1.1. Thermoplastics are ideal materials to achieve these goals since they have specific gravities substantially lower than metals generally and the injection-moulding process lends itself to lower production costs through the ability to integrate complex parts into one component and the substantial reduction in finishing processes.

## II. SIGNIFICANCE OF PROPOSED WORK

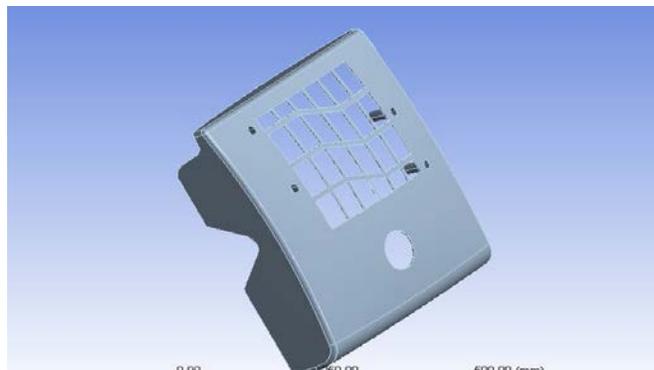
The introduction of plastics to replace the traditional materials in the vehicle industry do not only reduce product cost but also reduce production cost. Plastics are modern, synthetic materials. Plastics are oil and gas based, and consumes less our oil and gas reserves. The superior properties of plastics such as hygienic (clean or free from disease causing microorganisms) barrier properties, light weight, and durability contribute significantly to our health and quality of life. The factors that have contributed to this growth include the energy efficiency of plastic. All studies show that it takes less energy to make a product from plastics than just about any other material. As plastics continue to demonstrate that they are a safe and reliable alternative to traditional materials, new applications will emerge.

In the present work an attempt has been made to analyze the different composite materials for engine cover of Mahindra Scorpio vehicle with respect to static and modal analysis. Initially the engine cover model is prepared in catia software with actual dimensions. Analysis of engine cover model is done in ANSYS by importing the CATIA software model for 5

different materials viz Polypropylene with glass fiber, Nylon with glass fiber, Poly vinyl chloride(PVC) ,High density polyethylene(HDPE), Polybutylene terephthalate(PBT) and results for existing material poly propylene are studied. The objective of present work is to suggest the best material for Mahindra Scorpio vehicle engine cover by comparing obtained results with present material. The various parameters of interest are natural frequency, total deformation and equivalent stress. Based on results obtained with the study of above parameters ideal material for engine cover is suggested.

## III. STATIC STRUCTURAL ANALYSIS

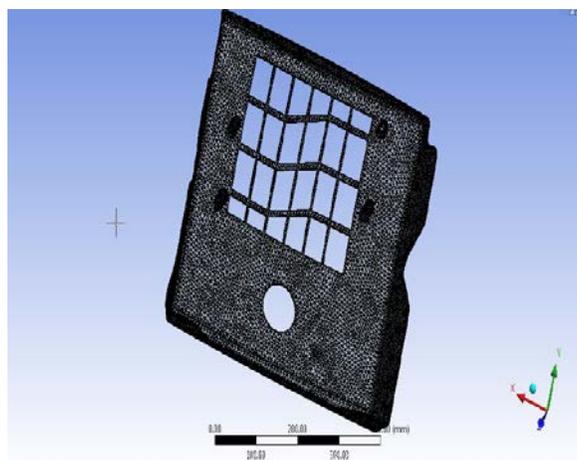
In the present work static structural analysis of engine cover of vehicle for five different alternative materials along with existing material of PP are studied. Initially measurements of engine cover are done and model is prepared in catia software. CAD model of engine cover is saved in the IGES format, and imported to ANSYS software for further analysis.



**Fig 4.1** CATIA Model of engine cover

Meshing of the engine cover is carried out using ANSYS software for imported model by using tetrahedral elements. The global model is discretized with element size of 2.5mm. Similar kind of element and size are used in the work of Laxmikant D. Rangari et al., 2012 and Umesh S. Ghorpade et al., 2012.

Tetrahedral element is robust and efficient element, with unique capabilities, can be used as a majority element in a mesh because it overcomes problems of volumetric locking for explicit dynamic problems, including those involving extreme strain, fragmentation and failure. Tetrahedral meshes are widely used in computer graphics for physically based modeling, in particular realistic simulation of deformable objects [Muller and Dorsey, 2002 and McMillan et al., 2002]. Figure 4.2 shows the mesh of the engine cover and details of mesh are indicted in Table. 4.1.



Details of "Mesh"	
<input type="checkbox"/> Relevance	0
<b>+</b> Sizing	
<b>+</b> Inflation	
<b>+</b> Advanced	
<b>+</b> Defeaturing	
<b>-</b> Statistics	
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Mesh Metric	Skewness
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<input type="checkbox"/> Max	0.877320832776415
<input type="checkbox"/> Average	0.353333950993138
<input type="checkbox"/> Standard Devi...	0.138586074584772

**Fig.4.2** Mesh of engine cover model

**Table.4.1** Mesh details

The FEM model is having 6 degrees of freedoms: translations in the nodal x, y, and z directions and rotations about the nodal x, y, and z axes.

In the present work static structural analysis has been done for 5 different materials viz, Glass reinforced polypropylene,

Glass reinforced nylon, Poly vinyl chloride, High density polyethylene, and Polybutylene terephthalate and results are compared with results of existing cover of Poly Propylene. The various material properties of material used for the present work are shown in Table 4.2.

**Table.4.2** Material properties

Material	E,(GPa)	Poisson's ratio	Density(g/cm3)	Yield Stress(MPa)
Glass reinforced pp	3.553	0.40	1.12	40
Glass reinforced nylon	7.5	0.40	1.4	48
PVC	1.5	0.42	1.4	53
HDPE	0.7	0.42	0.95	25
PBT	5	0.41	1.31	50
PP	0.9	0.40	0.89	35

The above material properties are assigned to the mesh of the engine cover and the bolt holes are fixed. This kind of boundary condition is in accordance with the work of Beomkeun Kim et al., 2007. The only load comes on the engine is Self weight of engine cover and all other kind of loads are neglected in the analysis. In the postprocessor of the software maximum equivalent stress and deformations are obtained. These

two kinds of parameter are used in the earlier work [Umesh S. Ghorpade et al., 2012].

#### IV. RESULTS AND DISCUSSION

Equivalent stresses, total deformation for 6 different materials as stated above are discussed in detail in the following section.

### Equivalent stress And Total elongation

Equivalent stress and total deformation from the postprocessor of ANSYS are obtained for 6 different materials and are shown in Fig.4.3 and Fig. 4.4.

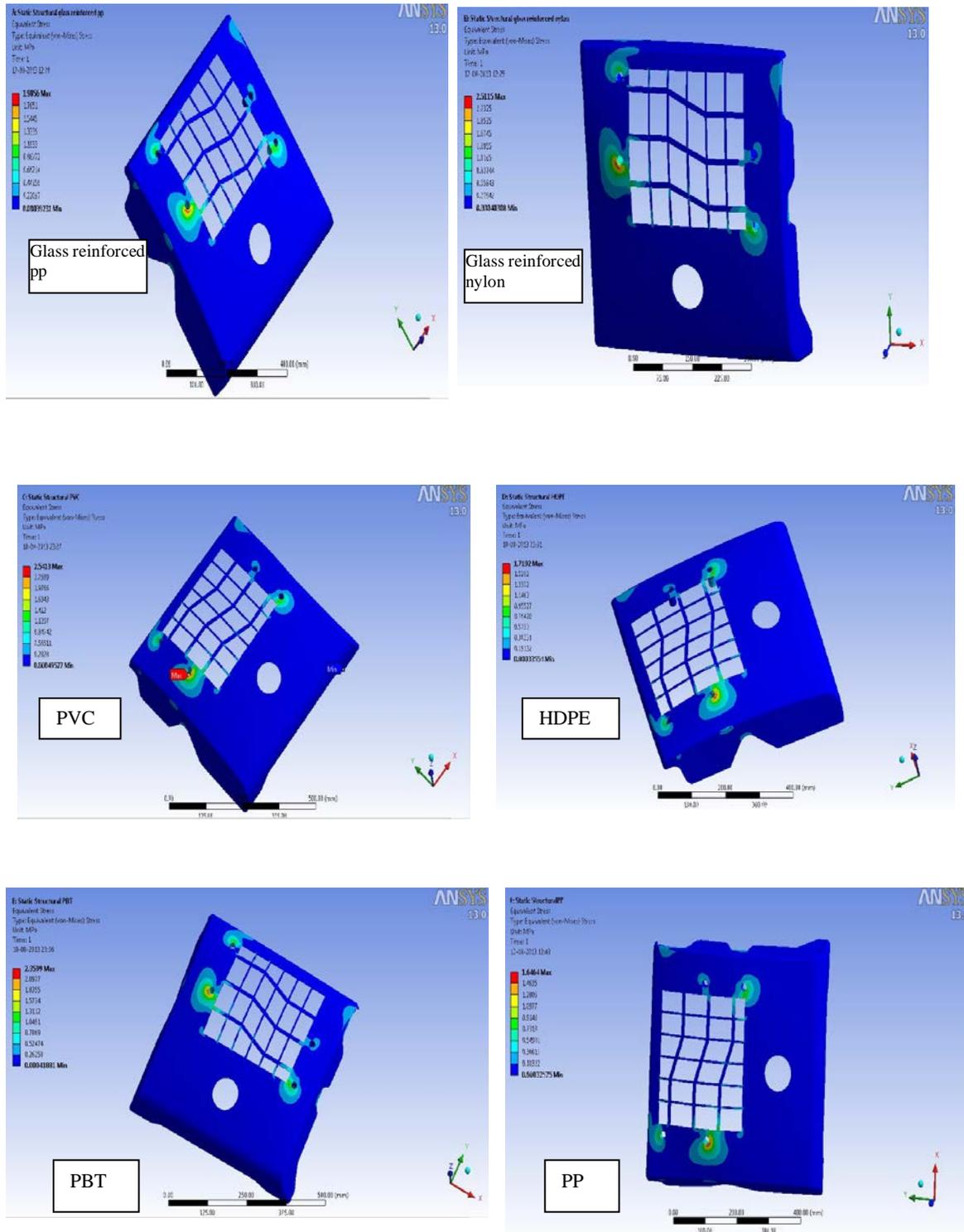
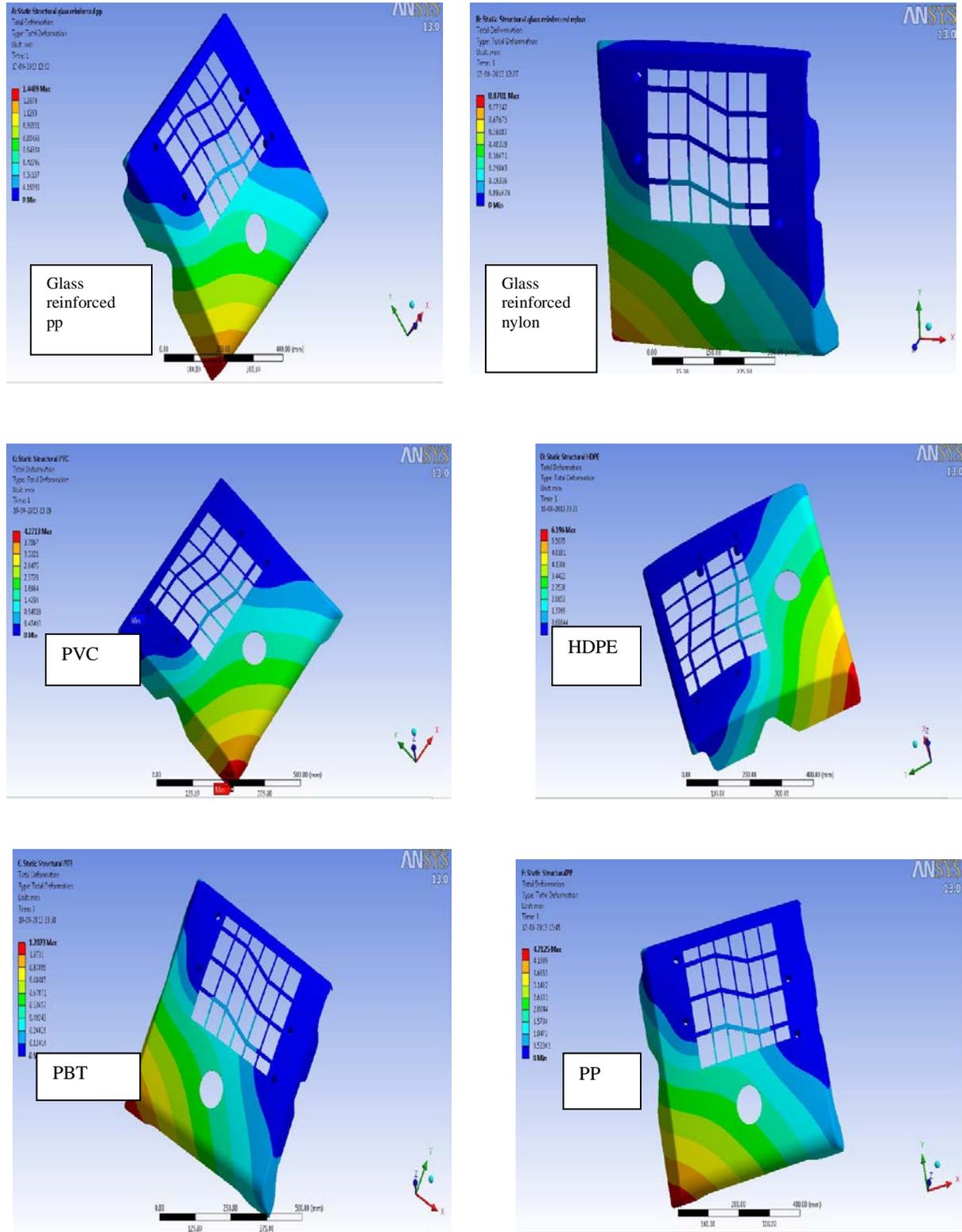


Fig 4.3 Pictorial view of equivalent stress of PVC, HDPE, PBT, PP, Glass reinforced PP and Glass reinforced nylon

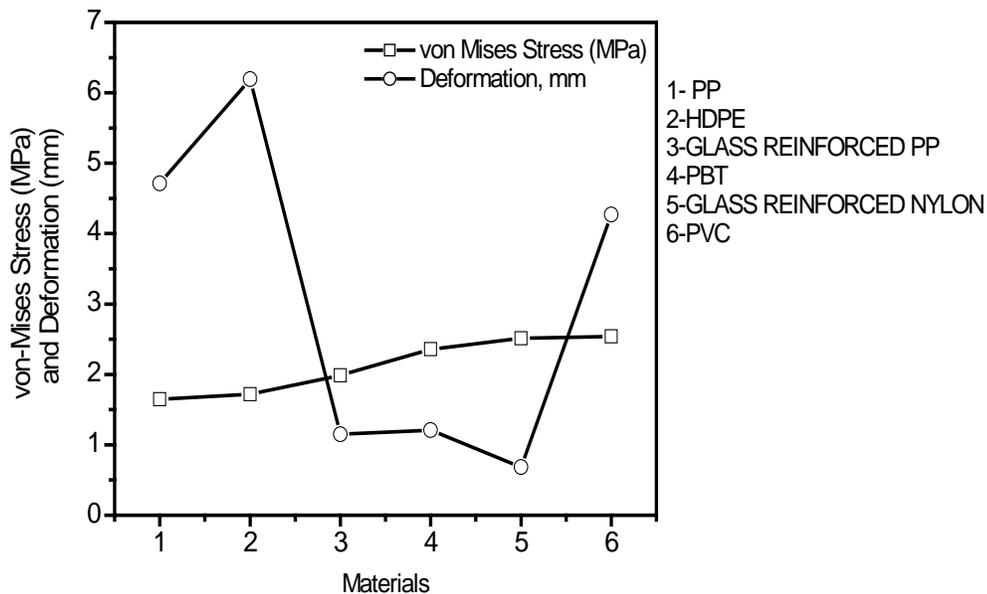


**Fig 4.4 Pictorial view of total deformation of PVC, HDPE, PBT, PP, Glass reinforced PP and Glass reinforced nylon**

The maximum values of equivalent stress and total elongation are shown in the Table 4.3 and plot of the same is shown in Fig. 4.5

**Table.4.3 Equivalent stress and total deformation**

Material	Equivalent stress(MPa)	Total deformation(mm)
PP	1.6464	4.7125
HDPE	1.7192	6.196
Glass reinforced pp	1.9856	1.1513
PBT	2.3599	1.2073
Glass reinforced nylon	2.5115	0.68363
PVC	2.5413	4.2713



**Fig 4.5 Plot of Equivalent stresses and Total deformation v/s Different materials**

From the Fig. 4.5 it is clear that the variations of equivalent stresses for different material are found to be almost equal and they are ranging from 1.642 to 2.54MPa. The developed stresses are well within the limits (Compared to yield Stress). At this level of analysis the optimization is not possible. The constraint is that the minimum thickness to be taken is 3mm. But, unlike stresses the deformations are not same for different materials when analysis is done using self-weight. The deformation is found to be maximum for HDPE material and minimum is found to be for Glass reinforced PP. This clearly indicates that such variation is attributed to different values of Young's modulus and

Poisson's ratio. At this moment with static analysis using self-weight as a parameter, Glass Reinforced PP is an alternate material to present existing material (PP) for the engine cover.

**Modal analysis of engine cover using finite element method**

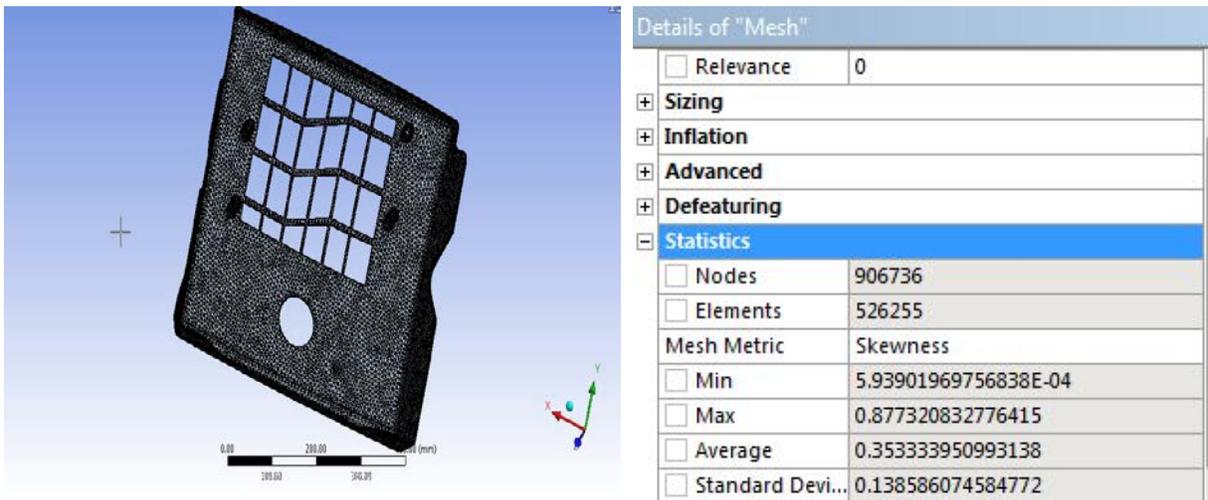
The objective of the present work is to estimate the natural frequencies and mode shapes of engine cover using different materials of interest. The details of the material used in the analysis are given in Table 5.1. The obtained mode shapes and frequencies are used to compare with the present existing material (PP) of the engine cover.

**Table.5.1 Material properties**

Material	E,(GPa)	Poission's ratio	Density(g/cm <sup>3</sup> )
Glass reinforced PP	3.553	0.40	1.12
Glass reinforced nylon	7.5	0.40	1.4
PVC	1.5	0.42	1.4
HDPE	0.7	0.42	0.95
PBT	5	0.41	1.31
PP	0.9	0.42	0.89

Engine cover model as per the dimension is prepared in CATIA software and is saved as IGES format. The model thus prepared is imported to ANSYS software through IGES format to carry out further analysis. Mesh is generated in ANSYS

software with tetrahedral element with element size 2.5mm, same as discussed in section 4.2. Number of elements and nodes are shown in Table .5.2.



**Fig.5.1 Meshed engine cover**

Modal analysis is carried out on engine cover model for 5 different materials viz. Glass reinforced polypropylene, Glass reinforced nylon, Poly vinyl chloride, High density polyethylene, and Polybutylene terephthalate and mode shapes of different materials are studied and compared with existing material PP by fixing four bolt holes which is the major constraint/boundary condition in this analysis. The results of modal analysis are explained in detail in section 5.3 along with pictorial views and various plots.

In order to check the correctness of methodology and validation purpose the analysis is carried out using the data provided in the earlier paper [Beomkeun Kim et al., 2007]. The plot of our results is superimposed with the results of Beomkeun Kim et al., 2007 and is shown in Fig. 5.2. The plots clearly demonstrate excellent match and hence validation of our present methodology. Similar approach is used further to analyse with other materials. The 3 mode shapes along with their frequencies of 6 different materials are shown pictorially below in Fig.5.3 (a), Fig5.3 (b) and Fig5.3(c).

### Results and discussion

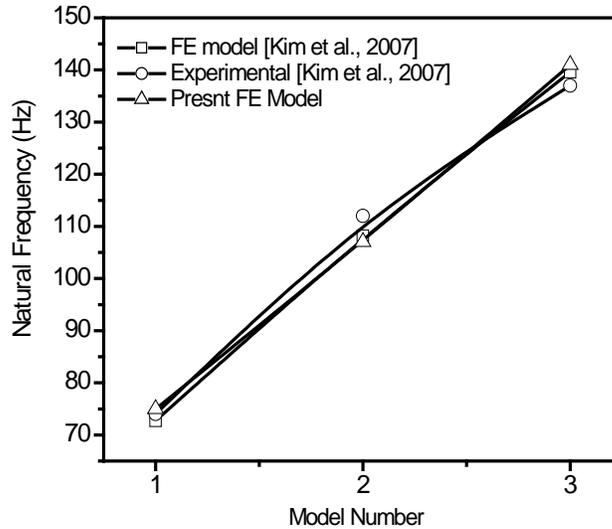


Fig 5.2 Plot of mode number Vs Natural frequency

#### 5.3.1 Mode 1

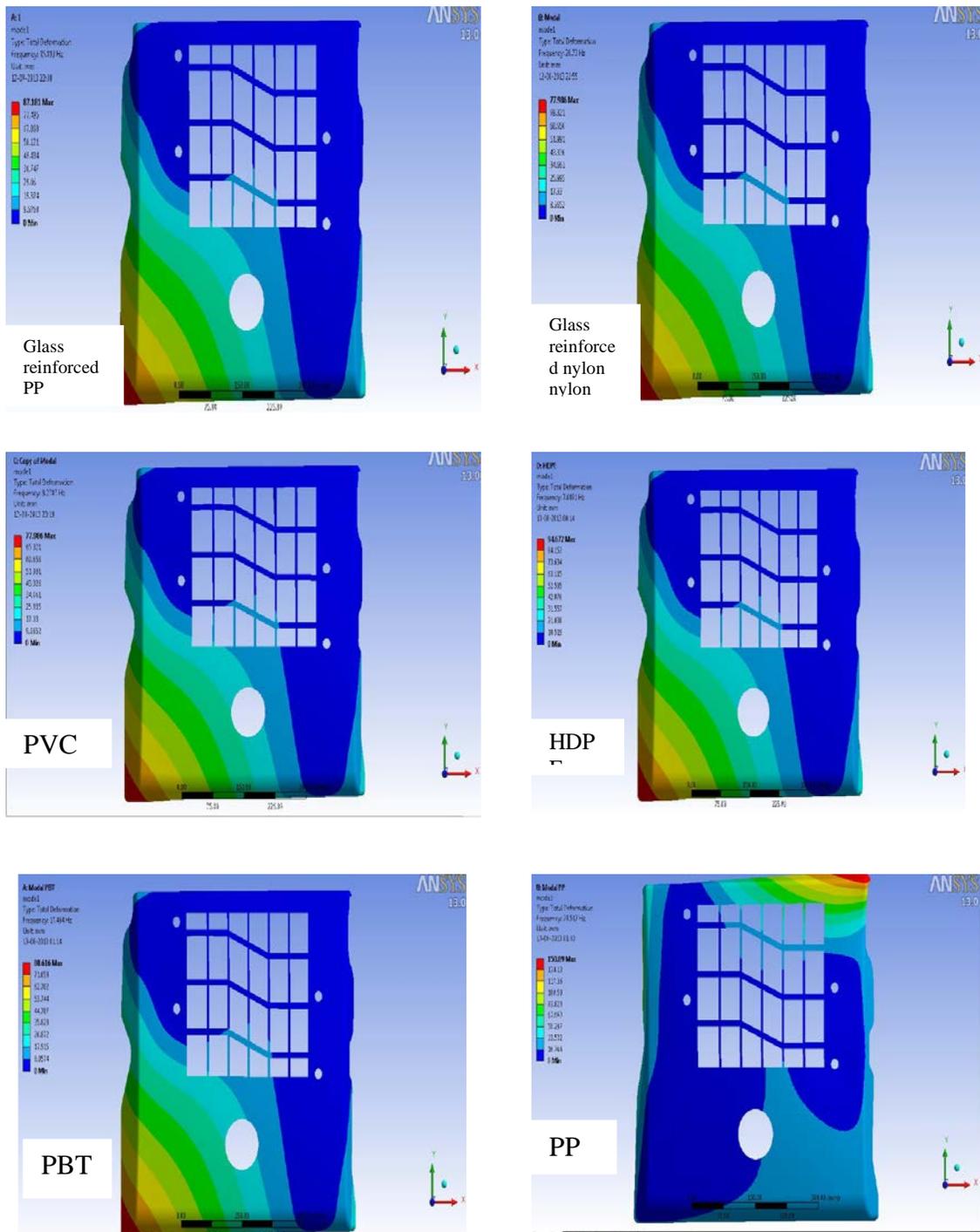


Fig.5.3 (a) Pictorial view of first mode shape of 6 different materials

### 5.3.2 Mode 2

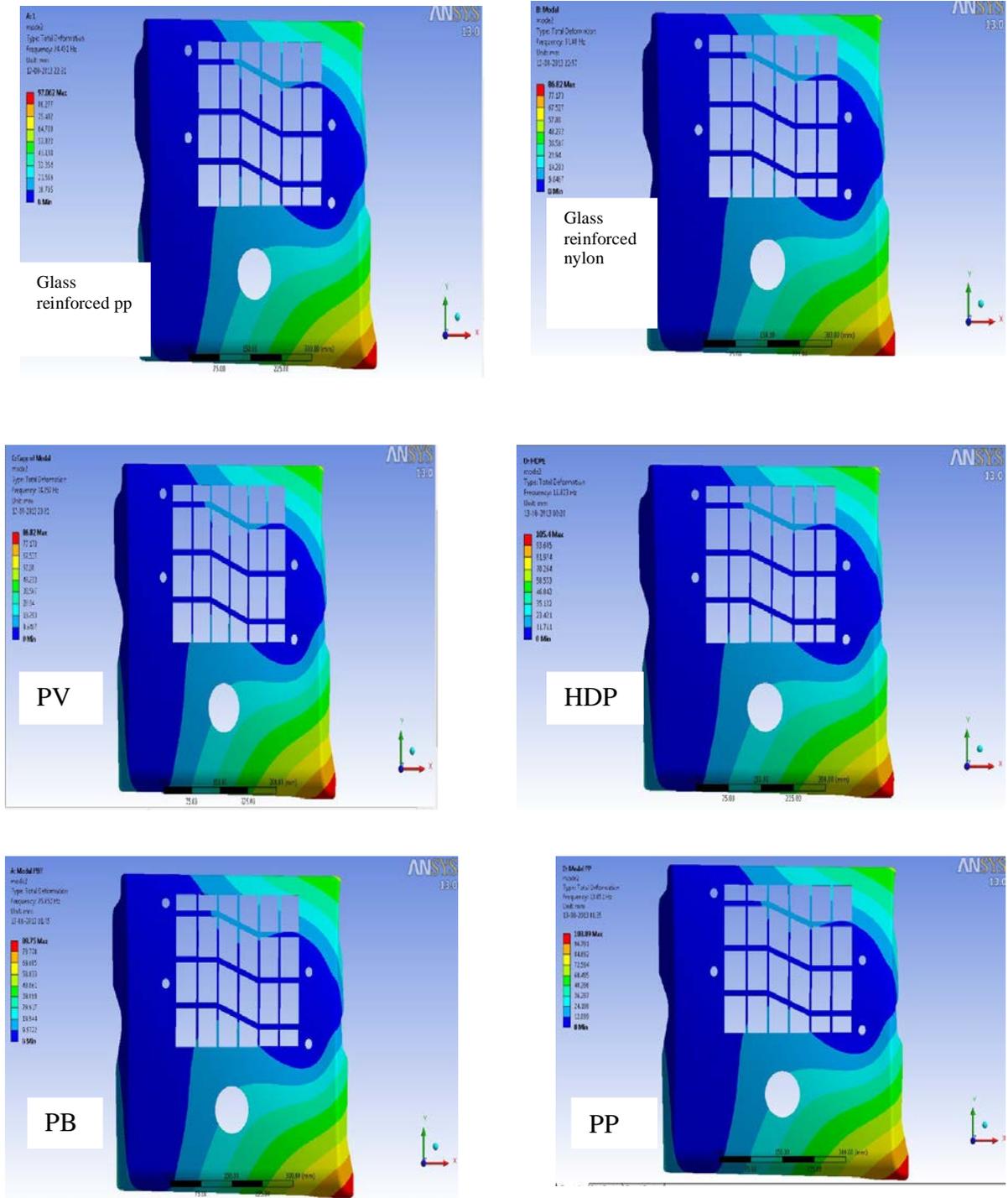


Fig.5.3 (b) Pictorial view of second mode shape of 6 different materials

### 5.3.3 Mode 3

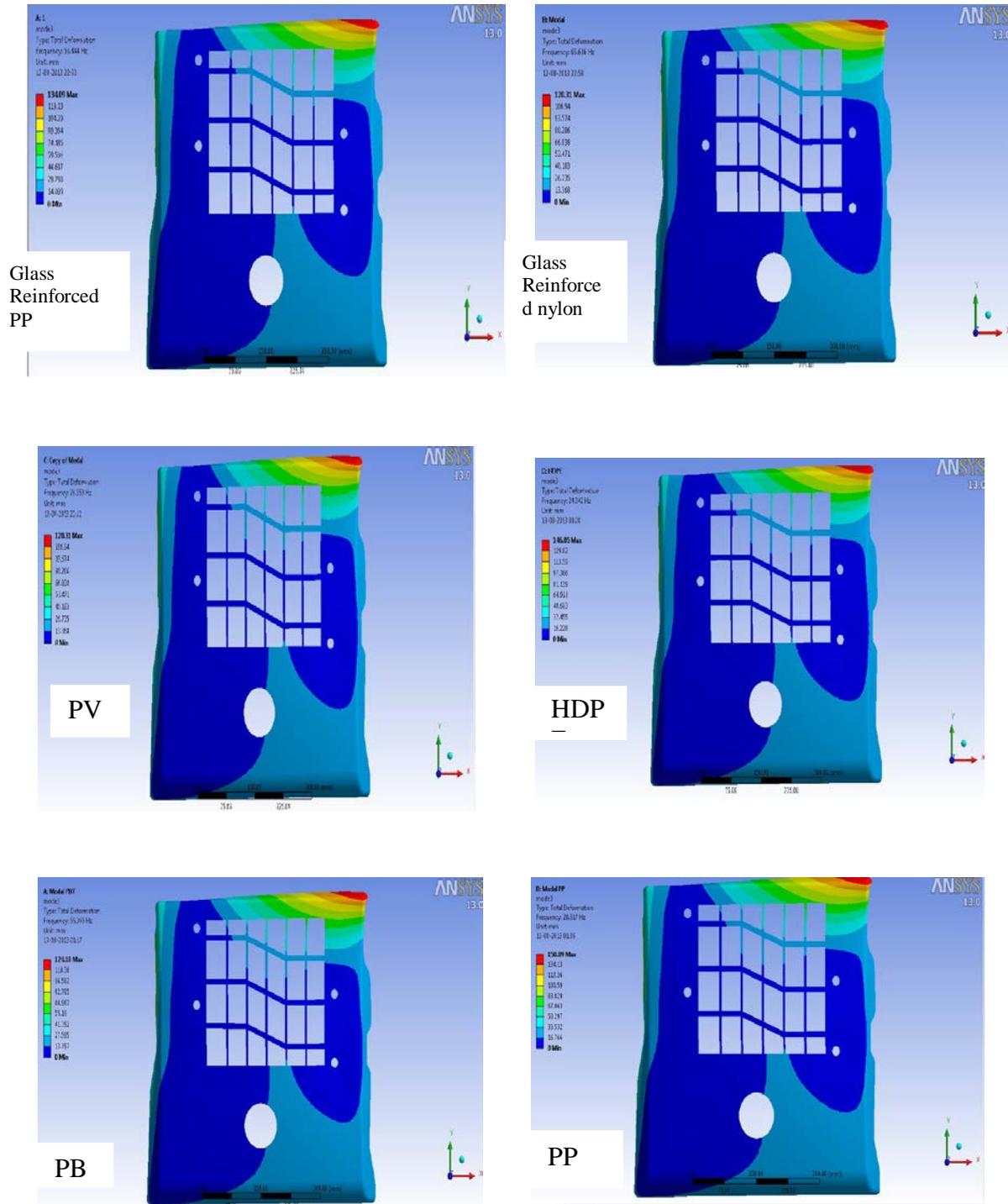
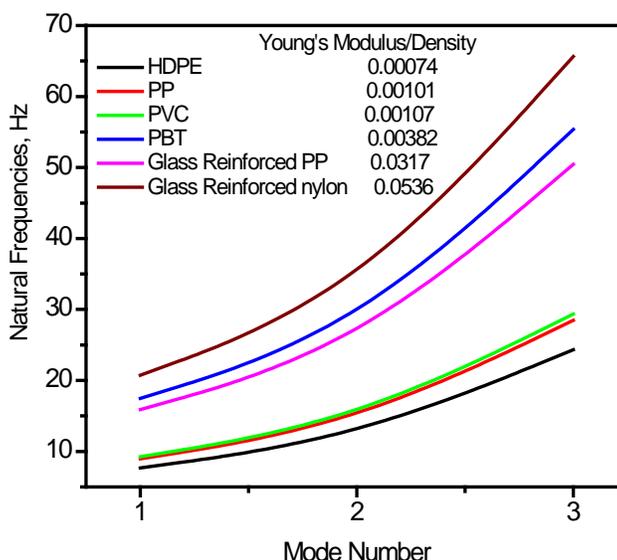


Fig.5.3 (c) Pictorial view of third mode shape of 6 different materials

The initial three mode shape frequencies of engine cover vibration for 6 different materials are shown in Table 5.3. A plot of the same is shown in Fig. 5.4.

**Table.5.3 Mode shape frequencies**

Material	Mode 1(Hz)	Mode 2(Hz)	Mode 3(Hz)	Specific Modulus
HDPE	7.6881	11.823	24.342	0.00074
PP	8.9734	13.794	28.48	0.00101
PVC	9.2707	14.257	29.353	0.00107
PBT	17.464	26.852	55.365	0.00382
Glass Reinforced PP	15.893	24.431	50.444	0.0317
Glass Reinforced nylon	20.73	31.88	65.636	0.0536



**Fig.5.4 Variation of mode shape frequencies of different materials with respect to Specific modulus**

Figure 5.4 clearly indicates that the natural frequencies are dependent on the specific modulus. Similar kind of variation is found in the work of Patil and Barjibhe [2013]. As specific modulus increases natural frequencies also increase and vice versa. This is in accordance with the work of Bondok, [2013]. The nature of variation is found to be same in all materials. The lowest natural frequency is found in HDPE and the highest is in Glass Reinforced nylon. The only material having lesser natural frequency is HDPE as compared to existing material of engine cover. The suitability of the material for the engine cover with reference to frequencies cannot be clearly indicated at this juncture unless further investigation is made. This kind of analysis helps practicing design engineers to safety design critical engine components. The present investigation also indicates that there is a need for a further experimentation for estimation of strength and frequencies. Future research on this area needs to be focused in these directions.

#### IV. CONCLUSION AND FUTURE SCOPE

In the present work engine cover of vehical has been modeled in CATIA software. Mesh is generated using ANSYS software with solid tetrahedron four node elements. Five different materials are used for the analysis. The static analysis clearly shows that minimum total deformation was found in Glass reinforced PP material and was lower than existing PP material. Hence it is better material as far as deformation is concerned. The deformation is found to be higher for HDPE material. It clearly infers that it is better to avoid HDPE material if deformation produced in engine cover is major design criterion. In order to study the vibrational behavior Modal analysis was carried out. The results have been presented for comparative study of different materials and comparing with existing PP material. The mode shape frequencies are found to be very less for HDPE material as compared to existing material. Hence the use of HDPE is better option for engine cover as far as modal analysis concerned. Finite element analysis results

indicated that the natural frequency increases as the specific modulus increases.

These natural frequencies and mode shapes gives designer/engineers an idea of how the design will respond to different types of dynamic loads. This allows to designer/engineer to change the design to avoid resonant vibrations or to vibrate at a specified frequency. Also helps in calculating solution controls (time steps, etc.) for other dynamic analyses. The suitability of material cannot be decided at this juncture.

An investigation of this kind requiring extensive FEA is naturally limited in a restrained time axis to probe several features of scientific interest in depth. It is considered that future work in this area of research should attempt to quantify other factors and experimental work. Fillet areas near the boss, where bolts are tightened, were found structurally critical. For complete structural analysis, fatigue life analysis of engine cover would be necessary to predict critical area.

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# Female RMG worker: Economic Contribution in Bangladesh

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**Abstract-** The Ready Made Garments (RMG) of Bangladesh started in the late 1970 and became an important pioneer in the economy (contributes 80% of total export earnings of Bangladesh) and in terms of foreign currency earnings Bangladesh is the second largest garments exporter next to china. In 2013-2014 about 4 million people, working in around 4222 (Source: BGMEA) garments factories and approximately 80% people of them are female. In FY (fiscal year) 2013-2014 Bangladesh reached the export value 24.59b (billion) USD and in July'2014-feb'2015 it reaches 16,551.49m USD that is 81.49% share of national export in this time (by export promotion bureau of Bangladesh). RMG sector has set a target to earn 30b USD by 2015 and 50b USD by 2021. Total amount of employment in RMG sector is 4 million where 3.2 million female are doing work on an average 11.12 hours/day in the garment factory/industry. In this regards, we took the study for the contribution of female worker in RMG as well as the contribution to the national economy of female garment workers in Bangladesh.

**Index Terms-** RMG, national GDP, national Economic Contribution, female RMG worker

**Objectives -** In this study, variables shall be considered as per the research objectives. The research objectives are to find out the national economic contribution of female workers of garment industries in Bangladesh.

## I. INTRODUCTION

Bangladesh is a developing country and its economy is largely dependent on agriculture. However the Ready Made Garment (RMG) has been placed largest export earnings of Bangladesh. Textile industry, pharmaceuticals, agribusiness, jute, leather, tea, food processing, etc. are contributing to the national economical development of Bangladesh. RMG has secured the first position for earning foreign currency amongst all. The first garment factory opened in 1976. The industry has grown dramatically over the past 35 years and treated as a life blood of the Bangladesh economy. it has been the fastest growing industry in the recent years and the industry employees about 4 million people and the growth rate of RMG export was over 20% in the last two decades (BGMEA, Members' Directory 2010-2011). In Bangladesh the industry was expanded mainly on the easy availability of labor especially of the female labor accessibility. This industry has provided the largest employment opportunities for female in the industrial sector where more than 85 percent of

the production workers are female (Islam and Zahid, 2012). RMG Employers prefer female workers for more vulnerable, docile and manageable than male workers. They accept without protest the flexible terms of employment and are also seen less likely to be organized and susceptible to "anti-management propaganda" from outside (Khan 2001).

[RMG sector](#) not only contributing to the national economy but also working on human resource development. It contributes significantly to Gross Domestic Product (GDP), female empowerment, socio economic development of female and gender equality. Last three decades RMG profile itself a good apparel sourcing spot in the world. GDP of Bangladesh is \$173.8b (nominal) (37th; 2014 est.) and \$419.2b (PPP) 36th; 2012-2013 est.). GDP growth is 6.12% (2013-14 est.) [1]. RMG sector contributes more than 13% of GDP of Bangladesh. The RMG sector helps for alleviating poverty from Bangladesh by offering jobs to males and females for improving GDP and earning 80% of foreign currency of total export earnings to the economic contribution, where the role of female garments worker are enormously important. In this context, this study was undertaken to assess contribution in the economy of the female garment workers in Bangladesh.

## II. LITERATURE REVIEW

[Ready-made Garments industry in Bangladesh](#) has started its journey in late 1970s. Reaz Garments, Jewel garments and Paris garments were the biggest ones amongst the nine industries in Bangladesh [6]. In 1978 this sector earned only 69 thousand USD when Reaz garments exported its first consignment in USA. Within a span of three decades exports have gone up to 21515.73m USD by FY 2012- 2013[2]. Since the establishment in 1960, Reaz store manufactured product for local buyers for thirteen years. In 1973, it changed its name to Reaz Garments Ltd. and started to export by selling 10,000 pieces of shirt. Desh Garments Ltd. Bangladesh in collaboration with Daewoo Corporation, S. Korea, established the first 100% export oriented company in 1979. In 1980, Youngone (49%) and Trexim (51% equity) formed a company named Youngone Bangladesh, exported the first consignment of padded and non padded jackets to Sweden. In 1983-1984 only 134 garments factories were in Bangladesh and 0.040m workers were working in this sector but in 2012-2013 the number of RMG units increases around 6000 with 4.0m employees [4]. The growth is done as a result of Multi Fiber Agreement (MFA) of General Agreement Tariff and Trade (GATT) and supportive policies of Government of Bangladesh (GoB) [7].

Despite many difficulties faced by the sector over the past years, it has carved a niche in world market and kept continuing to show robust performance

The readymade garments industry acts as the backbone of our economy and as a catalyst for the development of our country. We take pride in the sector that has been fetching billions of dollars as export earnings and creating jobs for millions of people in the country.

The “Made in Bangladesh” tag has also brought glory for Bangladesh, making it a prestigious brand across the globe. Bangladesh, which was once termed by cynics a “bottomless basket” has now become a “basket full of wonders.” The country with its limited resources has been maintaining 6% annual average GDP growth rate and has brought about remarkable social and human development.



It is really a matter of great interest to many – how the economy of Bangladesh continues to grow at a steady pace, sometimes even when rowing against the tide. Now we envision Bangladesh achieving the middle-income country status by 2021. We firmly believe that our dream will come true within the stipulated time and the RMG industry will certainly play a crucial role in materialising the dream.

After the independence in 1971, Bangladesh was one of the poorest countries in the world. No major industries were developed in Bangladesh, when it was known as East Pakistan, due to discriminatory attitude and policies of the government of the then West Pakistan. So, rebuilding the war-ravaged country with limited resources appeared to be the biggest challenge for us. The industry that has been making crucial contribution to rebuilding the country and its economy is none other than the readymade garment (RMG) industry which is now the single biggest export earner for Bangladesh. The sector accounts for 81% of total export earnings of the country.

When our lone export earner – the jute industry – started losing its golden days, it is the RMG sector that replaced it, and then, to overtake it. The apparel industry of Bangladesh started its journey in the 1980s and has come to the position it is in today. The late Nurool Quader Khan was the pioneer of the readymade garment industry in Bangladesh. He had a vision of how to transform the country. In 1978, he sent 130 trainees to South Korea where they learned how to produce readymade garments. With those trainees, he set up the first factory – Desh

Garments – to produce garments for export. At the same time, the late Akhter Mohammad Musa of Bond Garments, the late Mohammad Reazuddin of Reaz Garments, Md Humayun of Paris Garments, Engineer Mohammad Fazlul Azim of Azim Group, Major (Retd) Abdul Mannan of Sunman Group, M Shamsur Rahman of Stylecraft Limited, the first President of BGMEA, AM Subid Ali of Aristocrat Limited also came forward and established some of the first garment factories in Bangladesh.

Following their footsteps, other prudent and hard-working entrepreneurs started RMG factories in the country. Since then, Bangladeshi garment industry did not need to look behind. Despite many difficulties faced by the sector over the past few years, it has carved a niche in world market and kept continuing to show robust performance. Since the early days, different sources of impetus have contributed to the development and maturity of the industry at various stages. We learned about child-labour in 1994, and successfully made the industry free from child labour in 1995. The MFA-quota was a blessing to our industry to take root, gradually develop and mature. While the quota was approaching to an end in 2004, it was predicted by many that the phase-out would incur a massive upset in our export.

However, the post-MFA era is another story of success. Proving all the predictions wrong, we conquered the post-MFA challenges. Now the apparel industry is Bangladesh’s biggest export earner with value of over \$24.49bn of exports in the last financial year (from July 2013 to June 2014). Despite the epic growth of our RMG industry, and its bright prospects, challenges are still there. One of the biggest challenge currently faced by our RMG industry is to ensure workplace safety and better working conditions for the millions of garment workers. Two major accidents, the Tazreen fire and the Rana Plaza collapse, have brought the issue of workplace safety to the fore and led all stakeholders to act accordingly. Following the unfortunate incidents, various platforms such as the Bangladesh Accord on Fire and Building Safety, the Alliance for Bangladesh Worker Safety and National Plan of Action have been formed to improve building and fire safety of Bangladesh’s garment industry. All members of the BGMEA and BKMEA are working all-out to carry out the corrective action plans suggested by the Accord, Alliance and National Plan of Action after inspections, even investing huge amount of money.

With challenges on one side, a more glittering future is waiting for the ready-made garment industry of Bangladesh on the other side; at least facts and figures have made us believe so. A recent study jointly conducted by the United States Fashion Industry Association (USFIA) and the University of Rhode Island (URI) has made us more optimistic about the potentials of our RMG industry. According to the study, the US-based fashion companies are expected to boost their sourcing from Bangladesh in the next two years. McKinsey, a global management consulting firm, described Bangladesh as the next hot spot in apparel sourcing. The renowned firm forecasts export-value growth of 7-9% annually and our apparel export will double by 2015 and nearly triple by 2020 provided that we can successfully overcome a few challenges including developing infrastructure and skill workforce.

It is the responsibility of all of us to protect the interest of this industry which has given our economy a strong footing,

created jobs for millions of people, especially for female, lifted them from the abyss of chronic poverty and given them a dignified life. Now what we need to do is deal with all the challenges facing our garment industry, paving the way for its further development. The main highways namely Dhaka-Chittagong, Dhaka-Mymensingh, Dhaka-Tangail through which our apparel products and the raw materials for apparel and textile are transported from factories to port, are being widened (from two lanes to four lanes) and drive-worthy for tapping our export potential. This work needs to be completed as urgently, preferably by December 2014.

Connection of gas to the factories and uninterrupted power supply are prerequisite for the steady growth of the industry. So, the government should consider giving gas and electricity connections to RMG and textile units as the top priority. Producing the required number of skilled workers is another challenge and overcoming it will determine whether the country will be able to sustain the boom that is waiting to happen. Although BGMEA along with the government and other international organisations has taken the initiatives of developing skills of workers, yet more initiatives as such are required to meet the demand of the industry and enhance the productivity of the industry. The budget allocation of the government for the skill development also needs to be increased.

Starting from scratch, Bangladesh has come a long way and is now one of 10 new emerging countries in the world. The macroeconomic stability, 6% annual average GDP growth, robust performance of remittance and export, strong foreign currency reserve, and remarkable social and human development over the past decade – all reflect our underlying strengths. Given the dominance of the RMG industry in the overall economy of Bangladesh, we have to protect this sector. Rather than basking in the glory we should work hand in hand to retain sustainable growth and competitive edge of this industry.

### **Methodology**

This study is followed exploratory research design based on quantify and qualitative research approach. Whereas qualitative research is an unstructured, exploratory research methodology based on small samples intended to provide insight & understanding of the problem setting (Malhotra and Dash, 2010). This research focused on different methods and least square method of trend analysis is one of them. Data required for this quantitative and qualitative analysis were collected from primary sources and secondary sources like, face to face interview, project contract and records, Data and information from secondary sources were collected by consulting various relevant journals, studies conducted by various donor and development agencies, Bangladesh export statistics published by Export Promotion Bureau and Bangladesh Bank, Economic review of Bangladesh, annual reports of BGMEA and the publication of WTO. The information published in the different newspapers and websites in recent times have been consulted in order to present the recent labor unrest situation in garment sector. The collected data and information were then processed, tabulated and analyzed to present the findings in a logical and objective manner. This study mainly focused on three aspects: firstly, trend analysis & prospect of the sector and secondly, contribution in economy of female worker and finally recommend some

strategies. For trend and contribution analysis, three parameters such as factory, workers and export are considered. The contribution and prospect of this sector are gathered through face to face interview with the chief executive body and management level people. Further to make the study more broad based & informative this research conducted informal interview with an expert in this area. This expert is the consultant, project development, Infrastructure Investment Facilitation Company (IIFC). Materials of the paper were presented systematically for analytical purpose & also to draw inference there from.

### **Rationale of the study**

This paper will be significant for stakeholder's like- public sectors, private sectors, policy makers, analysts etc for gathering knowledge regarding readymade garments sector in Bangladesh. In light of the objectives of the study, the paper has been designed to examine some important aspects of garment industry in Bangladesh.

### **Analysis & Findings**

RMG productivity increases through process and product upgrading. The sector enhancing workers and managers work efficiency of production by the developing of the skills and installing the latest equipment day by day. Bangladesh has a very good market for RMG and it needs to focus on the long term sustainability of this sector.

Production cost: Bangladesh labor cost is very low especially female workers, Bangladesh produces quality garment at lower cost which has attracted the foreign buyers and International companies like JC Penney, Tommy Hilfiger H&M, Zara, Wal-Mart, Carrefour, Gap, Metro, Marks & Spencer, Kohl's, Levi Strauss and Tesco all import in bulk from Bangladesh. The advantages of low production cost are attracted foreign direct investment. As a result of that, both backward and forward linkage industry flourished in Bangladesh.

Government Support: Bangladesh Government are giving support to the apparel industry, which included measures like duty drawback facilities, tax holidays, cash assistance, income tax rebate, creation of export processing zones, zero tariff on machinery inputs, rebate on freight and power rate, bonded warehouse facilities, provision of import under back-to-back letters of credit, loans at concessional rate, export development fund, etc.

Back to Back LC: Back to Back LC (Letter of Credit) is one of the most imperative factors in the initial and long-lasting success of this sector. It significantly eases the financing prerequisite of garment business for the local entrepreneurs. The entrepreneurs are able complete the difficult process of manufacturing and export with very little of their own funds. Even if the turnover is tk. 100 million and the profit is only 5% the returns are still decent since the funds are came form back to back LC or borrowed largely from the banks. In the absence of back to back L/C, it would have been very difficult and some times impossible for the new entrepreneurs to raise funds from local financial.

Entrepreneurship: The export- oriented RMG sector started its journey entirely with private initiatives. The entrepreneurs faced tremendous constraints in terms of power and gas supply. Political instability, frequent hartals (strikes), poor port facility,

and labor unrest created longer lead time, which became another barrier in competing with neighboring nations. Amidst all the constraints, the RMG entrepreneurs lived up to the buyers' expectations of reduced price margin, improved compliance standards, and quality assurance. There were also significant investments in backward integration. Agile entrepreneurial capability and the production capacity in Bangladesh in RMG sector is second only to China and believed in both business community and researchers that the up-coming relocation of Chinese RMG factories will have an important share towards Bangladesh. The RMG industry enjoyed a meteoric rise from 30 enterprises in 1980 increased to about 5400 in 2011-12 fiscal years but in Political instability, frequent hartals (strikes) in 2013-14 some of factories are closed which publish by BGMEA.

**Growth of RMG Factories in Bangladesh**

Figure-01 shows that in 1984-85 the garments factories are only 384 and it setup new factories and raising 6000 factories in 2012-2013 but in 2013-14 the factories are decreasing 4222, but the employment of RMG sector in 2012-2013 and 2013-2014 are not change, in both year the employment is 4 million (figure-2). We found that some factories are shut down because of they could not getting order or secondary order. The reason of the small factories are not getting order is as; (I) compliance, (II) safety problem, (III) politically instability, (IV) Group of companies are expand their capacity of production. The following graph shows the number of garments factory in Bangladesh:

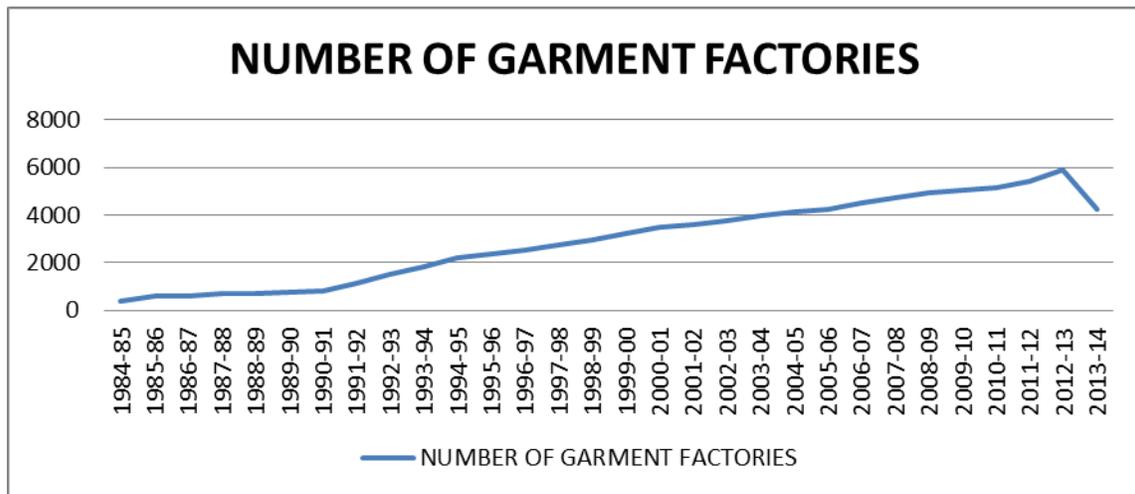
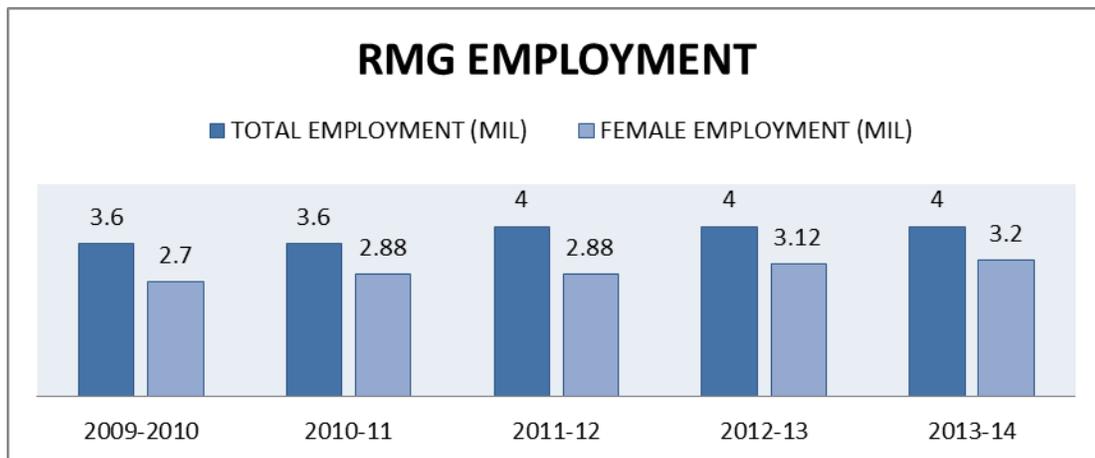


Figure-01

**Employment history of RMG and Contribution of female in RMG worker**

Figure 02 shows in 2014, out of 4 million manpower employed in garments industries, 3.20 million are female (80%). In 1999, the industry employed directly more than 1.4 million workers, about 80% of whom were female. With the growth of

RMG industry, linkage industries supplying fabrics, yams, accessories, packaging materials, etc. have also expanded. Many female are getting opportunities to work in those industries. The economic empowerment of these working female has changed their status in the family.



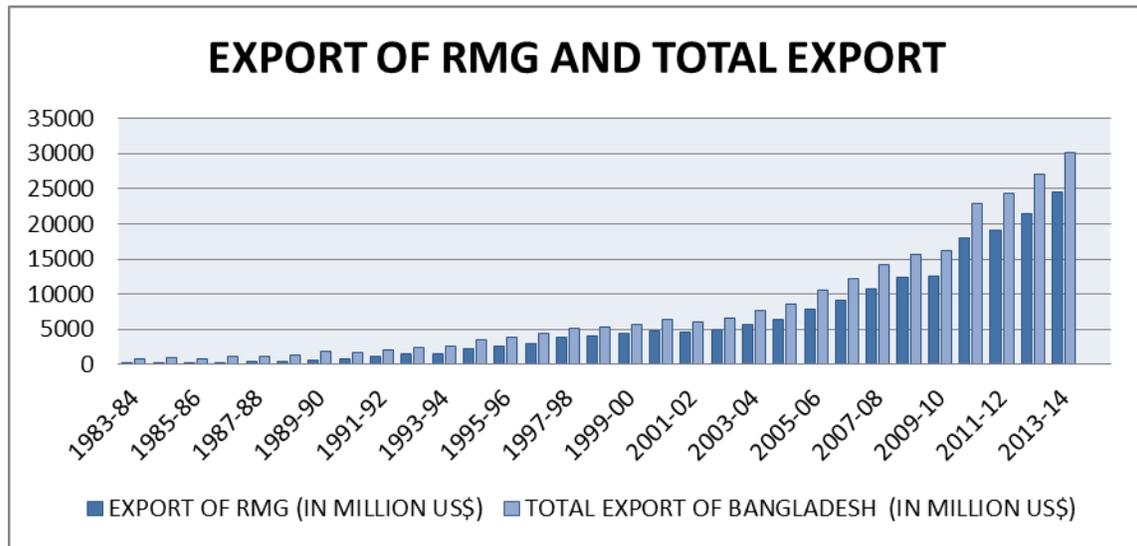
[Source: BGMEA]

Figure-02

**Statement of export of RMG and total export of Bangladesh**

It is the largest exporting industry in Bangladesh which is increased during the last 20 years. It attained a high profile in

terms of foreign exchange earnings, exports, industrialization and contribution to the country economy as well as GDP within a short span of time.



**Figure-03**

Figure-03 shows that in 1983-84 the garments exports only 31.57 million and the share of national export is only 3.89%. The RMG export is increasing in a good way and it reached 24491.88 and the share of national export is 81.13% as well as the major part of employment in Bangladesh getting from RMG sector

which is now 4 million where as female employment are 3.2 million (figure-2). Table-01 shows the Monthly Export Performance of RMG of Bangladesh for 2012-13, 2013-14 & 2014-15 in Million US (\$).

**Table 01: Monthly Export Performance of RMG of Bangladesh for 2012-13, 2013-14 & 2014-15 in Million US (\$)**

Year	Month	Knit	Woven	Total
<b>2012</b>	July	1001.07	993.84	1994.91
	August	792.53	765.85	1558.38
	September	746.32	697.17	1443.4
	October	873.16	761.48	1634.64
	November	653.96	710.04	1364
	December	908.93	1042.68	1951.62
<b>2013</b>	January	944.96	1147.64	2092.6
	February	811.24	979.71	1790.71
	March	854.68	991.77	1846.45
	April	795	835.17	1630.28
	May	1008.37	997.72	2006.09
	June	1085.63	1116.78	2202.41
<b>Total FY 12-13</b>		<b>10,475.88</b>	<b>11,039.85</b>	<b>21,515.73</b>
<b>Share in National Export</b>		<b>38.77%</b>	<b>40.86%</b>	<b>79.63%</b>
<b>Export Performance of RMG in FY 13-14 (in Million USD)</b>				
Year	Month	Knit	Woven	Total
<b>2013</b>	July	1253.76	1262.38	2516.14
	August	848.15	796.05	1644.2
	September	1058.29	985.26	2043.55

Year	Month	Knit	Woven	Total
	October	862.01	820.49	1682.5
	November	877.61	889.35	1766.96
	December	1048.87	1229.98	2278.85
<b>2014</b>	January	1045.83	1195.2	2241.03
	February	915.76	1049.64	1965.4
	March	920.69	993.37	1914.06
	April	972.38	944.95	1917.33
	May	1115.73	1092.26	2207.99
	June	1130.74	1183.14	2313.88
<b>Total FY 2013-2014</b>		<b>12,049.81</b>	<b>12,442.07</b>	<b>24,491.88</b>
<b>Share in National Export</b>		<b>39.93%</b>	<b>41.22%</b>	<b>81.15%</b>
<b>Export of RMG in FY 14-15 (Jul-Feb) (in Million USD)</b>				
Year	Month	Knit	Woven	Total
<b>2014</b>	July	1307.9	1210.08	2517.98
	August	898.44	815.34	1713.78
	September	1064.12	937.29	2001.41
	October	787.96	731.53	1519.49
	November	939.36	999.23	1938.59
	December	1063.8	1269.23	2333.03
<b>2015</b>	January	1116.1	1303.77	2419.87
	February	960.62	1146.72	2107.34
<b>Total FY 2014-2015 (Jul-Feb)</b>		<b>8,138.30</b>	<b>8,413.19</b>	<b>16,551.49</b>
<b>Share in National Export</b>		<b>40.02%</b>	<b>41.42%</b>	<b>81.49%</b>
<b>Source: Export Promotion Bureau, Bangladesh</b>				

### Contribution of Garments Industry to the Economy

Garments Industry occupies a unique position in the Bangladesh economy. It is the largest exporting industry in Bangladesh, which experienced phenomenal growth during last two decades. By taking advantage of an insulated market under the provision of Multi Fibre Agreement (MFA) of GATT, it attained a high profile in terms of foreign exchange earnings, exports, industrialization and contribution to GDP within a short span of time. The industry plays a key role in employment generation and in the provision of income to the poor. Nearly two million workers one directly and more than ten million inhabitants are indirectly associated with the industry (Ahmed and Hossain, 2006). The sector has also played a significant role

in the socio-economic development of the country. In such a context, the trend and growth of garments export and its contribution to total exports and GDP has been examined the following table shows the position.

Table 02 shows the percentage of ready-made garment (RMG) contribution to national export value and Gross Domestic Product (GDP) of Bangladesh. It shows that the percentage of ready-made garments (RMG) contribution to national export is 81.16% and Gross Domestic Product (GDP) is 14.07 in FY 2013-14. In FY 2012-13, the percentage of ready-made garments (RMG) contribution to national export is 79.61% and Gross Domestic Product (GDP) was 16.56%.

**Table 02: Percentage of RMG Contribution to GDP at Current Market Price (‘000)**

FY	Total RMG	National Export Value	Share in National Export (%)	Share in GDP (%)
2013-14	24491.88	30176.8	81.16	14.07
2012-13	21515.73	27027.36	79.61	16.57
2011-12	19089.73	24287.66	78.6	16.31
2010-11	17914.46	22924.38	78.14	16
2009-10	12496.72	16204.65	77.12	12.45

2008-09	12347.51	15565.19	79.32	13.81
2007-08	10699.8	14110.8	75.83	13.44
2006-07	9211.23	12177.9	75.64	13.45

It is revealed from the figure-4 that the value of garment exports, share of garments export to total exports and contribution to GDP have been increased significantly during the period from 2006-07 to 2013-14. This analysis suggests that Bangladesh needs to be very much perceptible about its readymade garment (RMG) export as any critical situation can

affect the ready-made garment (RMG) export of the country adversely. The buyers of Bangladesh are now very much sensitive to the working environment of garment factories. They are now more concerned about the workers safety and living conditions.

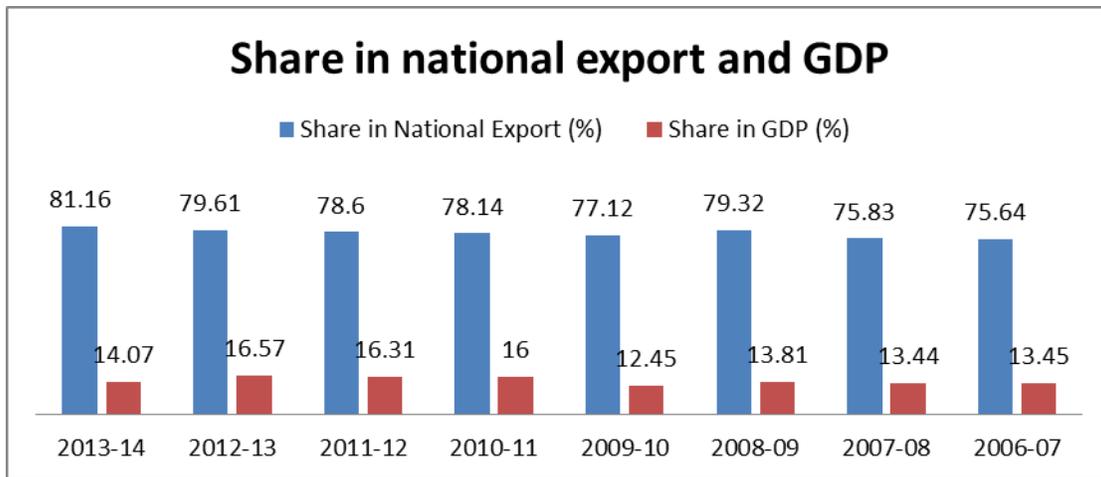


Figure-04

Source: Bangladesh Bank and Bangladesh Bureau of Statistics, BBS

**Contribution of female worker in national economy**

Bangladesh is a cheap labor country, especially female labor. Garments industry has become flourishing here because of female cheap labor (3.2 million female workers, which is 80% of total employment of RMG sector). Bangladeshi female are traditionally expert in sewing. They are creative in clothing. Due

to their creativity and hard work, they become a role model in the garments industry and the main exporting items in Bangladesh are garments products. No sectors can bring as much foreign currency (24 billion in 2013-14, which is the 81% of total national export) that Bangladesh earn from this sector.

**Table 03: Contribution of female RMG worker to national economy**

FY	Total RMG sector			Female RMG worker			
	National Export(%)	GDP (%)	Employment	worker	Worker (%)	National Export (%)	GDP (%)
2013-14	81.16	14.07	4	3.2	80	64.93	11.256
2012-13	79.61	16.57	4	3.16	79	62.89	13.0903
2011-12	78.6	16.31	4	2.88	72	56.59	11.7432
2010-11	78.14	16	3.6	2.88	80	62.51	12.8
2009-10	77.12	12.45	3.6	2.7	75	57.84	9.3375

Table-03 shows the main workforces in RMG sector are female. So we can say that, female herself indirectly earning this foreign currency. Table 03 is showing contribution of RMG female worker to national economy. Bangladesh is getting approximately 14.07% of GDP from garments industry. As female is the main “driver” in the garments sector, so we can again say that, female herself adding this value to GDP.

Figure-05 shows in 2009-2010, the total RMG export share in national economy is 77.12% where the women contribution in national economy is 57.84%, in 2010-2011, the total RMG export share in national economy is 78.14% where the women contribution in national economy is 62.51%, in 2011-2012, the total RMG export share in national economy is 78.6% where the women contribution in national economy is 56.59%, in 2012-

2013, the total RMG export share in national economy is 79.61% where the women contribution in national economy is 62.89% and the year of 2013-2014 the contribution of female RMG

worker is 64.93% where as the total contribution of RMG is 81.16%.

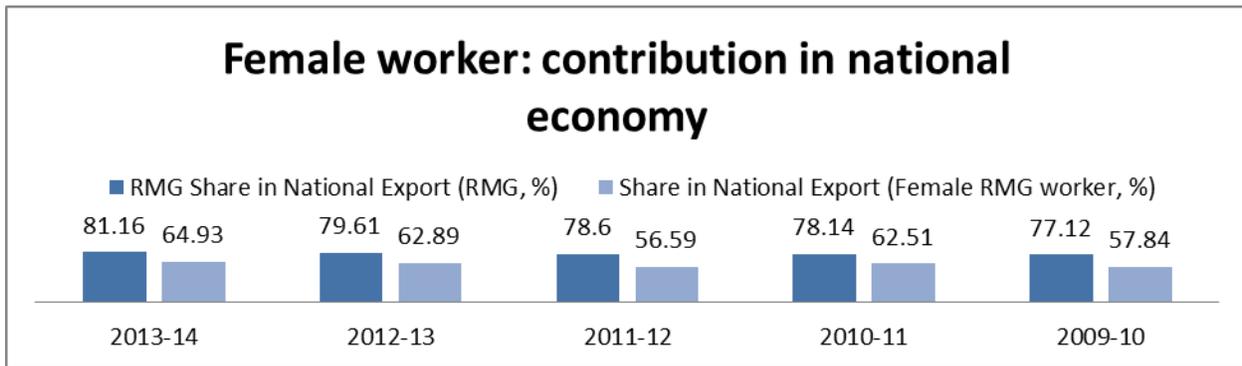


Figure-05

Figure-06 shows in 2009-2010, the total RMG contribution in GDP is 12.45% where the women contribution is 9.34%, in 2010-2011, the total RMG contribution in GDP is 16% where the women contribution in is 12.8%, in 2011-2012, the total RMG contribution in GDP is 16.31% where the women contribution in

is 11.74%, in 2012-2013, the total RMG contribution in GDP is 16.57% where the women contribution in is 13.09%, and the year of 2013-2014 the contribution of female RMG worker is 11.256% where as the total contribution of RMG is 14.07%.

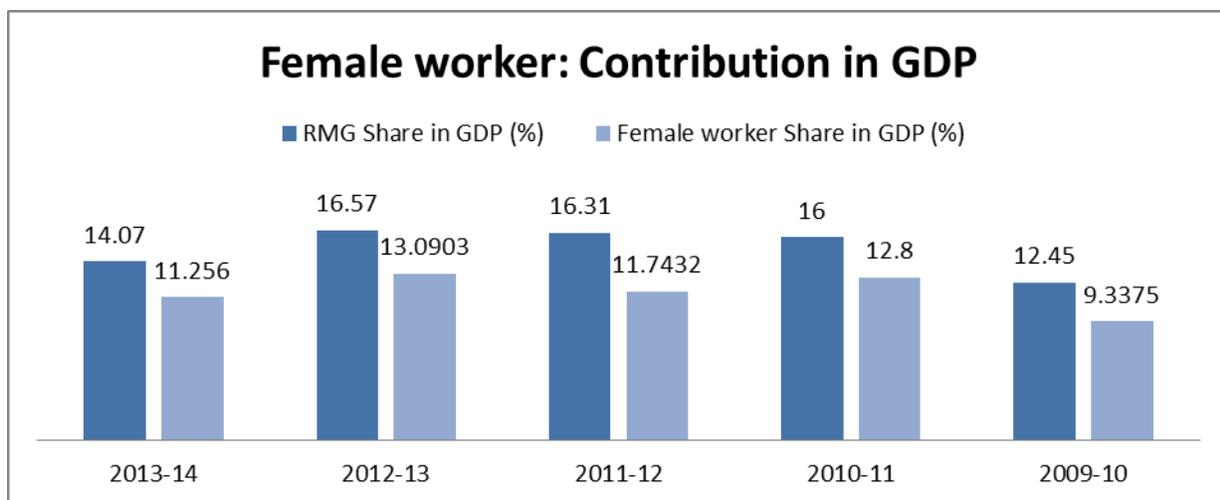


Figure-06

### III. RECOMMENDATIONS

Female workers are involved in a tremendous amount of work that has significant value to in national economy and GDP as well as family and society. The above figures make it clear that female make an enormous contribution to the national economy. The calculation of the exact economic value of female's work is complicated and difficult. We tried, in this research, to make a calculation of the amount that female's worker contribute to the national economy. This first attempt, however, need not necessarily be considered sufficient or adequate. Further research and analysis would help to arrive at a better figure and to understand more thoroughly the various issues involved in considering female workers contribute to the national economy. Some recommendations from the study are stated below:

- People's and policymakers' should be aware of the importance of female's economy contribution;
- Government should take some initiative for better and positive work environment for female;
- Arrange some skill development training especially for female RMG workers for increasing efficiency;
- RMG associations or owner or government should to take-up a better accommodation for female worker;

Convince government officials to include female's work in economic measurements of the nation economy contribution (such as export earning and GDP), and to incorporate an understanding of female's value when looking at programs to assist female and Spending money on female is an investment in the economic wellbeing of the country.

#### IV. CONCLUSION

A study of the socio-economic externalities originating from the RMG sector shows that women's participation in income generation activities gives them improved status within the family and provides them with considerable freedom (Paul-Majumder and Begum (2000)). In the "Findings and Analysis" part shows that the contribution female RMG worker in national economy is incredible, so this type of study should be in regular basis and adding that value to measures of national wealth and women empowerment. The Recommendations part is shows some action should be taken for female RMG workers, so that the status of female would be increase, and the treatment of female by their society, as well as officials, would be likely to improve, contributing to a more gender-equal society as well as a wealthier nation.

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# A chromosome cellular study for some Papilionoideae plants

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**Abstract-** The study was conducted on ten types of plants belonging to sub family Papilionoideae which belong to the Leguminosae family ,the aim of the study is to know the numbers of the chromosomes representing each the types under study , also to know the length of these chromosomes and their types depending on the location of the t central piece then studying the dimensions of the cells of the elongation zone of the types under the study .

The results of the study indicates that there are differences in the numbers of monocular chromosomes representing the types under study ,thus it was noticed that the monocular number (N=16) represents the type of *Vicia faba* and the monocular Number( 1N=17) represents *Lathyrus sativus* and *Pisum sativum* and *Lens esculenta* ,the monocular Number (1N=11) represents *Phaseolus vulgaris* and the types of *vigna unguiculata* and *Phaseolus mango* and the monocular Number (1N=18) represents the type of *Cicer arietinum* and *Trigonella foenum graecum* and the monocular Number (1N=20) represents *Glycin max* .

The results showed differences in the length of chromosomes belonging to the studied types and we find the longest type of chromosomes in *Glycin max* is an average of 93.6 micrometer, *Phaseolus mango* with a length of 64,6 micrometer, *Phaseolus vulgaris* with a length of 51.1 micrometer ,*Lens esculenta* with the length of 48.5 micrometer , *Lathyrus sativus* with a length of 48.1 micrometer , *vigna unguiculata* with 45.1 micrometer , *Trigonella foenum graecum* with 31,6 micrometer, *Vicia faba* with 28.7 micrometer and the less is *Cicer orietenum* with 1,27 micrometer .

The results showed differences in types of chromosomes belonging to the studies plants in their classification according to the location of central piece .We notice the existence of five pairs in the middle of Centromere of *vicia faba* , the existence of six pairs in the middle of Centromere , one pair under middle of Centromere *Lathyrus sativus* ,it was noticed that the pairs of *Phaseolus mango* all locate in the middle of Centromere ,found four pairs the middle of Centromere in *cicer ortietinum*, noticed four pairs the middle of Centromere and under the middhle of centromere in *Lens esculenta* , ten pairs of the middle centromere and one pair under the middle of centromere in *Vigna unguiculata* , eight pairs the middle centromere and three pairs under the middle of centromere *Phaseolus mango* , fourteen pairs the middle of centromere and sex pairs under the middle of centromere in *Glycin max* , sex pairs the middle of centromere and two pairs the middle of centromere in *Trigonella foenum graecum* .

The results clear to differences existence in the dimensions of cells elongation zone of the studies types ,thus it was noticed that the cells of *vicia faba* plant has an average of 26.6

micrometer is the longest ,and the less one is *Phaseolus vulgaris* with an average of 19.7 micrometer ,the average of the width of the cells was the highest on *pisum sativum* with an average of 16.9 micrometer and the less was in *Lathyrus sativus* of 13.0 micro meter .

Here we conclude ,that every type of the studied species have their own genetic nature which are represented in number of chromosomes and their length, the location of central piece and the dimensions of the cells that give the special characteristics to these plants .

## I. INTRODUCTION

The Papilionoideae is considere the plants which belong to fabaceae (Leguminosae)family and it is the most The biggest seed family after Asteraceae (composite)family from the number of its types [Bandal,1974] and one of the most important plant families from the economic perspective after Poaceae (Graminae) [Gust and Townsend ,1974] .

The Papilionoideae is considere the third big family of the developing plants after Orchidaceae and Asteraceae family .It contains 440 Genus and 12,000 species [Raven and Polhill,1981; 1996 Humphreys], the fabaceae family is divided to three sub-families which are The Papilionoideae.Mimosoideae and Caesalipinoideae [Ghafoor and others,2003] ,the Papilionoideae is considere the biggest. included about 440 Genus and 12,000 species distributed in the rainy area and dry and cold deserts ,it consists of 9 family but now includes 32 family [Giller and willson,1991] , The Papilionoideae its plants are usually grasses and less are trees ,its leaves are compound and plumy ,the flower is bisexual and the fruit is podded, and insect pollination [Dasgupta and Singh, 2003]this small family has nutritional importance as it consists of much Protein add to medical importance like *Giycyrrhiza glabra* plant ,and environmental importance it is has the capacity to adopt itself with some aerial microbes that could fixate Atmospheric nitrogen ,the most important genus belong to this sub family are ,*Cicer,Glycine,Lathyrus,Lens,phaselus,Pisum,Vicia,vigna,Trigonell,Archis*[Straub,2006]. Economically the legume plants was the best importance in dicotyledonous because was domesticated by human, the legumes supply Edible products further to seeds ,study the cases of polyploidy for the fabaceae family in north of Nigeria and the rate reached 15.4% ,rate in The Papilionoideae arrived 1.92% and they noticed that the role of non chromosomal imbalance in the development of fabaceae family is limited in general but some genus have (n=11,12,13) and the imbalance sequence of chromosomes wide type this is seen clearly in some

like genus *Senna* [Haecker and others, 2004;Khantoon and Ali 1993].

The cellular studies in The Papilionoideae Included different sides in chromosome like Number variations and composition and the study of the chromosomal features and the nature of meiosis division ,the cellular characteristics and share in the study of classification relations specially in the level of species and genus ,the importance of properties return the to the characteristics derived from chromosomes to the Genes exist on them, thus difference between the plants in the characteristics of the chromosomes reflects the genetic difference between them [2005 Okoli,Agbegwa] . indicated [Bhattacharya ,2003]for the study the polyploidy in different geneses of this sub family like *Onobrychis caputgalli* ,and thought that the development direction in most of these genus of this sub family was by reduce the basic number of chromosomes ,and considered that *Coronilla emerus* that has (2N=14 ) chromosome is the most genus of species primitive and the and developed the species like *C Viminalis* , *C scorpoide* that contain (12 ) bilateral chromosome dangerous more because of reducing of chromosome number from (14) to( 12) chromosomes but *C .Gluca* , *C .Varia* in which each of them has (12) chromosomes was because of multiplication of the basic number of chromosomes after reducing has occurred .Because of importance of this sub family and the less of cellular and chromosomal studies which done to their economic types ,the aim of this study was

- determine and calculate the chromosomal number of some economic types belonging to the sub family
- determine the length of chromosomes and their types belonging to this sub family
- compare the length of the chromosomes of different types in length and location of central piece
- study the dimensions of cells in the elongation zone - and its compare in studied species .

## II. MATERIALS AND METHODS

This study was conducted in Department of Biology – college of Education of pure science/University of Anbar in academic year 2012/2013 .By using ten plants belonging to the sub family papilionoideae (*Pisum Sativam* , *vicia faba* ,*vagna unguiculata* , *cicer arietinum* ,*Lens esculentus* ,*phaselous vulgaris* , *phaselous mango* ,*Trigonella feonum graecum* ,*Lathyrus sativus* ,*Glycin max*), where it was cultivation plant species above in Petri dishes on the Filtering paper at a rate of 10 seeds each dish Paper under laboratory environmental conditions using the incubator After fixing temperature at a rate of 25 c<sup>0</sup> with keeping wetting Hydration seed which germinated after 4 days ,the roots were cutting for Plant species in Length (2) cm , then all the samples placed in a solution Colchicine 0.01% In the refrigerator For 4 hours degree 4c<sup>0</sup> For the purpose of stopping cell division at stage of metaphase and activate Chromosomes , Then it was moved from the solution Colchicine to Fixed Farmer For 24 hour For the purpose of conservatism the structure of chromosomes and morphology , Then washed by water to dispose of the effects of alcohol and acid and conserved In ethyl alcohol Concentration 70% to conservative on the foundation of the roots, The samples are then placed in a solution Hcl Concentration 1N In a water bath by

temperature 60 To analyze the cell wall and the ease clarity of chromosomes , then transferred In a beaker containing stain Aceto -carmin For 5 minutes to conquest the chromosomes of the stain for ease of vision , then took the ends of the colored roots and place on a clean glass slide then worked in the longitudinal section for roots It was covered by a Cover slide and gently pressure it between two layers of filtering papers to disposal from excess stain and put the roots of plants species samples under check by microscope under the power enlarge (40x , 100x ) , through it has been personification and discrimination cells , chromosomes and their numbers with the naked eye, the measurements of lengths and width of the cells and chromosomes Been measured by standard Ruler kind by Measure unity micrometer.

## III. RESULTS AND DISCUSSION

In chromosomal studies the number of chromosomes were calculated in ten plants of sub Papilionoideae which are in *Vicia faba* as the table (1-4 ) and the image (1-4) represent the number of chromosomes that which carried cells of *Vicia faba*,The results show that the cells of the plant belonging to this species *Vicia* 1N=6 monocular chromosomes and the bilateral number 2N=12 chromosome , the results show that the total length of chromosomes are 28.7 micrometer , it was noticed that the longest chromosome is between 5.7 to 3.5 micrometer ,these chromosomes included five metacentric pairs in and one pair sub metacentric of Centromer,from noticed chromosomes length found her that three pairs of chromosomes classified as long chromosomes and two pairs are middle length and one pair is short . This number of chromosomes and their length is considered special for this type as it represents plants of this kind and differentiates them from others of the same sub family ,this was indicated [ Kumar, 1990].this number of chromosomes carry all the genes needed to give their morphological properties to this species , the number may indicate a positive development in plants of this species ,where the researchers that consider that less of chromosomes number which their carry by plant cells that consider positive development [2003 ,Bhattacharya],this development occurs because of environmental pressure and genetic mutations and new recombination that happen in the time of meiosis division, thus we notice that the *Vicia faba* plants has a different feature from other plants which belonging to the same sub family .



Image (1 -4) number of chromosomes in *Vicia faba*

Explain in the plant *Lathyrus Sativus* as the table (1-4) and image (1-4) which indicate in to the numbers and dimensions of chromosomes .The results show that number of monocular

chromosomes  $1n=7$  and bilateral chromosome  $2n=14$ , noticed differences in the length of chromosomes belonging to this species as the total length of chromosomes was 48.1 micrometer, also noticed that the longest chromosome was 10.1 micrometer, the shortest one was 5.2 micrometer, as it noted the existence of differences in the location of central piece where the results show that there are six pairs of metacentric and one pair sub metacentric, results show that there are two pairs of chromosomes classified as long and five pairs middle length. This number of chromosomes and their length is considered special for this type as it represents plants of this kind and differentiates them from others of the same sub family, this was indicated [Klamt,2000]. These numbers of chromosomes carry all the genes needed to give their morphological properties to this species, the number may indicate a positive development in plants of this species, where the researchers that consider that less of chromosomes number which they carry by plant cells that consider positive development [Bhattacharya,2003], this development occurs because of environmental pressure and genetic mutations and new recombination that happen in the time of meiosis division, thus we notice that the *Lathyrus Sativus* plants has a different feature from other plants which belonging to the same sub family.



**Image (2-4) shows numbers of chromosomes in *lathyrus Sativus***

In plant of *phaselous vulgaris* as the table (1-4) and image (3-4) represent the number of chromosomes that which carried cells of *phaselous vulgaris*, The results show that the cells of the plant belonging to this species *phaselous* ( $1N=11$ ) monocular chromosomes and the bilateral number ( $2N=22$ ) chromosome, the results show that the total length of chromosomes are 51.1 micrometer, it was noticed that the longest chromosome is between 6.5 to 3.5 micrometer and all chromosomes are metacentric, from noticed chromosomes length found her that four pairs of chromosomes classified as long chromosomes and four pairs are middle length and three pairs are short. This number of chromosomes and their length are considered special for this type as it represents plants of this kind and differentiates them from others of the same sub family, this was indicated [Mercado,1996]. this number of chromosomes carry all the genes needed to give their morphological properties to this species, the number may indicate a positive development in plants of this species, where the researchers that consider that less of chromosomes number which they carry by plant cells that consider positive development [2003, Bhattacharya], this development occurs because of environmental pressure and genetic mutations and new recombination that happen in the time of meiosis division, thus we notice that the *phaselous vulgaris* plants has a different feature from other plants which belonging to the same sub family



**A , n=11(40 x)**



**B , n=22(40 x)**

**Image( 3-4 )shows number of chromosomes in *phaselous vulgaris***

In the *pisum Sativum* plant as the table (1-4) and image( 4-4 ) represent the number of chromosomes that which carried cells of above plant, the results show that the cells of the plant belonging to this species *pisum Sativum* ( $1N=7$ ) monocular chromosomes and the bilateral number  $2N=14$  chromosome, the results show that the total length of chromosomes are 36.9 micrometer it was noticed that the longest chromosome is between 3.4 to 6.9 micrometer, as it noted the existence of differences in the location of central piece where the results show that there are four pairs metacentric and three pairs sub metacentric, from noticed chromosomes length found her that four pairs of chromosomes classified as long chromosomes and three pairs are middle length. this number of chromosomes and the location of central piece indicates to identity of the plant and distinguishes it from others that belong to the same sub family, this was indicated [Neuman ,2002] ,as it carries a group of necessary genes that gives it different characteristics, the number of chromosomes indicates positive development.



**Image (4-4) indicates Number of single chromosomes in *Pisum Sativum***

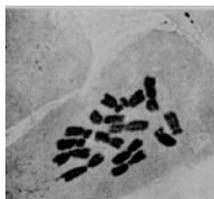
In *Cicer arietinum* plant as the table (1-4) and the image (4-5) represent the number of chromosomes that which carried cells of *cicer arietinum* the results show that the cells of the plant belonging to this species ( $1n=8$ ) monocular chromosomes and the bilateral number ( $2n=16$ ), the results indicate to the existence of obvious differences in the lengths of chromosomes, that the total length of chromosomes are 27.1 micrometer, the longest one is 4.8 and the shortest one at 2.3 micrometer and all chromosomes are metacentric, but classifying them according to length, found her that three pairs of chromosomes classified as long chromosomes and two pairs are middle length and three pairs are short. This number of chromosomes and the location of central piece indicates to identity of the plant and distinguishes it from others that belong to the same sub family, this was indicated [Ahmed ,2000] ,as it carries a group of necessary genes

that gives it different characteristics ,the number of chromosomes indicates positive development .



Image( 5-4 )indicates number of chromosomes in *cicer arietenum*

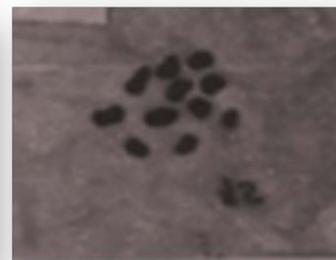
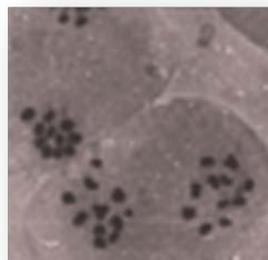
In *Lens esculenta* plant as the table (4-1) and image (6-4) represent the results that have been obtained from the study of species *Lens esculenta* belonging to sub family Papilionoideae , The results show that the cells of the plant belonging to this species *Lens*  $1n=7$  monocular chromosomes and the bilateral number  $2n=14$ , the results indicate to the existence of obvious differences in the lengths of chromosomes, that the total length of chromosomes are 84.5 ,the longest one is 9.4 and the shortest is 4.8 micrometer, as it noted the existence of differences in the location of central piece where the results show that there are four pairs metacentric and three pairs sub metacentric ,from noticed chromosomes length found her that three pairs of chromosomes classified as long chromosomes and four pairs are middle length .This number of chromosomes and their length is considered special for this type as it represents plants of this kind and differentiates them from others of the same sub family ,this was indicated [ Jahan, 1994 ] .This number of chromosomes carry all the genes needed to give their morphological properties to this species , the number may indicate a positive development in plants of this species ,where the researchers that consider , that less of chromosomes number which their carry by plant cells which consider positive development [2003 Bhattacharya]. This development occurs because of environmental pressure and genetic mutations and new recombination that happen in the time of meiosis division, thus we notice that the *Lens esculenta* plants has a different feature from other plants which belonging to the same sub family.



**Image (4-6) shows number of chromosomes in *Lens esculenta***

In *Vigna unguiculata* plant as the table( 4-1) and image (7-4 ) represent the number of chromosomes that which carried cells of *vigna unguiculata* , the results show that the cells of the plant belonging to this species(  $1n=11$  ) monocular chromosomes and the bilateral number (  $2n=22$  ) chromosomes , the results show that the total length of chromosomes are 45.1 , it was noticed that the longest chromosome are between 3.1 to 5.3 micrometer, It was noticed that there are ten pairs of

chromosomes of the metacentric and one pair in the sub metacentric, from noticed chromosomes length found her ,that four pairs of chromosomes classified as long chromosomes and four pairs are middle length and three pairs are short. This number of chromosomes and their length is considered special for this type as it represents plants of this kind and differentiates them from others of the same sub family ,this was indicated [1981, Pandey] . This number of chromosomes carry all the genes which needed to give their morphological properties to this species , the number may indicate a positive development in plants of this species ,where the researchers consider that less of chromosomes number which their carried by plant cells that consider positive development .



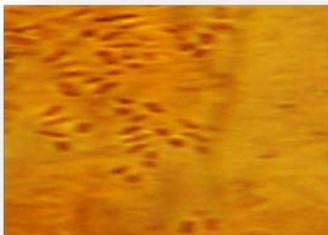
**Image( 4-7) indicates chromosomal number belonging to *vigna unguiculata***

In *Phaselous mango* plant as the table (4-1) and image (8-4) represent the number of chromosomes that which carried cells of *Phaselous mango* belonging to sub family Papilionoideae family , the results show that the cells of the plant belonging to this species  $1n=11$  monocular chromosomes and the bilateral number  $2n=22$  chromosome , shows differences in the length of chromosomes , it was noticed that the longest chromosome is between (3.1) to (7.6) , the results show that the total length of chromosomes 64.5 micrometer, as it noted the existence of differences in the location of central piece where the results show that there are eight pairs metacentric and three pairs sub metacentric ,from noticed chromosomes length found her that four pairs of chromosomes classified as long chromosomes and five pairs are middle length . This number of chromosomes and their length are considered special for this type as it represents plants of this kind and differentiates them from others of the same sub family ,this was indicated [Lewis and others,2005] .This number of chromosomes carry all the genes needed to give their morphological properties to this species , the number may indicate a positive development in plants of this specie ,where the researchers consider that less of chromosomes number which their carry by plant cells that consider positive development [2003 ,Bhattacharya], ,this development occurs because of environmental pressure and genetic mutations and new recombination that happen in the time of meiosis division, thus we notice that the *Phaselous mango* plants has a different feature from other plants which belonging to the same sub family .



**Image( 8-4 )indicates number of chromosomes in the phaselous mango( x40)**

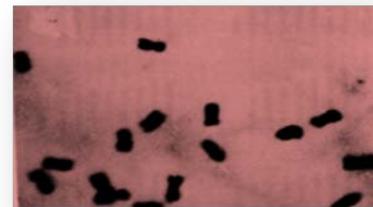
In *Glycin max* plant as the table (4-1) and image( 9-4 ) represent the number of chromosomes that which carried cells of *Glycin max* belonging to sub family Papilionoideae family , The results show that cells of the plant belonging to this species  $1n=20$  monocular chromosomes and the bilateral number  $2n=40$  chromosomes , the results show that the total length of chromosomes are 93.6 ,the longest one is 4.8 and the shortest one is 2.3, as it noted the existence of differences in the location of central piece where the results show that there are 14 pairs metacentric and six pairs sub metacentric ,from noticed chromosomes length found her that eight pairs of chromosomes classified as long chromosomes and 7 pairs are middle length and 5 pairs short . This number of chromosomes and their length is considered special for this type as it represents plants of this kind and differentiates them from others of the same sub family ,this was indicated (Blanc and Wolf, 2005) . It was noticed that there were no positive development in them as still the numbers of chromosomes are more ,these numbers carry some gens needed to give the features of this kind .



**Image( 9-4 )shows number of chromosomes belonging to of Glycin max**

In *Trigonella foenum graecum* plant as the table( 4-1) and image (10-4 ) represent the number of chromosomes that which carried cells of *Trigonella foenum graecum* belonging to sub family Papilionoideae , The results show that the cells of the plant belonging to this species  $1n=8$  monocular chromosomes and the bilateral number  $2n=16$  chromosomes , the results show that the total length of chromosomes are 31.6 , it was noticed that the longest chromosome are between 3.2 to 4.6 ,these chromosomes included six metacentric pairs and tow pairs sub metacentric of centromer,from noticed chromosomes length

found her that four pairs of chromosomes classified as long chromosomes and three pairs are middle length and one pair is short . This number of chromosomes and their length are considered special for this type as it represents plants of this kind and differentiates them from others of the same sub family ,this was indicated [Sadhu,1989] . This number of chromosomes carry all the genes needed to give their morphological properties to this species , the number may indicate a positive development in plants of this species ,where the researchers consider that less of chromosomes number which their carry by plant cells that consider positive development [2003 ,Bhattacharya],this development occurs because of environmental pressure and genetic mutations and new recombination that happen in the time of meiosis division, thus we notice that the *Trigonella foenum graecum* plants has a different feature from other plants which belonging to the same sub family .



**Image (10-4) shows number of chromosomes belonging to Trigonella foenum graecum**

In cellular Study the dimensions of the cells were studied in the elongation zone which the table (12-4) shows the width and length dimension of the studies cells ,the numbers indicate the average of the longest 30 cells ,we find that the first longest cells are in *Vicia Faba* plant with 27.4 micrometer ,the second in *Pisum Sativum* with 26.6 micrometer, the third in phaselous mango with 26.0 micrometer ,the fourth in *cicer orietinum* 25.8 micrometer ,the fifth in *Glycin max* 25.2 micrometer ,the sixth in *Trigonella foenum graecum* 24.5 micrometer , the seventh in *Lathyrus Sativus* 23.3 micrometer ,the ninth in *vigna unguiculata* 23 micrometer ,the less one in phaselous vulgaris plant with 19.7 micrometer . The average of the width of the plants ,the table (12-4 ) shows that the widest cell belonging to *pisum sativum* is 16.9 micrometer ,in *cicer orientinum* and *Vicia faba* 15.2 micrometer, in *phaselous* 14.4 micrometer , *Trigonella foenum graecum* and *Vigna unguiculata* 14.2 micrometer ,in *Lens esculenta* 13.7 micrometer ,in *phaselous mango* 13.2 micrometer and the less wide in *lathyrus sativus* 13.1 micrometer .the of cells differences in sizes ,may indicateto the size of the plant which according for studing species ,the cells number and their size indicate to siz of plant ,that the sizes of cells caused to increase in the size of plant .

**Table (4-2) Explain average of length and and width of elongation zone cells of studied types which measured by micrometer.**

Average of width the cells (micrometer)	Average of elongate the cells (micrometer)	Plant species
15.2	27.4	- 1 <u>Vicia faba</u> L
13.0	23.3	- 2 <u>Lathyrus sativus</u>
14.4	19.7	- 3 <u>Phaseolus vulgaris</u>
16.9	26.6	<u>Pisum sativum</u> - 4
15.2	25.8	-5 <u>Cicer arietinum</u>
13.7	23.9	6 - <u>Lens culinaris</u>
14.2	23	7 - <u>Vigna unguiculata</u>
13.2	26.0	8 - <u>Phaseolus mango</u>
13.3	25.2	9 - <u>Glycin max</u>
14.2	24.5	10 - <u>Trigonella foenum graecum</u>

**Table (4-1) Indicates to numbers of single double chromosomes and pairs number of each sample from chromosomes in types of sub family papilionoideae which under study.**

Total short arm length (micrometer)	Total length arm lengths(m)	Total Chromosomes lengths (m)	Chromosomes species			chromosomes		Plant species
			St.C	S m .C	M.C	(2N)	(1N)	
10.9	17.8	28.7	-	1	5	12	6	<u>Vicia faba</u>
20	28.1	48.1	-	1	6	14	7	<u>Lathyrus sativus</u>
21.5	29.6	51.1	-	-	11	22	11	<u>Phaseolus vulgaris</u>
13	23.8	36.9	-	3	4	14	7	<u>Pisum sativum</u>
12.1	15.9	27.1	-	-	8	16	8	<u>Cicer arietinum</u>
17.8	30.7	48.5	-	3	4	14	7	<u>Lens culinaris</u>
19.2	25.9	45.1	-	1	10	22	11	<u>Vigna unguiculata</u>
26.3	38.3	64.6	-	3	8	22	11	<u>Phaseolus mango</u>
33.1	60.5	93.6	-	6	14	40	20	<u>Glycin max</u>
12.8	18.8	31.6	-	2	6	16	8	<u>Trigonella foenum graecum</u>

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# Deadlock Detection and Resolution in Distributed Database Environment

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**Abstract:** A distributed database system is a combination of sub-database separated over many sites communicated through a network. Deadlock is one of the most common problems that occur in distributed database implementation. Deadlock occurs when a multiple transaction locks the same data sources and every transaction waits for other to release. Deadlock detection and resolution is not easy in a distributed database system, because such system is composed of more than one site communicated to central database. The main objective of this study is to analyze several proposed algorithms to detect and resolve the deadlock in distributed database and propose a new technique to avoid the drawbacks of previous algorithms, besides enhancing the efficiency of detection and resolving the deadlock in distributed database.

**Key Words:** Distributed database, Deadlock, Detection and Resolving

## I. Introduction

A distributed database environment is a combination of sub-database distributed over many sites communicated through a network (GROVER & KUMAR, 2012). According to Al-Murafi (2009), most organizations consider that the response time of the database is essential to achieve competitive advantage, such as for television companies. For example, the news programs are competing to obtain the most recent news early and broadcast early to satisfy the audience. Mitchell & Merritt (1984) mentioned that data retrieved from central database is the main bottleneck of time response exactly when the central database is distant from the organization. Thus, a distributed database enhances the organization's competitive advantage by increasing the efficiency and speed of data retrievals from different sites (Al-Murafi, 2009).

The database users interact with the database via transactions, which are defined as a set of logical units used to perform different tasks within the database, such as Read, Write, Update, Delete, and Insert (Jeffery, 2013). Concurrency problems occur when multiply users' access and update same source of data simultaneously (Himanshi Grover, 2013). According to Jeffery (2013), concurrency causes several drawbacks within the database, such as lost updates, uncommitted data and inconsistent retrievals.

The concurrency control is the processes of simultaneously managing the transaction and maintaining the database integrity without concurrency problems (Jeffery, 2013). The concurrency control uses two different techniques to prevent the concurrency, which are, (1) Locks: the transaction locks the data source needed in the current processes to prevent other transactions from accessing the same data through execution of transaction, and (2) Versioning: Database Management Systems (DBMS) provides a copy of the database with timestamp to every transaction that requires access to the database, then receives the update of database check if there is no conflict between multiple updates, the DBMS update central database, else based on timestamp, rejects the transaction, which causes the conflict (Jeffery, 2013).

Deadlock occurs when a transaction enters into wait state, for example multiple transaction locks the same data sources and every transaction waits for the other to release, when the requested data is not available because it is held by other transactions. There are three main approaches used to solve the deadlock, which are preventing the deadlock, avoiding the deadlock as well as detecting and resolving the deadlock (Chahar & Dala, 2013; Al-Murafi, 2009; Thakur & Deswal, 2014).

The main aim of this study is to review and analyze in detail some of the common algorithms proposed to detect and resolve the deadlock in distributed database. Furthermore, this study aims to determine the drawbacks of the proposed algorithms before providing recommendations that combine three algorithms together to avoid the individual weaknesses and enhance the efficiency of detecting and resolving the deadlock in distributed database systems.

## II. Related Works

### A. Related Deadlock Detection Techniques

There are too many studies conducted to detect and resolve the deadlock in distributed database. These studies address the deadlock by using three common techniques, which are prevention, avoidance or detection and resolution of the deadlock to increase the performance of distributed database.

**Avoidance the deadlock** : This technique handles the deadlock before it occurs. If the requested data sources are locked by other transactions, the current transaction has two choices: (1) wait for the locked data resource to be free, or (2) aborted (Swati Gupta, 2013; Thakur & Deswal, 2014; Bhatia & Verma, 2013).

**Prevention of the deadlock:** This technique stops the deadlock before it occurs. Each transaction identifies and blocks all data resources that will be used in transaction steps before executing the transaction (Swati Gupta, 2013; Thakur & Deswal, 2014; Bhatia & Verma, 2013). According to Jeffery (2013), preventing the deadlock is difficult to implement in real life because all programs are executed in a serial manner based on the demand routines, which means not all data sources needed in the transaction can be determined because some routines are not called yet.

**Deadlock Detection:** This technique detects the deadlock that has already occurred, by continuously scanning the transaction requests (subjects) and scanning the data sources (objects) to distinguish the deadlock. Then, one of the transactions detected as a victim to be aborted in terms of resolving the deadlock (Swati Gupta, 2013; Jeffery, 2013; Thakur & Deswal, 2014; Bhatia & Verma, 2013). There are several algorithms, techniques and procedures that are proposed to detect the deadlock and other criteria to detect the victim transaction in deadlock cycles. Table 1 illustrates some of these techniques and algorithms to detect the deadlock in distributed database, which is described in detail in the realistic example section 2.2 of the current study.

**Table 1:** Existing Techniques to Detect and Resolve the Deadlock

NO	Deadlock Detection Techniques	Description
1	B. M. Alom’s techniques	Detect and resolve the deadlock by using LTS , DTS and priority tables
2	Brian M’s algorithm	Detect and resolve the deadlock by using T-ID, Wait-For, Held-By, Request-Q and timestamp tables.
3	TWFG algorithm	Detect and resolve the deadlock by using Edges (E), Vertices (V) and timestamp tables
4	Path-pushing algorithms and Edge-Chasing algorithm	Detect and resolve the deadlock by using updated WFG tables and sending to neighbors

B. M. Alom (2009) has proposed a new algorithm to detect and resolve the deadlock in distributed database. The proposed algorithm is composed of two tables, which are local transaction structure (LTS) and distributed transaction structure (DTS) to record the transactions’ request of the data resources, and other table to record the priority of transactions. When the deadlock occurs and detected , the algorithm is detect the victim node based on the priority table, where the lowest priority transaction is aborted and all data resources held by the aborted transaction are granted to other transactions in terms of resolving the deadlock as will described in the realistic example section.

Brian M’s .Johnston et al. (1991) have proposed new algorithm to detect and resolve the deadlock in distributed database. The proposed algorithm has the main transaction table structure, which consists of T-ID ,Wait-for, Held-by, and Request-Q; when intersection occurs between the wait-for and requested –Q means there is deadlock. The victim transaction is allocated based on the timestamp of the younger transaction that will be aborted because it has a few requested data resources as will described in the realistic example section.

Mitchell & Merritt (1984), Chahar & Dala, (2013) and Swati Gupta (2013) have proposed Transaction-Wait-For-Graph algorithm to detect and resolve the deadlock in distributed database. The proposed algorithm composed from Edges (E) and Vertices (V) in current algorithm, where E represents transactions and V represents the data resources. The deadlock occurs when the graph contains a cycle of transaction that requests a resource held by them. The victim transaction is detected based on the timestamp of the younger transaction that will be aborted because it has a few requested data resources as describe in the realistic example section 2.2.

Bhatia & Verma (2013) have proposed a new algorithm to detect and resolve the deadlock in distributed database. The proposed algorithm uses WFG individually for each site of distributed database. When WFG allocates the deadlock, every sit updates its own WFG and sends to a number of neighbors. This process continues until one of the sits complete the whole picture about the global deadlock then try to solve the deadlock by one of three mechanisms, which are resolve by Preemption, resolve by Rollback, and resolve by Termination, as will described theoretically in the realistic example section.

**B. Realistic Example of Deadlock Detection and Resolutions**

This section applies and analysis the proposed algorithms in practical example of distributed database, only last Path-Pushing algorithms will discusses theoretically. Suppose the distributed database system ( DDS) consist from two sits site1 and site2 , site 1 maintaining four transactions which are t1,t2,t3, and t4 as well as sit2 maintaining other four transactions which are t5,t6,t7, and t8 as shown in Figure 1.

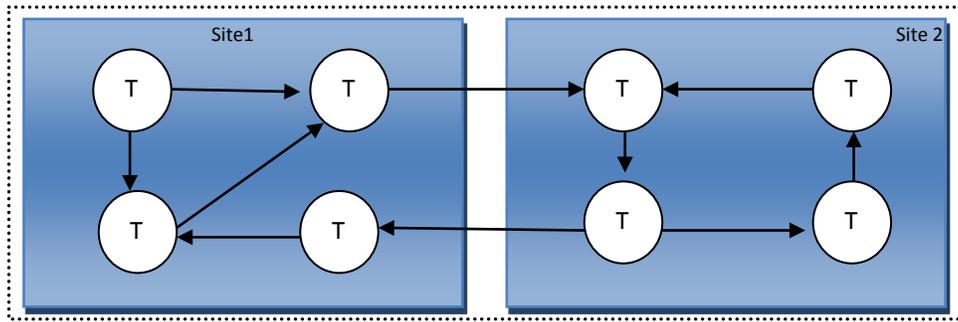


Figure 1: Example of distributed database structure composed of two sites

• **First over all analyzing the B. M. Alom’ algorithm based on the example present in figure 1:**

This algorithm consist from three tables which are (1) local transaction structure (LTS) is a tables recorded the locals transactions’ requests individually for each site as shown in table 2 for site1 and table 3 for site 2, (2) Distributed transaction structure (DTS) is a table to recorded the global transactions ‘requests which are participate more than one site as shown in table 4, and (3) transaction query is a table maintain the transactions ID related to their priorities as shown in table 5 and 6 related to site 1 and site 2 gradually and table 7 shows the transaction priority for DTS .

T-ID	Request -At
T1	2
T1	3
T2	3
T4	2

**Table 2:** Site 1  
Transactions’ request

T-ID	Request -At
T5	6
T6	8
T8	7
T7	5

**Table 3:** Site 2  
Transactions’ request

T-ID	Request -At
T1	2
T1	3
T2	3
T3	5
T5	6
T6	4
T4	2
T8	7
T7	5
T6	8

**Table 4:** DTS for  
site1 and site 2

T-ID	T-Priority
T1	1
T2	2
T3	3
T4	4

**Table 5:** Site 1  
Transactions’ Priority

T-ID	T-Priority
T5	3
T6	1
T7	4
T8	2

**Table 6:** Site 2  
Transactions’ Priority

T-ID	T-Priority
T1	1
T5	2
T3	3
T7	4
T2	5
T8	6
T4	7
T6	8

**Table 7:** DTS Priority

Detecting the deadlock is through scanning the transaction requests looking for any cycles. Table 2 illustrates that, there is no cycle between transactions’ request that mean there is no deadlock occurs, can say that site 1 is deadlock free. Table 3 illustrates that there is a clear cycle between transaction requests in site2, thus there is a deadlock. Table 6 shows that, T6 has lowest priority in site 2, thus T6 will be aborted because it is youngest transaction and has low requested resource. Table 4 illustrates that, there is a cycle between transaction’s requests from site1 and site 2, thus there is a deadlock occurs between transaction’s requests. Table 7 shows that T5 is lower priority transaction has participates in global deadlock. Thus, T5 has been aborted because it is youngest transaction in DTS caused the deadlock. Figure 2 show the distributed database without any deadlocks between transactions’ requests based on B. M. Alom’ algorithm .

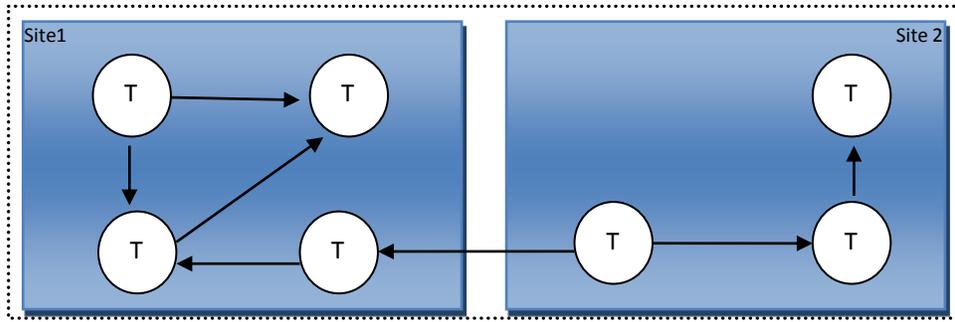


Figure 2: Distributed database without deadlocks

• **Second, analyzing the Brian M. Johnston’s algorithm based on the example present in figure 1:**

This algorithm considers that, each transaction has T-ID represent the transaction identification, and TS represent the timestamp associate with T-ID which presents when the transaction join the execution stage. From other hand, there are three main variables for each transaction which are (1) Wait-for, (2) Held-by, and (3) Request-Q. If the  $T_i$  is not waiting for any other transaction then Wait-for ( $T_i$ ) is set to nil, otherwise, Wait-for ( $T_i$ ) refer to which transaction is at the head of the locked data object. Held\_by ( $T_i$ ) is set to nil if the current transaction is executing, else it stores the transaction that is holding the data object required by the current transaction. Request-Q ( $T_i$ ) maintains all pending requests for data resources that are held other transaction. Each element in the Request-Q ( $T_i$ ) is a pair ( $T_j, D_i$ ), where  $T_j$  is the requesting transaction and  $D_i$  is the particular data source held by  $T_i$ .

When transaction  $T_i$  establish data request for to lock  $D_j$ , if  $D_j$  free can granted directly to  $T_i$  and locks under  $T_i$  identifications, else several processes required to perform which are :

- $D_j$  sends a not granted message to  $T_i$  along with the transaction identifier locking  $D_j$
- $T_i$  joins the Request-Q ( $T_j$ ) and sets its Wait-for equal to wait-for ( $T_i$ ).
- Now  $T_i$  initiates a update message to modify all the Wait-for variables which are affected by the changes in Locked by variable of the data objects.
- Update message is a recursive function call that will continue updating all elements of every Request-Q in the chain.
- When a transaction  $T_j$  receives the update message it checks if its Wait-for value is the same as the new Wait-for value.
- This message continues until  $T_i$  discovers that Wait-for ( $T_i$ ) intersected with Request-Q ( $T_i$ ) is not nil.
- Thus, the deadlock occurs then should abort the  $T_i$  and granted its data sources to other transaction required it.

Execute this algorithm by based on the example in figure 1. Table 8 and table 9 show the transaction structure for site 1 and site 2. Finally, table 10 shows the transaction structure in distributed environment both site1 and site 2.

T-ID	TS	Wait-for	Held-By	Request-Q
T1	2	T2,T3	T2,T3	Nil
T2	1	T2	T3	T1,T4
T3	3	Nil	Nil	T1,T2
T4	4	T2	T2	Nil

Table 8: Transaction Structure of site1

T-ID	TS	Wait-for	Held-By	Request-Q
T5	3	T6	T6	T7
T6	1	T6	T8	T5
T7	2	T6	T5	T8
T8	4	T6	T7	T6

Table 9: Transaction Structure of site1

Wait-for (T1)  $\cap$  Request-Q (T1) = nil  
 Wait-for (T2)  $\cap$  Request-Q (T2) = nil  
 Wait-for (T3)  $\cap$  Request-Q (T3) = nil  
 Wait-for (T4)  $\cap$  Request-Q (T4) = nil

Wait-for (T5)  $\cap$  Request-Q (T5) = nil  
 Wait-for (T6)  $\cap$  Request-Q (T6) = nil  
 Wait-for (T7)  $\cap$  Request-Q (T7) = nil  
Wait-for (T8)  $\cap$  Request-Q (T8) = T6

Based on reviews the intersection values of table 8 , there is no deadlock occur because there is no intersection exist between Wait – for(Ti) and request-Q(Ti) . The intersection values of table 9 shows that, there is a deadlock occur because  $Wait\text{-}for(T8) \cap Request\text{-}Q(T8) = T6$  , thus, one of these transactions T8 or T6 should be aborted based on lower timestamp. Therefore, the timestamp of T6 is 4 which is less than the time stamp of T8, thus T8 should be abort to resolve the deadlocks.

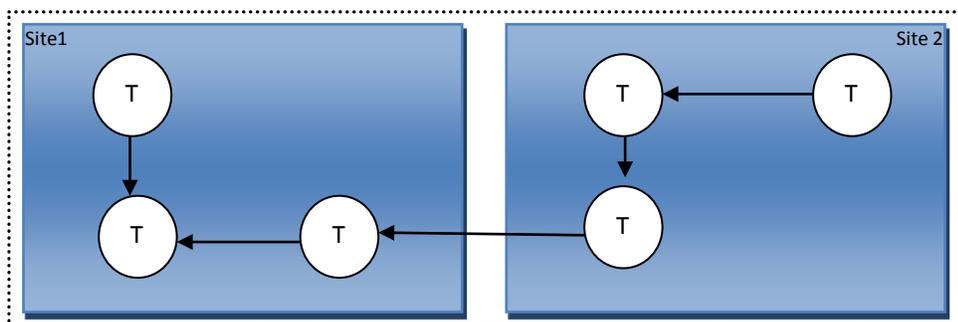
T-ID	TS	Wait-for	Held-By	Request-Q
T1	7	T2	T2,T3	Nil
T2	1	T2	T3	T1,T4
T3	5	T2	T5	T1,T2
T4	2	T2	T2	T6
T5	6	T6	T6	T7,T3
T6	3	T6	T4,T8	T5
T7	8	T6	T5	T8
T8	4	T6	T7	T6

**Table 10:** Transaction Structure of site1and site 2

The intersections review based on table 10 shows that, there in two deadlocks occur first one caused by transaction 3 and second one caused by transaction 8 as describe in the following intersection formulates.

- Wait-for (T0)  $\cap$  Request-Q (T0) = nil
- Wait-for(T1)  $\cap$  Request-Q (T1) = nil
- Wait-for (T2)  $\cap$  Request-Q (T2) = nil
- Wait-for(T3)  $\cap$  Request-Q (T3) = T2
- Wait-for(T5)  $\cap$  Request-Q (T5) = nil
- Wait-for(T6)  $\cap$  Request-Q (T6) = nil
- Wait-for(T7)  $\cap$  Request-Q (T7) = nil
- Wait-for(T8)  $\cap$  Request-Q (T8) = T6

To resolve the deadlock required to select the victims transactions based on time stamp values.  $TS(T2) < TS(T3)$  , thus T3 should be aborted to resolve first deadlock , and  $TS(T8) > TS(T6)$  , thus T8 should be aborted to resolve the second deadlock as shown in figure 3.



**Figure 3:** Distributed database without deadlocks

- **Third analyzing the TWFG algorithm which is proposed by Swati Gupta (2013), based on the example present in figure 1:**

This algorithm consists from two tables which are local transaction structure (LTS) maintains the local transactions' requests individually for each site and distributed transaction structure (DTS) stores the global transactions 'requests which are participate more than one site. LTS and DTS are created based on the transactions' timestamp. This algorithm will analysis based on the example present in figure 1 by executes the following steps.

1. All transaction  $T_i$  request data sources maintaining in array namely P and the data source have been needed stores in array called Q, array vector used to keep the scan values though execution this algorithm initially it is empty, stack to store the matching values, and finally temp variable used to store the searching values.
  2. First transaction from array P enters to vector array.
  3. The corresponding data sources from array Q is store in temp variable.
  4. Search the temp variable in array of transaction P, every matching value as a result of searching passed to stack.
  5. Repeat until complete array P is empty: Take the most top value in the stack, only the Q value then searching in vector array for matching results, if the results is false there is no matching values enter the value of P to the vector array and go to step 3. Else if the result is true that mean there is a deadlock occur. The victim transaction will be allocated and aborted based timestamp value resolve the problem of gridlock.
  6. For unsuccessful search if temp is not found in array P then make the stack empty.
- Finally, to detect the deadlock in global sites: create the DTS table to maintain the transaction request from different sites, implement the local deadlock detection algorithm in each site individually to resolve the global deadlock cycle.

Table 11 illustrates the transactions timestamp for site1 and site 2, Table 12 shows the LTS for site1 and site 2, and figure 4 and figure 5 explain the algorithm execution steps in site 1 and site 2.

Site1		Site2	
T-ID	TS	T-ID	TS
T2	1	T6	3
T4	2	T8	4
T3	5	T5	6
T1	7	T7	8

Table 11: Timestamp for site1 and site2

Site1		Site2	
P	Q	P	Q
2	3	6	8
4	2	8	7
1	3	5	6
1	2	7	5

Table 12: LTS for site1 and site2

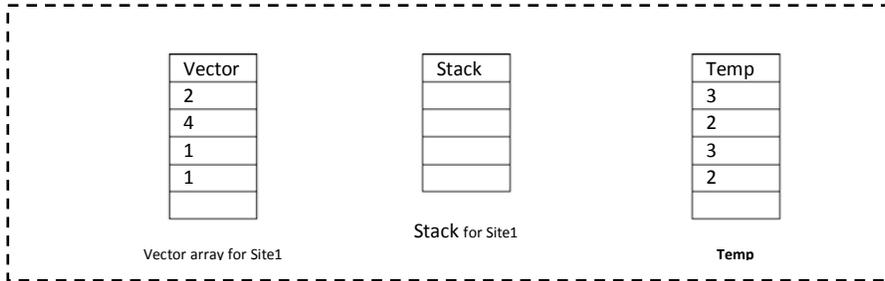


Figure 4: Deadlock detection in site 1

According to vector array and stack directions there is no matching occur between pairs (P, Q). Thus, there is no deadlock occur in site 1.

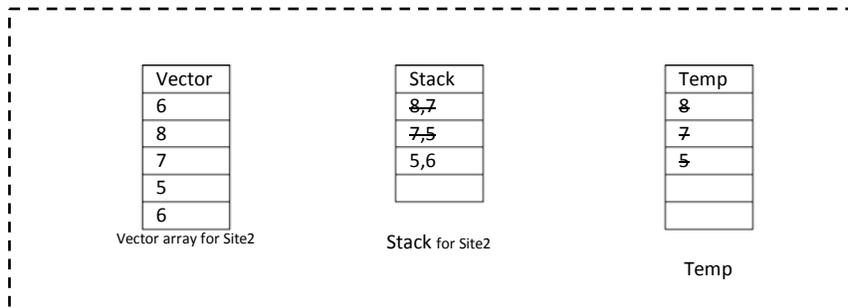


Figure 5: Deadlock detection in site 2

According to vector array of site 2 there is matching occur for the transaction from node 5 to node 6. Thus, the transaction with lowest timestamp should be aborted to resolve this problem. According to table 11, the  $TS(T5) > TS(T6)$ , thus, T5 will be aborted. Table 13 shows that, the LTS after detect and resolve the deadlock.

Site1		Site2	
P	Q	P	Q
2	3	6	8
4	2	8	7
1	3		
1	2		

Table 13: LTS for site1 and site2

Regarding to deadlock detection in distributed database table 15, illustrates the timestamp for site 1 and site 2 transactions that have participate in the cycle between two sites. Table 14 shows the DTS for site1 and site 2. Now, to detect the deadlock and victim transaction should use the P, Q, vector, stack and temp variable as shows in figure 6.

Site1&2	
P	Q
2	3
4	2
6	4
3	5
5	6

Table 14: DTS for both site1 and site2

Site 1 & 2	
T-ID	TS
2	1
4	2
6	3
3	5
5	6

Table 15: timestamp for site1 and site2

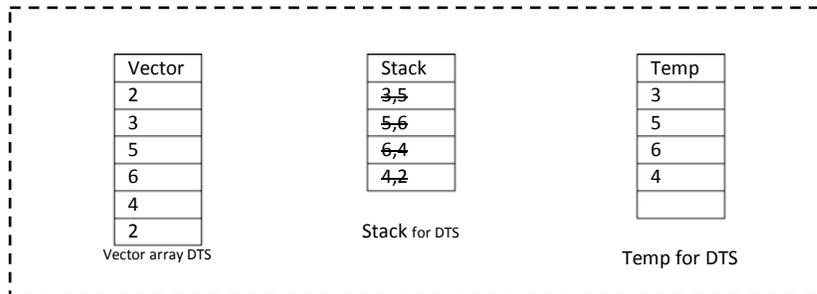


Figure 6: Deadlock detection in DTS

According to array vector values, there is a matching value between T2 and T4, thus the deadlock occur between T2 and T4. One of these two transaction should be aborted  $TS(T4) > TS(T2)$ , thus T4 will be aborted to resolve the deadlock problem and continuous without gridlock. Finally, figure 7 illustrates the distributed database without deadlock.

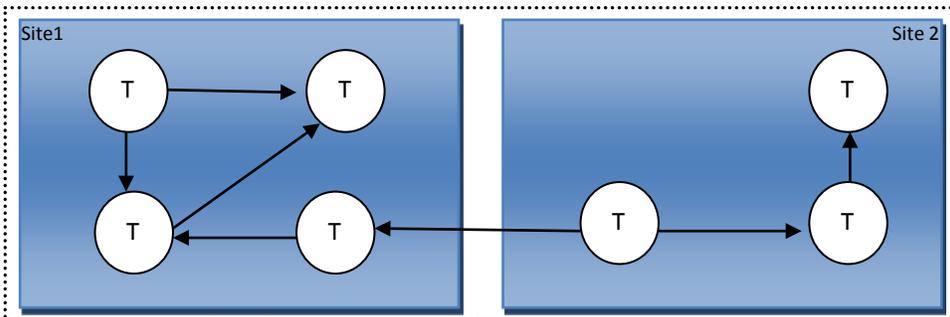


Figure 7: Distributed database without deadlock

- **Furth , Analyzing Path-pushing algorithms theoretically which is proposed by Bhatia & Verma (2013 )**

Path-pushing algorithms: The importance of this technique is creating a Global-Wait-for-Graph (GWFG) by depending on Local-Wait-For-Graph (LWFG). Every site sends its own LWFG to all neighbors' sites to detect the deadlock. The sites modified their LWFG based on shared information from neighbors. This process continues until some of the sites have completed a whole picture of the distributed database transaction. Finally, it can decide if there is existing deadlock or not. This algorithm is called path-pushing algorithms because it keeps track of the path along the sites to detect the transaction that causes the gridlock. On the other hand, edge-chasing algorithm is described as a deadlock in distributed database that can be detected by sending a message called probes along the edges of the graph. When the initiator probe receives a matching probe, it knows there is a cycle in the graph (Deadlock). To resolve the deadlock, there are three main approaches that can be used to perform this task, which are, 1) Resolve through Preemption, 2) Resolve through Rollback, and 3) Resolve through Termination.

### **III. Discussion**

B. M. Alom (2009) algorithm detects the deadlock cycle in site 1 and site 2 individually then in distributed database and solves the deadlock by using priority values. In site 1, there was no deadlock, but in site 2 and distributed database, there was a deadlock. The victim nodes are selected based on priorities of transactions. Transaction 6 was the main node that caused the deadlock in site 2 while transaction 5 was the main node that caused the deadlock in distributed database based on priority schedule. The main drawback of this algorithm is the deadlock detection depends only for the transaction priorities, if there is a change in the transactions priorities, the algorithm may fail to detect the right deadlock.

Brian M's algorithm allocates the deadlock in local and distributed database and resolves the deadlock by using timestamp values. The deadlock occurs in site 2 and distributed database while there is no deadlock in site 1. In terms of resolving the deadlock, the lowest timestamp transaction will be aborted to avoid the deadlock from occurring. Based on the timestamp schedule in site 2, transaction 8 was aborted and in distributed database, transaction 3 and transaction 8 were aborted to avoid the deadlock. The number of transactions is aborted by Brian M's algorithm in distributed database more than the number of transaction aborted by Alom's algorithm, which is only transaction 6. The main limitation of this algorithm is that there are no criteria of deciding which transaction needs to be aborted early to reduce the repeated time of detections.

TWFG's algorithm detects and resolves the deadlock in local and global database environments. There is no deadlock detection in site 1. However, site 2 and distributed database contains a deadlock. To resolve the deadlock, the victim transaction, which is the youngest transaction based on time stamp values, should be aborted. Transaction 5 was the main transaction causing the deadlock in site 2 and distributed database, thus it is selected to be aborted as the youngest transaction. The main problem of this algorithm is starvation; this algorithm often aborts the youngest transaction that causes the critical starve to the youngest transaction.

Finally , all the proposed algorithm detect and resolve the deadlock in distributed database, but all of them have some limitations such as priority, standard criteria and starvation. This justifies the need to create new techniques to remove the drawbacks of the proposed algorithms.

### **IV. Recommendation**

The main drawback of B. M. Alom's algorithm is detecting the deadlock by using transaction priorities schedule, when a change in the priorities would result in this technique possibly failing to detect the deadlock. The main drawback of Brian M's algorithm is that there are no standard criteria of allocating which transaction should to be aborted early to reduce the repeated time of detections. Meanwhile, the main drawback of TWFG algorithm is starvation. This algorithm often aborts the youngest transaction that causes the critical starve to the youngest transaction. We can suggest new techniques that composed of B. M. Alom, TWFG and Brian M's algorithms implemented together to solve these three weaknesses as the follows.

1. Detect the deadlock by using B. M. Alom's algorithm.
2. Use Brian M's algorithm to allocate the victim transaction to solve the changes of priorities problem based on timestamp.
3. Use flag variable associated with each transaction. Initially set all flags as Zero value (flag=0), which means not aborted yet.

4. When detecting the victim transaction as a younger transaction based on step 2, check if flag=0; this means that the transaction can be aborted and set the flag value as one (flag=1), which is not allowed to abort the youngest transaction and can abort the next earlier timestamp transaction.

This procedure detects the deadlock by using B. M. Alom's algorithm, resolve the deadlock by using Brian M's algorithm and solve the starvation drawback by using flag variable. Thus, the proposed algorithm detects and resolves the deadlock efficiently.

## V. Conclusion

The in-depth reviews of common algorithms which are used to detect and resolve the deadlock in distributed database show that there is no complete algorithm to detect and resolve without any negative effect, such as first algorithm facing drawback when the priorities of the transaction are changed; secondly algorithm faced a limitation where there is no standard criteria to resolve the deadlocks, and thirdly the algorithm has real weaknesses, which are starvations. This research proposed new techniques to detect and resolve the deadlock by using the reviewed algorithms' concepts together and add flag values as shown in the recommendation section.

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# Communication Problems among Sudanese EFL University Learners

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**Abstract-** The study probes into Sudanese EFL university learners communication habits to explore the nature of the problem they experience when communicating. To achieve the aim of the study, the researcher employed the analytic descriptive approach. The subjects of the study consisted of 70 Sudanese EFL students drawn from Faculty of Arts at Alneelain University. Two tools were employed for data collection: a questionnaire and an audio-recorded interview with the students. Results showed that the students knew what effective communication entails; proper negotiation of meaning through well constructed message. Result also showed that the students could understand the message addressed to them but they experienced difficulties responding properly. The students reported that the problem they faced in this respect was due to their limited knowledge about the target language and lack of confidence. Furthermore, result proved that the environment in which the students learn and practise English did not encourage the students to develop their communicative abilities. English does not have any communicative functions in the students' community. That is why the students have very poor communication strategies and in turn they fail to express their thoughts clearly and concisely.

**Index Terms-** oral communication, communication skills, communicative function, communication strategies

## I. INTRODUCTION

The ability to communicate effectively represents one of the factors that are highly recommended for obtaining a good job. Those people who are good communicators in English will succeed in achieving the tasks assigned to them properly. Pauline Rowson (2007) reports that many young people in particular are starting working life not knowing how to talk to their colleagues let alone customers and bosses, and many would rather use e-mail than pick up a telephone. People are forgetting how to talk, how to listen and how to pick up on subtle nuances of body language; this can lead to failed relationships and misunderstandings both in our social and our working lives. Sudanese students in many instances fail to make proper use of English. Using English to achieve certain communicative purposes is not that easy process for most of them. However, they are expected to possess a considerable knowledge about how to communicate so that they can contribute to the development of their local communities in different fields. Good communication skills maintains success and prosperity in workplace. Pauline holds that when things go wrong in a company, a friendship, a personal relationship, communication or

rather lack of it or misinterpreting it, is often at the heart of the problem. Improving your communication skills can bring huge rewards; it can help you to win more contracts and sales, gain promotion, manage your organization or your team more effectively, find friendship, even love.

## II. BACKGROUND

Sage (2006) states that communication is a complicated process that demands putting together information from many sources, and expressing thoughts with clarity and relevant content, according to established conventions, and an awareness of our conduct through the reactions of others to what we say and do. For Harryman, Kresheck, and Nicolosi, (1996) communication is any means by which an individual relates experiences, ideas, knowledge, and feelings to another. Communication can be expressed through both speech and gestures. Pauline Rowson (2007) assumes that people can communicate whether that is by speech, written word, sign language, Braille, body language, grunts, or simply the movement of the eyes if everything else is lost to us. Being able to communicate in some form is a great gift and one that we take for granted. Lani Arredondo (2007) hypothesizes that solutions to many unnecessary and serious problems lie in improving our ability to interact with others—in communicating more effectively. To manage well, you must communicate well.

Many of the previous studies highlight the importance of communication and the strategies for the development of the students' communication skills. Kamonpan Boonkit (2010), for example, claimed that building up confidence in speaking to an audience is a factor that strengthens speaking performance. The tasks based on speaking for special communication in a variety of situations designed a particular course can also help participants to prepare for speaking, and once each speaking task is well-prepared, this preparation becomes an effective strategy to minimize anxiety, and thus maximize speaking confidence. Şaziye Yaman, et al. (2013) stated that Turkish EFL students used negotiation for meaning, compensatory, and getting the gist strategies in communication. They also found that female students used communication strategies more than males and advanced level students. Fadila Rehaiem (2012) reported that the teachers are considered as the basic element in promoting the learners' communicative abilities in using a foreign language. Indeed, she discovered that EFL learners need more assistance from their teachers in order to be proficient in their communication process. Samira Al Hosni (2014) assumed that the main speaking difficulties encountered by students are linguistic difficulties, mother tongue use, and inhibition. Students

are unable to speak in English because they lack the necessary vocabulary items and grammar structures. They also lack sentence formation skills, which leads them to resort to their mother tongue. Students also think that the mistakes they make in front of their classmates are very embarrassing. Accordingly, they prefer not to take part in any communicative event. Thanyalak Oradee (2012) hypothesized that teachers should construct a variation of English speaking activities which motivate the students to learn. Communicative activities such as discussion, problem solving, and role-playing can be effective for the language classroom in Thai context. Other important factors to be recognized in the use of these activities are the order or sequence in which they are graded. Breaking the students into small groups will lead to better success and achievement in learning foreign languages. Vahid Norouzi Larsari (2011) argued that for the insufficient authentic resources and the need to use the target language, EFL learners generally encounter difficulties developing their communicative competence.

not surprising since English does not have any communicative functions in the Sudanese community. That is, English is not used by the students in their natural communication. They exercise English only in school and university as part of educational requirements.

**3- 2- Instruments**

For collecting the data of this paper two tools were used: a questionnaire and an audio-recorded interview. Using a variety of tools for collecting research data, provides a good means of getting a comprehensive view on the responses of the respondents. The interview helps the researcher to observe what cannot be revealed by the students' questionnaire. So, to have different tools for data collection means adopting a procedure through which the researcher can get a comprehensible data which yield reasonable results.

**3-3- The Questionnaire**

The questionnaire was designed to obtain information about how Sudanese EFL university learners appraise and assess their ability to engage into a fruitful communication event. It was also designed to make the students be aware of the knowledge required for good and effective communication. The questionnaire represents a tool to illicit information about respondents' ability to understand and respond properly to any communicative event. The questionnaire consists of four sections. The first section is about students' knowledge of good communication. The second section tackles the role of the learning environment in enhancing students' communication skills. Section three deals with the factors negatively influence students' ability to communicate. The fourth section involves the style and strategies adopted by the students when communicating.

**3- 4- The Audio-recorded Interview**

The interview was conducted with the participants to compare and contrast the facts about students' ability to communicate different kinds of meaning. It was conducted to be certain that the data used for the paper is more reliable and realistic. So the main reason behind the interview is to observe how the students communicate. This step is taken to help the researcher notice what cannot be seen through the analysis of the students' questionnaire.

**III. METHODOLOGY**

**3-1- Participants**

The participants in this study included 70 Sudanese EFL students who are taking English as their major at Alneelain university. The students at Alneelain university are from all parts of Sudan. This entails that the students in this university can be taken as a sample for the Sudanese EFL University learners' community. The students are supposed to have a considerable knowledge of English which enables them to express different functions of language. Students are also believed to demonstrate an awareness of the communicative use of English. This helps them play a very important role in the promotion of the fields which require the knowledge of English in their working life. Moreover, the students are expected to play an influential role in the development of the local communities where they live which eventually leads to the development of the country as a whole. The education which the subjects of the study received in English should make it easy for them to be good practitioners of English in the Sudan. But many of the students who have taken English in their university study are not able to make an effective use of English. This lets many researchers become frustrated and assume that research which depends on the data retrieved from the performance of these students will deem to failure. This is

**IV. RESULTS AND DISCUSSION**

**4- 1- Students' Knowledge of Good Communication**

No	Item	Yeas	No	Median
1	I know that good communication entails expressing one's thoughts clearly and effectively.	90%	10%	1
		63	7	

2	I have the ability to understand all the messages addressed to me during any communicative event.	52.3%	47.7%	3
		37	33	
3	Limited knowledge of English is one of the problems I encounter when communicating.	51.1%	48.9%	3
		36	34	
4	I ignore many of the conventions and norms of language use.	51.1%	48.9%	3
		36	34	
5	I do not experience any problem developing my oral communication abilities.	35.6%	64.4%	4
		25	45	
6	The education that I receive gives much importance to the communicative use of language.	44.4%	55.6%	4
		31	39	
7	My learning syllabus incorporates activities which help me develop my communicative competence.	25.6%	74.4%	4
		18	52	

Most of the students agree that good communication means negotiating one's thoughts more clearly and effectively. The students also claim that they have the ability to understand the messages addressed to them when communicating. But they experience great difficulties during oral communication. Their knowledge of the target language is limited which causes difficulties for the students making the right rhetorical choices to express their thoughts. They ignore the socio-cultural rules and conventions that they should abide by when communicating. The subjects of the study assume that it is not easy for them to raise

an awareness of how to develop their communication abilities. The education the students receive does not put much emphasis on the communicative use of language. That is, the learning syllabus does not contribute to the development of the students' oral communication abilities. This coincides with the results obtained from the interview conducted with the students. It was obvious that the students experience great problems expressing their thoughts and making themselves understood during the interview.

#### 4- 2- The role of the Learning Environment in Enhancing Students' Communication Skills

No	Item	Yeas	No	Median
8	My teacher comments negatively on the mistakes I make during speaking sessions.	60%	40%	2
		42	28	
9	My colleagues comment on the mistakes I make during oral communication.	50%	50%	3
		35	35	
10	My teacher encourages me to develop my communicative competence.	31.1%	68.9%	4
		22	48	
11	I cooperate with my colleagues in order to develop my communicative skills.	71.1%	28.9%	1
		50	20	
12	The community in which I live fosters and enhances my speaking abilities.	38.9%	61.1%	4

		27	43	
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The environment where the students learn and practise their English does not play any influential role in the development of the students communication abilities. The students maintain that their teachers negatively comment on their poor performance. Their colleagues also negatively comment on the mistake they make when communicating. This in turn, makes the students fear making mistakes which eventually leads them not to take part in any activity. In any learning situation it is known that the role of the teacher is to increase the students opportunities to learn properly. However, the respondents claim that their teachers do not encourage them to develop their communicative competence. The community also does not play any important role in

encouraging the students to develop and improve their communication abilities. This is not surprising since English does not have any communicative function in the students' local community. Analyzing the interview conducted with the students also revealed that the students possess poor communication skills. Some of the students found it very difficult to express what they feel. Part of the respondents refused to take part in the interview asserting that they did not know what to say or how to express their thoughts to others. This makes it obvious that the community does not play any influential role in developing students' communication abilities.

**4- 3- Factors Negatively Influence Students' Communicative Abilities**

No	Item	Yeas	No	Median
13	I do worry about the mistakes I commit when speaking.	57.7%	42.3%	3
		40	30	
14	I Fear speaking English in public; therefore I encounter difficulties when communicating.	58.9%	41.1%	3
		41	29	
15	I am afraid that my colleagues laugh at me when I make mistakes while conversing in English.	65.6%	34.4%	2
		46	24	

There are some psychological factors which hinder the students from performing well in the instances of their oral communication. The students state that they worry about the mistakes they commit during communication sessions. They also show that they fear speaking English in public. Furthermore, the students are afraid that when they make mistakes their peer will laugh at them. Being as such, the students might not attempt to

exploit their cognitive abilities in order to engage into an effective and meaningful learning process. The result of the interview showed that the students lack the necessary confidence to be involved in a real and natural communication. It takes much time and great effort to push some of the subjects of the study to talk.

**4- 4- The Style and Strategies Adopted by the Students when Communicating**

No	Item	Yeas	No	Median
16	I can make correct and effective word choice for the content of my message.	47.7%	52.3%	4
		33	37	
17	I consider the function of the grammatical structures of the message I wish to convey.	44.4%	55.6%	4

		31	39	
18	I engage into group work and discussion to develop my communication skills.	12.3%	87.7%	4
		9	61	
19	I often practise English with my colleagues in the university.	47.7%	52.3%	4
		33	37	
20	I practise my English whenever I get the opportunity.	31.1%	68.9%	4
		22	48	
21	I consider the relation that holds between me and the other participants in any communicative event.	32.3%	67.7%	4
		23	47	
22	I have ability to correct myself when I feel that my message is not appropriate.	25.6%	74.4%	4
		18	52	
23	I adopt different styles while speaking to make my message more effective and comprehensible.	30%	70%	4
		21	49	

The students have problems selecting the appropriate and the right content for the message they wish to communicate. If the students consider the functions of the structures they use in their oral performance, they will manage to adopt an effective style in their communication. Unfortunately, the students never consider the communicative value of the structures they employ when communicating. This might be due to the gaps in their linguistic repertoire. They are not so proficient to the extent that they can retrieve a variety of grammatical structures in order to construct the message they wish to convey. No attempts are made from the part of the students to engage into group work or discussion so that they can improve their communication skills. They do not use English for their natural communication which makes it difficult for them to improve their oral competence. The students also do not have the strategies that enable them to consider the sort of the relationship that holds between the participants. As such, the students ignore the fact that the nature of the relationship between the parties involved in any communicative event determines the paths and the end product of this event. Students report that they lack the strategies that enable them to correct themselves if their message is not appropriate while communicating. Furthermore, the students maintain that they adopt no particular style or strategy during their oral communication. The performance of the students during the interview was very poor. This supports the claim they made that they are not aware of any effective strategies or styles that facilitate communication process. But a few students performed well and they expressed themselves without any apparent difficulty; they spoke clearly and concisely.

#### V. CONCLUSION

Results show that the students know what effective communication implies: negotiation of meaning in a more proper and effective way. Result also shows that the students can

understand the message addressed to them. But their limited knowledge about the target language and lack of confidence make oral communication a great problem for them. The environment in which the students learn and practise English does not encourage or motivate the students to develop their communicative competence. English does not have any communicative functions in the students' community. Furthermore, result reveals that the students possess very poor communication strategies which makes it difficult for them to express their thoughts clearly and concisely. Syllabus designers should incorporate the activities that develop students' abilities to communicate when devising any learning programme. Teachers also should consider the needs of the students during their teaching process. As for the students, they need to be more motivated and prepared to engage in a more serious and effective process of learning.

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# Phenological Study of Flamboyant Tree (*Delonix regia* (Boj.)Raf.) Growing in Onitsha, Anambra State, Nigeria

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**Abstract-** Phenology is the study of the timing of recurring biological events in plant and animal world, especially with regard to seasonal and interannual variations in climate, as well as habitat factors. Phenological study of *Delonix regia* (Boj.) Raf. occurring in Onitsha with a tropical dry deciduous vegetation was carried out to collect information about the different phenological phases of the tree. The early to late stages of four phenophases, leafing, flowering, fruiting and ripening were observed and recorded once in every two weeks for a yearly cycle. Two-digit codes were used for inclusion of the principal growth stages and the secondary growth stages, and these defined the phenological phases observed. The results showed that changes in the prevailing seasons influenced the leafing and flowering phenology in *D. regia*. Flowering phenology started soon after the tree had resumed leafing with the early rains in the rainy season. Leafing, flowering and fruiting phenology started at different time periods and peaked synchronously. Also, the result showed that deciduousness in *D. regia* started with the onset of dry season in November and ended shortly before the rains in February. In addition, the study has provided baseline information on the phenology of *D. regia*, and this will, in the future, serve as a correlation between phenology and climate change in the area. Thus, it is suggested that functional and effective meteorological station be established in the area for integration of climatic records.

**Index Terms-** Phenology, *Delonix regia*, seasons and climate

## I. INTRODUCTION

Plants tend to possess definite recurring growth and developmental phases in any given environment over time. The entire developmental cycles of plants occur as rhythmic events. This phenomenon is termed phenology. Phenology is an aspect of science that deals with the study of the timing of recurrent biological events in plant and animal world, the causes of their timing with regard to biotic and abiotic factors, and the interrelations among phases of the same or different species (Snell, 1955; Lieth, 1974). Phenological events include, among others, the dates of emergence of leaves and flowers, the dates of leaf colouring and fall in deciduous trees, dates of egg-laying of birds and amphibians, or the timing of the developmental cycle of temperate-zone honey bee colonies. In ecology, the term is used more generally to indicate the time frame of any seasonal biological phenomena, including the dates of last appearance (e.g., the seasonal phenology of a species may be from April through September (Singh and Kushwaha, 2006).

The task of plant phenology is to observe and record the periodically recurring growth stages and to study the regularities and dependency of the yearly cycles of development on environmental conditions. Individual (genes, age) and environmental factors (weather and climate conditions in the micro- and macro- scales, soil conditions, water supply, diseases, competition, e.t.c.) influence plants. They can be viewed as the integrative measurement devices for the environment. The seasonal cycle of plants, however, is influenced to a great extent by temperature, photoperiod and precipitation (Sarvas, 1974; Morellato and Haddad, 2000; Keathy and Fletcher, 2003).

In particular, spring development in the mid-latitudes depends especially on temperature, in the tropics and sub-tropics rainfall regime is predominant (Morellato and Haddad, 2000). Studies of multiple species show differences among species in the extent of the phenological change. Many phenological series recorded have shown significant advances and delays in the flowering and leafing phenology (Menzel, 2000). These variations are influenced to a great extent by temperature changes and precipitation (Keathy and Fletcher, 2003). Seasonal duration of leafing, flowering and fruiting maturity determine phenological behaviour in tropical trees.

In view of the prolonged drought in the dry tropics, the predominant tree species are expected to be deciduous, showing early dry season leaf fall, leaf-flushing after the first rains, and the onset of the reproductive phase (flowering) in the early dry period following cessation of rains. The tropical dry forests harbour several phenological functional types showing widely varying leafless periods and rates of resource use during vegetative growth which increases with deciduousness (Kushwaha and Singh, 2005).

The actual timing of phenological events can be of importance for issues in tourism and recreation, giving information on events that potentially can interest people; biodiversity and ecology, assessing the impacts of mismatch of timing of phenological events on species interactions and community patterns; and education, involving students and the public in scientific research by a cost-effective and easy-to-observe method. The information on characteristics of the current year (especially early to late year) may increase the public awareness and may act as a motivation for people to actively observe natural processes and their seasonal chronologies (Vliet *et al.*, 2003). Determination of the sequence in the seasonal appearance of phenophases in *D. regia* in a yearly cycle and the establishment of baseline information on the phenology of *Delonix regia* found in Onitsha are the specific objectives of this study.

II. MATERIALS AND METHODS

2.1 Study Area

The study was carried out in Onitsha, Anambra State, Nigeria. Onitsha is in a tropical region with dry deciduous vegetation and experiences two seasons, rainy season (March-October) with temperature ranges from 23.9<sup>0</sup> C to about 31.2<sup>0</sup> C and dry season (November-February) where temperature can reach 33.9<sup>0</sup> C. Onitsha is an urban area with patches of trees mainly ornamental trees and is located in the south-eastern Nigeria between latitude 6<sup>0</sup>10' 0" N and longitude 6<sup>0</sup>47'0" E. Onitsha urban covers a land area of 36.19 km<sup>2</sup>. The average daily minimum and maximum temperatures of Onitsha is 26<sup>0</sup> C and 33<sup>0</sup> C respectively, with mean annual rainfall of 1886.88 mm (Ifeka and Akinbobola, 2015).

2.2 Data Collection

The extended BBCH-scale of Meier (1997) based on Zadoks *et al.* (1974) was used for data collection. Here, all the phases from the species under study were grouped in one line following their natural development. Four principal growths (leafing, flowering, fruiting and fruit ripening) were used for the study. They were denoted with the ordinal numbers 1, 6, 7 and 8 as they appear in the (10) chronologically arranged principal growth stages of plants according to Meier (1997). The principal growth stages range from 0 to 9. The secondary growth stages were introduced to define the short developmental stages in the

principal growth. They were also coded with numbers ranging from 0 to 9, where 0 denoted the beginning and 9 the end in the principal growth stage. The values 1, 2, 3, 4, 5, 6, 7, 8 that are intermediate between 0 and 9 denoted the percentile values (10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%) of the secondary growth stages respectively.

Thus, the combination of the principal growth stages and the secondary growth stages provided the 2-digit codes, BBCHXY, which denoted the phenophases appearance. 'X' denoted the principal growth while 'Y' denoted the secondary growth. Estimations of changes in the phenophases were made by visual observation, which exploited colour changes for fruit ripening, the numbers of flower buds that opened as in flowering, the numbers of fruits and developing leaves. Since light and visibility exert an influence on the sensitiveness for colour of the human eye, the researcher ensured uniform condition by taking the observations at 1:00 pm when the sun was high and behind the observer. Observations were made once every 2 weeks for a yearly cycle between March 2013 and February, 2014.

III. RESULTS

The results of the phenological study of *Delonix regia* are presented in the table below:

Table 1: The Observed Phenophases of *Delonix regia* (Boj.) Raf.

DURATION (Month) (Week)	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
	1 <sup>st</sup> -2 <sup>nd</sup> 3 <sup>rd</sup> -4 <sup>th</sup>	1 <sup>st</sup> -2 <sup>nd</sup> 3 <sup>rd</sup> -4 <sup>th</sup>	1 <sup>st</sup> -2 <sup>nd</sup> 3 <sup>rd</sup> -4 <sup>th</sup>	1 <sup>st</sup> -2 <sup>nd</sup> 3 <sup>rd</sup> -4 <sup>th</sup>	1 <sup>st</sup> -2 <sup>nd</sup> 3 <sup>rd</sup> -4 <sup>th</sup>	1 <sup>st</sup> -2 <sup>nd</sup> 3 <sup>rd</sup> -4 <sup>th</sup>	1 <sup>st</sup> -2 <sup>nd</sup> 3 <sup>rd</sup> -4 <sup>th</sup>	1 <sup>st</sup> -2 <sup>nd</sup> 3 <sup>rd</sup> -4 <sup>th</sup>	1 <sup>st</sup> -2 <sup>nd</sup> 3 <sup>rd</sup> -4 <sup>th</sup>	1 <sup>st</sup> -2 <sup>nd</sup> 3 <sup>rd</sup> -4 <sup>th</sup>	1 <sup>st</sup> -2 <sup>nd</sup> 3 <sup>rd</sup> -4 <sup>th</sup>	1 <sup>st</sup> -2 <sup>nd</sup> 3 <sup>rd</sup> -4 <sup>th</sup>
Principal Growth Stages												
Leafing	BBCH 10 BBCH 11	BBCH 13 BBCH 14	BBCH 15 BBCH 16	BBCH 17 *	BBCH 18 BBCH 19	*	*	*	*	BBCH 91	BBCH 92 BBCH 94	BBCH 95 BBCH 96
Flowering	* BBCH 60	BBCH 61 BBCH 63	BBCH 64 BBCH 65	BBCH 66 BBCH 67	BBCH 68 BBCH 69	*	*	*	*	*	*	*

Fruiting	*	*	*	*							*	*	*	*	*	*	*	*	*	*	*	*	*	*
					BBCH 70	BBCH 72	BBCH 75	BBCH 77	BBCH 78	BBCH 79														
Fruit Ripening	*	*	*	*	*	*	*	*	*	*	*	*	BBCH 81	BBCH 86	BBCH 89	*	*	*	*	*	*	*	*	*
	P h e n o l o g I c a l											P h a s e s												

**Note:** The asterisks (\*) in the table denote the absence of observed phenophases

**RESULTS**

Table 1 above shows the time frames of phenophases occurrence in the yearly cycle of development in *Delonix regia*. Leafing phenology started 1<sup>st</sup> to 2<sup>nd</sup> week of March, 2013 and by the 3<sup>rd</sup> to 4<sup>th</sup> week of March, 10% had developed (Table 1). Thirty per cent developed in the 1<sup>st</sup> to 2<sup>nd</sup> week of April; 40% in the 3<sup>rd</sup> to 4<sup>th</sup> week of April and 50% of the leaves developed in the 1<sup>st</sup> to 2<sup>nd</sup> week of May. Leafing ended in the 4<sup>th</sup> week of July (Table 1). Leaf fall began in the 1<sup>st</sup> to 2<sup>nd</sup> week of November with 10% leaf fall. By the 1<sup>st</sup> to 2<sup>nd</sup> week of December, 20% of the leaves had fallen. Half of the entire leaves fell in 1<sup>st</sup> to 2<sup>nd</sup> week of December, whereas 70% fell in the 3<sup>rd</sup> to 4<sup>th</sup> week of January, 2014. These show that *D. regia* is deciduous.

Flowering phenology started with bud formation in the 3<sup>rd</sup> to 4<sup>th</sup> week of March. Ten percent of the buds opened in the 1<sup>st</sup> to 2<sup>nd</sup> week of April, and by the 3<sup>rd</sup> to 4<sup>th</sup> week of April, 30% of the flowers had opened. Forty percent of the flowers opened in the 1<sup>st</sup> to 2<sup>nd</sup> week of May and by 3<sup>rd</sup> to 4<sup>th</sup> week of May, 50% had opened. Flowering phenology ended by the 4<sup>th</sup> week of July (Table 1).

Fruiting phenology started in May, and by the 3<sup>rd</sup> to 4<sup>th</sup> week of May, 20% of fruits had developed (Table 1). Fifty percent developed in the 1<sup>st</sup> to 2<sup>nd</sup> week of June and 70% in the 3<sup>rd</sup> to 4<sup>th</sup> week of June. Fruiting ended in the 3<sup>rd</sup> to 4<sup>th</sup> week of July.

Fruit ripening started in the 1<sup>st</sup> to 2<sup>nd</sup> week of September when 10% of the fruits ripened. Sixty per cent was ripened in the 3<sup>rd</sup> to 4<sup>th</sup> week of September and ripening ended in the 1<sup>st</sup> to 2<sup>nd</sup> week of October (Table 1).

In the extent of life span in development, leafing started in March and peaked in July, covering a period of approximately 5 months. Flowering started immediately after new foliage began to emerge in April and peaked in July, covering a period of approximately 4 months. Fruiting started in May and peaked in the 4<sup>th</sup> week of July, covering a period of approximately 3 months. Fruit ripening started in September and peaked in 2<sup>nd</sup> week of October, covering a period of approximately 1 month and 2 weeks (Table 1).

**IV. DISCUSSION**

The study clearly outlined the phenological activities of *Delonix regia* in a yearly cycle. The results show that the flowering comes shortly after the tree has resumed foliage

growth after a period of approximately four months of deciduousness. This agrees with the analysis of the proximate controls of flowering in tropical deciduous forest species by River *et al.* (2002) as they concluded that the timing of vegetative phenology strongly determines the flowering period, and thus flowering at least depends indirectly on environmental periodicity. This shows that flowering depends on the leaf development. This is accentuated by van Schaik *et al.* (1993) as they opined that phenological events are not mutually independent in woody species and flowering may be partly or wholly dependent on leafing activity.

Luna (1996) observed that *D. regia* in India remained leafless from March to May and the new leaves appeared at the end of the hot season in May or June. This, however, does not agree with the present study as leafing resumed in March after prolonged period of dryness, which started in November and ended in February. These variations in time frames can be attributed to seasonal differences in the two study areas.

From the result, leaf development lasted approximately eight months from March to October prior the start of leaf fall. This shows that vegetative growth is favoured by the long rainy season. It is concluded here that the study area has longer growing season, thus it is expected to have a high productivity. This is corroborated by Lieth (1974) as he asserted that areas with longer growing seasons have greater average productivity than those with shorter growing seasons unless moisture or another limiting factor intervenes. The study also revealed that *D. regia* shed its leaves progressively from January reaching its peak in February when almost 70% of the leaves had dropped. In view of the prolonged drought in the dry tropics, the predominant tree species are expected to be deciduous, showing early to late dry season leaf fall. Kushwaha and Singh (2005) also observed that the tropical dry forests harbour several phenological functional types showing widely varying leafless periods and rates of resource use during vegetative growth which increases with deciduousness

**V. CONCLUSION**

Phenology in *D. regia* is influenced by seasonal changes. Leaf development in *D. regia* spanned the rainy season. Leafing and flowering in *D. regia* start with the advent of rain and both occur once in a yearly cycle. Flowering phenology depends of

leaf development. Leafing, flowering and fruiting phenology of *D. regia* start at different times and peak approximately at the same time period. Difference in phenology among regions can be attributed to different climate conditions and this reflects on the difference in the prevailing environmental periodicity. This study can provide baseline information on the phenology of *D. regia*, and this will, in the future, serve as a basis for attempting a correlation between climate change and phenology in the tropics. Thus, it is suggested that functional and effective meteorological station needs to be established in the area for easy integration of climatic records.

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# Tree Crown Architecture: Approach to Tree Form, Structure and Performance: A Review

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**Abstract-** Crown architecture of trees is the manner in which the foliage parts of trees are positioned in various microenvironments. Trees tend to attain a characteristic shape when grown alone in the open due to inherited developmental programme. This developmental programme usually implies the reiterative addition of a series of structurally equivalent subunits (branches, axes, shoots, leaves), which confer trees a modular nature. The developmental programme is the result of plant evolution under some general biomechanical constraints. The functional implications of the modular nature and the biomechanical constraints of shape, which in addition to the environment where the tree grows determine the tree crown architecture. Plant performance has a crucial link between its phenotype and its ecological success, and the crown architecture becomes ecologically and evolutionary relevant when it affects performance. Crown architecture is crucial for light capture and for the distribution of light to each particular photosynthetic unit of the crown. Tree crown architecture can be represented with 'models' which delineate the basic growth strategies that determine the successive architectural phases. More growth 'models' have been identified for the tropical trees than in the temperate trees. The forms and morphogenesis of trees are far more variable in the tropics than in the temperate regions.

**Index Terms-** Trees, Crown architecture, developmental programme and performance

## I. INTRODUCTION

The crowns of trees possess a striking forms and structures, which are difficult to interpret. This phenomenon is termed crown architecture. The study of plant architecture emerged as a new scientific discipline some 30 years ago, and derived, in several ways, from earlier works on plant morphology (Oldeman, 1974; [Hallé et al., 1978](#)). Plant architecture involves the manner in which the foliage is positioned in different microenvironments and determines the flexibility of a shoot system to take advantage of unfilled gaps in the canopy, to allocate and utilize assimilates, and to recover from herbivory or mechanical damage (Kuppers, 1989).

Tree architectural studies were first initiated in tropical regions and were, at first, concerned with the analysis of the aerial vegetative structure of tropical trees ([Hallé and Oldeman, 1970](#)). Since their definition, architectural concepts have provided powerful tools for studying plant form or even tropical forest structure and the understanding of its dynamics ([Vester, 1997](#)). Investigations based on these concepts quickly spread to temperate species([Stecconi et al., 2000](#)), herbs ([Perreta et al.,](#)

[2000](#)), lianas ( [Caballé, 1998](#)) and root systems ([Atger and Edelin, 1994a](#)).

Several factors influence the forms and structures of tree crowns. Commenting on the contributing factors to crown architecture, Randolph and Donna (2007) asserted that individual tree crown conditions is the result of a combination of many factors including genetic traits, growing site characteristics and past and present external stresses (e.g., drought, insect outbreak, fire, e.t.c.). The results of these factors include different branching patterns, different shapes of boles, orientation of the leaves, branch angle, e.t.c. The architecture of a plant depends on the nature and on the relative arrangement of each of its parts; it is, at any given time, the expression of equilibrium between endogenous growth processes and exogenous constraints exerted by the environment.

Tree crowns are highly variable. The general shape varies from relatively dense conoids for young and healthy trees of excurrent habits to wide open hemispheric shapes for older trees of deliquescent habits (Cris, 1999). Shapes and branching habits of tree trunks and crowns are far more variable in the tropics than in temperate regions. A recent classification of form and morphogenesis in young tropical trees has identified as many as about 21 types or 'models' even though only about 25 per cent of the African species were taken into account ([Hallé and Oldeman, 1970](#)).

## The Plant Design

The shape of a given plant is determined by the shape of the space that it fills, but most plants attain a characteristic shape when grown alone in the open due to an inherited developmental program (Horn, 1971). This developmental program usually implies the reiterative addition of a series of structurally equivalent subunits (branches, axes, shoots, leaves), which confers plants a modular nature. This developmental program is the result of plant evolution under some general biomechanical constraints. For instance, the shape of the crown of a tree is constrained by the fact that the cost of horizontal branches is greater than that of vertical branches (Mattheck, 1991).

## Modular Nature of Plants

In the crown of most vascular plants, it is easy to recognize a hierarchical series of subunits. The largest subunit is the branch, which is made up of modules (Porter, 1983). Module is a general term that refers to a shoot with its leaves and buds, and the term can be applied to either determinate (structures whose apical meristem dies or produces a terminal inflorescence) or indeterminate shoot axes (Waller, 1986). Modules are, in turn, made up of smaller subunits consisting of a leaf, its axillary buds, and the associated internode. These small subunits have been

called metamers (White, 1984). Since plants have many redundant modules or organs that have similar or identical functions (e.g., leaves or shoots transforming absorbed light into biomass), plants have been seen as metapopulations (White, 1979). Such redundant modules are not fully dependent on one another, and, in fact, individual modules continue to function when neighbour organs are removed (Novoplansky *et al.*, 1989).

### **The Concept of Reiteration**

Although some plants conform to their architectural unit during their whole life, most plants repeat their architectural unit during their development, late in ontogeny, or under particular conditions. Oldeman (1974) named this process 'reiteration' and defined it as a morphogenetic process through which the organism duplicates its own elementary architecture, i.e. its architectural unit. The result of this process is called a 'reiterated complex' (Barthélémy *et al.*, 1991) or a 'reiterate' (Millet *et al.*, 1998a). Reiteration encompasses several aspects (sprouts, root-suckers, etc.) that have been known incidentally by botanists for a long time. The fundamental interest of this concept resides on its regrouping all these phenomena into a coherent whole, to bring out a common morphogenetic event. Matheck (1991) called this developmental programme. This developmental programme is the result of plant evolution under some general biomechanical constraints (Matheck, 1991).

Reiteration at first was considered as an opportunistic (non-automatic) process (Hallé *et al.*, 1978). 'Opportunistic reiteration' may today be considered as any kind of reiteration linked to the individual history of each tree and may have two main origins: (1) 'adaptive reiteration' is a response to an increase in resource levels whereas (2) 'traumatic reiteration' is a response of a plant after it has been damaged and lost a major part of its structure.

### **Branching: The Framework of a Crown Architecture**

Although the architecture of some trees consists only of a single vegetative axis during their whole life span, most display a more complex architecture consisting of several axes, one derived from another by a repetitive process known as branching.

Plants exhibit an extraordinary variety of branching patterns. The branching and consequent growth of trees and shrubs can be characterized by vertical or longitudinal, and horizontal or lateral symmetries. Vertical symmetry is characterized by growth of branches at the top (acrotony) or at the base (basitony), whereas lateral symmetry is characterized by branch growth at the upper or lower side of the lateral branch (epitony and hypotony, respectively). Logically, shrubs exhibit a basitonic branching, whereas trees are characterized by acrotonic branching. Analogously, while typical trees exhibit a hypotonic branching, most shrubs and small trees exhibit epitonic branching. However, there are many exceptions to these rules. For instance, the pyramidal shape of the crown of many conifers is due to the combination of basitonic branching (typically a shrub pattern) with a monopodial growth of the bole.

### **Apical Control and Apical Dominance Shaping Trees**

Shoot branching patterns can be greatly affected by apical control and apical dominance (Wilson and Keathy, 1994). Apical control is the inhibition of a lateral branch growth by shoots

above it (distal shoots). It refers to the physiological condition governing the excurrent (single stem, pyramidal) or decurrent (branchy) pattern of growth. Apical dominance is the tendency for current year's lateral buds to remain dormant as the shoot expands. Species with strong apical dominance have weak apical control and this results in branchy trees whereas species with weak apical dominance have strong apical control and this results in columnar tree.

### **Plant Biomechanics: Coping with Gravity and Wind**

While plant architecture is an outcome of many selective pressures, the shapes of plant parts, their elasticity, and resistance to strain, are constrained by well-known mechanical principles (Niklas, 1992). Because aerial plant parts face the obvious forces of gravity and wind, a fraction of the biomass must be devoted to support. As mechanical structures of similar shape become increasingly inefficient with increasing size, the fraction required to support plants increases rapidly with increasing plant size. For instance, the strength of a column (e.g., a branch or a stem) scales with the square of its diameter, whereas its mass increases with diameter squared times length (Gere and Timoshenko, 1997). For any given plant, the mechanical costs associated with its crown geometry must be balanced with the photosynthetic benefits associated with its light-capture efficiency.

Although gravity leads to static loading of a plant based on the weight of individual parts, the dynamic loading caused by wind is often transitory (Speck *et al.*, 1990). However, the wind exerts permanent modifications of the overall shape of plants and affects the anatomy and density of the wood, inducing biomechanical changes at architectural and anatomical levels (Ennos, 1997). The greatest effects of strong winds on trees are seen near the tree line, where most species exhibit the so-called krummholz form (Ennos, 1997). Krummholz refers to environmentally dwarfed trees, in which the crown is a prostrate cushion that extends leeward from the short trunk (Arno and Hammerly, 1984).

Crown architecture is crucial for light capture and for the distribution of light to each particular photosynthetic unit of the crown, but must also serve several other functions. The architectural design of a given plant must provide safety margins to cope with gravity and wind; therefore, biomechanical constraints must be taken into account when assessing the influence of morphology and architecture on plant performance.

### **Structural Determinants of Light Capture**

Canopy photosynthesis rate depends on the biochemical capacities of the foliage as well as on the distribution of light within the canopy (Sinoquet *et al.*, 2001). A major outcome of variation in crown architecture is modification of the overall light harvesting and the efficiency of light harvesting. The total leaf area supported by given crowns is the most basic structural property that affects the fraction of absorbed radiation. However, the distribution and arrangement of leaves within a crown can strongly modify the light harvesting efficiency of unit foliage area (Cescatti and Niinemets, 2004). As the three-dimensional arrangement of leaves in a crown is difficult to measure, light interception and canopy photosynthesis is often simulated assuming that foliage is randomly dispersed throughout the canopy volume (Beyschlag and Ryel, 1999).

### Crown Architecture in Extreme Light Environments

Light can be a limiting resource in understoreys of dense stands or for plants subject to strong neighbourhood competition, whereas light can be excessive and even harmful in open environments where plant metabolism is impaired by environmental stresses. Plant shape and size have been shown to change as a function of the light environment, and plants are capable of orienting their light-capturing surfaces in different ways to increase or decrease the leaf surface area projected in the direction of ambient light (Cescatti and Niinemets, 2004). Plants exhibit a remarkable within-species and within-individual variability in their structural features. For instance, branching pattern of trees is not stationary, and it has been shown that the variation of branching pattern can be the result of developmental–phenotypic interaction (Steingraeber, 1982). While in some cases it can be due to a malfunction of the genetic program, in most cases this variability is a plastic response to local conditions, and light is possibly the most spatially and temporally heterogeneous environmental factor affecting plant survival and growth. Structural plasticity of plants enables a fine-tuning with environmental changes so that the efficiency of the limiting processes at each stage is maximized. A common environmental change experienced by plants is the decreasing availability of light with the advance of succession. It has been shown for the succulent thalophyte *Salicornia europaea* that morphological changes in the branching patterns during succession maximized light interception (Ellison and Niklas, 1988). However, even phylogenetically close species differ in their capacity for a plastic response to the light environment (Valladares *et al.*, 2000). Interestingly, certain species that exhibit architecture suited to high irradiance conditions do not change significantly when grown in the shade. That was the case for mangroves in Malaysia: architecture and allometry of shaded mangroves were consistently more similar to those of exposed mangroves than to shaded, broad-leaved, evergreen, rainforest trees (Turner *et al.*, 1995).

### When Light is Scarce

When plants grow in dense stands or in the understory, the resource of radiant energy becomes scarce, unpredictable, and patchy. In these environments, evolution has led to two principal approaches for survival: shade avoidance and shade tolerance. Angiosperms, in particular, have evolved an impressive capacity to avoid shade. The so-called shade avoidance syndrome involves accelerated extension growth, strengthened apical dominance, and retarded leaf and chloroplast development, among other processes (Smith and Whitelam, 1997). Here the focus is on the functional aspects of the crown of plants that tolerate shade and on the structural features that are relevant for such tolerance.

### The Concept of Architectural Model

For a tree species the growth pattern which determines the successive architectural phases is called its architectural model, or shorter, its model (Hallé and Oldeman, 1970). The

architectural model is an inherent growth strategy that defines both the manner in which the plant elaborates its form and the resulting architecture. It expresses the nature and the sequence of to the fundamental growth programme on which the entire architecture is established. The identification of the architectural model of any given plant is based on the observation of the features belonging to the four major groups of simple morphological features: (1) the growth pattern, i.e. determinate vs. indeterminate growth and rhythmic vs. continuous growth; (2) the branching pattern, i.e. terminal vs. lateral branching, no branching, monopodial vs. sympodial branching, rhythmic vs. continuous branching, immediate vs. delayed branching; (3) the morphological differentiation of axes, i.e. orthotropic vs. plagiotropic vs. axes with mixed morphological and/or geometrical features (with plagiotropic and orthotropic portions); and (4) lateral vs. terminal flowering.

Each architectural model is defined by a particular combination of these simple morphological features and named after a well-known botanist. Although the number of these combinations is theoretically very high, there are apparently only 23 architectural models found in nature. Each of these models applies equally to arborescent or herbaceous plants, from tropical or temperate regions, and which can belong to closely related or distant taxa. Architectural models are a convenient starting point for interpreting plant form, but there is a series of variations and exceptions to each program of development that complicates classification and suggests the search of additional descriptions of crown shapes. For instance, *Arbutus sp.* exhibit two different architectural patterns depending on the light environment, and *Acer pseudoplatanus*, as with many other woody plants, undergo significant changes of branching patterns during the ontogeny, switching from one model to another (Bell, 1993).

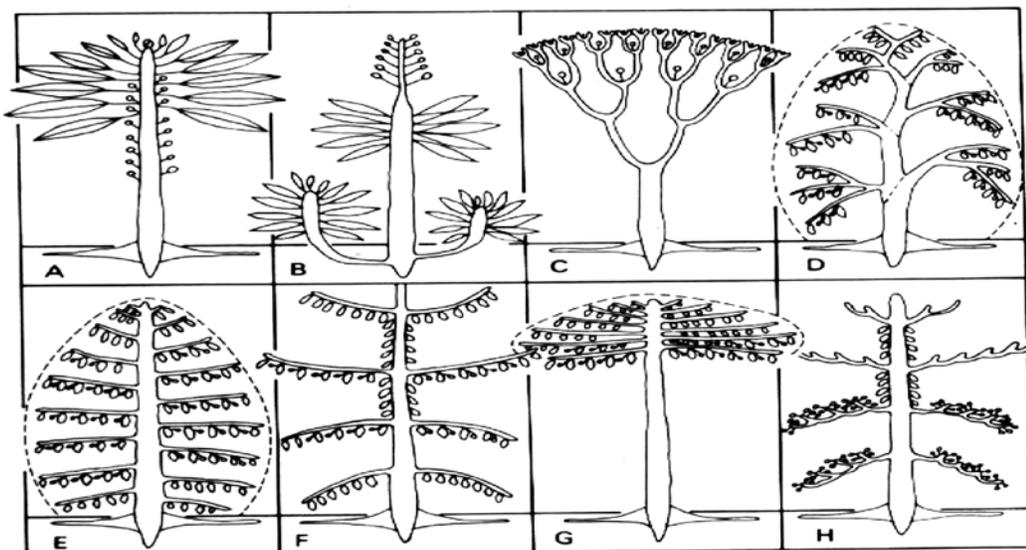
### Tree Growth Types or ‘Models’ in the Tropics

Many palms, tree-ferns and a few dicotyledons have a single stem which is normally unbranched throughout life (Fig. A). These are all ‘palm-like’ trees, but in addition the juvenile stages of a number of others, for example some Meliaceae and Dipterocarpaceae, are unbranched for a number of years.

The great majority of trees branch sooner or later and can be divided into three types: firstly those where the branches are all of equal status (see Figs. B, C), secondly where there are clearly different orders of branches (see Figs. E-H), and the third type where the main stem consists of a succession of sympodially growing axes whose terminal parts curve over and form branches (Fig. D).

The crown shape of mature tree depends partly on which of these categories it belongs to, but also on its adult characteristics and the environments in which it has grown.

The majority of tropical trees possess a smooth, light-coloured bole of a cylindrical shape. Some, however, show features such as fluting, spiral twisting, large spines as in *Fagara macrophylla* or *Erythrina mildbraedii* (utilized as ‘rubber stamps’), adventitious roots such as in *Afrosersalisia nobilis*.



Diagrammatic interpretations of some branching and reproductive patterns in tropical trees, according to the classification of 'models' by Hallé and Oldeman (1970):

**Unbranched trees:**

A – Model of Corner; e.g. *Elaeis guineensis*, *Mauritia flexuosa*, *Cocos nucifera*, *Pycnocomia angustifolia*, *Phyllobotryum soyauxianum*, *Ficus theophrastoides*.

**Branched trees:**

branches all of equal status:

B – Model of Tomlinson; e.g. *Raphia gigantea*, *Euterpe oleracea*.

C – Model of Leeuwenberg; e.g. *Manihot esculenta*, *Plumeria acutifolia*, *Rauvolfia vomitoria*, *Anthocheista nobilis*, *Alstonia sericea*.

sympodially-formed trunks and branches:



*Distemonanthus africanus*, *Diospyros matherana*, *Cassia javanica*, *Parinari excelsa*, *Pterocarpus officinalis*. (Also the European tree, *Tilia platyphyllos*.)

branches of different status:



E – Model of Rauh; e.g. *Hevea brasiliensis*, *Pentadesma butyracea*, *Entandrophragma utile*, *Triplochiton scleroxylon*, *Cecropia peltata*, *Artocarpus incisa*, *Musanga cecropioides*, *Khaya ivorensis*. (Also many common European trees; e.g. *Quercus*, *Fraxinus*.)

F – Model of Massart; e.g. *Ceiba pentandra* (see Plate 18), *Diospyros matherana*, *Pycnanthus angolensis*, *Anisophyllea* spp.

G – Model of Cook; e.g. *Phyllanthus mimosoides*, *Panda oleosa*, *Canthium glabriflorum*, *Glochidion laevigatum*.

H – Model of Aubréville, otherwise known as 'pagoda-trees'; e.g. *Terminalia catappa*, *T. ivorensis*, (see Plate 23A), *Sterculia tragacantha*, *Omphalocarpum elatum*, *Manilkara bidentata*.

**Tree Growth Patterns in the Temperate Regions**

The following shoot growth processes are predominant in most temperate tree species:

**Preformed (Fixed Growth)**

Here, a pattern of bud development, dormancy and activation found in many trees that survive periods of environmental extremes by going dormant is common. In the case of rhythmic growth, all the metamers and organs of the future elongated shoot may be present at an embryonic stage in a bud before the elongation of the shoot deriving from it; in this case the shoot is referred to as 'preformed' and its constitutive organs as 'preformed organs' or 'preformation', 'early leaves', or 'fixed growth' (Hallé et al., 1978). At bud break, the preformed

primordial elongate, with expansion limited by the number of primordial cells formed the previous year. The duration of preformed organs at an embryonic stage in a bud may vary from several days or weeks (Sabatier et al., 1995) to several years (Meloche and Diggle, 2001). Examples of trees with preformed growth pattern include Oaks (*Quercus* spp.), Douglas-fir (*Pseudotsuga menziesii*) (Plate II), Hickories (*Carya* spp.), Spruces (white) (*Picea glauca*), Ashes (*Fraxinus* spp.) and some pines (white) (*Pinus strobes*). Trees with preformed growth generally form distinctive annual rings (ring porous) because of difference between early and late wood.

**Neoformed (Sustained Growth)**

Not all primordial develop prior to active shoot elongation. In other cases, more organs than those included at an embryonic stage in the bud are elongated. These supplementary, non-preformed elements are referred to as 'neoformed organs' (i.e. 'neoformation' or 'late leaves', 'sustained growth' (Plate I). As a consequence stems or shoots may comprise only preformed metamers) or, more rarely, may be entirely neoformed (El-Morsy, 1991). In many cases, a preformed part can be followed

by a neoformed part and thus give rise to a mixed shoot (Souza et al., 2000). Species having neoformed growth include Sweet gum (*Liquidambar styraciflua*), Hemlock (*Tsuga canadensis*), Red alder (*Alnus rubra*), Yellow poplar (*Liriodendron tulipifera*), and Red maple (*Acer rubrum*). Trees with neoformed growth produce less definitive growth rings (diffuse porous) because there is little difference between wood formed early in the season and wood formed later in the growing season.



Plate I: *Tsuga Canadensis*

Neoformed Growth



Plate II: *Pseudotsuga menzeisii*

Preformed Growth

## II. CONCLUSION

Crown architectures of most trees are intricately variable. The functional implications of the two general aspects, the developmental programme and the biomechanical constraint of shapes, which in addition to the environment where the trees grow, determine the tree architecture.

The architectural design of a given plant must provide safety margins to cope with gravity and wind; therefore, biomechanical constraints must be taken into account when assessing the influence of morphology and architecture on plant performance. Crown architecture is crucial for light capture and for the distribution of light to each photosynthetic unit of the crown since canopy photosynthesis rate depends on the biochemical capacities of the foliage as well as on the distribution of light within the canopy.

Crown architecture of trees can be delineated with 'models', which is an inherent growth strategy that defines both the manner in which the plant elaborates its form and the resulting architecture. It expresses the nature and the sequence of the

fundamental growth programmes on which the entire architecture is established.

The crown architecture of trees is far more variable in the tropics than in the temperate regions.

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# Experimental Investigation of the Suitability of Orange Peel Oil as a Blend with Cotton Seed Oil as Alternate Fuel for Diesel Engines

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**Abstract-** As a renewable, sustainable and alternative fuel for compression ignition engines, biodiesel instead of diesel has been increasingly fueled to study its effects on engine performances and emissions in the recent 10 years. But these studies have been rarely reviewed to favor understanding and popularization for biodiesel so far. In this work, reports about biodiesel engine performances published by highly rated journals in scientific indexes, were cited preferentially since 2000 year. From these reports, the effect of biodiesel on engine power, economy, durability and the corresponding effect factors are surveyed and analyzed in detail. The use of biodiesel leads to the imperceptible power loss, the increase in fuel consumption and increase in break thermal efficiency in conventional diesel engines with no or fewer modification. And it favors to reduce carbon deposit and wear of the key engine parts. Therefore, the blends of biodiesel with small content in place of petroleum diesel can help in controlling air pollution and easing the pressure on scarce resources without significantly sacrificing engine power and economy. However, many further researches about optimization and modification on engine, low temperature performances of engine, new instrumentation and methodology for measurements, etc., should be performed when petroleum diesel is substituted completely by biodiesel.

**Index Terms-** Bio-fuel, Performance, Emissions, alternative fuel

## I. INTRODUCTION

**D**iesel engine will be the major power source for automobiles in the twenty-first century. To reduce emissions and solve the energy crisis, designing diesel engines with low emission and less energy consumption has always be an objective for researchers across the globe. However, with the development of new technologies, today's diesel engines have better emission characteristics and the less energy consumption compared with its predecessor. But, there is still lot to do on diesel engines aimed to achieve our goal of clean and effective diesel engine. Accordingly, research on a clean burning fuel instead of conventional fuel is advisable, which could not only decrease exhaust gas to a great extent, but, also provide more options of energy sources. The use of alternative fuels for internal combustion engines has attracted a great deal of attention due to fossil fuel crisis and also GHG impact. Alternative fuels should be easily available, environment friendly, and techno-

economically competitive. Successful alternative fuel should fulfill environmental and energy security needs without sacrificing engine operating performance. Renewable resources offer the opportunity to tap local resources and reduce dependency on fossil energy resources. Most biodiesel oils, particularly of the nonedible type can be used as fuel in diesel engines. One of the promising alternative fuels considered for diesel engine is biodiesel.

Biodiesel fuels are renewable, as the carbon released by the burning of biodiesel fuel is used when the oil crops undergo photosynthesis. Biodiesel also offers the advantage of being able to readily use in existing diesel engines without engine modifications. The alkyl monoester of fatty acids as bio-diesel which was obtained from renewable oil and fats materials by transesterification reaction is a good alternative. Biodiesel can be obtained from raw vegetable oil by transesterification with methanol or ethanol after chemical reactions. Vegetable oils present a very promising alternative to diesel oil since they are renewable and have similar properties as of diesel. Many researchers have studied the use of vegetable oils in diesel engines. This recommends the intensive studies on the use of alternative fuels especially renewable ones like vegetable oils and alcohols. Biodiesels such as Jatropa, Karanja, Sunflower and cottonseed are some of the popular biodiesels currently considered as substitute for diesel.

When biodiesel is used as a substitute for diesel, it is highly essential to understand the parameters that affect the combustion phenomenon which will in turn have direct impact on thermal efficiency and emission. In the present energy scenario lot of efforts is being focused on improving the thermal efficiency of IC engines with reduction in emissions. The problem of increasing demand for high brake power and the fast depletion of the fuels demand severe controls on power and a high level of fuel economy.

## II. LITERATURE SURVEY

### 2.1 Diesel Engine

A **diesel engine** (a type of **compression-ignition engine**) is an internal combustion engine that uses the heat of compression to initiate ignition and burn the fuel that has been injected into the combustion chamber. This contrasts with spark-ignition engines such as a petrol engine (gasoline engine) or gas engine (using a gaseous fuel as opposed to gasoline), which use

a spark plug to ignite an air-fuel mixture. The engine was developed by German inventor Rudolf Diesel in 1893.

The diesel engine has the highest thermal efficiency of any standard internal or external combustion engine due to its very high compression ratio. Low-speed diesel engines (as used in ships and other applications where overall engine weight is relatively unimportant) can have a thermal efficiency that exceeds 50%.

### 2.1.1 Brake specific fuel consumption (BSFC)

It is a measure of the fuel efficiency of a shaft reciprocating engine. It is the rate of fuel consumption divided by the power produced. It may also be thought of as power-specific fuel consumption, for this reason. BSFC allows the fuel efficiency of different reciprocating engines to be directly compared.

To calculate BSFC, use the formula

$$BSFC = x/p \quad (2.1)$$

Where:

$x$  is the fuel consumption rate in grams per second (g/s)

$P$  is the power produced in watts where  $P = T \times N$

$N$  is the engine speed in revolutions per second

$T$  is the engine torque in [newton meters](#) (N·m)

Commonly BSFC is expressed in units of grams per kilowatt-hour (g/kW·h). The conversion factor is as follows:  
BSFC [g/kW·h] = BSFC [g/J] × (3.6 × 10<sup>6</sup>)

An IC engine is used to produce mechanical power by [combustion](#) of fuel. Power is referred to as the rate at which work is done. Power is expressed as the product of force and linear velocity or product of [torque](#) and [angular velocity](#). In order to measure power one needs to measure torque or force and speed. The force or torque is measured by [Dynamometer](#) and speed by [Tachometer](#). The power developed by an engine and measured at the output shaft is called the brake power (bp) and is given by,

$$BP = \frac{2\pi NT}{60} \quad (2.2)$$

Where:

$T$  is the torque,

$N$  is the rotational speed,

However while calculating the Mechanical efficiency another factor called Indicated power is considered. It is defined as the power developed by combustion of fuel in the combustion chamber (IP). It is always more than brake power. It is given by

$$IP = \frac{P_m L A N k}{60} \quad (2.3)$$

Where:

$P_m$  is the [mean pressure](#),

$A$  is the area of the [piston](#)

$N$  is Rotational speed of the engine, rpm (It is  $N/2$  for four stroke engine), and

$k$  is the number of [cylinders](#)

$L$  is length of stroke

Therefore the difference between  $i_p$  and  $b_p$  indicates the power loss in the mechanical components of engine (due to friction). So the mechanical efficiency is defined as ratio of brake power to the indicated power. Friction power is the difference between indicated power and brake power.

### 2.1.2 Thermal Efficiency and Heat Balance

Thermal efficiency of an engine is defined as the ratio of the output to that of the chemical energy Input in the form of fuel supply. It may be based on brake or indicated output. It is the true indication of the efficiency with which the chemical energy of fuel (input) is converted into mechanical work. Thermal efficiency also accounts for combustion efficiency, i.e., for the fact that whole of the chemical energy of the fuel is not converted into heat energy during combustion.

$$\frac{b_p}{m_f \times CV}$$

$$\text{Brake thermal efficiency} = \quad (2.4)$$

Where,

$CV$  = Calorific value of fuel, kJ/kg, and

$m_f$  = Mass of fuel supplied, kg/sec.

The energy input to the engine goes out in various forms – a part is in the form of brake output, a part into exhaust, and the rest is taken by cooling water and the lubricating oil. The break-up of the total energy input into these different parts is called the **Heat Balance**. The main components in a heat balance are brake output, coolant losses, heat going to exhaust, radiation and other losses. Preparation of heat balance sheet gives us an idea about the amount of energy wasted in various parts and allows us to think of methods to reduce the losses so incurred.

### 2.1.3 Exhaust Smoke and Other Emissions

Smoke and other exhaust emissions such as oxides of nitrogen (NO<sub>x</sub>), unburned hydrocarbons (UBHC), etc. are nuisance for the public environment. With increasing emphasis on air pollution control all efforts are being made to keep them as minimum as it could be. Smoke is an indication of incomplete combustion. It limits the output of an engine if air pollution control is the consideration. Exhaust emissions have of late become a matter of grave concern and with the enforcement of legislation on air pollution in many countries; it has become necessary to view them as performance parameters.

### 2.2 Criteria for a Fuel to be Engine Fuel

In IC engine, the thermal energy is released by burning the fuel in the engine cylinder. The combustion of fuel in IC engine is quite fast but the time needed to get a proper air/fuel mixture depends mainly on the nature of fuel and the method of its introduction into the combustion chamber.

The fuel should therefore satisfy the following performance.

1. High energy density.
2. Good combustion characteristics.

3. High thermal stability.
4. Low deposit forming tendencies.
5. Compatibility with the engine hardware.
6. Good fire safety.
7. Low toxicity.
8. Less pollution.
9. Easy transferability and onboard vehicle storage.

The combustion process in the cylinder should take as little time as possible with the release of maximum heat energy during the period of operation. Longer operation results in the formation of deposits which in combination with other combustion products may cause excessive wear and corrosion of cylinder, piston and piston rings. The combustion product should not be toxic when exhausted to the atmosphere. These requirements can be satisfied using a number of liquid and gaseous fuels. The biodiesel from non edible sources like Jatropha, Pongamia, Mahua, Neem etc. meets the above engine performance requirement and therefore can offer perfect viable alternative to diesel oil in India.

### 2.3 Biodiesel Standard

Biodiesel has a number of standards for its quality. The European standard for biodiesel is [EN 14214](#), which is translated into the respective national standards for each country that forms the [CEN](#)(European Committee for Standardization) area e.g., for the United Kingdom, [BS EN 14214](#) and for Germany [DIN EN 14214](#). It may be used outside the CEN area as well. The main difference that exists between EN 14214 standards of different countries is the national annex detailing climate related requirements of biodiesel in different CEN member countries.

**Table 2.1: ASTM D-6751 / BIS standards for Biodiesel**

sr.no.	ASTM D-6751 / BIS standards for Biodiesel	
11	Flash point (closed cup)	130°C min. (150°C average)
22	Water and sediment	0.050% by vol., max.
33	Kinematic viscosity at 40°C	1.9-6.0 mm <sup>2</sup> /s
44	Sulfated ash	0.020% by mass, max.
55	Sulfur	0.05% by mass, max.
66	Copper strip corrosion	No. 3 max
77	Cetane	47 min.
88	Carbon residue	0.050% by mass, max.
99	Acid number -- mg KOH/g	0.80 max.
110	Free glycerin	0.020 % mass
111	Total glycerine (free glycerine and unconverted glycerides combined)	0.240% by mass, max.

112	Phosphorus content	0.001 max. % mass
113	Distillation	90% @ 360°C

### 2.4 Features of Biodiesel

1. Biodiesel is a clean burning fuel
2. Biodiesel does not have any toxic emissions like mineral diesel
3. Biodiesel is made from any vegetable oil such as Soya, Rice bran, Canola, Palm, Coconut, mustard or peanut or from any animal fat like Lard or tallow.
4. Biodiesel is a complete substitute of Mineral diesel (HSD).
5. Biodiesel is made through a chemical process which converts oils and fats of natural origin into fatty acid methyl esters (FAME). Biodiesel IS NOT vegetable oil.
6. Biodiesel is intended to be used as a replacement for petroleum diesel fuel, or can be blended with petroleum diesel fuel in any proportion.
7. Biodiesel does not require modifications to a diesel engine to be used.
8. Biodiesel has reduced exhaust emissions compared to petroleum diesel fuel.
9. Biodiesel has lower toxicity compared to petroleum diesel fuel.
10. Biodiesel is safer to handle compared to petroleum diesel fuel.
11. Biodiesel quality is governed by ASTM D 6751 quality parameters.

### 2.5 Advantages and Disadvantages of Biodiesel

Compared to other alternative fuels, biodiesel fuel supports some unique features and qualities. Unlike any other alternative fuels, it has successfully passed all the health effects testing requirements, meeting the standards of the 1990 Clean Air Act Amendments

#### 2.5.1 Advantages of Biodiesel Fuel

- Biodiesel fuel is a renewable energy source unlike petroleum-based diesel.
- An excessive production of soybeans in the world makes it an economic way to utilize this surplus for manufacturing the Biodiesel fuel.
- One of the main biodiesel fuel advantages is that it is less polluting than petroleum diesel. The lack of sulfur in 100% biodiesel extends the life of catalytic converters.
- Another of the advantages of biodiesel fuel is that it can also be blended with other energy resources and oil.
- Biodiesel fuel can also be used in existing oil heating systems and diesel engines without making any alterations.
- It can also be distributed through existing diesel fuel pumps, which is another biodiesel fuel advantage over other alternative fuels.
- The lubricating property of the biodiesel may lengthen the lifetime of engines.

### 2.5.2 Disadvantages of Biodiesel Fuel

- At present, Biodiesel fuel is about one and a half times more expensive than petroleum diesel fuel.
- It requires energy to produce biodiesel fuel from crops; plus there is the energy of sowing, fertilizing and harvesting.
- Another biodiesel fuel disadvantage is that it can harm rubber hoses in some engines. As Biodiesel cleans the dirt from the engine, this dirt can then get collected in the fuel filter, thus clogging it. So, filters have to be changed after the first several hours of biodiesel use.
- Biodiesel fuel distribution infrastructure needs improvement, which is another of the biodiesel fuel disadvantages.

### 2.6 Characteristics of Cottonseed oil:

India is the fifth largest cotton producing country in the world today, the first-four being the U.S, china, Russia and Brazil. Our country produces about 8% of the world cotton. Cotton is a tropical plant. Cottonseed oil is a vegetable oil extracted from the seeds of the cotton. After being freed from the linters, the seeds are shelled and then crushed and pressed or treated with solvents to obtain the crude cotton seed oil. Cotton seed oil is one of the most widely available oils and it is relatively inexpensive.

### 2.7 Comparison of Properties of Biodiesel & Diesel:

**Table 2.2: Properties of Biodiesel and Diesel comparison**

Ssr .no	Test	Unit	Diesel	Blend		
			B00%	B20%	B30%	B40%
11	Colour		Golden	NA	NA	NA
22	Density	Kg/m <sup>3</sup>	830	835	846	858
33	Viscosity	Cst	2.9	3.6	4.1	4.6
44	Cetane Number	-	51	51.3	51.4	52.4
55	CV	MJ/kg	42.5	41.3	41.18	40.1
66	Flash Pt.	°C	65	76	108	130
77	Fire pt.	°C	72	84	117	141

### 2.8 Pre-heating of Biodiesel

Different vegetable oils are considered as alternative fuels for diesel engines. The important advantages of vegetable oils as fuel are that they are renewable, can be produced locally, cheap and less pollutant for environment compared to diesel fuel. According to literature, use of vegetable oils as fuel in diesel engines causes several problems, namely poor fuel atomization and low volatility originated from their high viscosity, high molecular weight and density. After the use of vegetable oils for a long period of time, these problems may cause important engine failures. To improve fuel properties and decrease viscosity and density of oils, various methods such as heating the vegetable oils, mixing with diesel fuel, emulsion with alcohol and transesterification have been employed. Many experiments have clearly revealed that the widely applied and convenient

method for reduction of viscosity and density of vegetable oils is transesterification.

## III. SYSTEM DEVELOPMENT

### 3.1 Introduction

Direct injection diesel engines occupy an important place in the developing countries since they power agricultural pumps, small power tillers, light surface transport vehicles and other machineries. The problem of increasing demand for high brake power and the fast depletion of the fuels demand severe controls on power and a high level of fuel economy. Many innovative technologies are developed to tackle these problems. Modification is required in the existing engine designs. Some optimization approach has to be followed so that the efficiency of the engine is not comprised. As far as the IC engines are concerned the thermal efficiency and emission is the important parameters for which the other design and operating parameters has to be optimized.

DOE is a technique of defining and investing all possible combinations in an experiment involving multiple factors and to identify the best combination. In this, different factors and their levels are identified. Design of experiments is also useful to combine the factors at appropriate levels, each with the respective acceptable range, to produce the best results and yet exhibit minimum variation around the optimum results.

The methods of Design of Experiment are as follows:

- 1) Full Factorial method,
- 2) Taguchi method,
- 3) Response surface method and
- 4) Mixture method.

Among the available methods, Taguchi design is one of the most powerful DOE methods for analyzing the experiment. The salient features of this method are:

- 1) A simple, efficient and systematic method to optimize process to improve the performance and reduce cost.
- 2) Help arrive at the best parameters for the optimal conditions with the least number of experiments.

It is a scientifically disciplined mechanism for evaluating and implementing improvements in products, processes, materials, equipments and facilities.

DOE technique is used to identify the key factors that make the greatest contributions to the variation in response parameters of interest. It introduced the loss function concept which combines cost, target and variations into one metric. The signal-noise ratio is a Figure of merit and relates inversely to the loss function. It is defined as the ratio of the amount of energy for intended function to the amount of energy wasted. DOE recommends orthogonal array (OA) for lying out of the experiments which is significant part of this method. Instead of varying one factor at a time, all factors are varied simultaneously as per the design array and the response values are observed. It has the ability to evaluate several factors in a minimum number of tests. The results of the experiments are analyzed to achieve the following objectives.

- To establish the optimum conditions for the BTHE, BSFC, HC, NOx;

- To estimate the contributions of individual parameter to the response;
- To predict the response under optimum conditions;
- To develop mathematical model for thermal efficiency.
- To run the confirmation test for validation.

The optimum condition is identified by studying the main effects of each of the parameters. The main effects indicate the general trend of influence of each parameter.

The steps involved in DOE method are:

- Identifying the response functions and control parameters to be evaluated;
- Determining the number of levels of the control parameters;
- Selecting the appropriate orthogonal array, assigning the parameters to the array and conducting the experiments;
- Analyzing the experimental results and selecting the optimum level of control parameters;
- Validating the optimal control parameters through a confirmation experiment.

To find optimum parameters, it is required to find out parameters which make maximum effect on the performance of diesel engine. Series of experiments were conducted for Specific Fuel Consumption and Brake Thermal Efficiency. Taguchi method is being applied to select the control factor levels (Blend Ratio, Injection Pressure and Engine Load and speed) to come up with optimal diesel engine control parameters.

There are two types of factors that affect functional characteristics that are control factors and noise factors. The factors which are easily control are control factors. Noise factors are those factors which are difficult or some time impossible or too expensive to control. The preferred parameter settings are then determined through the analysis of S/N ratio. There are three types of SN ratio, Smaller the best, Nominal the best and Larger the best, are selected depending on desire performance.

Once all SN ratios have been computed for each run of experiment, Taguchi advocates graphical approach to analyze the data. In the graphical approach, S/N ratios and average mean response are plotted for each factor against each of its levels. The optimum parameters are then examined through peak point in SN ratios. By using minitab16 software, 4 factors and 3 levels in Taguchi design of experiment method inserted and got following array perform experiment.

**3.2 Determining Parameter Design Orthogonal Array**

The effect of many different parameters on the performance characteristic in a condensed set of experiments can be examined by using the orthogonal array experimental design proposed by Taguchi. Once the parameters affecting a process that can be controlled have been determined, the levels at which these parameters should be varied must be determined. Determining what levels of a variable to test requires an in-depth understanding of the process, including the minimum, maximum, and current value of the parameter. If the difference between the minimum and maximum value of a parameter is large, the values being tested can be further apart or more values can be tested. If the range of a parameter is small, then less value can be tested or

the values tested can be closer together. Also, the cost of conducting experiments must be considered when determining the number of levels of a parameter to include in the experimental design. Typically, the number of levels for all parameters in the experimental design is chosen to be the same to aid in the selection of the proper orthogonal array.

Knowing the number of parameters and the number of levels, the proper orthogonal array can be selected. Using the array selector table shown below, the name of the appropriate array can be found by looking at the column and row corresponding to the number of parameters and number of levels. Once the name has been determined (the subscript represents the number of experiments that must be completed), the predefined array can be looked up. These arrays were created using an algorithm Taguchi developed, and allows for each variable and setting to be tested equally.

**Table 3.1: Orthogonal Array Selection Table**

		Number of Parameters (P)																																
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31			
Number of Levels (L)	2	L4	L4	L8	L8	L8	L8	L8	L12	L12	L12	L12	L12	L16	L16	L16	L16	L16	L16	L20	L20	L20	L20	L20	L20	L20	L20	L20	L20	L20	L20	L20	L20	L20
	3	L9	L9	L9	L9	L9	L9	L9	L9	L18	L18	L18	L18	L18	L18	L18	L18	L18	L18	L18	L18	L18	L18	L18	L18	L18	L18	L18	L18	L18	L18	L18	L18	L18
	4	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16	L16

**3.3 Grey Relational Analysis.**

Signal-to-noise ratio (S/N) is a measure used in science and engineering for comparing the level of a desired signal to the level of background noise. Since the present study aimed at optimizing eight response parameters, it might so happen that the higher S/N ratio for one performance characteristic may exhibit a lower S/N ratio for another characteristic. Therefore, the overall evaluation of the S/N ratio was required for the optimization of multiple performance characteristics. Grey relational analysis was found to be an efficient tool for analyzing this kind of problem. It was used to determine the key factors of the system and their correlations. The key factors were identified by the input and output sequences.

The experimental results were first normalized in the range between zero and one. Afterwards, the grey relational coefficients were obtained from the normalized experimental data to express the relationship between the desired and actual experimental data. Lastly, the overall grey relational grade was obtained by averaging the grey relational coefficients corresponding to each selected process response. The evaluation of the multiple process response was based on the grey relational grade. This method was employed to convert a multiple response process optimization problem into a single response problem with the objective function of overall grey relational grade. The corresponding level of parametric combination with the highest grey relational grade was considered as the optimum process parameter.

Therefore, when the target value of the original sequence was “the higher-the-better” the original sequence was normalized as follows:

$$x_i(k) = \frac{y_i(k) - \min y_i(k)}{\max y_i(k) - \min y_i(k)} \tag{3.1}$$

When the purpose was “the lower-the-better” the original sequence was normalized as follows:

$y_i(k)$  is the original reference sequence,  $x_i(k)$  is the sequence for comparison,  $i = 1, 2, \dots, m$ ,

$k = 1, 2, 3, \dots, n$ , with  $m, n$  being total no of experiments and responses.  $\min y_i(k)$  is the smallest value of  $y_i(k)$  and  $\max y_i(k)$  is the highest value of  $(k)$ . Here,  $(k)$  was the value after the grey relational generation. An ideal sequence was  $x_0(k)$ . The grey relational grade revealed the relational degree between the experimental run sequences  $[x_0(k)$  and  $x_i(k), i = 1, 2 \dots ]$ . The grey relational coefficient  $\xi_i(k)$  could be calculated as

$$\xi_i(k) = \frac{\Delta_{\min} + \psi \Delta_{\max}}{\Delta_{oi}(k) + \psi \Delta_{\max}} \tag{3.2}$$

Where,

$$\Delta_{oi} = \|x_0(k) - x_i(k)\|$$

was the difference of the absolute value between  $x_0(k)$  and  $x_i(k)$ .  $\Delta_{\min}$ ,  $\Delta_{\max}$  were the minimum and maximum values of the absolute differences ( $\Delta_{oi}$ ) of all comparing sequences. The purpose of distinguishing coefficient  $\psi$  ( $0 \leq \psi \leq 1$ ) was to weaken the effect of  $\Delta_{\max}$  when it became too large. After averaging the grey relational coefficients, the grey relational grade  $\gamma_0$  is to be calculated. The higher value of grey relational grade was considered to be the stronger relational degree between the ideal sequence  $x_0(k)$  and the given sequence  $x_i(k)$ . The ideal sequence  $x_0(k)$  was supposed to be the best process response in the experimental layout. Thus the higher relational grade implied that the corresponding parameter combination was closer to the optimal.

**3.4 Grey Relational Grade Generation.**

Accordingly, while converting multiple grey relation grades, the value of weighting factor in engine performance was taken higher than that of emission characteristics. When appropriate, weighting factors  $\beta$  was used with the sequence values; the general form of grey relational grades became

$$\gamma_0 = \sum_{k=1}^n \xi_i(k) \beta \gamma_i \dots, \quad \sum \beta = 1. \tag{3.3}$$

The different sequence value of weighting factor ( $\beta$ ) could be specified from experience, or appropriate weights could be computed by processes such as singular value decomposition using preliminary grey relational grade values. One should note that the use of weighting factors would not be equivalent to changes in the sequence value units used or the choice made for sequence normalization.

The criteria for optimization of the response parameters was based on the smaller the better  $S/N$  ratio:

$$\frac{S}{N} = -10 \log \left[ \frac{1}{r} \sum_{i=1}^r y_i^2 \right] \tag{3.4}$$

Where,  $y_i$  represents the measured value of the response variable  $i$ .

The  $S/N$  ratio with the higher – the-better characteristic can be expressed as:

$$\frac{S}{N} = -10 \log \left[ \frac{1}{r} \sum_{i=1}^r 1/y_i^2 \right] \tag{3.5}$$

Where,  $y_i$  represents the measured value of the response variable.

The negative sign is used to ensure that the largest value gives an optimum value for the response variable and therefore robust design.

**3.5 ANOVA**

The analysis of variance (ANOVA) is one of the most commonly used methods of analyzing experiments. It is a flexible and powerful tool of analysis. The mathematics involved requires diligence in calculation, yet the way ANOVA works is relatively simple.

In any experiment several factors are allowed to vary, a situation called experimental error exists. Experimental error is the random errors created in the experiment from the chance variations in uncontrollable factors such as quality of material, environmental conditions and operators involved. Taken together this experimental error creates a background “noise” in the data. ANOVA measures this background noise. The ANOVA measures the amount of signal each factor under study creates. The signal is the strength of the factor to create a real change in the response variable. If a factor is creating a signal that has more magnitude than the background noise, we say that this factor has the significant effect. Factor that cannot overcome the noise are said to be insignificant as we shall see even insignificant factors can be important in improvement.

ANOVA is an extremely useful technique concerning researchers in the field of engineering, technology, economy, biology, education, psychology, and sociology and business industries. In many industrial cases, we will have to compare three or more averages.

There may be variations between samples and within sample items. ANOVA consist of splitting the variances for analytical purpose. Hence it is the method of analyzing the variance to which response is subject in to its various components corresponding to various varieties of seeds or fertilizers or soils differ significantly so that the policy decision could be taken accordingly, concerning a particular variety in the context of agriculture research.

Thus through ANOVA technique one can, in general investigate any number of failure, which are hypothesized or said to influence the dependent variable. One may as well investigate

the differences amongst various categories within each of these factors, which may have a large number of possible values. We are said to use one-way ANOVA and in case we investigate two factors at the same time, then we use two-way ANOVA. In two or more way ANOVA the interaction (i.e. interaction between two independent variable factors) if any, between two independent variables affecting a dependent variable can as well be studied for better decisions.

### 3.5.1 Basic principles of ANOVA

The basic principle of ANOVA is to test for differences among of the population by examining the amount of variation within each of samples, relative to the amount of variation between the samples. In terms of variation within given population, it is assumed that the values of (X) differ from the mean of this population only because of random effects i.e. there are influences on (X) which are unexplainable, whereas in examining differences between populations we assume that the difference between the mean of  $j^{\text{th}}$  population and ground mean is attributable to what is called specific factor or what is technically described as treatment effect. Thus while using ANOVA we assume that each of the samples is drawn from normal population and that of these populations has the same variances. We also assume that all factors other than the one or more being tested are effectively controlled. Third in other words means that we assume the absence of many factors that might affect our conclusions concerning the factors to be studied.

### 3.5.2 Steps in ANOVA

Following steps are involved in carrying out ANOVA:

Carrying out the number of experiments as per design matrix selected maintaining the combination of factor level in each experiment as per experiment design.

1) Preparing ANOVA table as follows:

a) In first column put factor or interaction.

b) In second column put degree of freedom for each factor or interaction. This is obtained by number of factor levels minus one. For interaction, degree of freedom is obtained by product of degree of freedom of each interacting factor.

c) In third column put sum of squares calculated for each factor or interaction. This is traditional statistical calculation, which represents variability.

d) In fourth column put the value of mean sum of squares or variance by dividing the sum of squares by degree of freedom for each factor or interaction.

e) Sum of squares for all response values is calculated and is called total sum of squares. The difference between total sum of squares and the total of sum of squares of all the factors and interactions is called as residual or error or no effect sum of squares.

f) In fifth column ratio of variance (mean square) of each factor to the residual/error/no effect variance is calculated and put. This is called as variance ratio or 'F' ratio.

1) The F ratio will follow 'F' distribution with (i, j) degree of freedom. Find out the critical F values in ANOVA table with this critical value. If F value for a factor or interaction is exceeding critical F values then it can be concluded that the factor or interaction has a real effect on response variable. Larger the difference between F value and critical; F values from the table,

larger is the effect of that particular factor or interaction on response variable.

2) If residual/error/no effect mean square (variance) is too high: it indicates improper factor selection and improper design of experiment.

Now computer software is also available for doing all statistical calculation and preparing regression analysis and ANOVA based on experimental design selection. All that we have to do is to mechanically enter the data in the manner prescribed by the software. Such software save engineers from spending time on statistical calculations and allow them to concentrate more on an experimental designs and experiments itself.

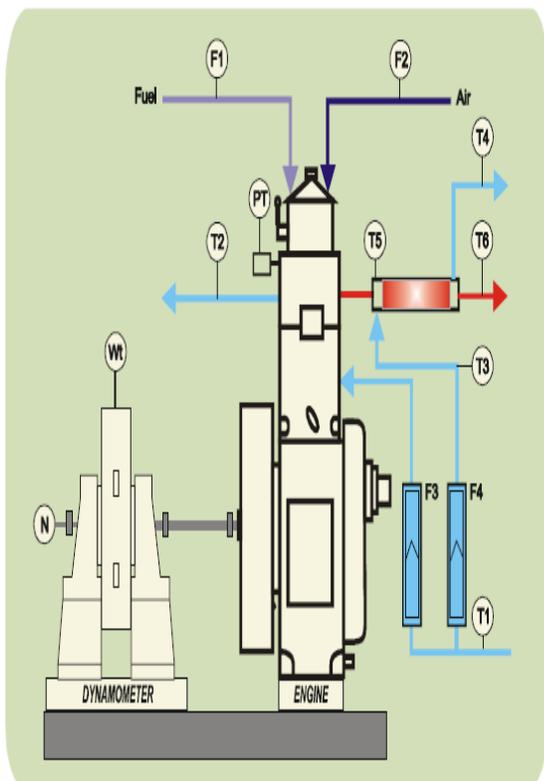
### 3.6 Experimental Setup

The setup consists of single cylinder, four stroke, VCR (Variable Compression Ratio) Diesel engine connected to eddy current type dynamometer for loading. The compression ratio can be changed without stopping the engine and without altering the combustion chamber geometry by specially designed *tilting cylinder block* arrangement. Setup is provided with necessary instruments for combustion pressure and crank-angle measurements. These signals are interfaced to computer through engine indicator for P $\theta$ -PV diagrams. Provision is also made for interfacing airflow, fuel flow, temperatures and load measurement. The set up has stand-alone panel box consisting of air box, two fuel tanks for duel fuel test, manometer, fuel measuring unit, transmitters for air and fuel flow measurements, process indicator and engine indicator. Rotameters are provided for cooling water and calorimeter water flow measurement. The setup enables study of VCR engine performance for brake power, indicated power, frictional power, BMEP, IMEP, brake thermal efficiency, indicated thermal efficiency, Mechanical efficiency, volumetric efficiency, specific fuel consumption, A/F ratio and heat balance.

Schematic arrangement of test set up is as shown in figure below:



**Figure 3.1: Engine Test Setup**



**Fig.3.2.Schematic arrangement**

**Table 3.2: Engine Specifications:**

**Product :** VCR Engine test setup 1 cylinder, 4 stroke, Diesel (Computerized)

**Product code:** 234

**Engine:** Make Kirloskar, Type 1 cylinder, 4 stroke Diesel, water cooled, power 3.5 kW at 1500 rpm, stroke 110 mm, bore 87.5 mm. 661 cc, CR 17.5, Modified to VCR engine CR range 12 to 18

**Dynamometer:** Type eddy current, water cooled, with loading unit

**Propeller shaft:** With universal joints

**Air box:** M S fabricated with orifice meter and manometer

**Fuel tank:** Capacity 15 lit with glass fuel metering column

**Calorimeter:** Type Pipe in pipe

**Piezo sensor:** Range 5000 PSI, with low noise cable

**Crank angle sensor:** Resolution 1 Deg, Speed 5500 RPM with TDC pulse.

**Data acquisition device:** NI USB-6210, 16-bit, 250ks/s.

**Piezo powering unit:** Make-Cuadra, Model AX-409.

**Digital millivoltmeter:** Range 0-200mV, panel mounted

**Temperature sensor:** Type RTD, PT100 and Thermocouple, Type K

**Temperature transmitter:** Type two wire, Input RTD PT100, Range 0–100 Deg C, Output 4–20 mA and Type two wire, Input Thermocouple, Range 0–1200 Deg C, Output 4–20 mA

**Load indicator:** Digital, Range 0-50 Kg, Supply 230VAC

**Load sensor:** Load cell, type strain gauge, range 0-50 Kg

**Fuel flow transmitter:** DP transmitter, Range 0-500 mm WC

**Air flow transmitter:** Pressure transmitter, Range (-) 250 mm WC

The test rig consists of:

- 1] Loading arrangement
- 2] A fuel input measuring arrangement
- 3] An arrangement for measuring the heat carried away by cooling water from engine jacket.
- 4] An arrangement for measuring the heat carried away by cooling water from exhaust

**3.6.1.Loading arrangement**

A rope brake dynamometer arrangement with a brake drum couple to the engine shaft and provided with a cooling water arrangement and spring balances. The load can be varied by increasing the rope tension on the brake drum with moving the hand wheel provided on the frame.

**3.6.2.A fuel input measuring arrangement**

This arrangement consists of a fuel tank of suitable capacity mounted on a stand. The fuel goes to the engine through 50 ml burette. The burette facilitates the measurement of fuel consumption for a definite period with the help of stopwatch.

**3.6.3.An arrangement for measuring the heat carried away by cooling water from engine jacket.**

Suitable pipefitting is provided for circulating the cooling water into the engine water jacket. For measuring the rate of flow of cooling water, a water meter is provided. With these entire arrangements, we can find the heat carried away by cooling water. The temperature of inlet and outlet water can be directly read from the digital temperature indicator.

### 3.6.4. An arrangement for measuring the heat carried away by cooling water from exhaust

It consists of exhaust gas calorimeter to measure the heat carried away by exhaust gases. Exhaust gas calorimeter consists of a central tube and an outer jacket. Exhaust gases pass through central tube and water is circulated in outer jacket to get the maximum temperature difference of exhaust gases at inlet and outlet of calorimeter. The volume of water circulation is measured with the help of water meter and stopwatch. Thermocouples are provided to get the inlet and outlet temperature of exhaust gases and water circulated.

### 3.7. Design of Experiment

#### 1. Selection of control parameters

The following control parameters are selected for the experimental investigation with the three levels.

**Table 3.3: Control parameters and their levels**

Factors	Level 1	Level 2	Level 3
Blend Ratio (%)	20	30	40
Load (kg)	5	8	10
Speed (rpm)	1520	1510	1490

#### 1. Selection of Taguchi orthogonal array

Factors: 3 and Levels: 3

In this study, a L9 orthogonal array with three columns and nine rows will be used.

No. of Runs: 9

**Table 3.4: L9 Orthogonal Array**

Experiment No.	Blend Ratio (%)	Load (kg)	Speed (rpm)
1	20	5	1520
2	20	8	1510
3	20	10	1490
4	30	5	1520
5	30	8	1510
6	30	10	1490
7	40	5	1520
8	40	8	1510
9	40	10	1490

1. Setting optimum conditions and prediction of response parameters

The next step in DOE analysis is determining optimal conditions of the control parameters to give the optimum responses. In this work the response variables to be optimized were BTHE, has to be maximized and B.S.F.C. to be reduced as much as possible. Hence the optimum parameter settings will be those that give maximum values of the BTHE and minimum

values of B.S.F.C, HC, and NOx. The optimum settings of the parameters were achieved from the S/N Tables of the control parameters.

### 3.8 Analysis Method

Experiment is planned according to Taguchi's L9 orthogonal array, which has 9 rows corresponding to the number of tests with 3 columns at three levels as shown in table. The first column of table is assigned to Blend proportion i.e. % of cottonseed Biodiesel in diesel, the second to Load, the third column is assigned to Engine Speed. It means a total 9 experiments must be conducted using the combination of levels for each independent factor. This orthogonal array is chosen due to its capability to check the interactions among factors. The experimental results will then transferred in to a Signal to Noise (S/N) ratio. The category the higher-the better for Brake Thermal Efficiency and smaller the better for Brake Specific Fuel Consumption will be used to calculate the S/N ratio for finding optimum set of parameters.

#### 1. Determination of fuel consumption:

Fuel tank is attached with a graduated burette. The valve at the bottom of the tank is closed when fuel consumption rate is to be measured so that fuel is consumed only from the burette. The time taken for 'x' amount of fuel consumption is recorded to measure the fuel consumption rate.

#### 2. Determination of brake power:

The equivalent load 'W' is recorded from the calibrated circular scale incorporated in the dynamometer setup. Brake power is obtained by using the formula:

$$B.P = (\pi D W N) / 60$$

Where,

D is diameter of the brake drum in mm

N is speed of the engine in r/min

#### 3. Determination of brake thermal efficiency

$$\text{Brake thermal efficiency} = (B.P \times 3600) / (mf \times C.V)$$

Where,

mf is fuel consumption in kg/h

C.V is calorific value of the fuel used in MJ/kg

4. Grey analysis and weighting factor assigning to the response parameters and obtaining optimal levels of engine performance process parameters. Finally, confirmation experiments will be conducted.

5. Develop Mathematical method for thermal efficiency of engine with biodiesel blends and validate the model with experimental results.

## IV. EXPERIMENTATION

**4.1 Experimental observations:** Observation table for different biodiesel blend at variable load is shown below at compression ratio 18.

**Table:4.1 Observations for different blends of fuel**

sr. no	blend (%)	comp. ratio	load (kg)	bp (kw)	airflow (kg/h)	fuel flow (kg/h)	a/f ratio
1.	0.00	18	0.1	0.03	30.28	0.52	58.37
			5.00	1.46	29.22	0.51	57.49
			8.00	2.29	28.30	0.50	56.26
			10.0	2.81	27.16	0.49	55.08
2.	20	18	0.1	0.03	29.93	0.48	62.13
			5.00	1.72	29.04	0.46	62.59
			8.00	2.76	28.67	0.46	62.38
			10.0	3.45	28.30	0.46	62.14
3.	30	18	0.1	0.03	29.75	0.52	57.44
			5.00	1.44	28.85	0.51	56.84
			8.00	2.29	28.49	0.50	57.24
			10.0	2.85	28.11	0.48	58.15
4.	40	18	0.1	0.03	29.75	0.54	55.48
			5.00	1.45	28.85	0.53	54.93
			8.00	2.29	28.49	0.52	54.78
			10.0	2.84	28.11	0.51	55.16

V. DESIGN OF EXPERIMENT

5.1 Response table for efficiency

**Table 6.1 Response table for efficiency**

LEVEL1	BLEND	LOAD	SPEED
1	41.70	26.92	39.76
2	40.23	41.14	40.85
3	38.11	51.98	39.43
DELTA	3.58	23.06	1.42
RANK	2	1	3

Result:-

1. Table shows that as the load increases the speed decrease so the delay time decrease & the efficiency increase.
2. As the blend mixture increase efficiency decrease from DOE.

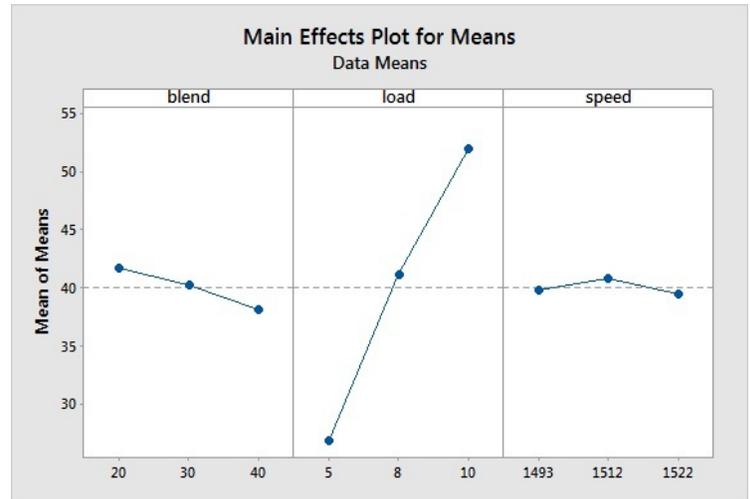
**5.2 Orthogonal Array:-**

From the below table we can see that 20% blend has the highest efficiency (54.31) & s/n ratio (34.6976) in experiment number 03.

S/N Ratio:- (bigger is the better)

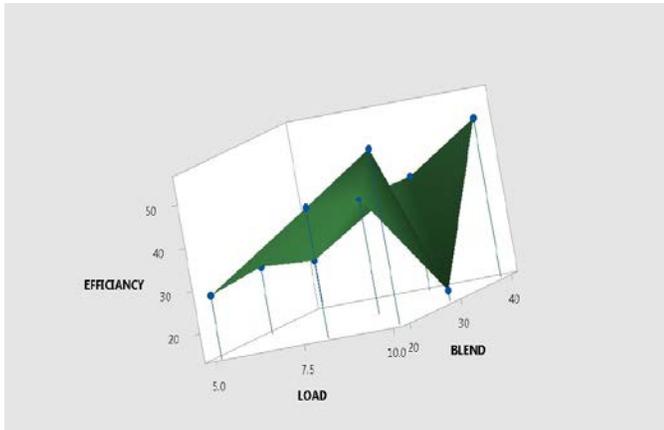
**Table 6.2 Optimization for blending mixture**

Sr. No	Blend	Load	Speed	Efficiency	S/N Ratio
1	20	5	1522	27.18	28.6850
2	20	8	1512	43.60	32.7897
3	20	10	1493	54.31	34.6976
4	30	5	1512	28.88	29.2119
5	30	8	1493	40.26	32.0975
6	30	10	1522	51.56	34.2463
7	40	5	1493	24.70	27.8539
8	40	8	1522	39.56	31.9451
9	40	10	1512	50.08	33.9933



**Graph 5.2 Main Effects Plot for Means**

**5.2.1 Comparison Graph**



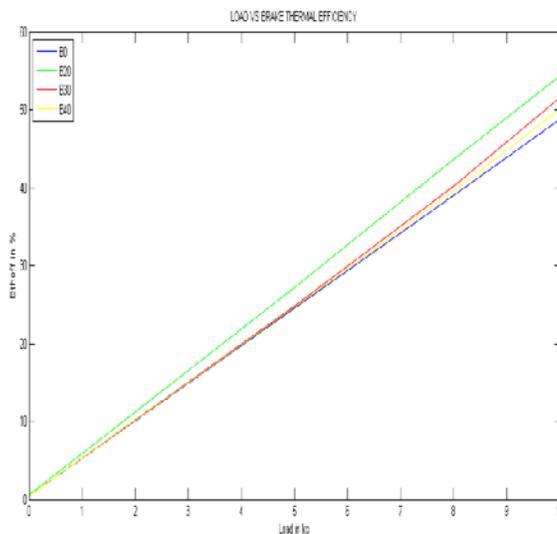
**Graph 5.1 Load Vs blend & efficiency**

**VI. RESULTS AND CONCLUSION**

6.1. Following are the results obtained from mathematical calculations:-

**Table 6.1 Result table for mathematical analysis**

Sr. No	B(%)	Load (Kg)	BP (KW)	bsfc (Kg/kwh)	BTh.eff (%)	A/F Ratio
1.	0.00	0.1	0.03	17.56	0.49	58.37
		5.00	1.46	0.35	24.59	57.49
		8.00	2.29	0.22	39.07	56.26
		10.0	2.81	0.18	48.77	55.08
2.	20	0.1	0.03	16.46	0.53	62.13
		5.00	1.72	0.32	27.18	62.59
		8.00	2.76	0.20	43.60	62.38
		10.0	3.45	0.16	54.31	62.14
3.	30	0.1	0.03	17.69	0.49	57.44
		5.00	1.44	0.35	24.88	56.84
		8.00	2.29	0.22	40.26	57.24
		10.0	2.85	0.17	51.56	58.15
4.	40	0.1	0.03	18.27	0.49	55.48
		5.00	1.45	0.36	24.70	54.93
		8.00	2.29	0.23	39.56	54.78
		10.0	2.84	0.18	50.08	55.16



**Graph 6.1 Variation of BTh efficiency with load**

**6.2 Variation of Bth efficiency with load:-**

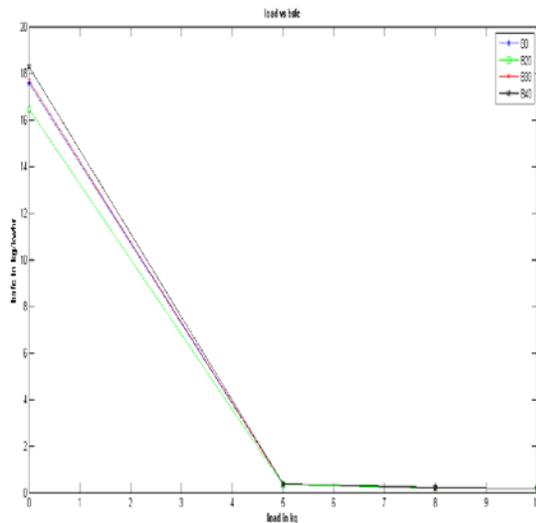
**Table 6.2 Load and B<sub>th</sub> at different Blends**

Sr. No	Blend (%)	Load (Kg)	BTh.eff (%)
1.	0.00	0.1	0.49
		5.00	24.59
		8.00	39.07
		10.0	48.77
		10.0	48.77
2.	20	0.1	0.53
		5.00	27.18
		8.00	43.60
		10.0	54.31
		10.0	54.31
3.	30	0.1	0.49
		5.00	24.88
		8.00	40.26
		10.0	51.56
		10.0	51.56
4.	40	0.1	0.49
		5.00	24.70
		8.00	39.56
		10.0	50.08
		10.0	50.08

**6.3 Variation of Bsfc with load:-**

**Table 6. 3 Load and B<sub>th</sub> at different Blends**

Sr. No	Blend (%)	Load (Kg)	BSFC (Kg/kwh)
1.	0.00	0.1	17.56
		5.00	0.35
		8.00	0.22
		10.0	0.18
2.	20	0.1	16.46
		5.00	0.32
		8.00	0.20
		10.0	0.16
3.	30	0.1	17.69
		5.00	0.35
		8.00	0.22
		10.0	0.17
4.	40	0.1	18.27
		5.00	0.36
		8.00	0.23
		10.0	0.18



**Graph 6.2 Variation of BTh efficiency with load**

## VI. CONCLUSIONS

- 1 From the above experiment we can conclude that B20 is the optimum mixture of cotton seed & orange peel oil in diesel having higher S/N ratio of 34.697.
- 2 Based on the observations of this experiment, it can be conclude that the performance test done on various blends of biodiesel shows that for 20% blend the overall efficiency of the engine is more as compared to diesel and has break thermal efficiency is higher i.e 54.31% as compare to other blends.
- 3 Based on the observations of this experiment, it can be concluded that the performance test done on various blends of biodiesel shows that for 20% blend the BSFC of the engine is less i.e 0.16 kg/kwhr as compared to diesel.

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# Study of Static Anthropometric Measurements and Body Somatotypes of Women

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**Abstract-** The present investigation entitled “Study Static Anthropometric Measurements of and Body Somatotypes of Women” was undertaken by conducting survey among 200 selected women from Parbhani city. The data regarding anthropometric measurements, body mass index, were assessed by using questionnaire, scientific equipment and observations. Statistical analysis such as standard deviation, analysis of variance and correlation co-efficient test was applied to find out the difference between selected parameters of women with different body types and correlation between selected independent and dependent variables. Findings of the study indicated that there was wide variation in static anthropometric measurements of selected women except for palm length. Major group of selected women was mesomorphic in body type having medium hand grip strength. Thus it can be said that to remain healthy and more productive it is better to maintain ectomorphic body somatotype.

**Index Terms-** Women, Static Anthropometry, Somatotype

## I. INTRODUCTION

The human physique is a continuously distributed characteristic. The history of classification and analysis of human physique can be traced back to the very ancient times when the people with strong bodies with great ability to fight, hunt and organize must have achieved distinction and got noticed by the society kings. Hippocrates a great Greek philosopher and physician of the fifth century BC described two different types of bodies; thin and lean persons with long extremities and short persons with thick and massive bodies. Since ages various efforts have been made to categorize the human body on the basis of physical structure. Physique is closely linked to body type. It is something that person is born with and develops naturally. It is determined genetically and therefore has little control over it. Body shape, composition and musculature can be improved but one cannot make drastic changes. (Bhasin and sweta, 2007). Independent of body size, a somatotype is a convenient shorthand descriptor of overall physique in terms of body shape and composition. It reflects an overall outlook of the body and conveys a meaning of the totality of morphological features of the human body. A three-exact decimal score of component of somatotype refers to endomorphy representing relative fatness mesomorphy representing relative muscularity and ectomorphy representing relative linearity. Somatotype has often been used to study morphometric variations in human body. (Tetri et al,

2011). Anthropometry is the single most universally applicable, inexpensive and non invasive method available to assess the size proportion and composition of the human body. Static anthropometry refers to the body measurements in stationary and natural position (Sing and Kukarni, 1999)

## II. EXPERIMENTAL PROCEDURE

The present study was conducted in selected colonies of Parbhani city of Marathwada region of Maharashtra State in 2014. The sample of study comprised randomly selected 200 women without any physical deformities. The questionnaire was developed to collect the information on selected variables related to study. Information was collected through personal interview and observation method. Selected static anthropometric measurements of women were recorded by use of anthropometer and flexible measuring tape. Portable weighing machine was used to record body weight of selected women. Body types were classified on the basis of Body Mass Index of women.

### Assessment of Body Mass Index and Body types

BMI is the ratio of body weight (kg) to height (meter)<sup>2</sup>. It is known as quetelet’s index. Body Mass Index of selected women was calculated by using formula (Garrow, 1981)

$$BMI (kg / m^2) = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

On the basis of assessed BMI score the body types were categorized as per the guidelines of WHO (2006). In view of the present study the body types were categorized as Ectomorph, Mesomorph and Endomorph as shown below

### Classification of body types:

BMI (kg/m <sup>2</sup> )	WHO Classification	Operational classification of body types
≤16.0-18.0	Underweight	Ectomorph
18.5-24.9	Normal	
25-29.9	Over weight	Mesomorph
≥30-40	Obesity	Endomorph

Physical fitness level was assessed on the basis of Vo<sub>2</sub> max of the selected women and the grip strength was determined with the help of grip dynamometer A hand grip dynamometer was

used to measure the hand grip strength of right hand of selected women.

### III. RESULTS AND DISCUSSION

#### General information of selected women

General information of selected women is presented in table 1. It is understood from the table that majority of the selected women were in the age group of 35 to 45 years (46.5%) followed by the age group of 25-35 years (37.5%). Lower percentage of women was between the age of 45 and 55 years (16%). Among the selected women 48.5 per cent of women were school educated followed by college educated (31%) and non literate (20.5%). Majority of the selected women were housewives (79%). Lower percentages of selected women were in the occupation of service (17%) and business (4%). Approximately equal percentage of selected women were having monthly family income between Rs. 10,000 and Rs. 15,000 (37.5%) and Rs.15,001 and Rs. 20,000 (40%). Only 22.5 per cent of selected women had monthly family income more than Rs. 20,000.

#### Static linear anthropometric measurements and body weight of selected women in standing position

Static linear anthropometric measurements in standing position and body weight of selected women are given in table 2. It is evidenced from the table that normal standing height of women was 152.92 cm in the range of 138 -167.5 cm. The mean eye height was recorded as 141.49 cm in the range of 126-154.5 cm. The mean values for the mid shoulder height, waist height and elbow height of selected women recorded were 127.36 cm, 92.97 cm and 97.77 cm respectively in the corresponding ranges of 114-141.6 cm, 70-102 cm and 84-111 cm. Average full hand length and palm length of selected women was noted as 72.89 cm and 17.12 cm respectively in the corresponding ranges from 64 to 87 cm and 14 to 19 cm. Mean body weight of the selected women was 50.65kg in the range between 33 and 69 kg. Finding on normal standing height and eye height of selected women in this study are in line with the study carried out by Fluegel et al (1986) among East German adults.

On the whole 25 to 30 cm range was observed in minimum and maximum measurements of all linear static measurements except for palm length of selected women. The variation between minimum and maximum measurement of palm length was very less (5 cm).

#### Body circumference measurements of selected women

Body circumference measurements of selected women are noted in table 3. It is evidenced from the table that the mean body circumference measurements of abdomen, arm, chest, waist and hip were 100.34 cm, 27.16 cm, 88.03 cm, 80.93 cm and 93.66 cm respectively. The ranges reported for abdominal, arm, chest, waist and hip circumference were 79-120 cm, 22-41 cm, 71-101 cm, 61-108 cm and 77-116 cm respectively.

Thus a wide variation of 30 to 40 cm in lower and upper limit was noticed for abdominal circumference, arm circumference, chest circumference, waist circumference and hip circumference measurements of selected women.

#### Body types, Physical fitness level and grip strength of selected women

Body types were classified on the basis of Body Mass Index of women. Physical fitness level was assessed on the basis of  $Vo_2$  max of the selected women and the grip strength was determined with the help of grip dynamometer and presented in table 4. It was observed from the table that majority of the selected women (57.5%) were mesomorph followed by ectomorph in body type (27.5%). Only 15 per cent of the selected women had endomorphic body type.

On the whole it was observed that majority of the selected women were mesomorphic in body type. These findings are in line with the findings indicated by wilsmore (1987) that mesomorphy was dominant somatotype component among female hockey players. Readings of the  $Vo_2$  max indicated that maximum percentages of the selected women (37.5%) were having good physical fitness level followed by high average physical fitness level (34%). The percentage of the selected women having low average physical fitness level (26.5%) was less. Meager percentage of selected women (2%) had very good level of physical fitness level.

It was further noted that majority of the selected women (75%) were having medium grip strength. The percentage of women having high grip strength of 23-26 kg (15.5%) and low grip strength of 15 to 18 kg (9.5%) was low.

Thus it can be concluded that majority of the selected women were mesomorphic in body somatotype having good physical fitness level and medium grip strength.

#### Correlation between selected independent and dependent variables

Correlation of body somatotype, grip strength and  $Vo_2$ max with selected independent variables of selected women is reported in table 5. It was revealed from the readings that the age of selected women was negatively correlated with  $Vo_2$  max ( $r=-0.97^{**}$ ) of women indicating that with an increase in the age of women  $Vo_2$  max was decreased. The body weight of women was found to be positively correlated with body somatotype ( $r=0.71^{**}$ ) and grip strength ( $r=0.60^{**}$ ) of selected women. This indicated that with increase in body weight the women were moving towards mesomorphic and endomorphic in body type and had more grip strength. Body height ( $r=0.40^*$ ) and education ( $r=0.50^{**}$ ) of selected women were positively correlated with  $Vo_2$  max of women, which indicated that taller and highly educated women had good  $Vo_2$  max level. The fact may be attributed to that due to education women become health conscious and maintain good health condition.

It was concluded that the age was negatively correlated with  $Vo_2$  max had positive correlation with body somatotype and grip strength. Whereas body weight, body height and education had correlation with body somatotype, grip strength and  $Vo_2$  max of selected women.

### IV. CONCLUSION

On the whole findings of the study indicated that majority of the selected women were in the age group of 35- 45 years, school educated , not holding any job and having family income between Rs.15,000 and Rs. 20,000 per month.

Average normal standing height of selected women was noted as 152.92 cm and eye height was 141.49 cm. A wide range of 25 to 30 cm was observed in minimum and maximum measurements of all linear static measurements except for palm length of selected women. The variation between minimum and maximum measurement of palm length was very less (5 cm). Mean body circumference measurements of selected women ranged between 80 to 100 cm. with wide variation of 30 to 40 cm in lower and upper limit for abdominal circumference, arm circumference, chest circumference, waist circumference and hip circumference measurements of selected women.

Majority of the selected women (57.5%) were mesomorphic in body type. Higher percent of the selected women were having good physical fitness level and majority of them (75%) had medium grip strength of 19-22 kg. It was observed that the age, body weight, body height and education of selected women had correlation with body somatotype, grip strength and  $VO_2$  max.

**Table 1 General information of selected women**

Attributes	Frequency	Percentage
<b>Age (yrs)</b>		
25-35	75	37.5
35-45	93	46.5
45-55	32	16
<b>Education</b>		
Non literate	41	20.5
School educated	97	48.5
College educated	62	31
<b>Occupation</b>		
House wife	158	79
Service	34	17
Business	08	4
<b>Monthly Income (Rs)</b>		
10000-15000	75	37.5
15001-20000	80	40
20001 and above	45	22.5

**Table 2 Static linear anthropometric measurements and body weight of selected women in standing position**

Anthropometric variables	Measurements (cm)		
	Mean $\pm$ S.D.	Minimum	Maximum
Normal standing height	152.92 $\pm$ 7.26	138	167.5
Eye height	141.49 $\pm$ 6.37	126	154.5
Waist height	92.97 $\pm$ 6.31	70	102

Mid shoulder height	127.36 $\pm$ 6.45	114	141.6
Elbow height	97.77 $\pm$ 5.12	84	111
Full hand length	72.89 $\pm$ 5.26	64	87
Palm length	17.12 $\pm$ 1.13	14	19
Body weight (Kg)	50.65 $\pm$ 7.72	33	69

**Table 3 Body circumference measurements of selected women**

Body circumference	Measurements (cm)		
	Mean $\pm$ S.D.	Minimum	Maximum
Abdominal	100.34 $\pm$ 10.08	79	120
Arm	27.16 $\pm$ 4.25	22	41
Chest	88.03 $\pm$ 7.95	71	101
Waist	80.93 $\pm$ 11.32	61	108
Hip	93.66 $\pm$ 9.94	77	116

**Table 4 Body somatotypes, physical fitness level and grip strength of selected women**

Attributes	Classification	Frequency and percentage
<b>Body somatotype</b>	<b>BMI( kg/m<sup>2</sup>)</b>	
Ectomorph	< 20	55(27.5)
Mesomorph	20-25	115(57.5)
Endomorph	>25	30(15)
<b>Physical fitness level</b>	<b>Vo<sub>2</sub>max(ml/kg/min)</b>	
Poor	up to 15	--
Low average	16-25	53(26.5)
High average	26-30	68(34)
Good	31-40	75(37.5)
Very good	41-45	4(2)
<b>Grip strength</b>	<b>(Kg)</b>	
Low	15-18	19(9.5)
Medium	19-22	150(75)
High	23-26	31(15.5)

Figures in Parentheses indicate percentages

**Table 5 Correlation of body somato type, grip strength and Vo<sub>2</sub>max with selected independent variables of selected women**

Dependent Variables Independent Variables	Correlation coefficient(r)		
	Body somatotype	Grip strength	Vo <sub>2</sub> max
Age	0.08NS	0.04 NS	-0.97**
Weight	0.71**	0.60**	0.10 NS
Height	0.00 NS	0.01 NS	0.40*
Education	-0.18 NS	-0.12 NS	0.50**
Occupation	-0.14 NS	-0.11 NS	-0.08 NS

\*Significant at 5 % level \*\*Significant at 1% level NS Non significant

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# Instant data transmission in daily use

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**Abstract-** This paper builds about the analysis of electricity board efforts to providing electricity each required places and to maintaining all the complications. To reduce a complication about meter reading, implement a transmitter into that meter which can be able to provide instant reading of that meter to a specified location/substation.

**Index Terms-** Transmitter, Reciever.

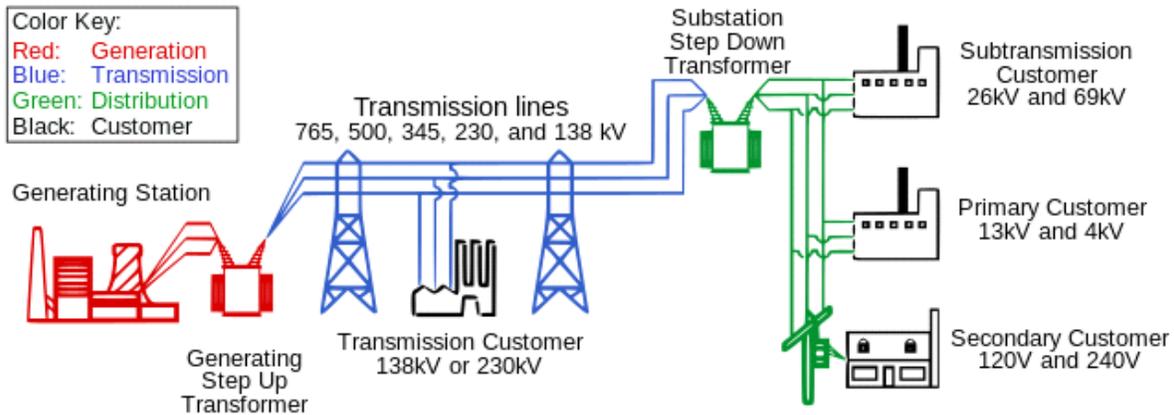
## I. INTRODUCTION

Electric energy is measured in watts and metered and billed in kilowatt-hours. A watt equals the voltage multiplied by the amperage or current. If electric energy was a stream, the voltage would be the width and depth of the stream. The amperage would be how fast the stream is flowing. Wattage is simply how much water is in the stream at a given time. Watt-hours is how much

water passes through the stream in an hour's time. For example, if a 120v electric motor draws 10 amps, the connected load would be 1200 watts or 1.2 kilowatts. The motor would consume 1.2 kWh over a one-hour period and 12 kWh over a ten-hour period.

An electricity meter, electric meter, or energy meter is a device that measures the amount of electric energy consumed by a residence, business, or an electrically powered device.

Electric meters work very much like an electric motor. The energy entering the home is passed through a set of small wires surrounding a shaft. The current passing through the wires creates an electric field that "induces" the shaft to turn. The shaft is connected to a graduated disk and a set of gears that turn a set of numbers much like an odometer in a car. A set number of revolutions of the large disk corresponds to one kilowatt-hour.



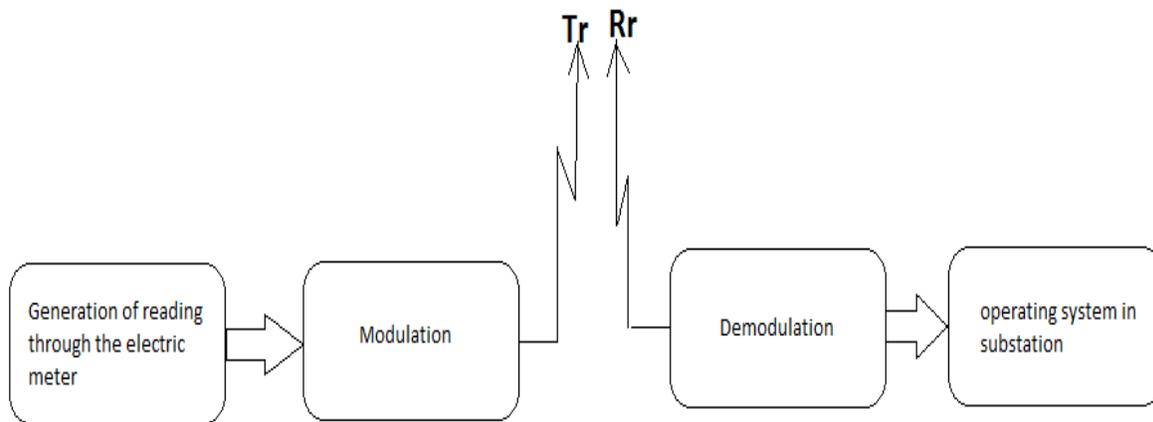
Our meter is read approximately every 30 days. Electric utility personnel come onto your premises to read the meter and write the reading onto a meter reading sheet. The past month's reading is subtracted from the current reading to determine the monthly kWh usage. You can always compare your usage against the monthly readings provided on your utility bill.

## II. TRANSMITTING AND RECEIVING

Now, if a transmitter is implemented in the meter then the generated reading is to be transmitted to a substation during a

specified time of period. On the otherhand we can say, that the reading generates continuously and transmitter transmit the reading to the substation. An implementation is to be also require in substation to receive that readings.

Some time before when electric meter is not introduced, reading is carried out by a rotating plate. But now in electronic meter readings get a form of PULSE, so it will be easy to send it through a transmitter by using any of the modulation technique (as Pulse code modulation).



The transmitter uses mobile communication networking architecture to transmit the signal to substation and only one man require to operate these in substation.

Electrical communication transmitter and receiver techniques strive toward obtaining reliable communication at a low cost, with maximum utilization of the channel resources. The information transmitted by the source is received by the destination via a physical medium called a channel. This physical medium, which may be wired or wireless, introduces distortion, noise and interference in the transmitted information bearing signal. To counteract these effects is one of the requirements while designing a transmitter and receiver end technique. The other requirements are power and bandwidth efficiency at a low implementation complexity.

Modulation is a process of encoding information from a message source in a manner suitable for transmission. It involves translating a baseband message signal to a passband signal. The baseband signal is called the modulating signal and the passband signal is called the modulated signal. Modulation can be done by varying certain characteristics of carrier waves according to the message signal. Demodulation is the reciprocal process of modulation which involves extraction of original baseband signal from the modulated passband signal.

Several factors influence the choice of a digital modulation scheme. A desirable modulation scheme provides low bit error rates at low received signal to noise ratios, performs well in multipath and fading conditions, occupies a minimum of bandwidth, and is easy and cost-effective to implement. The performance of a modulation scheme is often measured in terms of its power efficiency and bandwidth efficiency. Power efficiency describes the ability of a modulation technique to

preserve the fidelity of the digital message at low power levels. In a digital communication system, in order to increase noise immunity, it is necessary to increase the signal power. Bandwidth efficiency describes the ability of a modulation scheme to accommodate data within a limited bandwidth.

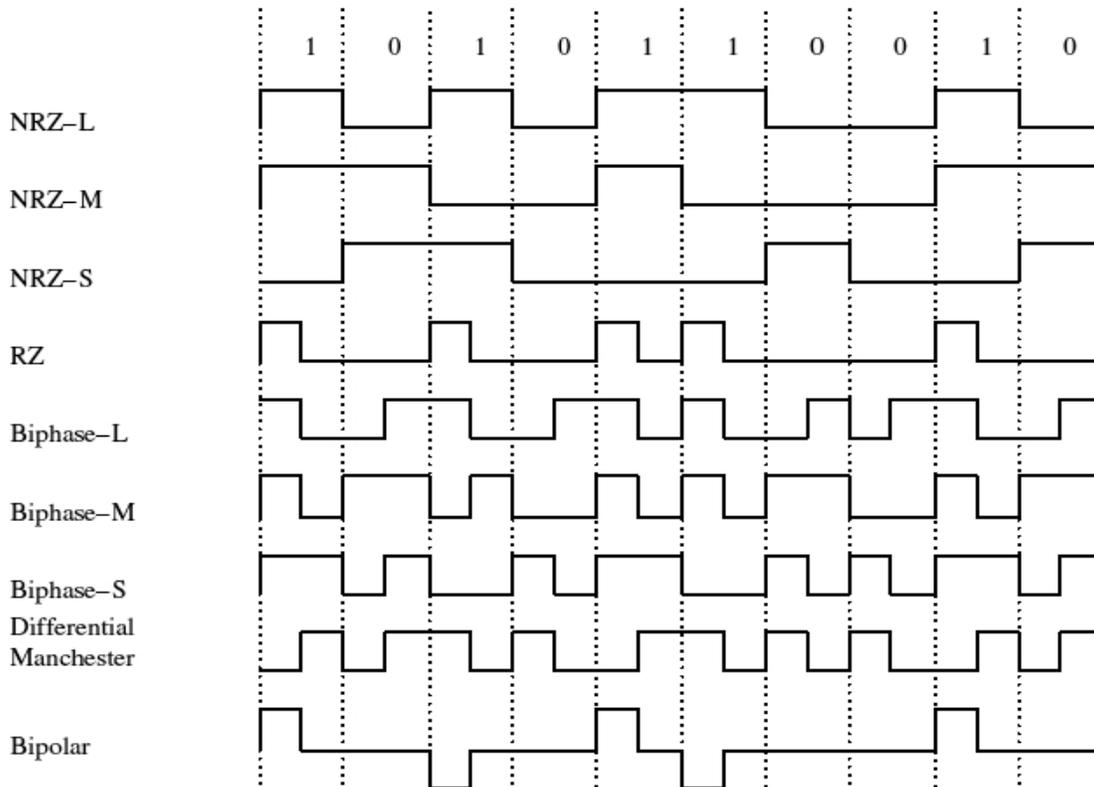
The nature of the information generating source classifies a modulation technique as an analog or digital modulation technique. When analog messages generated from a source pass through a modulator, the resulting amplitude or angle modulation technique is called analog modulation. When digital messages undergo modulation the resulting modulation technique is called digital modulation.

Specific waveforms are required to represent a zero and a one uniquely so that a sequence of bits is coded into electrical pulses. This is known as line coding. There are various ways to accomplish this and the different forms are summarized below.

1. Non-return to zero level (NRZ-L): 1 forces a high while 0 forces a low.
2. Non-return to zero mark (NRZ-M): 1 forces negative and positive transitions while 0 causes no transitions.
3. Non-return to zero space (NRZ-S): 0 forces negative and positive transitions while 1 causes no transitions.
4. Return to zero (RZ): 1 goes high for half a period while 0 remains at zero state.
5. Biphase-L: Manchester 1 forces positive transition while 0 forces negative transition.

In case of consecutive bits of same type a transition occurs in the beginning of the bit period.

6. Biphase-M: There is always a transition in the beginning of a bit interval. 1 forces a transition in the middle of the bit while 0 does nothing.



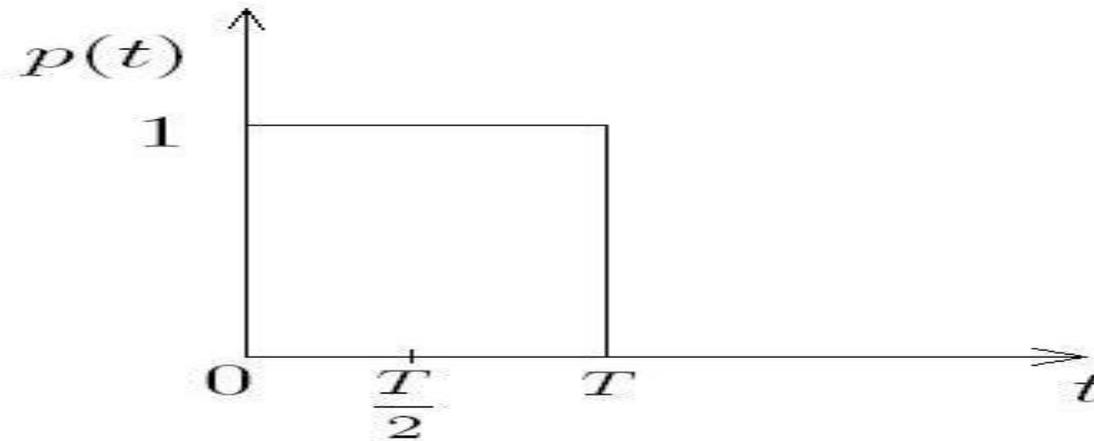
7. Biphas-S: There is always a transition in the beginning of a bit interval. 0 forces a transition in the middle of the bit while 1 does nothing.

8. Differential Manchester: There is always a transition in the middle of a bit interval. 0 forces a transition in the beginning of the bit while 1 does nothing.

9. Bipolar/Alternate mark inversion (AMI): 1 forces a positive or negative pulse for half a bit period and they alternate while 0 does nothing.

### III. PULSE SHAPING

Let us think about a rectangular pulse as defined in BPSK. Such a pulse is not desirable for two fundamental reasons:



(a) the spectrum of a rectangular pulse is infinite in extent. Correspondingly, its frequency content is also infinite. But a wireless channel is bandlimited, means it would introduce signal distortion to such type of pulses,

(b) a wireless channel has memory due to multipath and therefore it introduces ISI.

In order to mitigate the above two effects, an efficient pulse shaping function or a premodulation filter is used at the Tx side so

that QoS can be maintained to the mobile users during communication. This type of technique is called pulse shaping technique. Below, we start with the fundamental works of Nyquist on pulse shaping and subsequently, we would look into another type of pulse shaping technique.

IV. NYQUIST PULSE SHAPING

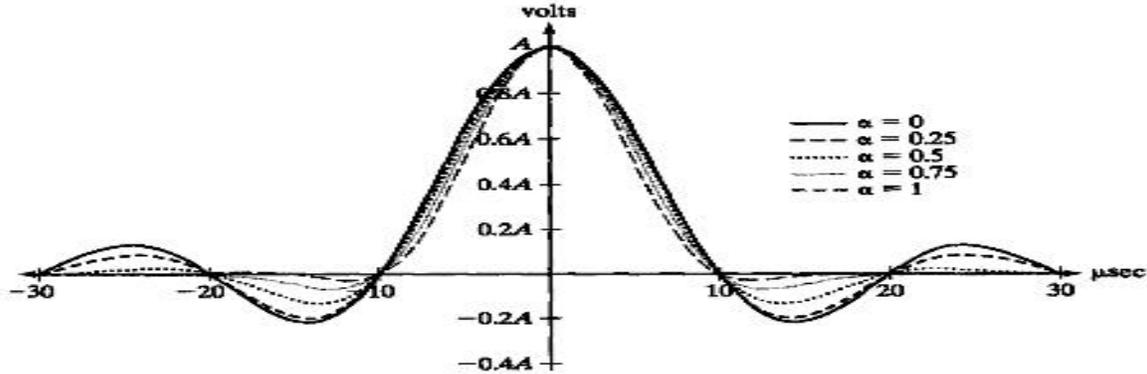
There are a number of well known pulse shaping techniques which are used to simultaneously reduce the inter-symbol effects and the spectral width of a modulated digital signal. We discuss here about the fundamental works of Nyquist. As pulse shaping is difficult to directly manipulate the transmitter spectrum at RF frequencies, spectral shaping is usually done through baseband or IF processing.

Let the overall frequency response of a communication system (the transmitter, channel and receiver) be denoted as  $Heff(f)$  and according to Nyquist it must be given by:

$$Heff(f) = 1/fsrect(f/fs)$$

Hence, the ideal pulse shape for zero ISI, given by  $heff(t)$ , such that,

$$Heff(f) \leftrightarrow heff(t)$$



is given by:  
 $heff(t) = \sin(\pi t/Ts)/\pi tTs$ .

Realization of Pulse Shaping Filters

Since  $heff(t)$  is non-causal, pulse shaping filters are usually truncated within  $\pm 6Ts$  about  $t = 0$  for each symbol. Digital communication systems thus often store several symbols at a time inside the modulator and then clock out a group of symbols by using a look up table that represents discrete time waveforms of stored symbols.

This is the way to realize the pulse shaping filters using real time processors.

Non-Nyquist pulse shaping are also useful, which would be discussed later in this chapter while discussing GMSK.

Advantage

A most advantage to implement this in meter is reduces human effort for getting reading after each generation. Only one can handle it in substation. Daily reading is updated automatically.

Disadvantage

- Only the time of implementation faces some difficulties as:
1. to renew all the existed meters.
  2. to setup a new arrangement in substations etc.

discussed. It should be noted that albeit implementing these efficient modulation techniques, the channel still introduces fading in different ways. In order to prevent that, we need some additional signal processing techniques mainly at the receiver side.

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V. CONCLUSION

A major chunk has been devoted to digital communication systems which obviously have certain distinction in comparison to their analog counterpart due to their signal-space representation. The important modulation techniques for wireless communication such as QPSK, MSK, GMSK were taken up at length. A relatively new modulation technology, OFDM, has also been discussed. Certain practical issues of concern are also



# Effect of Fillers on Di-electric Strength of PTFE Based Composites

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**Abstract-** In the present work, a systematic study on the effect of different fillers namely; glass (f), granite, graphite, garnet, antimony trisulphide, alumina, carbon, marble, mica, sand, porcelain, bronze, tioxlex-25, china clay and wollastonite on di-electric strength property of virgin PTFE and different filled PTFE composites (filler content 5-50%) were made with an idea to arrive at optimum filler content for achieving maximum properties. 5% marble filled PTFE shows the highest di-electric strength value than other filled grades and the lowest di-electric strength shown is 20% in case of graphite filled PTFE as graphite itself is a conductive material.

**Index Terms-** PTFE, fillers, di-electric strength

## I. INTRODUCTION

Poly tetra fluoro ethylene (PTFE) is a highly crystalline, chemically inert plastic and has excellent electrical, insulation and thermal properties. PTFE is resistant to practically every known chemical or solvent and its surface is so slippery that almost no substance would stick to it. Moisture did not make it swell and it did not degrade after long exposure to sunlight and its melting point is 327°C.

PTFE has a wide spectrum of applications – right from the kitchen upto hi – tech purposes: This high profile and versatile engineering plastic is indispensable in areas of defence, space research, nuclear energy, chemical, mechanical, electronic, solar energy and electrical systems. Important electrical properties of PTFE are: PTFE is one of the best insulators known. In thin sections, it will insulate to 5.00 kV / mm. These are specific grades of PTFE which have greater dielectric strength. It is frequently used in wire and cable wrap, and to separate conductive surfaces in capacitors. Thick walled close tolerance extruded tubing is the PTFE shape of choice where machining or drilling long lengths to close tolerances is impossible. Multi hole tubing can be extruded. From PTFE can also be machined into standoff insulators, and it can also be used in different types of high voltage encapsulation devices for electrical components.

Different fillers are incorporated into PTFE to improve its properties like low wear resistance, low thermal conductivity, high elongation, low load bearing capacity, etc., The fillers selected for present work are ceramic, metallic and non-metallic based, namely; glass (f), granite, graphite, garnet, antimony trisulphide, alumina, carbon, marble, mica, sand, porcelain, bronze, tioxlex-25, china clay and wollastonite with filler contents varying from 5 – 50%. The choice and quantity of fillers

to be incorporated into PTFE depends upon specific end applications.

In the present work, an attempt is made to study the effect of filler and filler content on di-electric strength / breakdown voltage.

## II. EXPERIMENTAL METHODS AND PROCEDURE

### 2.1. Selection of raw materials (fillers) and their characterization:

The study is on polytera flouro ethylene (PTFE) used in the filled grades HIFLON 71 grade. The properties of HIFLON 71 and fillers used are;

PTFE (H - 71): HIFLON H-71 is a white fine powder of virgin PTFE grade with an average particle size of approximately 50 microns. It is a non – flowing and lumpy due to very fine particle size. This grade is generally recommended for making various filled grades.

**1. Glass (f) filler:** Glass fiber is the most widely used filler. It improves the creep resistance of PTFE, both at low and high temperatures. It is chemically stable (except to strong alkalis and HF). It has little affect on electrical properties of PTFE and its wear and friction behavior. A known uncommon problem with glass filled PTFE is discoloration of the unfinished parts, in particular, on the inside of the large billets. The glass used in PTFE compound was treated by a proprietary process by certain resin manufactures to reduce this discoloration.

Type: E- glass, Miled fibers, nominal diameter, 13 micron

Appearance: White powder

Nominal length: 0.8mm

Aspect ratio: Min.10

Density: 2.5gm/cc

Particle size: 800 microns

Name of the supplier or source: M/s. Owens Corning fiber glass corporation TELEDO, OHIO

Screen size: 794 micron

Moisture, % w/w: 0.08 maximum

**2.Granite filler:** Granite is coarse- grained igneous rock consisting essentially of quartz (20-40 %) alkali feldspar and mica. They have a high proportion of silica ( 77%) and relatively high soda and potash. It has a low specific gravity (2.7 gm/ cm<sup>2</sup>) and this fact is of great importance in understanding the nature of continental and oceanic surface. Granite and related rocks make up the great bulk of the continental crust. Granite ranges in

colour from light grey to medium grey and pink. The colour of feldspar has the greatest influence on the overall colour of the rock.

Source: Khammam Granite (stone rock) Quarries. Black granite were broken into pieces, crushed and ground in a ball-mill at laboratory of college of technology, OU, Hyderabad, Telangana.

**3.Graphite filler:** Graphite is a crystalline modification of high purity carbon. Graphite filled PTFE has one of the lowest coefficients of friction. It has excellent wear properties, in particular against soft metals, displace high load carrying capability in high speed contact applications and is chemically inert. It is often used in combination with other fillers.

Appearance: Black fine powder, irregular particles

Refuse on sieve: 44 microns

% w/w: 1.0 max

Source: synthetic

Purity: greater than 99 % C, 1.00% ash content

Particle size: < 7.5 m

Density: 2.26 gm/cc

Name of the supplier: M/s. Industrial graphite, Uppal, Hyderabad, Telangana

**4.Garnet filler:** Garnet stones are very hard and whitish in colour with unknown composition.

Source: Garnet stones which are available at University College of technology are used.

**.Antimony trisulphide filler:** Black crystals, orange-red crystals. They are insoluble in water, soluble in conc. HCl and sulphide solutions.

Specific gravity: 4.562

Melting point: 546°C

Derivation: (a) occurs in nature as black crystalline stibnite (b) as precipitated from solutions of salts of antimony trisulphide is an orange-red precipitate, which is filtered, dried and ground.

**6.Alumina filler:** Alumina in a highly pure form is obtained by dehydration of a high grade bauxite after it is purified from iron oxide. It is an excellent electrical insulator and is used to improve mechanical properties of compounds used in high voltage applications. As it is very hard, machining of the sintered part should be avoided whenever possible. Complicated shapes should be made by isostatic moulding

Purity of Alumina: 99.5%

Particle size: < 25 microns

Name of the supplier: Carborandum Universal Limited, Cochin

**7.Carbon filler:** Amorphous carbon is one of the most inert fillers except in oxidizing environments, where glass performs better. Carbon adds to the creep resistance, increases the hardness and raises the thermal conductivity of PTFE. Carbon filled compounds have excellent wear properties, in particular when combined with graphite. The combination of the above properties makes carbon / graphite compounds and the performed material for non- lubricated piston rings. The use of softer carbon has the additional advantage that it lowers tool wear during machining. Thus allowing machining to very close tolerances.

Carbon containing compounds have some electrical conductivity and are therefore antistatic.

Base: Amorphous petroleum coke

Purity: 99%

Particle size: < 75 microns

Density: 1.8 gm/cc

**8.Marble filler:** It is a metamorphic form of calcium carbonate usually containing admixtures of iron and other minerals which impact various colour patterns. Marble chips are often used as source of carbon dioxide in laboratory experiments.

Source: University College of technology, OU, Hyderabad, Telangana. Cured porcelain blocks are crushed and ground in a ball mill at laboratory of College of technology, OU, Hyderabad, Telangana.

**8.Mica filler:** Many of several silicates of varying chemical composition but with similar physical properties and crystal structure. All characteristically cleave into thin sheets, which are flexible and elastic. Synthetic Mica is available which has electrical and mechanical properties superior to those of natural mica, it is also water-free. Mica is soft, translucent solid, non combustible. Heat resistant to 600°C. Colourless to slight red, brown to greenish yellow.

Specific gravity: 2.6 – 3.2

Refractive index: 1.56- 1.60

Di-electric constant: 6.5- 8.7

Hazards (dust): irritant by inhalation, may damage lungs

**9.Sand (Silica/ Silicon dioxide) filler:** Occurs widely in nature as sand, quartz, flint and diatomite. It is colourless crystal or white powder which is odorless and tasteless. Insoluble in water and acids except HF. Soluble in molten alkali when finely divides and amorphous. Combines chemically with most metallic oxides melts to a glass with lowest know coefficient of expansion. It is used in the manufacture of glass, water glass, ceramics, abrasives, water filtration, pharmaceuticals, cosmetics, hydrated and precipitated grades as rubber reinforcing agents including silicone rubber, anticaking agent in food and as thermal insulator. Fused ablative material in rocket engines, space craft etc.

Specific gravity: 2.2- 2.6

Melting point: 1710° C

Boiling point: 2230° C

Hazard: toxic by inhalation, chronic exposure to dust may cause silicosis

Source: Chinnagudem lake (water flow), Nalgonda, Telangana. Washed and dried sand was crushed and ground in a ball mill at laboratory of College of technology, OU, Hyderabad

**11.Porcelian filler:** Potassium aluminum silicate, a mixture of clays, quartz and feldspar usually contain atleast 25% of alumina. Ball and china clays are ordinarily used. A slip or slurry is formed with water to form a plastic, moldable mass which is then glazed and fired to a hard smooth solid. It has high impact strength, impermeable to liquids and gases, resistant to chemicals except HF and hot string caustic solutions, usable upto 1093 ° C but subject to heat shock. It is used in reaction vessels, spark plugs, electrical resistors, electron tubes, corrosion resistant

equipments, ball mills and grinders, food processing equipments, piping, valves, pumps, tower packing, and lab ware.

Specific gravity: 2.41

Compression strength: 100.00kg/cm<sup>2</sup>

Grades: chemical and electrical

Source: University College of technology, OU, Hyderabad, Telangana. Cured porcelian blocks are crushed and ground in a ball mill at laboratory of University College of technology, OU, Hyderabad, Telangana

**12. Bronze filler:** It is an alloy of copper and tin, usually containing 1-10 % tin. Special types contains 5-10 % of Al, fractional % of P as deoxidizer or low % of Silicon. Addition of high % of bronze powder to PTFE results in a compound having high thermal conductivity and better creep resistance than most of the other compounds. Bronze filled PTFE is often used for components in hydraulic systems, but it is not suited for electrical applications and it is attacked by certain chemicals. Bronze has a tendency to oxidize, bronze filled compounds should therefore be used fresh and containers should always be kept closed. Some discoloration of the finished part during the sintering cycle is normal and has no impact on its quality. It is used in spark resistant tools, springs, cosmetics (as powder), electrical hardware, architecture and fine arts.

Appearance: Brown powder

Flow ability: 20/30 sec/ 50gm

Apparent density: 3200- 4800 gm/ml

Refuse on sieve at 63 microns: 0.1 max

Refuse on sieve at 40 microns: 5.0 max

Particle size: < 60 microns

Density: 8.95 gm/cc

Copper % w/w: 88.2- 89.8

Tin % w/w: 8.5-9.5

Zinc % w/w: 1.7-2.3

Phosphorous % w/w: 0.1 max

Others % w/w: 0.5 max

Hazard: powder is flammable

Source: Metal powder Limited, Coimbatore

**13. Tioxlex- 25 filler:** Tioxlex- 25 is a white fine free flowing synthetic hydrated sodium silico aluminate obtained by precipitation.

Drying loss (2hours at 105 °C): 8 max

Ignition loss at 900 °C: 14 max

DOP absorption: 200-270 gm/cc

Specific gravity: 2.0-2.1

Ultimate particle size: approximately 20 microns

Tap density: 0.28 – 0.33 gm/cc

**14. China clay (Kaoline) filler:** A white burning aluminium silicate which due to its great purity has high fusion point and is the most refractory to all clays. Its composition is mainly Kaolinite (40% alumina, 55 % silica + impurities and water). It is white to yellowish or grayish fine powder. It is insoluble in water, dilute acids and alkali hydroxides. It has high lubricity (slipperiness), non-toxic, non combustible. It is used in filler and coatings for paper and rubber, refractories, ceramics, cements, fertilizers, chemicals (especially aluminium sulphate) catalyst carrier, anti caking preparations, cosmetics, insecticides, paint, adsorbent for clarification of liquids and electrical insulators

Occurrence: South eastern US, England, France

Grades: Technical, NF, also graded on basis of colour and particle size

Containers: cartons, paper bags, drums bulk

Specific gravity: 1.8- 2.6

**15. Wollastonite:** It is a natural calcium silicate, available in metamorphic rocks. It is used in fine medium paint grades, ceramics, paint extender, welding rod coat, rubber filler, silica gels, paper coating, filler in plastics, cements, mineral wool, wall board and soil conditioner.

Colour: white to brown, red, grey, yellow.

Mohs hardness: 4.5- 5.0

Specific gravity: 2.8-.2.9

Occurrence: New York, California

Source: Wolkan Limited, Udaypur, Rajasthan



**Photograph 1: Virgin PTFE and different fillers used.**

The fillers are mixed intimately with PTFE in various proportions; percentage of fillers used are 5, 10, 15, 20, 25, 30, 40 and 50 on the basis of weight. Weighed quantity of filled PTFE powder is moulded into a standard bush shape (billet) at room temperature by compression moulding technique. The billets are then sintered at maximum temperature of 375°C following a specific sintering cycle depending on the dimensions (94mm×25mm) of the billet. Di electric strength was measured on the skived tapes veneered out from said sintered billet.

**NOTE:** Tixolex – 25 filled PTFE having more than 25% is not suitable to make billets, and it failed filler stability test (400°C for 45 minutes).

### 2.1. Studies on effect of sintering temperature and moulding pressure on di-electric strength for virgin PTFE and its filled composites:

Constant pressure and temperatures are for virgin PTFE and its filled PTFE composites (5-50%) i.e, 250 kg/cm<sup>2</sup> and 350°C respectively.

### 2.2. Machine used:

Di-electric machine: BIPLEX, ATOCHEM, FRANCE

Type of machine: Electrical balance

Model: AE-160

Accuracy: 0.0001gm ( 0.01 gm/mg)

### 2.3 Testing and characterization of the composites:

**a) Moulding of the billets:** PTFE compression moulds are simple in design. In most of the cases, moulds are cylindrical in shape whose internal surface is smooth and free from scratches and other defects. Moulds are normally made of carbon steel. In case of large scale production, hard chrome plated moulds are recommended. Billet size is 94mm×26mm. A weighed quantity of filled PTFE was taken into the clean and dry stainless steel mould and pressed in between two pusher plates. The lumpy material was sieved with 2mm aperture sieve. The lower plate inside the mould rests on the lower platen of the 150tonnes capacity hydraulic press, while the upper plate, must freely slide within the mould cavity. For pressing the hydraulically operated press is used. It is a vertical hydraulic type having sufficient daylight since PTFE powder has a compression ratio of upto 4:1. The closer speed of the press is also critical to avoid air tapping in the mould. Initially, the mould is rested over a support. The material was poured into the mould. Then the support is removed and placed on the mould. After placing the top pusher, the powder was pressed (as per recommended pressure) in the hydraulic press at a speed of 2mm/sec. Spacer bar was removed after applying the 100kg/cm<sup>2</sup> pressure to the mould for 2 minutes. This material was compressed at 500 kg/cm<sup>2</sup> pressure, pressure rise time is 5 minutes and holding for 5 minutes. The pressure

was released within 2 minutes. The pressed PTFE block called preform (green block) is removed slowly from the mould. The preform is brittle. Hence, handling of the preform should be done carefully. Final stage in the moulding process is the ejection of the preformed part from the mould. Preform ejection from the mould was carried out in one smooth continuous stroke at a speed of 3.5mm/sec

**Calculations:**

$$P_1 S_1 = P_2 S_2$$

$$P_1 = P_2 S_2 / S_1$$

$P_1$  = Recommended pressure as per grade given

$P_2$  = Pressure to be given

$S_1$  = Moulding area

$S_2$  = Ram area

$$S_1 = D^2$$

$$\text{Billet weight} = C/A \times \text{Density} \times \text{Height}$$

**b) Sintering of the billets:** The billet which was taken from mould is now placed in free air circulation oven for sintering. The oven started for sintering. During this process, the PTFE in filled PTFE melts (softness) and coalesces and adhesion bonds will be produced in between PTFE particles and filled particles, which makes the billet rigid. After cooling to room temperature the billet was taken out for doing various tests.

**c) Skiving of the billets:** Skiving of the billet was done on the skiving machine. For this purpose special arrangement was done. This arrangement consists a low rpm motor with spring loaded drum on to which tapes will be wound during skiving operation. For the experiment purpose of dielectric strength, 0.1mm thickness tape has been made.



**Photograph2: Virgin PTFE and its filled composite billets- before and after sintering including skiving tapes.**

**2.5. Test procedure of machines and calculations:**

**Determination of di-electric strength:**

For determining the di-electric strength, 0.5mm thickness tapes are skived from the billet and these are conditioned at 23° C for 24 hours before testing its breakdown voltage. For this required. The measurement consists of applying an increasing A.C electric field across two standardized electrodes in which the sample tape is tightly gripped and the voltage at which breakdown results was then noted only HIFLON 71 grade and only 0.1mm tapes were specified for testing breakdown voltage / di-electric strength according to ASTM standard \*D 149 volume- 8.01 (these specification recommends very fine particle size of PTFE. Particle size of HIFLON 71 satisfy this requirement of ASTM standard). As per the requirement of ASTM standard, 0.1mm thickness virgin PTFE and 15 % glass, granite, garnet, graphite, antimony trisulphide, alumina, carbon, marble, mica, porcelain, sand, bronze and wollastonite filled PTFE tapes were made and subjected to breakdown voltage test. Three consecutive tests were carried out for each sample and average breakdown voltage is taken to calculate the dielectric strength.

**III. RESULTS AND DISCUSSIONS**

**3.1. Physical observation on billets of filled PTFE (5 – 50%) composites (before and after sintering & skiving ) at constant temperature (375° C) and pressure (250 kg / cm<sup>2</sup>):**

**1. Glass(f) filled PTFE:** Before sintering, all performed billets are smooth and shining with off white colour. There are no cracks and bulging on their surface. Roughness and off white colour were observed for all the percentages (5 – 50%) in increasing order. Cracks in 50% glass filled PTFE may be due to improper mixing of filler in PTFE. From 5 to 40% filled PTFE, the tape is smooth. The smoothness decreases with increasing filler content.

**2. Granite filled PTFE:** The colour of granite powder is black. Before sintering, the billet colour is cement gray for 5 to 50% filler content. After sintering, the roughness increased with increasing filler content. There were no cracks observed before and after sintering for 5 – 50% granite filled PTFE. But while skiving the tape, the billets of 40 and 50% filled PTFE got damaged and this may be due to poor bonding between filler and PTFE.

**3. Graphite filled PTFE:** Billets from 5 – 50% showed no cracks and no bulging is noticed before sintering and shining

surface is seen on their part. But after sintering, all billets become rough on surfaces with black colour as filler percentage increased. 50% graphite filled PTFE billet got damaged while skiving and inserting the rod for making tape.

**4. Garnet filled PTFE:** Before sintering, 5 – 50% garnet filled PTFE billet shows colour changes from light gray as percentage of filler increases. After sintering, the colour is light chocolate to dark chocolate as filler content increases. For 50% filled PTFE, the billet got damaged while skiving the tape. The roughness also increases as increases as percentage of filler increases.

**5. Antimony tri sulphide filled PTFE:** 5 to 50% antimony tri sulphide filled PTFE billets were made with shining surface before sintering but after sintering 25 to 40% billets developed cracks on diameter side and 50% billet got damaged while skiving the tape. Shining surface was observed after sintering also.

**6. Alumina filled PTFE:** Before and after sintering, there are no cracks and no bulging for alumina filled PTFE billet. The colour of alumina filled PTFE billet has gradually increased from white to off white as percentage of filler content increased. Roughness is found in increasing order from 5 to 50% on surfaces of alumina filled PTFE ( after sintering ) billets.

**7. Marble filled PTFE:** Before sintering the billet colour is very bright, whitish like PTFE upto 15%. From 20 to 50 % off white colour is observed with increases in filler content. No cracks and no bulging took place before sintering. After sintering 5 to 10% the colour of the billet is off white. 15 to 50% billet colour is stonish (cement). For 30 and 40% marble filled PTFE, visible bulging and multiple cracks were developed on the surface.

**8. Mica filled PTFE:** With 5 to 20% mica filled PTFE, billets could be made. However, for percentage above 20%, we could not make billet due to very fine particle size of mica powder. Before and after sintering for 5 to 20% mica filled PTFE, cracks and bulging are not observed. As percentage of filler increases, the colour of the billet has changed from light colour to off white colour.

**9. Sand filled PTFE:** Before sintering, the billet colour is light ash to dark ash as 5 of filler increases. After sintering at 375<sup>0</sup>C for 14 hours sintering cycle, the colour of the billets vary from light brownish to dark brownish as filler content increases.

**10. Bronze filled PTFE:** The colour of the pre sintered billet varies from brown to chocolate brown with increase in percentage of filler content. After sintering also there is no

change in colour but roughness has developed like other filled PTFE billets. No cracks and no bulging were observed before and after sintering at 375<sup>0</sup>C for 14 hours sintering cycle.

**11. China clay filled PTFE:** For 5% china clay filled PTFE, the billet has no cracks and bulging before sintering and after sintering. The colour of the billet is white before and after sintering. For 10% china clay filled PTFE, the single crack was observed on the surface. But for 15% filled PTFE, multiple cracks were observed before sintering. Billet got into two pieces before sintering for 20% china clay filled PTFE and from 25 to 50% filled PTFE, there was no billet formation. This may be due to particle size of china clay being below 25 microns and hence not compatible to PTFE (~ 60 microns).

**3.2. Report on Di – electric strength of 5 – 50 % filled grades PTFE:**

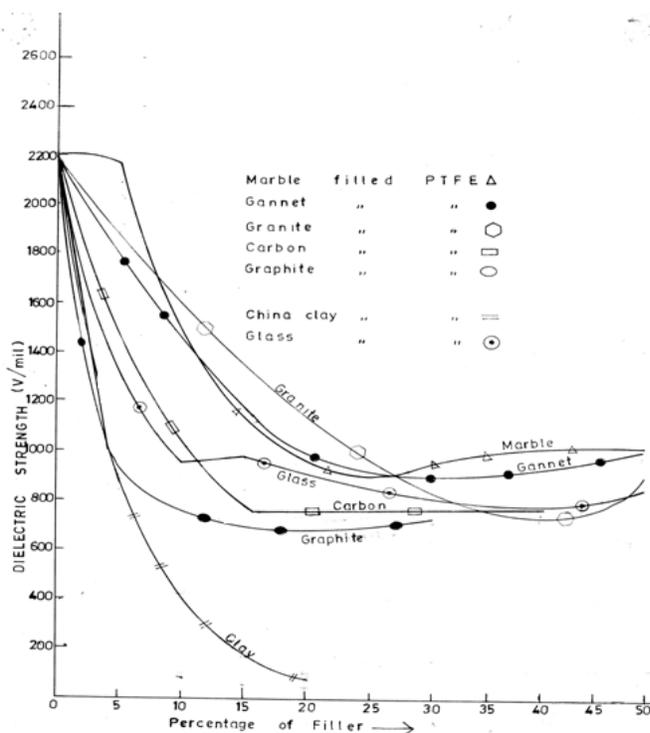
Fig. 1 (a, b, c) and Table 1 shows the di – electric strength of filled PTFE. It is a measure of the ability of the material to hold energy at high voltage; di – electric strength is voltage per unit length at which failure occurs if the di – electric strength exceeded, the di – electric material begins to break down and the passage of current ( electronic ) occurs. Break down voltage of skived tape (0.1mm thick) was measured following ASTM standard D 149 Vol. – 8.01; Di – electric strength values were calculated from the break down voltage (BDV) value. In this study, filler content of 5 – 50% was used in PTFE for all the fillers (glass, graphite etc.) . Di – electric strength study was done against pressure variation, keeping temperature constant ( 375<sup>0</sup>C), and against temperature variation, keeping pressure constant (250 kg / cm<sup>2</sup>). The effect of filler and its content on di – electric are shown in Fig. 1 ( a, b, c ). In case of glass(f), granite, marble, antimony tri sulphide and alumina filled PTFE, di – electric strength decreased with increase in filler content upto 40 % for glass, granite, alumina and antimony tri sulphide; and 25% for marble filled PTFE. Thereafter di electric strength started increasing with further increase in filler content. Maximim di electric strength value ( 21.844 kV /mm) was found with 5% marble filled PTFE and minimum di electric strength value of 7.11200 kV / mm was observed in case of 20% graphite filled PTFE respectively; whereas, in case of bronze, porcelain filled PTFE, di – electric strength decreased with increase in filler content upto certain percentage (25%, 20%). Thereafter di electric strength started increasing in cases of mica, wollastonite, sand etc., and then decreased with increase in filler content.

Sl. No.	% of Filler Content	Dielectric Strength (V/Mil) of						
		Glass filled PTFE	Granite filled PTFE	Graphite filled PTFE	Garnet filled PTFE	Alumina filled PTFE	AntimonyTr isul-phide filled PTFE	Carbon filled PTFE
01.	5	1117.600	1625.600	795.000	1930.400	1854.200	2014.900	947.420
02	10	931.164	1201.400	790.000	1524.000	1016.000	1303.800	863.600
03	15	990.000	1117.600	736.600	1143.000	990.600	1247.400	769.600
04	20	887.500	990.600	711.200	878.840	977.900	1099.800	740.000
05	25	871.900	965.200	711.200	914.400	939.800	985.500	720.000
06	30	850.900	863.600	711.200	926.600	889.000	947.400	720.000
07	40	845.800	726.440	-	939.800	850.900	762.000	720.000
08	50	863.000	853.440	-	980.440	956.600	812.800	-

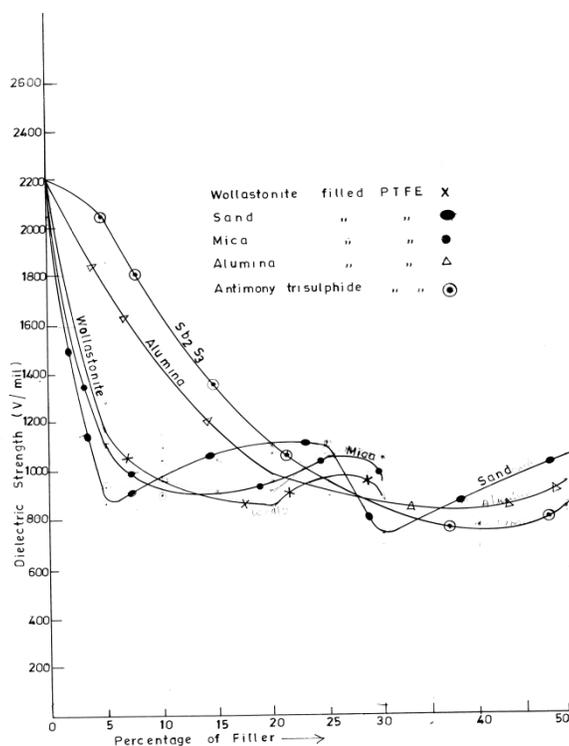
Sl No.	% of filler con-tent	Marble filled PTFE	Mica filled PTFE	Sand filled PTFE	Bronze filled PTFE	Wollastonite filled PTFE	Porcelain filled PTFE	China Clay filled PTFE
01	5	2184.400	1108.960	863.600	1964.200	931.200	1270.000	914.400
02	10	1625.600	897.400	914.800	1278.400	956.600	1150.600	-
03	15	1134.500	939.800	1005.800	1028.700	905.800	1041.400	-
04	20	999.060	905.800	1016.000	947.600	922.800	878.800	-
05	25	846.600	1066.800	1049.000	896.600	998.200	1066.800	-
06	30	914.400	939.800	751.800	965.200	876.300	1031.200	-
07	40	948.200	-	863.600	845.820	-	795.200	-
08	50	982.200	-	1023.600	812.800	-	795.200	-

Dielectric Strength of Virgin PTFE – 2200 V/Mil.

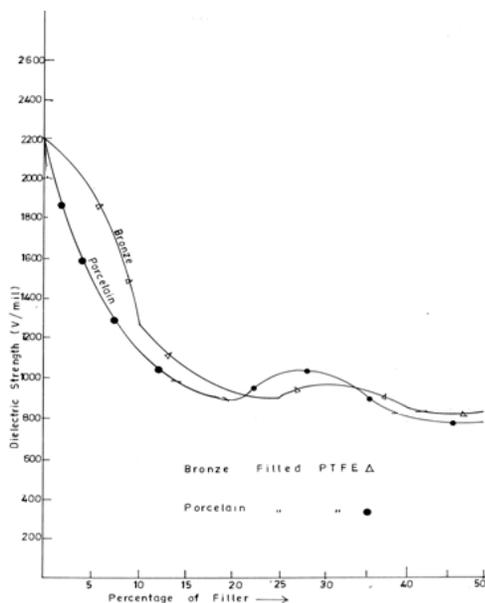
**Table: 1:- Di electric strength (kV /mm) values of glass(f), graphite, garnet, alumina, antimony tri sulphide, carbon, marble, china clay, porcelain, sand, bronze and wollastonite filled PTFE at different filler content.**



**Fig.1 (a): Di-electric strength vs % of filled PTFE composites**



**Fig.1 (b): Di-electric strength vs % of filled PTFE composites**



**Fig.1 (c): Di-electric strength vs % of filled PTFE composites**

IV. CONCLUSION

In the present study, an attempt is made to check billet formation and electrical property like di electric strength of glass(f), granite, graphite, garnet, antimony tri sulphide, alumina, carbon, marble, mica, sand, porcelain, bronze, tixolex – 25, china clay and wollastonite filled PTFE as a detailed study.

In all the cases, there is no significant weight change / loss within the testing temperature range of 25 to 400<sup>0</sup>C ; both PTFE and fillers are quite stable . Thermal stability of the fillers upto

375<sup>0</sup>C is very much essential for making a good quality moulded filled composites.

However, Tixolex – 25 cannot be used as filler in filled PTFE as it failed in filler stability test (400<sup>0</sup>C).

5% marble filled PTFE shows the highest di-electric strength value than other filled grades and the lowest di-electric strength shown is 20% in case of graphite filled PTFE as graphite itself is a conductive material.

#### ACKNOWLEDGEMENTS

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# Classification and Summarization on rating of Mobiles features

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**Abstract-** The rise of Social Media such as E- Commerce and social networks has interest in sentiment analysis. With the rapid increase of reviews, ratings, recommendations and other forms of online expression, online opinion is nothing but virtual currency for businesses looking to market their products, identify new opportunities and manage their reputations. Opinions of product express the ideas, interests and emotions about particular product for the world. With the increasing use of internet sources for all needs of life and peoples choices on how to send their life around computers new organizations on the web such as online networks, forums important source of and blogs are the new meeting point for the people. The difficulty comes out by the personalized design and the size of the blogosphere; every blog has a different structure which prevents us to find the information or related data with several tracking from one to another the Aim of this paper is to create an analysis framework using web mining principles on opinion mining application to grab people's opinions and emotions about recent mobile from contents of website addition to this, we also introduce an architecture, implementation, and evaluation of a web mining application called the Opinion mining, which will extracts classifies people's opinions & emotions about mobile reviews.

**Index Terms-** Mining, Blog mining, SentiWords, SVM

## I. INTRODUCTION

With the evolution of web technology, user uses the data which is present on the internet in huge amounts. Users use the available resources in the web, and give their feedback, which generate additional useful information. Due to large amount of user's opinions, views, feedback and suggestions available through the web resources, it's very necessary to explore, analyze and organize users views for better decision making.

Opinion mining is a latest study in the part of Text Mining (TM) that has been specific by different conditions like sentiment analysis, subjectivity analysis, or sentiment Orientation. Sentiment classification can be considered as a binary-classification process in traditional period [1]

Opinion Mining or Sentiment Analysis is a Natural Language Processing and Information Extraction task that identifies the user's or opinions explained in the form of positive, negative comments.

Current-day Opinion Mining and Sentiment Analysis is a study of Information Retrieval (IR) and Natural Language Processing (NLP) and share some characteristics with other disciplines such as text mining and Information Extraction.

Opinion mining is a technique to detect and extract subjective information in text documents. In general, sentiment analysis tries to determine the sentiment of a writer about some aspect or the overall contextual polarity of a document. The sentiment may be his or her judgment, mood or evaluation. A key problem in this area is sentiment classification, where a document is labeled as a positive or negative evaluation of a target object (film, book, product like mobiles etc.).

Opinion mining is not only useful for clients, but also helps organizations to evaluate opinions and behavior of clients towards their corporation and its product. Opinion Mining or Sentiment Analysis is a Natural Language Processing and Information Extraction task that identifies the user's views or opinions explained in the form of positive, negative or neutral comments and quotes underlying the text.

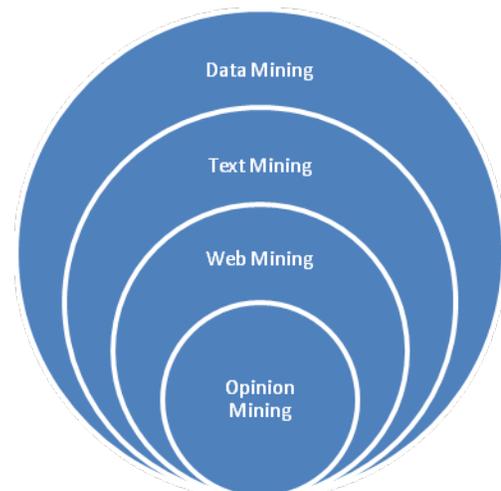


Fig 1: Hierarchy of Data Mining

There are two main types of textual information on the Web.

1. Facts
2. Opinions

Current search engines search for facts. Facts can be expressed with topic keywords.

Search engines do not search for opinions. Opinions are hard to express with a few keywords

Example:

How do people think of Motorola Cell phones?

Current search ranking strategy is not appropriate for opinion retrieval/search.

user generated content  
Word-of-mouth on the Web

One can express personal experiences and opinions on almost anything, at review sites, forums, discussion groups, blogs ... (called the user generated content.)

They contain valuable information

Web/global scale: No longer – possible only in one's circle of friends

Our interest: to mine opinions (sentiments) expressed in the user-generated content

An intellectually is very challenging problem, but practically useful.

### Two types of evaluation

Direct Opinions: sentiment expressions on some entities, e.g., products, events, topics, persons.

E.g., "the picture quality of this camera is great"

Subjective

Comparisons: relations expressing similarities or differences of more than one entity. Usually expressing an ordering.

E.g., "car A is cheaper than car B."

Objective or subjective.

We will evaluate mobile phones using regular opinions.

Search Options

Ranking: produce two rankings

Positive opinions and negative opinions

Some kind of summary of both, e.g., # of each

Or, one ranking but

The top (say 30) reviews should reflect the natural distribution of all reviews (assume that there is no spam), i.e., with the right balance of positive and negative reviews.

We have applied an opinion mining approach to summarize the unstructured and ungrammatical users' reviews, based on Support Vector Machine (SVM) and Sentiment analysis using sentiwordnet.

Two levels of classification are applied:

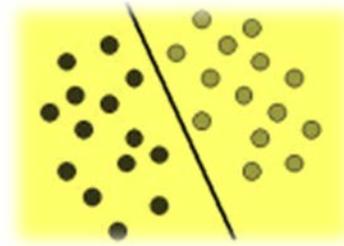
Features classification and

Polarity classification for every feature class

### Support Vector Machine (SVM)

SVMs are a new technique used for binary classification.

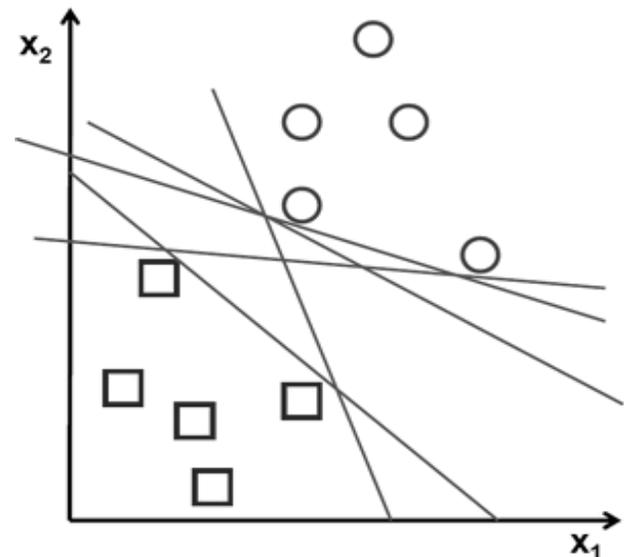
Support Vector Machines is discriminative classifiers which uses the decision planes concept define decision boundaries. A decision plane separates a set of objects having different class memberships. A diagrammatic example is shown below. In this, the objects belong either two class GRAY or BLACK. The separating line defines a boundary on the right side of which all objects are GRAY and to the left of which all objects are BLACK. Any new object (white circle) falling to the right is labeled, i.e., classified, as GRAY



A Support Vector Machine (SVM) is a discriminative classifier defined by a separating hyperplane, given labeled training data the algorithm outputs an optimal hyperplane which classify new examples.

In which sense is the hyperplane obtained optimal? Let's consider the following simple problem:

For a linearly separable set of 2D-points which belong to one of two classes, find a separating straight line.

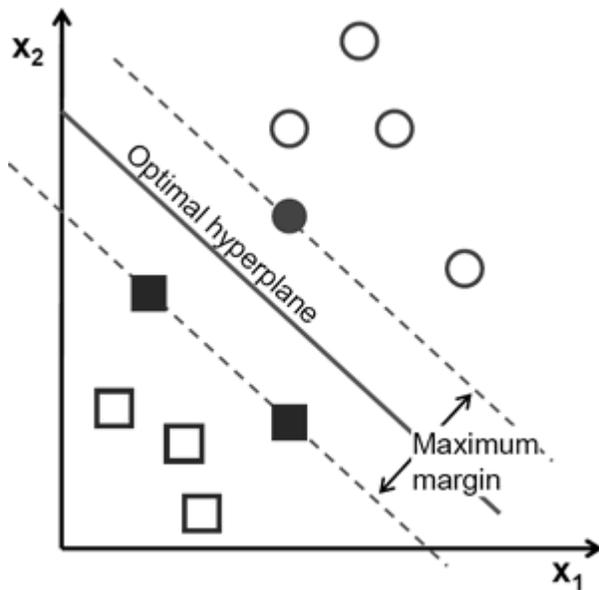


In the above diagram there exists multiple lines which gives a solution to the problem. Is any of them better than the others?

We can define a criterion to estimate the worth of the lines:

A line is not good if it passes too close to the points because it will be noise sensitive and not generalize correctly. So, our goal should be to find the line passing as far as possible from all points.

Then, the operation of the SVM algorithm is based on the hyperplane that gives the largest minimum distance to the training examples. Twice, this distance receives the important name of margin within SVM's theory. Therefore, the optimal separating hyperplane maximizes the margin of the training data.



### Advantages of SVM

- Effective in high dimensional spaces.
- Useful in cases where number of dimensions is greater than the number of samples.
- Uses a subset of training points in the decision function (called support vectors), so it is also memory efficient.
- Versatile: different [Kernel functions](#) can be specified for the decision function. Common kernels are provided, but it is also possible to specify custom kernels.
- SVM gives unique solution, since the optimality problem is convex. This is an advantage compared to Neural Networks, which have multiple solutions associated with local minima

### Sentiwordnet

The aim of SentiWordNet is to provide an extension for wordnet, such that all synset can be associate with a value concerning the negative, positive and objective connections. SentiWordNet 3.0 is improved version of 1.0

SentiWordNet is a lexical resource for opinion mining. SentiWordNet is a large database use in opinion mining. SentiWordNet allotted to each synset of WordNet three sentiment numerical scores positivity, negativity and objectivity, describing how Positive, Negative and Objective the terms contained in the synset are. Range of each score is from 0.0 to 1.0 and sum is 1.0 for each synset. It means that a synset may have nonzero scores for all the three categories, which indicate that the corresponding terms have, in the sense indicated by the synset, each of the three opinion related properties only to a certain degree. The entries contain the parts of speech category of the displayed entry, its positivity, negativity, and synonyms

### Summarization of mobile reviews

Customers opinion about the product is consider by feature based summarization. Product features and opinion words are important in feature based summarization.

We have implemented Aspect-Based Opinion Summary.  
Example:

I bought Samsung mobile. It was nice phone. The touch screen was too good. The quality of voice was clear. Battery life was not long, that is ok. However, my friend was mad with me as I did not tell him before I bought the phone. He also thought the phone was too expensive, and wanted me to return it to the shop. ...”

Aspect Based Summary is as follows

#### Aspect1: Touch screen

The touch screen was too good.

The touch screen was so easy to use and can do amazing things.

The screen is easily scratched.

Difficulty in removing finger marks from the touch screen.

#### Aspect2: Battery

The battery life was not long

The aspects are the features of Mobile phones.

At the aspect level:

Level 1 (entity extraction and grouping):

Extract all entity expressions, and group synonymous entity expressions into entity clusters. Each cluster indicates a unique entity  $e_i$ .

Level 2 (aspect extraction and grouping): Extract all aspect expressions of the entities, and group synonymous aspect expressions into clusters. Each aspect expression cluster of entity  $e_i$  indicates a unique aspect  $a_{ij}$ .

Level 3 (opinion holder and time extraction): Extract these pieces of information from the text or structured data.

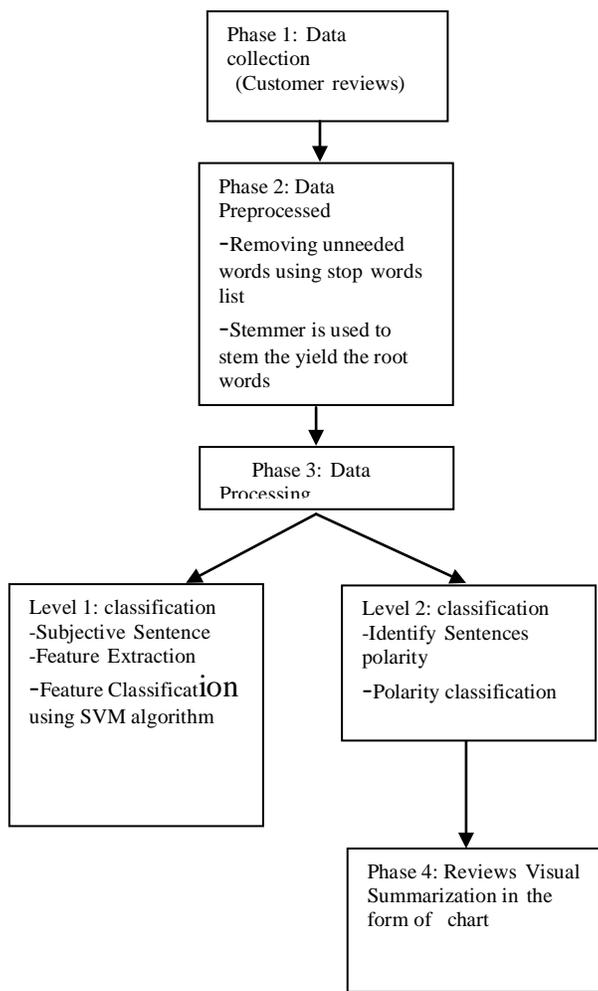
Level 4 (aspect sentiment classification): Determine whether each opinion on an aspect is positive, negative or neutral.

Level 5 (opinion quintuple generation): Produce all opinion quintuples ( $e_i, a_{ij}, o_{ijkl}, h_k, t_l$ ) expressed in D.

## II. PROPOSED SYSTEM

- The proposed system is used to provide an interface to the user to state views or opinions in the form of positive, negative or neutral comments of mobiles.
- Classification of the reviews will be performed using binary SVM algorithm.
- The system will summarize the reviews (including positive reviews and negative reviews) and provide the user an overview about the reviews.
- Mobile-review summarization is similar to customer review that focuses on product feature. This summarization task is different from traditional text summarization because it will mine the features of the product on which the customers have expressed their opinions and whether the opinions are positive or negative. Latent Semantic analysis will be performed for review summarization in which features will be extracted from the reviews. Particle swarm algorithm will be used in the summarization based on semantic and linguistic features.

- e. During review summarization at the feature level, feature-opinion pairs are extracted from review documents using part-of-speech (POS) tagging. Through the POS tagging, the most frequent noun words that describe the feature within the set of reviews are selected. Wordnet will be used to identify the POS.



**Fig 3. Proposed system**

**Phase 1: Data Collection (Customer Reviews)**

Customer reviews for the product are taken through the UI of the system.

Also the system uses the customer’s feedback of mobile phones from the websites like amazon.com and ebay.com.

**Phase 2: Data preprocessed**

Collected reviews are pre processed by the stop words.

To perform the stemming of the words to return its root word to easily extract features and identify polarity.

**Phase 3: Data processing:**

This process consists of two main sub phases as following:

Level 1 Classification: This consists of three parts as follows:

Subjective sentences: As a result of the second phase, each review is split into sentences by using comma, full stop and exclamation mark as sentences splitter. Then, sentences, which talk explicitly about at least one feature on the product, are obtained.

Feature extraction: Features are extracted from the sentences.

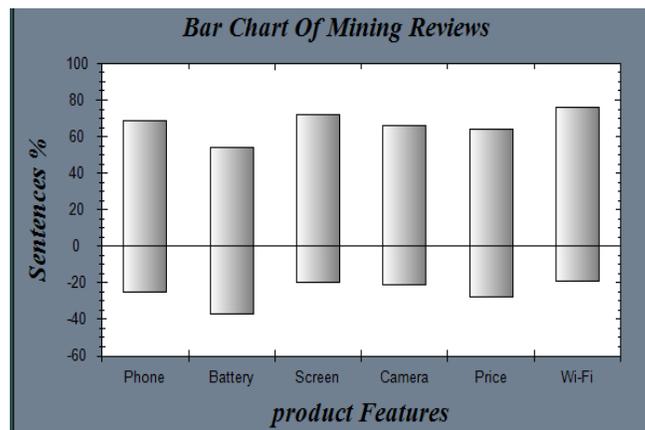
Feature classification: reviews are classified using SVM algorithm

Level 2 classification: consists of two parts as follows:

Identify Sentences polarity: inside the class of each feature, the mining system classifies the sentences into two classes (Positive and Negative) according to the polarity of the sentence. Classify each product features based on number of positive and negative sentences.

Feature	Features Polarity	
	Pos.	Neg.
Phone	222	81
Battery	19	13
Screen	18	5
Camera	43	14
Price	16	7
Wi-Fi	20	5

**Phase 4: Reviews Visual Summarization:** In order to generate a summary of the customer reviews mobile phones product, the system produces a visual summary based on the features of the product and the polarity (Positive and Negative) of the sentences.



**Fig.4 : Result of Sentiment v/s SVM**

III. CONCLUSION

An opinion mining system is developed using software which is able to extract knowledge from examples in a database and create new data to improve performance over time. The process can be as simple as learning a list of positive and negative words, or as complicated as conducting parsing of the data in order to understand the grammar and sentence structure

used. Specially mobile related websites which has become the major source of the information, the mobile user often overwhelmed with the information.

In this study, an opinion mining applications are introduced that is created for calculating positive or negative scores from user reviews. Unsupervised SVM approach used to calculate the mobile review for the future study and want to improve this application for the Sentiment Mining with the extra feature of the Spell Check which further improve the accuracy and performance of the mining.

#### ACKNOWLEDGMENT

I would like to take the opportunity to express our heartfelt gratitude to the people whose help and co-ordination has made this project a success. I thank Prof. Sanjivani Deokar for knowledge, guidance and co-operation in the process of making this project.

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We are also grateful to the library staff of Lokmanya Tilak College of Engineering for the numerous books, magazines made available for handy reference and use of internet facility. Lastly, we are also indebted to all those who have indirectly contributed in making this project successfully.

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# Study on seed coat of some *Vigna* species following scanning electron microscopy (SEM)

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**Abstract-** Variation in spermoderm features along with macromorphological characters of eighteen wild and cultivated genotypes of *Vigna* were studied by scanning electron microscopy (SEM). On the basis of wax deposition, seed surface type is grouped in four groups. It is observed that though there were differences in seed coat colour and seed size in the wild progenitors of *Vigna* but the pattern of wax deposition on the seed coat is similar type.

**Index Terms-** Mungbean, Scanning electron microscopy (SEM), Seedcoat, Seedsurface, Spermoderm, *Vigna*, Wax deposition

Eighteen different genotypes of *Vigna* (Table-I) varying in seed size, colour and texture were used as experimental materials for SEM study. The genotypes were collected from different places of India. The seeds were treated with glycerol : acetone (2:1) in osmium tetroxide. The treated seeds were dehydrated in a series of ethanol and coated with gold. Seed surface observation were taken through Scanning Electron Microscopy (Make: Carl Zeiss, SBF-SEM SIGMA 3View) under different magnification at 20KV. Seed size, shape, colour, dry seed weight and seedcoat types were observed for the genus *Vigna* subgenus *Ceratotropis* separately for each genotypes.

## I. INTRODUCTION

The subgenus *Ceratotropis* of the genus *Vigna* comprises of five important Asiatic pulses; mungbean (*V. radiata* (L) Wilczek), blackgram (*V. mungo* (L) Hepper), mothbean (*V. aconitifolia* (Jacq) Marechal), ricebean (*V. umbellata* (Thunb) Ohwi and Ohashi) and adzukibean (*V. angularis*). Among these mungbean and blackgram are major beans from ancient time in Asia.

*Vigna* is native to India-Burma region of Asia and has been grown in India since ancient times. Principally it is protein rich crop and an important source of high calories next to cereal crops. At present mungbean is cultivated worldwide because of its easy digestibility than blackgram.

External seed morphology is one of the important taxonomic characters. Though illustrations on seed surface of the genus *Vigna* is represented before but little such work has been done through scanning electron microscopic study (SEM) of seed surface. Gonzales-Andres and Ortiz [1], Lopez *et al.* [2] worked on seedcoat surface of Leguminosae using SEM. Gunn [3] has summarized the major seed characters of Leguminosae. In *Vigna* seed coat is generally smooth and patterned type. Hilum plays an important role in seed morphology. Pithy pods are formed which completely obscures the central position of hilum [4] as dense mass of white tissue at hilum remains behind. SEM of spermoderm was found to be useful in establishing taxonomic and phylogenetic relationship in the Indian species of *Vigna*. In the present investigation an attempt has been made to characterize seed coat on different species of *Vigna* based on scanning electron microscopy (SEM).

## II. MATERIALS AND METHODS

Spermoderm features, hilum structure and cellular structure of seed coat of wild and cultivated species of the genus *Vigna* were studied using scanning electron microscopy (SEM).

## III. RESULTS AND DISCUSSION

The macromorphological variability of seeds including size, shape, colour and spermoderm features of different species of *Vigna* were studied and summarized in Table –II. Remarkable variation was found among these species. SEM study of seed coat was found to be very useful in establishing phylogenetic relationship among the species of *Vigna*.

**Seed colour:** The seeds of *Vigna radiata* var *sublobata* (2/2) were blackish green and *Vigna radiata* var *sublobata* (18A) were green in colour. The two other wild species of *Vigna* namely *Vigna radiata* var *setulosa* (2) and *Vigna radiata* var *setulosa* (4) showed black seedcoat colour. The colour of seedcoat of wild cowpea was black whereas that of cultivated species is yellow with smooth and shiny surface. The seed surface texture of accessions of *V. aconitifolia* were rough with green coloured seed coat. Seeds of *V. minima* blackish green in colour with shiny texture whereas in seeds of *V. umbellata* were yellow, bold, smooth and shiny.

**Seed size:** The seed size ranges from 1mm to 3.5mm. The seed size of *Vigna radiata* var *setulosa* were small in size as compared to *Vigna radiata* var *sublobata*. The seed size of *V. aconitifolia* were very small around 0.3cm and non-hairy in nature. The hilum is large and exposed. The seed size of *Vigna mungo* var *silvestris*-10 (wild) is small with hardy seedcoat and prominent hilum compared to *Vigna mungo* (T9) which is cultivated type with large, shiny and varigated seedcoat. The two other genotypes namely *V. minima* and *V. umbellata* depicted similarity on seed coat sculpturing pattern i.e. maculo-reticulate type sculpturing with minutely longitudinal reticulate-striae with varied shapes and sizes of the meshes. Seeds of *V. minima* were minute in size. The seeds of *V. trilobata* were blackish green in colour with hard seed coat and prominent hilum

**Seed shape:** The cultivated species of *Vigna radiata* exhibited oval shaped seed along with their progenitor *Vigna radiata* var *sublobata*. The seeds of two accessions of *Vigna*

*radiata* var *setulosa*, *V. aconitifolia* and *Vigna hainiana* were found square and hardy in nature. Both wild and cultivated species of *Vigna unguiculata* showed reniform shaped seed which is unique among the studied materials.

**Seed coat ornamentation:** Through SEM study distinctive sculpturing pattern of seed coat due to various types of wax deposition over the seedcoat in different genotypes is observed. High diversity is found in sculpturing pattern on seedcoat among different species. The wild cultivars have thick deposition compared to cultivated ones. Based on the ornamentation pattern and structure of epidermal cells of the seedcoat, particularly the arrangement of the cells and the extent of elevation of the anticlinal cell walls, four morphological types could be distinguished, viz. reticulate, punctulate, rugose and captor-ridged. The captor-ridged type is unique, occurring in only one species. Punctulate type is also uncommon occurring only in two members. The other two types were common. Reticulate type could be further divided into subdivisions according to the arrangement of the epidermal cells of the seedcoat. Spermoderm features of these genotypes were shown in Table- II.

*Vigna sublobata* is a polymorphic taxon [5]. It had two distinct morphological groups *Vigna radiata* var *sublobata* and *Vigna radiata* var *setulosa*. These were wild progenitors of cultivated mungbean. During the study of sculpturing pattern of the seedcoat of the two accessions of these genotypes namely *Vigna radiata* var *sublobata* and *Vigna radiata* var *setulosa* it is found that despite of differences in seed coat colour and seed size, pattern of wax deposition on the seed coat is similar type i.e. maculo reticulate. Though the cultivated species of mungbean (*V. radiata*) also exhibited same type of seedcoat pattern but their wax deposition is much less or thin than that of the wild genotypes. The ornamentation pattern of seed coat of different genotypes of cultivated species of *Vigna radiata* is typically maculo reticulate type (Table-II).

Similarly the sculpturing pattern on seed coat surface of both wild and cultivated species of cowpea (*V. unguiculata*) is maculo-reticulate type.

The genotypes namely *V. minima*, *V. trichuriensis* and *V. umbellata* depicted similarity on seed coat sculpturing pattern. All of these have maculo-reticulate type sculpturing with minute longitudinal reticulate-striae with varied shapes and sizes of the meshes.

Among the two genotypes of *V. mungo* studied *Vigna mungo* var *silvestris*-10 is wild type and *Vigna mungo* (T9) is cultivated type. The interesting point is that though there were differences in the macromorphological characters of seeds, while comparing the pattern of wax deposition on seed coat no

difference is observed. The primary ornamentation of seed coat is punctulate type with differences in quantity of wax deposition.

Study of sculpturing pattern of two accessions of *V. aconitifolia* viz. *V. aconitifolia* -2 and *V. aconitifolia* -3 is found unique. Primary ornamentation is captor-ridged, with incomplete or complete ridges.

The other two genotypes namely *V. trilobata*, and *V. hainiana*-14 though showed similar sculpturing pattern but in *V. hainiana*-14 honeycomb-like supercellular pits is observed.

Macromorphology of seed, and cellular structure of seed coat are found characteristic to each species and appeared to be species-specific. Considerable morphological similarities were observed between cultivated species of *V. radiata* with its related wild species *V. radiata* var. *sublobata* and *Vigna radiata* var *setulosa* and *V. mungo* with that of *V. mungo* var. *silvestris*. Similar findings was also observed by Chandel *et. al.* [6]. So SEM study of seed coat structure could be a useful in establishing taxonomic and phylogenetic relationship among the Indian species of *Vigna*.

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**Table-I : List of Materials**

Name	Status
<i>V. radiata</i> var <i>radiata</i> (B1)	Cultivated
<i>V. radiata</i> var <i>radiata</i> (4441D1)	Cultivated
<i>V. radiata</i> var <i>sublobata</i> -2/2	Wild
<i>V. radiata</i> var <i>sublobata</i> -18A	Wild
<i>V. radiata</i> var <i>setulosa</i> -2	Wild
<i>V. radiata</i> var <i>setulosa</i> -4	Wild
<i>V. mungo</i> (T9)	Cultivated
<i>V. mungo</i> var <i>silvestris</i> -10	Cultivated
<i>V. unguiculata</i>	Cultivated
<i>V. unguiculata</i>	Wild
<i>V. umbellata</i>	Cultivated
<i>V. trichuriensis</i>	Wild
<i>V. trilobata</i>	Wild
<i>V. hainiana</i> -14	Wild
<i>Allo sp</i> 6/3	Allopolyploid
<i>V. aconitifolia</i> -2	Cultivated
<i>V. aconitifolia</i> -3	Wild
<i>V. minima</i>	Wild

**Table-II : Macro-morphological and spermoderm features of different genotypes of mungbean**

Plant material	Seed shape	Seed colour	Mean dimension of seeds		100 seed-weight (gm)	Seed surface type
			Length ( $\pm 0.02$ ) (cm)	Breadth ( $\pm 0.01$ ) (cm)		
<i>Vigna radiata</i> var <i>sublobata</i> -2/2	Oval	Blackish-green	0.3	0.2	3.73	Maculo reticulate
<i>Vigna radiata</i> var <i>sublobata</i> -18A	Roundish square	Green	0.4	0.6	3.08	Maculo reticulate
<i>Vigna radiata</i> var <i>setulosa</i> -2	Square	Black	0.6	0.3	1.92	Maculo reticulate
<i>Vigna radiata</i> var <i>setulosa</i> -4	Square	Black	0.6	0.3	2.12	Maculo reticulate
<i>Vigna radiata</i> var <i>radiata</i> (4441D1)	Oval	Green	0.5	0.3	2.38	Maculo reticulate
<i>Vigna radiata</i> var <i>radiata</i> (B1)	Oval	Yellow	0.5	0.4	3.35	Maculo reticulate
<i>Vigna unguiculata</i> (wild)	Remiform	Black	0.4	0.3	13.9	Maculo reticulate
<i>Vigna unguiculata</i>	Remiform	Cream	0.7	0.5	14.2	Maculo reticulate
<i>Vigna hainiana</i> -14	Square	Brown	0.3	0.2	3.66	Rugose
<i>Vigna umbellata</i>	Cylindrical	Cream	0.9	0.6	6.94	Maculo reticulate
<i>Vigna trichuriensis</i>	Cylindrical	Black	0.2	0.3	3.53	Maculo reticulate
<i>Vigna trilobata</i>	Cylindrical- round	Blackish green	0.3	0.3	1.85	Rugose
<i>Vigna mungo</i> (T9)	Cylindrical -round	Black	0.4	1.2	2.72	Puncticulatae
<i>Vigna mungo</i> var <i>silvestris</i> -10	Square	Black	0.3	0.5	2.87	Puncticulatae
<i>Allo sp.</i> - 6/3	Cylindrical	Black	0.4	0.3	2.23	Maculo reticulate
<i>Vigna aconitifolia</i> -3	Roundish square	Green	0.3	0.2	1.24	Captor ridged
<i>Vigna aconitifolia</i> -2	Square	Green	0.3	0.2	1.12	Captor ridged
<i>Vigna minima</i>	Cylindrical	Blackish Green	0.2	0.1	1.36	Maculo reticulate

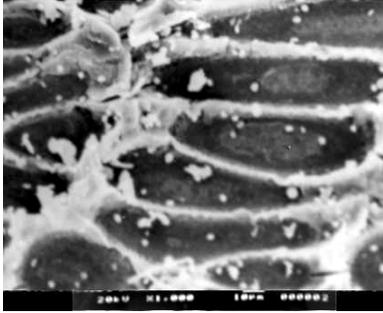


Fig:I. *V. radiata* var *radiata* (B1)

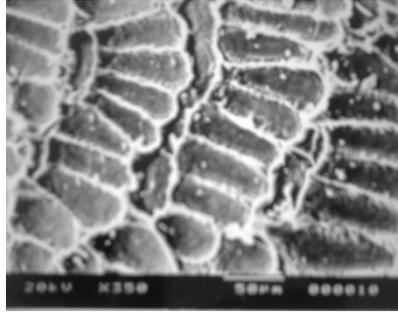


Fig:II. *V. radiata* var *radiata* (4441D1)

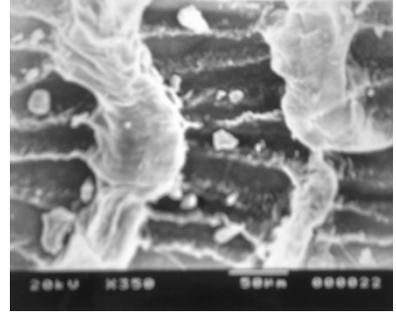


Fig:III. *V. radiata* var *sublobata*-2/2

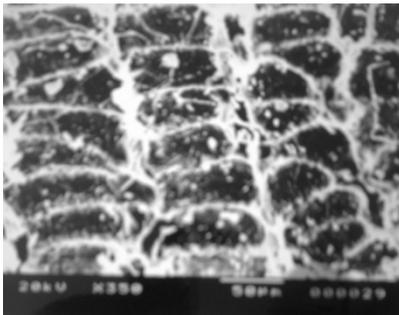


Fig:IV. *V. radiata* var *sublobata*-18A

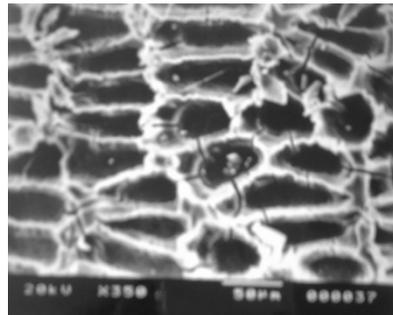


Fig:V. *V. radiata* var *setulosa*-2

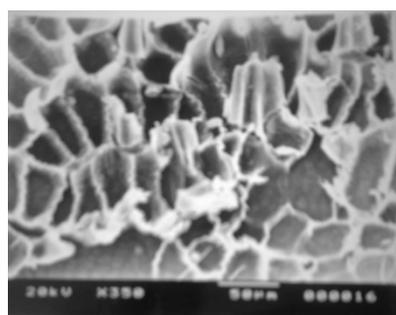


Fig:VI. *V. radiata* var *setulosa*-4

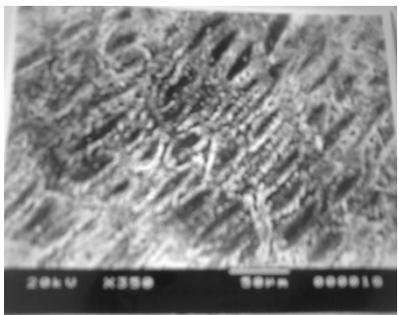


Fig:VII. *V. mungo* (T9)

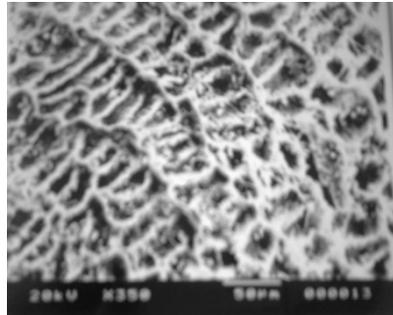


Fig:VIII. *V. mungo* var *silvestris*-10

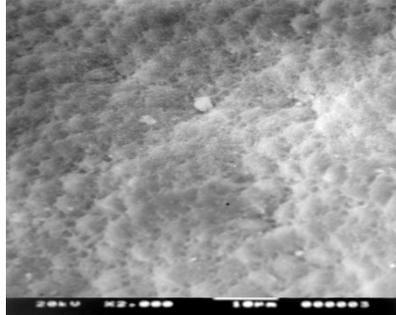
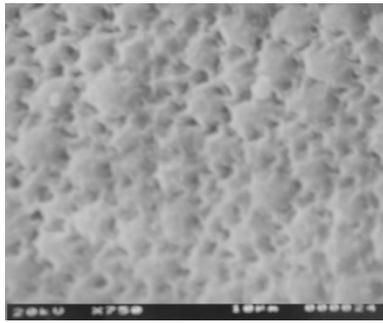
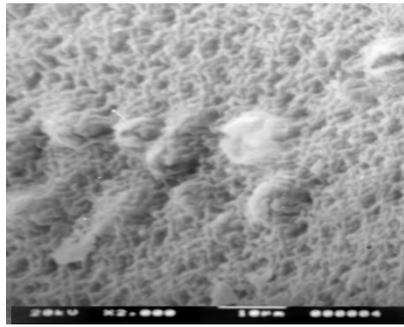


Fig:IX. *V. unguiculata* (Cultivated)

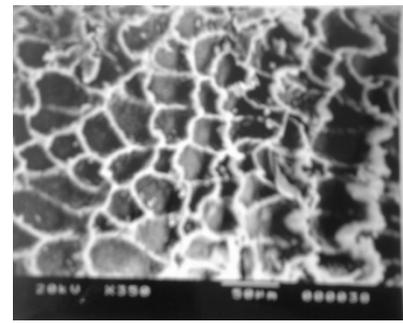
Fig I-IX. Scanning electron micrographs of seed coat patterns of the of the *Vigna* sp.



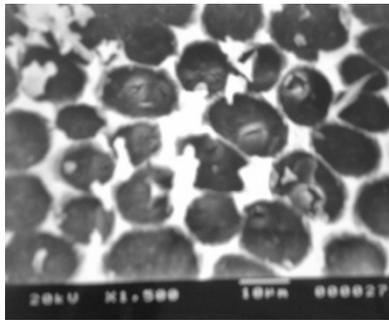
*Fig:X. V. unguiculata* (Wild)



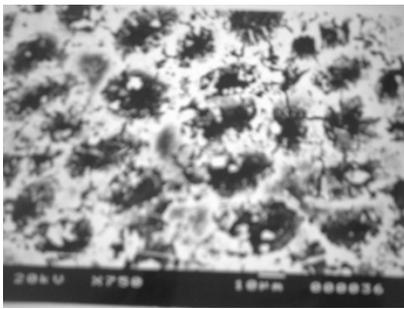
*Fig:XI. V. umbellata*



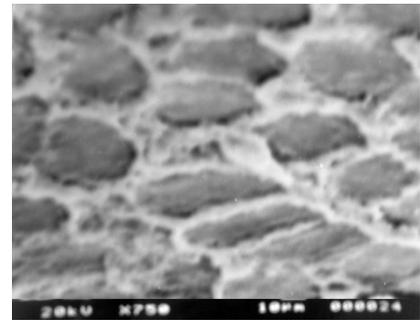
*Fig:XII. V. trichuriensis*



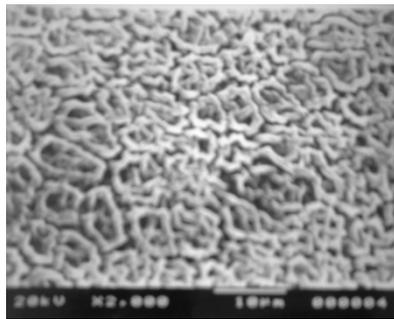
*Fig:XIII. V. trilobata*



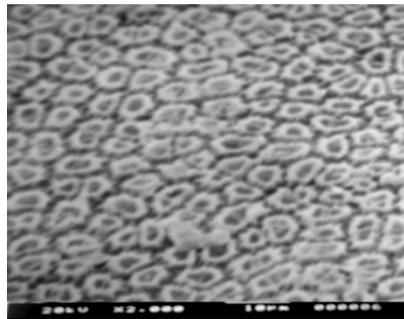
*Fig:XIV. V. hainiana-14*



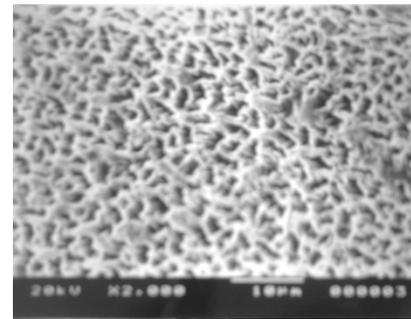
*Fig:XV. Allo sp 6/3*



*Fig:XVI. V. aconitifolia-2*



*Fig:XVII. V. aconitifolia-3*



*Fig:XVIII. V. minima*

**Fig X-XVIII. Scanning electron micrographs of seed coat patterns of the *Vigna* sp.**

# GEOLOGY, WATER TYPES AND FACIE EVOLUTION OF THE OHAOZARA SALINE LAKE AREAS OF EBONYI STATE, NIGERIA

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**Abstract:** Geological and Hydrochemical investigation of Okposi and Uburu Saline spring Areas of Ohaozara and Environs of Ebonyi State has been carried out. The study area is underlain by shales which vary from light to dark grey in colour, fine grained sandstone and mudstone which belong to the Asu River Group and the Ezeaku Shale, (Albian and Turonian respectively). Results of hydrochemical analysis revealed that  $Ca^{2+}$ ,  $Mg^{2+}$ ,  $Fe^{2+}$ ,  $Na^+$  (cations),  $Cl^-$ ,  $SO_4^{2-}$ ,  $NO_3^-$ ,  $HCO_3^-$  (anions) and  $Br^-$ ,  $Mn^{2+}$ ,  $F^-$ ,  $I^-$ ,  $Al^{3+}$ ,  $Mo^{2+}$ ,  $Co^{2+}$ ,  $Hg^{2+}$ ,  $Cr^{3+}$ ,  $Ni^{2+}$ ,  $Cd^{2+}$ ,  $Ag^+$  and  $Mn^{2+}$  are the main geochemical constituents. Water facie evolution shows three water types namely, the calcium bicarbonate facies in the northern parts and sodium chloride facies with sodium/potassium bicarbonate facies in the southern parts. Groundwater flow pattern reveals predominance of recharge and discharge at the northern and southern parts respectively.

**Index Terms:** Hydrochemical, Water types, Facies, Asu River Group and Ezeaku Group.

## I. INTRODUCTION

Water is the most common solvent. Geographically, it covers about 71% of the entire area of the earth's surface and it is found in oceans, streams, seas, rivers, lakes, ponds, springs and underground (Ogunji et al, 2004). Biologically, water makes up a large proportion of the total body fluid system. The domestic, industrial, agricultural and recreational uses of water have been on the increase.

Water pollution resulting from artificial and natural sources has always been the problem militating against municipal, rural and general water supply in Nigeria. The pollutant sources have either been from improper refuse disposal, contaminants in host rock or natural processes of volcanism and water transportation processes beneath the earth. This is pertinent, as water during its movement and storage in aquifers, tends to dissolve minerals in their host rocks. Other possible sources of dissolved chemical and biological constituents in water include residues and leachates of metals from mining, agricultural fertilizers and organic inputs and outputs, disposal of radioactive wastes materials and sewage disposal. Higher concentrations of these constituents above tolerable standards tend to render the water unwholesome for any type of use (Freeze and Cherry, 1979). Obasi and Akudinobi (2013) and Egboka and Uma (1985) have carried out the assessment of the chemical constituent of the available water resources in the area and showed the major and minor constituents of the water resources of the area. This work is aimed at classifying the water resources of the area in terms of their hydrochemical facies, based on the distribution and amount of dissolved hydrochemical facies. Recommendations on the best option on management/utilization of water resources in the area by comparing the results of the study with global water quality guidelines will be made.

## II. The Study Area

The study area covers Uburu and Okposi and environs in Ohaozara and Onicha Local Government Areas of Ebonyi State. (Fig.1.0). Geographically, the area is located between latitudes  $6^{\circ}00'N$  and  $6^{\circ}10'N$ , and longitudes  $7^{\circ}42'50''E$  and  $7^{\circ}52'50''E$ . The area extends from Isu in the North to Okposi in the South. Laterally, it extends from Asumgbom through Okposi and Uburu, and bounded by Umuka. Major villages within the study area include Uburu, Okposi, Umuka, Ndiagu-Onicha, Eneagu, Isuachara, Onicha – Uburu, Nkwegu-Isu, Obina and Umuniko.

Saline springs and lakes occur within a relatively narrow belt, which extends in a northeast-south- southwest direction. This include the Okposi Salt Lake ( $06^{\circ} 02.23 N$ ,  $007^{\circ} 48.337 E$ ) and the Uburu Salt Lake ( $06^{\circ} 02.971 N$ ,  $007^{\circ} 44.799 E$ ) (Obasi and Akudinobi, 2013). Surface drainage in the study area is irregular and consists originally of a number of small ephemeral streams. The streams generally flow in the north-south direction (Fig.2.0) into the Asu River, which is about 15Km south of the study area. Asu River controls the drainage of the study area. Flow of the Asu River during the dry season is near zero, implying a negligible base flow contribution. Other rivers and smaller streams, which contribute to the drainage, are Asumgbom River, River Atte, River Azuu, River Ovum, River Enu and River Oshi.



**Fig. 2: Map study area showing water sample locations**

### III. METHOD OF STUDY

Geologic field mapping was carried out to determine the geology of the area. Strikes and dips of beds were measured, and rock samples were collected for laboratory investigation. Water samples were also collected. A total of twenty-eight (28) Water samples were collected from groundwater and surface water sources for hydrochemical analysis. Twenty (20) samples were collected from boreholes while eight (8) were collected from surface sources (Fig 2.0). Temperature, electrical conductivity and pH were measured using a digital meter. Laboratory analysis for the concentration of major ions comprising  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{Fe}^{2+}$ ,  $\text{Na}^+$ ,  $\text{SO}_4^{2-}$ ,  $\text{NO}_3^-$ ,  $\text{Cl}^-$ ,  $\text{HCO}_3^-$  and  $\text{CO}_3^{2-}$  was done using DR 2010 spectrophotometer. The results were analyzed and compared with the World Health Organization (WHO) standards for water quality.

### IV. GEOLOGY OF THE STUDY AREA

The study area is underlain by the Asu River Group and the Ezeaku Formation (Fig 3.0). The Asu River Group is the oldest sedimentary rock in southeastern Nigeria (Simpson, 1954). It is exposed variously in the Abakaliki area where they are often referred to as the Abakaliki Shale. These rocks are overlain by the Ezeaku Formation, as there is no evidence to suggest the break between the Asu River Group and the Ezeaku Shale, although the junction has not been seen (Simpson, 1954). The area is predominantly underlain by shale, sandstones, siltstones, sandy shale and limestone. Based on the lithologic, structural and stratigraphic positions, three broad lithostratigraphic units have been recognized. These are: Unit A: the light-grey shale; unit B: the sandstone/siltstone; and unit C; the dark-grey shale, (Table 1.0, Fig.3). These units strike in the NE-SW direction and dip in the Southeast (SE) direction, with dips ranging between  $17^\circ$  -  $45^\circ$ .

**UNIT A: The Light-Grey Shale Unit** covers a greater portion of the study area, predominantly the Western parts. The unit is composed of light-grey shale, which weathers into brownish shale. The shales are often pyritic, fossiliferous, easily fragmented, laminated, fissile and generally micaceous. This unit is also composed of fine-grained micaceous sandstones and sandy shale.

**UNIT B: The Sandstone/Siltstone Unit** overlies the light-grey shale unit although the contact is gradational. The unit is composed of whitish, fine to medium grained consolidated sandstone, siltstone and mudstone. The sandstone is well bedded, calcareous and highly indurated. The outcrops are massive in some places. These sandstones are intercalated with very fine whitish to greyish siltstones and mudstones, which occupy the lower parts of the unit.

**UNIT C: Dark-Grey Shale Unit** is predominant in the eastern part of the study area. The unit is composed of dark-grey, flaggy shale. These shales are highly indurated and calcareous. This is due to high content of organic matter. This unit is also composed

of dark-grey calcareous limestones facie, interbedded with calcareous fine grained sandstone. These limestones occur as thin interbeds in the shale.

**V. Results and Discussion**

Ca<sup>2+</sup> values of the study area ranges between 0.01mg/l-1.22mg/l, except in the Okposi salt lake where it increased excessively to 274.5mg/l.

Iron mostly occurs in the form of ferrous bicarbonates (Fe(HCO<sub>3</sub>)<sub>2</sub>), ferrous sulphate (FeSO<sub>4</sub>), or ferrous chloride (FeCl<sub>2</sub>), especially when it occurs in acidic surface water (Back and Hanshaw, 1971). The values of iron (Fe<sup>2+</sup>) in the area ranges between 0 to 0.07mg/l, and the maximum value was recorded in the Uburu salt lake. However, the boreholes have low Fe<sup>2+</sup> content. The Fe<sup>2+</sup> content indicates a uniform value for all the aquifer units. The analysis revealed that the magnesium ion concentration in water samples in the area ranges between 0.34-2.62mg/l for the boreholes while that of surface water is also on that average, but the Okposi salt lake is excessively high, having a value of 990mg/l.

Potassium (K<sup>+</sup>) and sodium (Na<sup>+</sup>) are present in natural waters in low concentrations. They occur in plant and animal matters, and may be introduced to the environment as sewages, industrial effluents, agricultural fertilizers and other farm inputs. All these are leached into natural waters, contributing to concentrations in natural waters.

The concentration of HCO<sub>3</sub> ions ranges between 0.34mg/l-2.82mg/l for the boreholes and about the same range for the surface waters except for the Okposi salt lake with about 1204.5mg/l. This indicates a high level of hardness for the salt lake. The concentration of sulphate in the study area ranges between 0m/l to 3.0mg/l. The concentration of Cl<sup>-</sup> in the study area is excessively high in some places. This includes the Ahia Ochie boreholes (927mg/l), Okposi Ukwu borehole (822mg/l), and Ndiagu Onicha (528mg/l). Other boreholes in the area have low concentrations (between 0.62-5.6mg/l). The Cl<sup>-</sup> concentration values in the surface water samples are also high (between 235.5mg/l- 679.0mg/l). The areas of higher concentrations are areas closer to the salt lakes, and within the fractured shale aquifer units, while those in the sandstone/siltstone aquifers are low. These high concentrations may be due to leachate from the brine loaded bedrocks and halite mineralization, which is not far from the area. It might also be as a result of sewage disposal. The concentration of NO<sub>3</sub> in the study area ranges from 0 mg/l (in many places) to 0.30 mg/l (the highest value). This concentration is high due to excessive use of agricultural fertilizers and nitrogenous waste dumping in the area.

**Water Types, Hydrochemical Sequence and Facie Evolution**

Results of hydrochemical analysis are used to determine the cumulative impacts or concentrations of certain constituents in water. The distribution and concentration of chemical constituents in natural waters is controlled by a number of factors including geology, amount of water supply, vegetation and climate (Todd, 1980). Egboka, et al, (1993), enumerated five major factors that can influence the distribution of the aqueous species in groundwater. These include:

- a. Diagenetic processes of recrystallization, dolomatization and cementation;
- b. The existence of geological structures (such as fractures, fissures, joints, bedding planes, lithologic boundaries and solution cavities);
- c. Chemical mass-transfer, which is controlled by mass balance;
- d. Thermodynamic variables related to physicochemical environment, ande.
- e. Hydrodynamic factors (such as flow pattern, permeability, hydraulic gradient) which govern the flow path and discharge.

**TABLE 1.0 STRATIGRAPHY OF THE STUDY AREA.**

AGE	FORMATION	UNIT	LITHOFACIES
TURONIAN	EZEAKU	C: DARK-GREY SHALES	Dark, Flaggy and hard shales. Contains minor bands of sandstones. With highly calcareous indurated limestones.
		B: SANDSTONE/SILTSTONE	Sandstones, whitish and calcareous. Siltstones are also whitish and interbedded with mudstones.
ALBIAN	ASU RIVER GROUP	A: LIGHT-GREY SHALES	Shales, light grey in colour, contains finegrained micaceous sandstones and sandy shales.

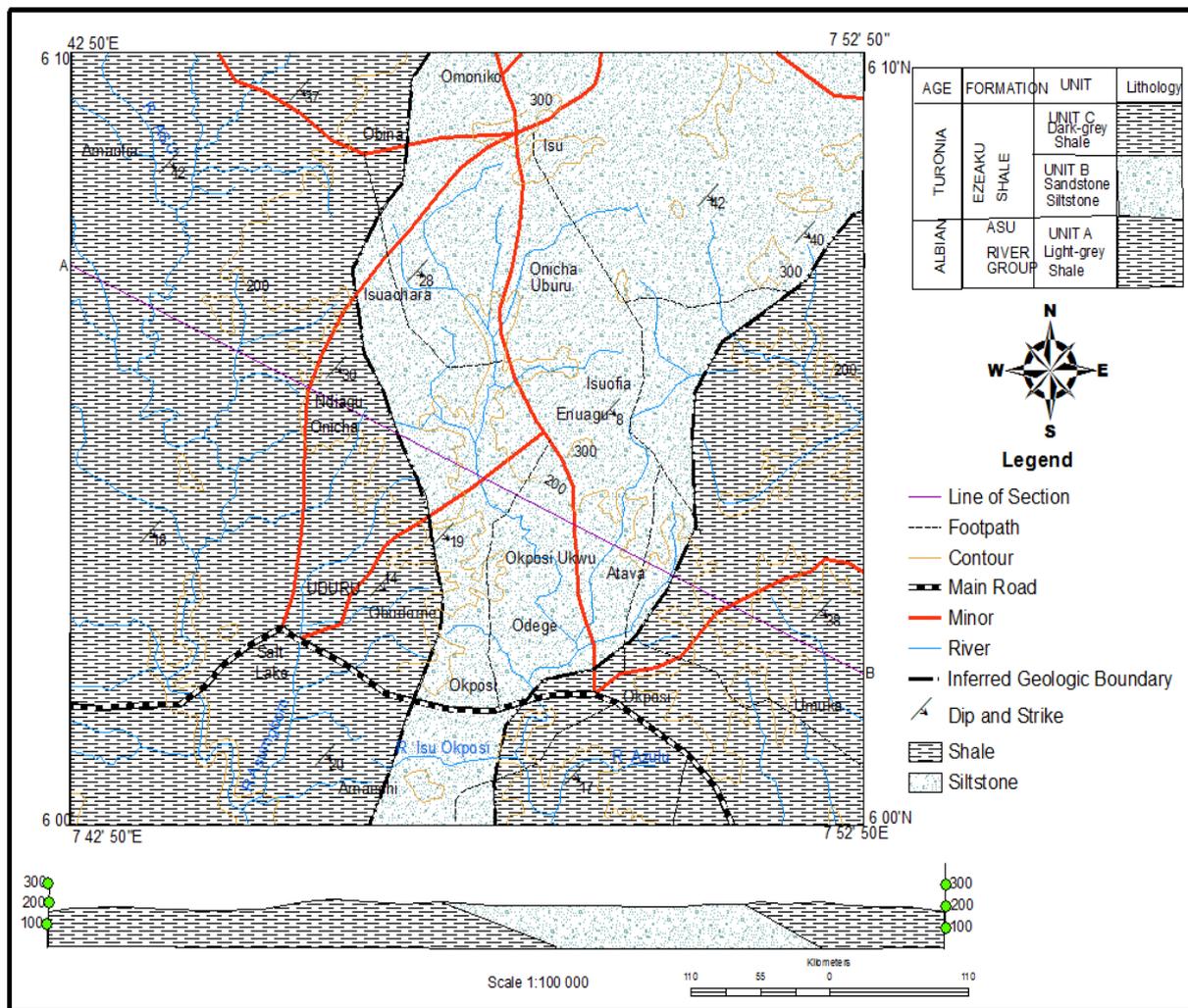


Fig. 3: Geologic map of Okposi-Uburu And environs

TABLE 2.0: CONCENTRATION OF PHYSICAL PARAMETERS IN WATER SAMPLES ANALYZED

SAMPLE LOCATION	SAMPLE NO	Colour	p <sup>H</sup> (mg/l)	Electrical Conductivity (µScm)	Turbidity (mg/l)	Total Solid (mg/l)	Dissolved (TDS)
Okposi salt lake	OP/09/L2	5.00	11.50	527.10	10.00	497,700.00	
Uburu salt lake	OP/09/L5	10.00	10.60	13.00	23.00	129,600.00	
Ahia Ochie Uburu	OP/09/L6	30.00	9.60	2.10	149.00	699.00	
Okposi Ukwu	OP/09/L10	10.00	9.40	1.92	158.00	928.00	
Nkwegu-Isu	OP/09/L11	18.00	7.50	0.18	10.00	96.00	
Omoniko	OP/09/L12	9.00	7.30	0.19	28.00	86.00	
Hand dug wel (Ameachi )l okosi	OP/09/L3	15	8.4	0.12	48	53.00	
Isuachara onicha	OP/09/L7	10	8.3	0.21	11	98	
Onicha Uburu	OP/09/L8	10	8.2	0.23	15	102	
Atavo Okposi	OP/09/L9	10	8.0	0.22	37	110	
Umuka	OP/09/L13	17	8.2	2.00	148	284	
Ndiagu Onicha	OP/09/L14	10	9.4	2.06	1800	80	
River Atta (Okposi)	Op/09/L1	5	9.4	4.38	18	1510	
River Asumgbom (Uburu)	Op/09/L4	5	8.5	0.18	15	81	

TABLE 3.0: CONCENTRATION OF MAJOR CATIONS AND ANIONS IN WATER SAMPLES ANALYZED

S/N	SAMPLE LOCATION	SAMPLE NUMBER.	Ca <sup>2+</sup> (mg/l)	Mg <sup>2+</sup> (mg/l)	Na <sup>+</sup> + k <sup>+</sup> (mg/l)	Fe <sup>2+</sup> (mg/l)	Cl <sup>-</sup> (mg/l)	No <sub>3</sub> (mg/l)	So <sub>4</sub> <sup>2-</sup> (mg/l)	HCO <sub>3</sub> <sup>-</sup> (mg/l)
1	Ahia Ochie Uburu	OP/09/L6	0.00	0.34	68.20	0.01	927.00	0.00	1.00	0.34
2	Atavo Okposi	OP/09/L9	0.02	2.62	54.9	0.02	0.01	0.00	1.00	2.82
3	Hand dug wel (Ameachi) l okosi	OP/09/L3	0.82	0.48	17.8	0.04	0.01	0.03	1.00	1.3
4	Isuachara onicha	OP/09/L7	0.02	2.1	10	0.01	0.1	0.00	0.00	2.1
5	Ndiagu Onicha	OP/09/L14	0.02	2.00	18	0.01	0.1	0.01	0.00	1.58
6	Nkwegu-Isu	OP/09/L11	0.02	1.98	3.05	0.01	0.84	0.00	0.00	2.00
7	Okposi salt lake	OP/09/L2	274.50	990.00	1805.00	0.01	679.00	0.30	1.00	1204.50
8	Okposi Ukwu	OP/09/L10	0.87	0.38	7.00	0.01	822.00	0.00	1.58	096.00
9	Omoniko	OP/09/L12	0.02	1.50	1.05	0.00	0.62	0.12	0.98	1.86
10	Onicha Uburu	OP/09/L8	0.01	2.2	8	0.01	0.11	0.00	0.00	2.24
11	River Asumgbom (Uburu)	Op/09/L4	1.22	3.02	52.1	0.01	0	0.12	3.00	4.24
12	River Atta (Okposi)	Op/09/L1	0.14	1.41	78.3	0	235.5	0.03	1.00	1.55
13	Uburu salt lake	OP/09/L5	0.02	1.87	2,280.00	0.07	5,160.00	0.01	0.00	1.89
14	Umuka	OP/09/L13	0.22	2.08	48.8	0.02	4.90	0.00	0.00	2.46

**TABLE 4: CONCENTRATION OF HALOGENS IN SOME OF THE WATER SAMPLES ANALYZED**

SMAPLE LOCATION	SAMPLE NUMBER	Bromide (mg/l)	Chloride (mg/l)	Flouride (mg/l)	Iodine (mg/l)
Okposi salt lake	OP/09/L <sub>2</sub>	643.50	679.000	1.030	1014.000
Uburu salt lake	OP/09/L <sub>5</sub>	1.06	5,160.000	0.500	0.001
Ahia Ochie Uburu	OP/09/L <sub>6</sub>	0.88	927.000	0.000	1.180
Okposi Ukwu	OP/09/L <sub>10</sub>	0.90	822.000	0.000	1.900
Nkwegu-Isu	OP/09/L <sub>11</sub>	0.05	0.840	0.060	0.020
Omoniko	OP/09/L <sub>12</sub>	0.07	0.620	0.040	0.010
Hand dug wel (Ameachi) l okosi	OP/09/L <sub>3</sub>	0.44	3.2	0.00	0.67
Isuachara onicha	OP/09/L <sub>7</sub>	0.06	0.9	0.08	0.04
Onicha Uburu	OP/09/L <sub>8</sub>	0.07	2.4	0.07	0.04
Atavo Okposi	OP/09/L <sub>9</sub>	0.86	5.6	0.58	1.45
Umuka	OP/09/L <sub>13</sub>	0.78	4.9	0.54	1.24
Ndiagu Onicha	OP/09/L <sub>14</sub>	1.00	528	0.08	0.03
River Atta (Okposi)	Op/09/L <sub>1</sub>	0.69	236	0.09	1.25
River Asumgbom (Uburu)	Op/09/L <sub>4</sub>	0.02	2.8	0.2	0.06

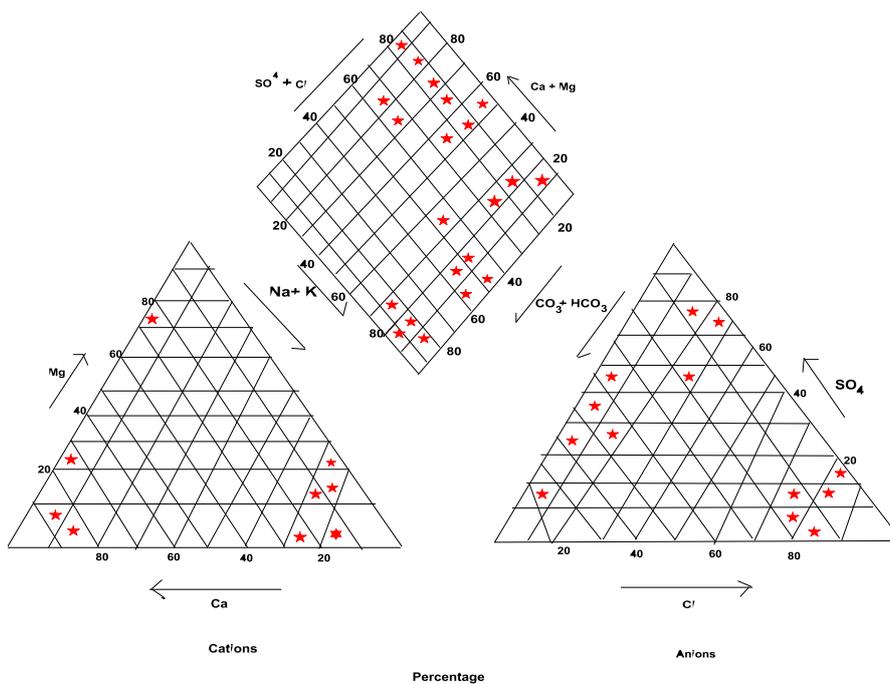
Hems (1989) also showed that rock deposits (geology) impose its chemistry on the groundwater system. These factors enhance inter/intra aquifer transfer of the chemical species in solution, giving rise to the formation of mixed groundwater of varying composition.

The evolutionary trend of hydrochemical facies in groundwater system reveals a sequence from bicarbonate to sulphate and chloride stages. These processes proceed very gradually since diffusion is a very slow process. This accounts for pockets of sulphate and bicarbonate waters in some places like Isu and Ndiagu Onicha respectively. The anion evolution sequence and the tendency for Total Dissolved Solute (TDS) to increase along the groundwater flow paths define the flow history of the water. The hydrogeochemical facies map (Fig 6) shows the various geochemical facies present in the study area. This depicts calcium bicarbonate facies at the northern parts and sodium chloride facies at the southern part with pockets of sodium facies in Umunuka – Okposi, Ezi-Okposi and Enuagu. The geochemical facies are inherent in the bedrocks. The calcium bicarbonate facies migrates from the carbonate – rich sandstones/siltstones and shales which underline the northern part while the sodium chloride facies in the southern parts emanates from the brine-loaded bedrocks and weathered/fractured shales which underlie the Okposi and Uburu area. Figure 4 is a tri-linear diagram of water types in the study area which shows the various percentage composition of major cations and anions contain in water. It shows high compositions of Cl<sup>-</sup>, Ca<sup>2+</sup>, CO<sub>3</sub><sup>-</sup> + HCO<sub>3</sub><sup>-</sup> and Na + K with low compositions of Mg<sup>2+</sup> and SO<sub>4</sub><sup>2-</sup>. This composition is imperative for the classification of the water into three water types ie

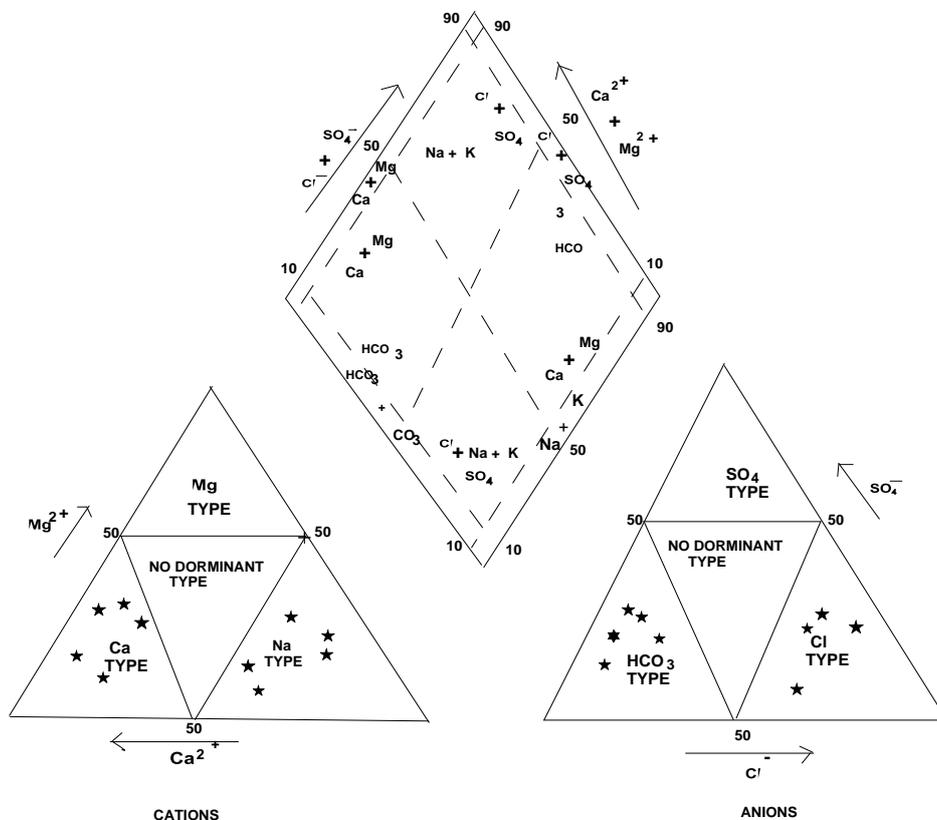
- a. Calcium bicarbonate
- b. Sodium chloride and
- c. Sodium/potassium bicarbonate.

Fig 5 shows the classification of the main anions and cations facies in terms of their major ionic percentage. This result shows that in the study area the

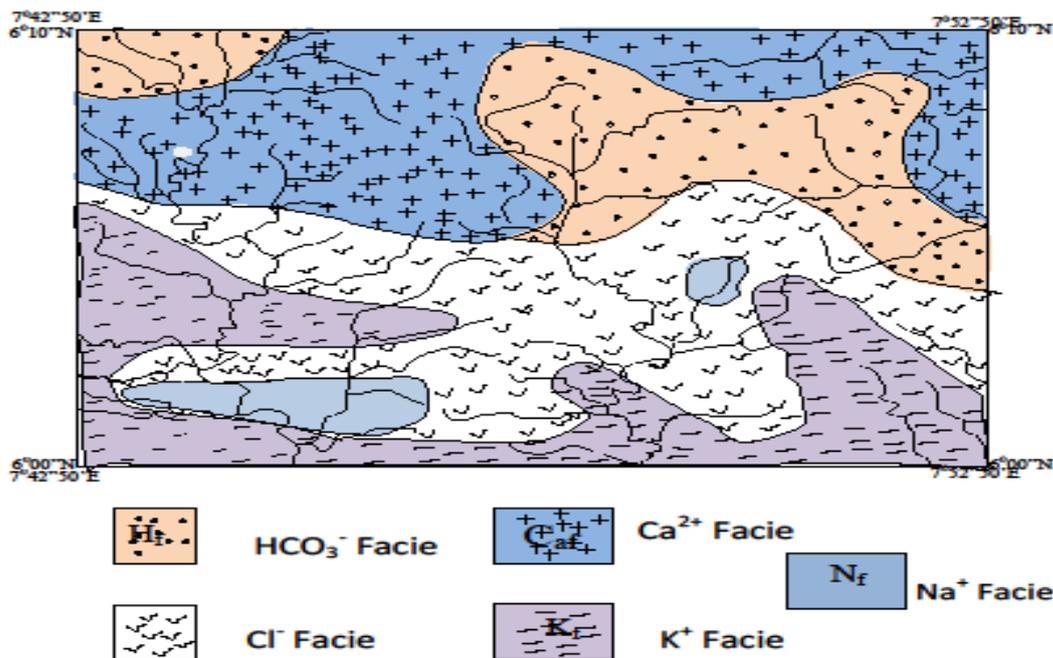
dominant cation types are calcium(Ca<sup>+</sup>) and sodium (Na<sup>+</sup>) while the dominant anions are the bicarbonate (HCO<sub>3</sub>) and chloride (Cl<sup>-</sup>) ions. In comparison with the tri-linear diagram, this result shows that although magnesium (Mg<sup>+</sup>) and sulphate (SO<sub>4</sub><sup>-</sup>) ions occur in the study area, they are minimal and do not occur as the dominant ions.



**FIG 4.0 TRILINEAR DIAGRAM SHOWING WATER TYPES IN THE STUDY AREA.**



**FIG 5.0 CLASSIFICATION OF ANIONS AND CATIONS FACIES IN TERMS OF MAJOR IONIC PERCENTAGE AND WATER TYPES, (AFTER MORGAN AND WINNER, 1962; BACK 1962.**



**Fig 6: WATER TYPES AND THEIR HYDROCHEMICAL FACIES.**

**VI. SUMMARY AND CONCLUSION**

The Geology and Hydrochemical investigation of Okposi and Uburu areas of Ohaozara and Environs of Ebonyi state was carried out.

Geologically, the area is underlain by shale, sandstones, siltstones and sandy shale. These sediments belong to the Asu River Group and Ezeaku Formation deposited in the Albian and Turonian times respectively. The salt waters may have been trapped during the regressive phases that occurred within these periods. They migrate through veins, faults and fractures, which characterize the sediments.

The concentration of the major cations such as  $Ca^{2+}$ ,  $Mg^{2+}$ ,  $Fe^{2+}$ ,  $K^+$ ,  $Na^+$ , and anions such as  $SO_4^{-}$ ,  $HCO_3^{-}$ ,  $CO_3^{2-}$ ,  $Cl^-$ , and  $NO_3^{-}$ .  $Cl^-$  falls above the WHO recommended standard. This is linked to the high salinity of water resources in the area. There is high concentration of  $Ca^{2+}$  and  $HCO_3^{-}$ , low concentrations of  $Mg^{2+}$  and  $SO_4^{2-}$  in the recharge areas, while high concentration of  $Na^+$ ,  $Cl^-$ ,  $K^+$  and  $HCO_3^{-}$  predominate in the discharge areas.

Hydrogeochemical classification of the water types indicates prevalence of calcium bicarbonate water in the northern parts, while sodium chloride and sodium/potassium bicarbonate waters exist in the southern parts of the study area. The distribution of these chemical constituents in the water resources of the area is in line with the groundwater flow pattern in the Cross River Basin and hydrochemical facies evolutionary trend. This study also shows that, the geology of the area has much effect on the hydrochemistry of the area.

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# Exploring the Factor Structure of Talent Erosion in the BPM Industry of Rajasthan: An Empirical Analysis

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**Abstract-** The Indian Business Process Management (BPM) industry has grown exponentially in size and has been holding the supreme position in the global BPM outsourcing arena for more than a decade now. However, talent-erosion is an area of paramount concern for the industry. The present study attempted to identify and explore causal agents of 'talent erosion' in the BPM industry by collecting data from junior and middle level employees of prominent BPM companies in Rajasthan. Using sequential steps of Exploratory Factor Analysis, thirteen selected latent variables of 'Talent Erosion' have been reduced to five major factors viz., Substandard Nature of Job, Hostile Organisational Culture, Perceptual Factors, Unfavourable Work Conditions, Personal Factors. The BPM industry should strategically focus on effective management of these causal agents in order to keep growing at an impressive pace.

**Index Terms-** BPM industry, Demographic Dividend, Talent Erosion, Causal agents

## I. INTRODUCTION

The Indian Business Process Management (BPM) industry has grown exponentially in size and has been holding the supreme position in the global BPM outsourcing arena for more than a decade now. The industry has been reaping the benefits of 'Demographic Dividend' in true sense due to the availability of pocket-friendly labour, information technology and connectivity through internet. However, being a service-oriented industry, customer satisfaction through BPMs is guaranteed by quality of its trained workforce.

The BPM industry is one of the highest employment providers in India with more than 60% of its workforce comprising the youth of the country or the generation-y employees. However, monotonous work profile, low value attached to the industry, high performance monitoring, social isolation and erratic duty hours create a stressful work environment for its young employees. Trained staff has been quitting the industry at an alarming rate – the problem being more chronic amongst the junior level of employees. **Thus,**

**talent-erosion is an area of paramount concern for the industry.**

## II. METHODOLOGY OF THE STUDY

**Research Design:** The design of the present study was exploratory in nature. It aimed to identify and explore causal agents of 'talent erosion' in the BPM industry of Rajasthan. The survey was conducted under natural (un-manipulated) field conditions.

**Data Sources and Collection:** The study was mainly based on the primary data or collection of empirical evidence; however, reference to secondary data available on the internet was made besides the published and unpublished materials like the newsletters, articles, journals etc. in order to supplement the information. Data was collected from 100 junior and middle level employees of three prominent BPM companies based in Rajasthan, viz., Systweak Software; Vkalp Outsourcing Services Pvt Ltd and Teleperformance with the help of administration of questionnaire based on five point Likert scale.

**Data Analysis Approach:** The data was coded, tabulated and analysed using PASW Statistics 18 (formerly SPSS Statistics) and statistical tools such as *Cronbach's Alpha Test*, *Kaiser-Meyer-Olkin Measure of Sampling Adequacy*, *Bartlett's Test of Sphericity* and *Exploratory Factor Analysis (EFA)* were used.

## III. ANALYSIS AND DISCUSSION

In the present study, Exploratory Factor Analysis (EFA) was applied to twenty four causal agents of 'Talent Erosion'. The singularity in the data was checked (by scanning for correlation coefficients greater than 0.9) and due to the problem of multicollinearity, eleven variables were eliminated in this stage. Table 1 reflects the acceptable correlation coefficients of the remaining thirteen agents, which were then used to construct the factor structure.

**Table 1: Reproduced Correlations**

	TE1	TE4	TE5	TE7	TE8	TE9	TE11	TE13	TE14	TE18	TE20	TE21	TE17	
<b>Reproduced Correlation</b>	TE1	.648	-	-	.004	-	.225	-.092	-.038	-.037	-.295	.044	.051	-.515
	TE4	-	.439	-	.145	.226	-	.392	.076	-.057	.139	.021	.100	-.081
	TE5	-	-	.473	-	-	.190	-.376	.027	-.067	-.106	.083	.011	.239
	TE7	.004	.145	-	.740	.351	.111	-.015	-.148	.313	-.362	-.284	-.243	.111
	TE8	-	.226	-	.351	.658	.435	.012	-.254	.113	.251	-.187	-.172	.030
	TE9	.225	-	.190	.111	.435	.667	-.339	-.233	.002	.094	-.062	-.112	-.029
	TE11	-	.392	-	-	.012	-	.428	.213	-.163	.113	.140	.220	-.044
	TE13	-	.076	.027	-	-	-	.213	.645	-.647	-.208	.611	.680	.224
	TE14	-	-	-	.313	.113	.002	-.163	-.647	.813	.010	-.726	-.781	-.190
	TE18	-	.139	-	-	.251	.094	.113	-.208	.010	.739	-.084	-.115	.043
	TE20	.044	.021	.083	-	-	-	.140	.611	-.726	-.084	.662	.712	.167
	TE21	.051	.100	.011	-	-	-	.220	.680	-.781	-.115	.712	.783	.166
	TE17	-	-	.239	.111	.030	-	-.044	.224	-.190	.043	.167	.166	.621
	<b>Residual</b>	TE1		.010	-	.019	-	-	-.010	.028	.034	.153	-.066	-.009
TE4		.010		.265	-	-	.061	-.171	.008	.007	-.058	.023	-.100	.013
TE5		-	.265		.055	.054	-	.172	.008	-.010	.019	-.016	-.031	-.167
TE7		.019	-	.078		-	-	.004	-.029	-.043	.217	.047	.047	-.100
TE8		-	-	.054	-	-	-	-.071	.073	.036	-.096	-.028	.035	-.074
TE9		-	.061	-	-	-	-	.212	-.008	.019	-.088	.014	-.074	.011
TE11		-	-	.172	.004	-	.212		-.098	-.013	-.074	-.011	-.055	.011
TE13		.028	.008	.008	-	.073	-	-.098		.118	.069	-.098	-.053	-.041
TE14		.034	.007	-	-	.036	.019	-.013	.118		.016	.078	.007	.029
TE18		.153	-	.019	.217	-	-	-.074	.069	.016		-.007	.047	.020
TE20		-	.023	-	.047	-	.014	-.011	-.098	.078	-.007		-.120	-.052
TE21	-	-	-	.047	.035	-	-.055	-.053	.007	.047	-.120		-.034	

		.009	.100	.031			.074							
	TE17	.296	.013	-	-	-	.011	.011	-.041	.029	.020	-.052	-.034	
				.167	.100	.074								

**Extraction Method: Principal Component Analysis.**

The next step was to apply Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity to the remaining thirteen linear

components in order to measure the sample adequacy and strength of the relationship among factors.

<b>Kaiser-Meyer-Olkin Measure of Sampling Adequacy.</b>		.710
<b>Bartlett's Test of Sphericity</b>	Approx. Chi-Square	276.298
	Df	78
	Sig.	.000

A KMO statistical value of 0.710 indicated that patterns of correlations amongst the remaining thirteen causal agents were relatively compact and therefore it was concluded that factor analysis should yield distinct and reliable factors. Bartlett's measure tests the null hypothesis that the original correlation matrix is an identity matrix (Field, 2005). Table 2 shows that for the collected data, Bartlett's test was highly significant ( $p < 0.001$ ); therefore factor analysis was deemed appropriate for the study.

**Factor Extraction**

Table 3 lists the eigenvalues associated with each linear component (latent variable) before extraction, after extraction and after rotation. The eigenvalues associated with each factor represent the variance

explained by that particular linear component of talent erosion. In our case, factor 1 explained 24.287% of total variance, factor 2 explained 11.933%, factor 3 explained 10.109%, factor 4 explained 9.146%, and factor 5 explained 8.483%. All the remaining factors were insignificant since their eigenvalues were less than 1; hence they were discarded in the Extraction Sums of Squared Loadings. Finally, the Rotation Sums of Squared Loadings was also obtained to equalize the relative importance of the identified factors since rotation has the effect of optimizing the factor structure as given by Fields (2005).

The cumulative percentage of total variance explained by the collected data was 63.959% which was within acceptable limit and implied that the random errors in the measures have been taken care of.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
<b>1</b>	3.157	24.287	24.287	3.157	24.287	24.287	2.987	22.978	22.978
<b>2</b>	1.551	11.933	36.220	1.551	11.933	36.220	1.551	11.931	34.908
<b>3</b>	1.314	10.109	46.330	1.314	10.109	46.330	1.329	10.225	45.134
<b>4</b>	1.189	9.146	55.476	1.189	9.146	55.476	1.282	9.861	54.995

5	1.103	8.483	63.959	1.103	8.483	63.959	1.165	8.964	63.959
6	.901	6.928	70.887						
7	.829	6.377	77.264						
8	.732	5.634	82.898						
9	.639	4.915	87.812						
10	.578	4.447	92.259						
11	.431	3.319	95.578						
12	.393	3.020	98.598						
13	.182	1.402	100.000						

**Extraction Method: Principal Component Analysis.**

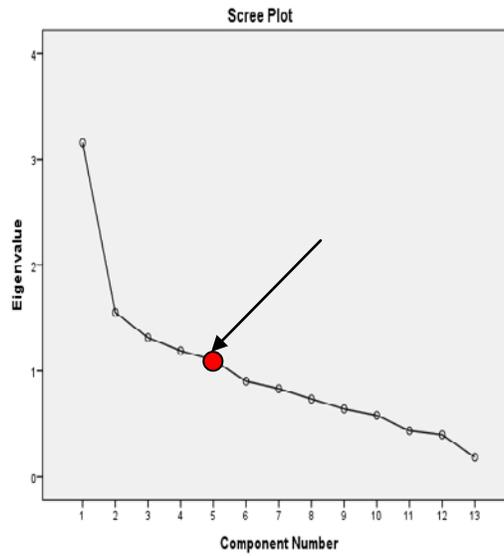
Table 4 depicts the communalities before and after the extraction of factors. Since one of the underlying assumptions of Principal Component Analysis is that variance of all components before the extraction of factors is common, therefore initial communalities of all the components was one. However, after the extraction of factors, the communality of each variable portrayed the common variance in the data structure. The highest communality after extraction was depicted by the variable 'Lack of Self-Motivation' (with value 0.813) and lowest by the variable 'Irregular Work Hours' (with value 0.439) signifying that while 81.3% of the respondents agreed that lack of self-motivation has been causing talent erosion in the BPM industry, only 43.9% of the respondents felt that irregular work hours cause it.

Before the rotation of the obtained component matrix, the extraction of factors was confirmed with the help of a scree plot depicted in Figure 1, as obtained by the PASW software, where the arrow denotes the 'Point of Inflexion'. As can be seen, after five points on the scree plot, the curve starts becoming concave thereby confirming that there are five significant factors which led to flight of human capital.

	Initial	Extraction
<b>Ineffective Supervision</b>	1.000	.648
<b>Irregular Work Hours</b>	1.000	.439
<b>Poor Mentoring</b>	1.000	.473
<b>Personal Reasons</b>	1.000	.740
<b>No Career Growth</b>	1.000	.658
<b>Low value of BPM job</b>	1.000	.667
<b>Power &amp; Politics</b>	1.000	.428
<b>Monotonous Desk Work</b>	1.000	.645
<b>Lack of Self-Motivation</b>	1.000	.813
<b>Lack of Specialised Skill</b>	1.000	.739
<b>Social Isolation</b>	1.000	.662
<b>Repetitive Nature of Work</b>	1.000	.783
<b>Unsatisfactory Work Conditions</b>	1.000	.621

**Extraction Method: Principal Component Analysis.**

**Figure 1**



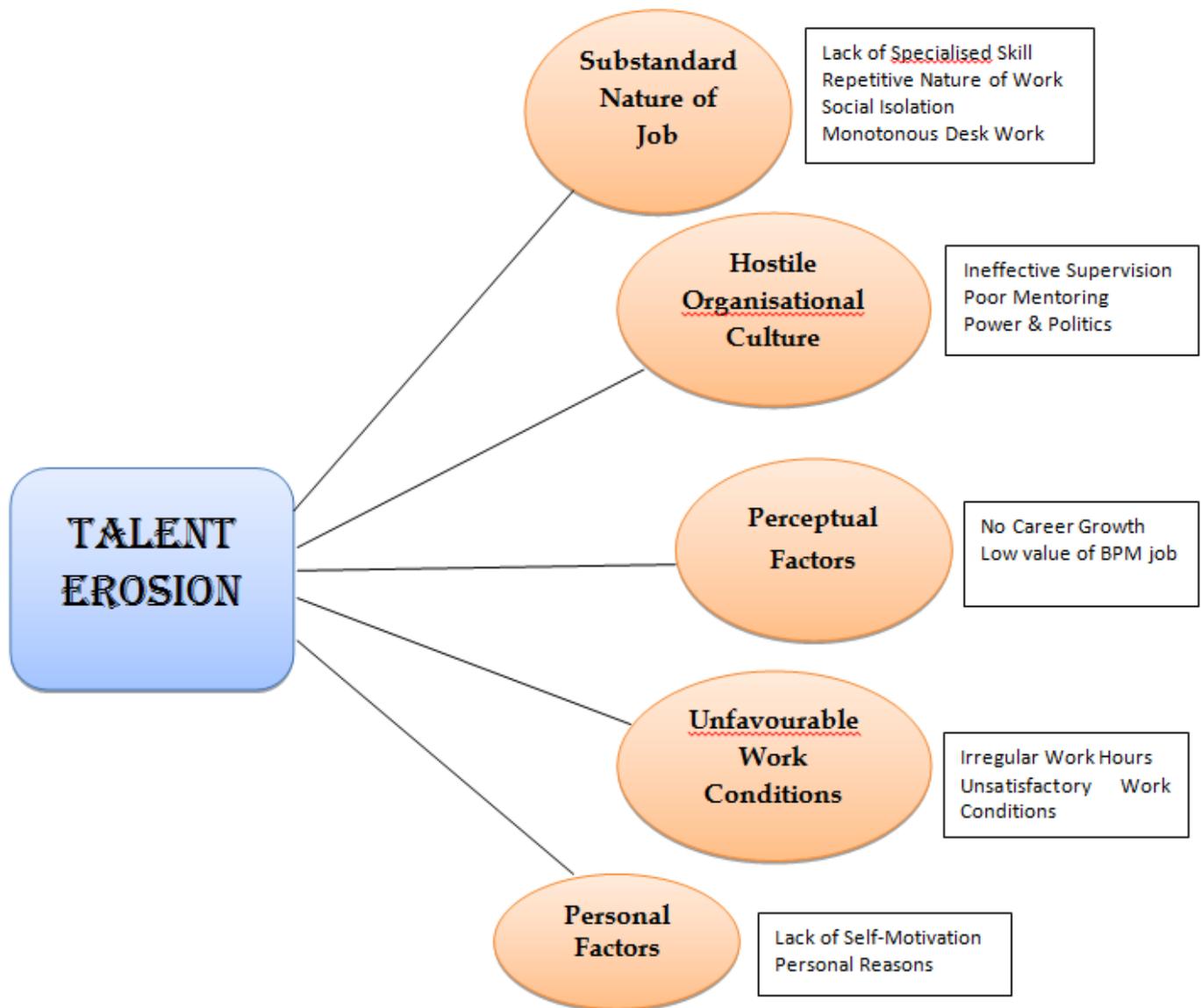
**Factor Rotation**

Table 5 depicts the Rotated Component Matrix which produces a matrix of the factor loadings for each component variable on to each factor. In our study, factor loadings less than 0.6 were suppressed. Also, the component variables were listed in the order of size of their factor loadings and each variable load on to only one factor.

On the basis of the nature of component variables which load on to same factor, common themes were identified for all the five factor structures respectively and a model of the factor structure of ‘Talent Erosion’ in the BPM industry of Rajasthan was constructed (Figure2) which highlights the reasons behind alarming rate of attrition in the Indian BPM industry.

<b>Table5: Rotated Component Matrix<sup>a</sup></b>					
Item	Component				
	1	2	3	4	5
Lack of Specialised Skill	.892				
Repetitive Nature of Work	.877				
Social Isolation	.808				
Monotonous Desk Work	.749				
Ineffective Supervision		.664			
Poor Mentoring		.653			
Power & Politics		.608			
No Career Growth			.751		
Low value of BPM job			.711		
Irregular Work Hours				.774	
Unsatisfactory Work Conditions				.732	
Lack of Self-Motivation					.755
Personal Reasons					.720
<b>Extraction Method: Principal Component Analysis.                      Rotation Method: Varimax with Kaiser Normalization.<sup>a</sup></b>					
<b>a. Rotation converged in 5 iterations.</b>					

**Figure 2: Factor Structure of Talent Erosion**



**Reliability Statistics**

Reliability statistics of scales used for the study were tested by using Cronbach’s Alpha and results were found satisfactory. As is evident from the table 6 that all the dimensions have

acceptable values of Cronbach’s Alpha which signify construct validity of the factor structure of ‘Talent Erosion’ in the BPM companies.

Table6 : Reliability Statistics		
Name of the Factor	Cronbach's Alpha	Component Variables (Factor Loadings)
Substandard Nature of Job	0.813	Lack of Specialised Skill Repetitive Nature of Work Social Isolation Monotonous Desk Work
Hostile Organisational Culture	0.683	Ineffective Supervision Poor Mentoring Power & Politics

<b>Perceptual Factors</b>	0.712	No Career Growth Low value of BPM job
<b>Unfavourable Work Conditions</b>	0.649	Irregular Work Hours Unsatisfactory Work Conditions
<b>Personal Factors</b>	0.613	Lack of Self-Motivation Personal Reasons

#### IV. CONCLUSION

The study followed sequential steps of Exploratory Factor Analysis to deduce that there are five key factors (comprising thirteen causal agents) which create stressful environment in, and hence propel erosion of talent from the Indian BPM industry. Since the work environment in the BPMs is based on unrealistic standards, it can be very daunting for its young professionals. The need of the hour is to hire HR managers who can devise industry specific policies and programs to address the challenge of high turnover of employees at the middle and junior levels. Employees who leave the organization take along with them valuable information regarding the firm, its customers, current projects, other confidential data and cause potential customer loss, thereby, negatively impacting the morale and productivity of other employees in the company, thereby initiating a negative vicious cycle of attrition and brand image. The model for talent erosion that is depicted in this study lists out the crucial parameters that need to be worked upon by HR professionals for effective management of flight of human capital, which has become a compelling necessity for the Indian BPM industry.

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# A retrospective study of clinical, histopathological and direct immunofluorescence spectrum of immunobullous Disorders

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**Abstract- Background:** Immunobullous disorders are a group of disorders characterized by autoantibodies directed against various skin autoantigens resulting in blister formation. These disorders maybe further classified as intraepidermal and subepidermal depending on the level of bulla. In cases where clinical and histopathological diagnosis could be very challenging, direct immunofluorescence will help at arriving with an accurate diagnosis. Immunofluorescence techniques help in better understanding and classification of the various immunobullous disorders.

**Objectives:** 1. The study aims to correlate Direct immunofluorescence (DIF) with clinical and histopathological findings

2. To analyze the utility of immunofluorescence in the diagnosis of these disorders

**Materials and methods:** The present study included various immunobullous disorders diagnosed by histopathology and immunofluorescence over a period of 2 years from July 2012 to July 2014.

**Conclusion:** Immunofluorescence helps in the confirmation of diagnosis of immunobullous diseases whenever there is a clinical and histopathological overlap. Individually, none of these methods were conclusive of the immunobullous disorder.

**Index Terms-** Immunobullous disorders, Direct Immunofluorescence, Autoimmune bullous disorders

## I. INTRODUCTION

Immunobullous disorders constitute an important group of skin diseases caused by pathogenic autoantibodies directed against target antigens present in the intercellular or dermoepidermal junction. This group may be further subdivided into intraepidermal and subepidermal. Immunofluorescence studies are considered to be the 'gold standard' in the diagnosis of immunobullous disorders and along with the clinicopathological correlation it will help us at arriving with an accurate diagnosis.<sup>1,2</sup>

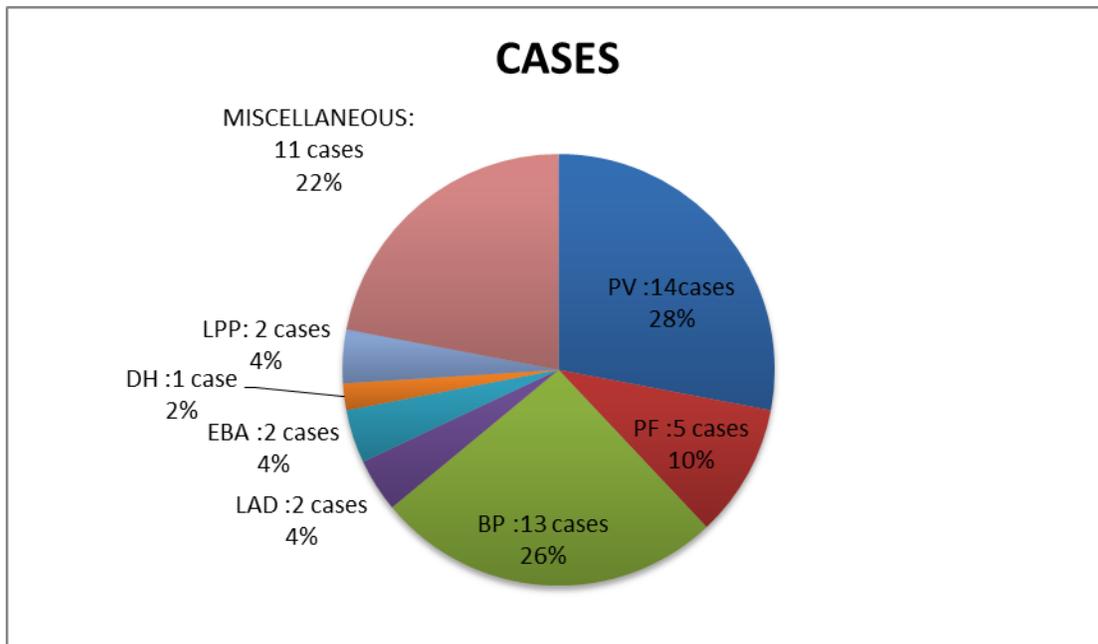
## II. MATERIALS AND METHODS

A total of 100 biopsies received over a period of 2 years by the Departments of Dermatology and Pathology were studied ( July 2012 to July 2014 ). Clinical data was collected from the files of department of Dermatology and the same was recorded along with the reports of histopathological and direct immunofluorescence diagnosis. For histopathological examination ( HPE ), skin or mucosal biopsy was obtained from a fully developed vesiculobullous lesion ( lesional biopsy ) and sent in 10% formalin. Following standard processing, the sections were stained with hematoxylin and eosin and observed under light microscope. For direct immunofluorescence ( DIF ), skin or mucosal biopsy was obtained from perilesional area within 2 cm diameter of the lesion ( perilesional biopsy ) and was sent in Michel's transport medium immediately where it was stained and seen under immunofluorescence microscope.

## III. RESULTS

The study group comprised of 50 biopsies. The age group ranged from 4 years (a male diagnosed with EBA ) to 80 years ( a male diagnosed with BP ) with a mean age of 45.52 years. The male to female ratio was 1 : 2. Oral lesions were observed in 4 patients. DIF showed positive findings in 39 skin biopsies, whereas no significant immune complex deposits were seen in 11 biopsies.

In this study, pemphigus vulgaris was the commonest immunobullous dermatosis observed ( 14 ). Of the total, 19 cases ( 38%) belonged to pemphigus group, 13 cases ( 26%) were bullous pemphigoid ( BP ), 2 ( 4%) were linear IgA disease ( LAD ), 2 cases ( 4%) were epidermolysis bullosa ( EBA ), 1 case (2% ) of dermatitis herpetiformis ( DH ) and 2 cases 4% were lichen planus pemphigoidus ( LPP ). Out of the 19 cases of pemphigus group, 14 cases ( 68.4%) were pemphigus vulgaris ( PV ) and 5 cases ( 31.5%) were pemphigus foliaceus ( PF ).



**Figure 1: Distribution of immunobullous disorders in this study**

Itching and burning sensation of the eroded skin were the common symptoms. Vesicles, bullae, erosions and crusting were the most common clinical findings observed. 24 patients of PV, PF, BP had lesions over the trunk ( 48%). Involvement of extremities was seen in 26 patients (52%). Face and scalp involvement was seen in 9 patients (18%) with PV and PF. Both cases of LPP presented with violaceous papules and plaques apart from vesicles and bullae over normal and involved skin. Flaccid bullae was the characteristic presentation in 16 ( 84% ) cases diagnosed with pemphigus. 9 ( 69.2% ) of the cases diagnosed with BP classically presented with tense bullae over an erythematous base and itching was their most common associated symptom.

On histopathology, all cases of PV showed suprabasal bulla with features of acantholysis. Predominant inflammatory infiltrate consisted of neutrophils.

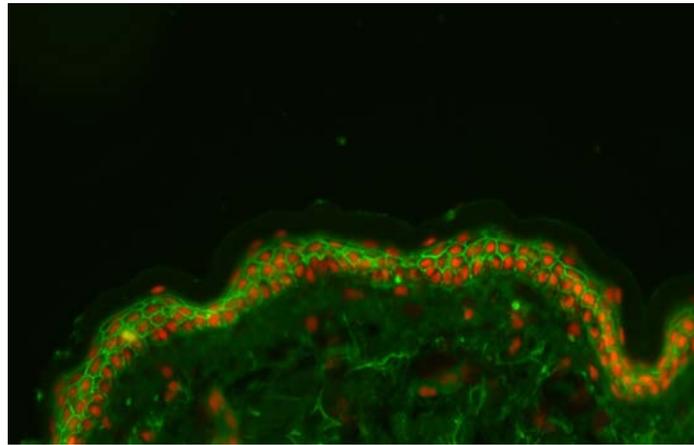
All cases of PF and BP showed subcorneal bulla and subepidermal bulla respectively. All patients with BP had eosinophils within the subepidermal bulla. LAD, EBA showed subepidermal bulla in all the cases. Both cases of LPP showed subepidermal bulla with basal cell degeneration.

On DIF examination, intercellular space ( ICS ) deposition of IgG was seen in all the cases of pemphigus vulgaris resembling a fishnet pattern. 16 cases out of 19 also showed C3 deposition at the ICS. All cases of PF showed ICS deposition of IgG. All cases of BP showed linear IgG and C3 deposition in the BMZ.

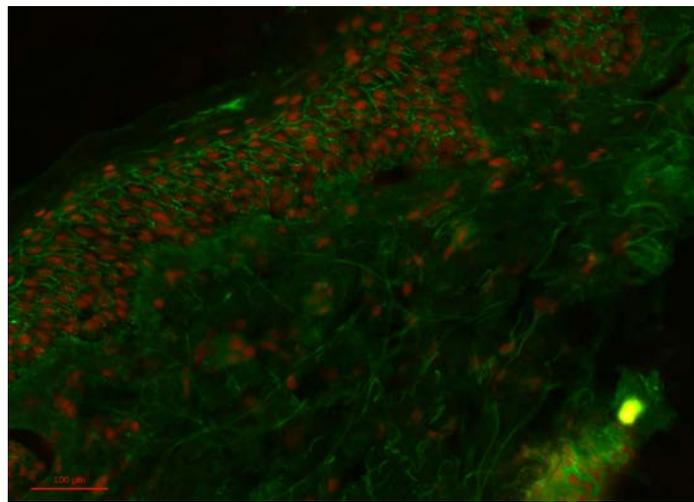
Both the patients of LAD showed linear deposition of IgA along the basement membrane zone ( BMZ ). Subepidermal split was seen in both the cases of EBA. LPP in both the cases showed a linear deposition of IgG and C3 at the BMZ. All except one clinically suspected cases of DH were not confirmed either by histopathology ( HPE ) or direct immunofluorescence ( DIF ). The final diagnosis was based on histopathology and DIF findings.

**Table 1: Clinical, histopathological and immunological correlation in 50 cases**

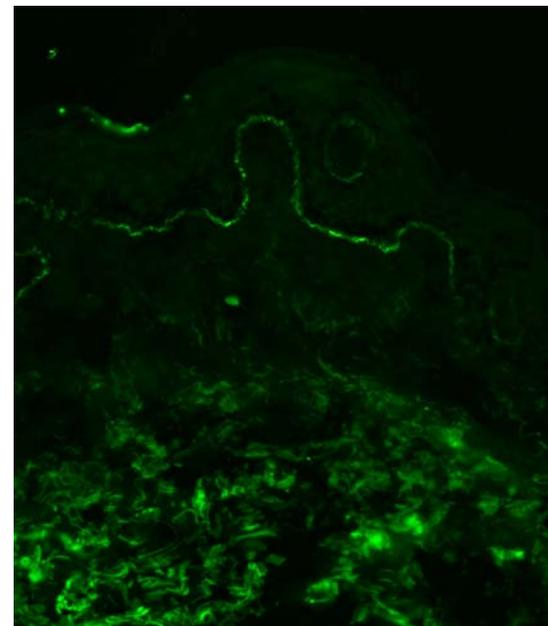
DISEASE	CLINICAL DIAGNOSIS	CONSISTENT HPE DIAGNOSIS	CONSISTENT DIF DIAGNOSIS
PV	17	14	14
PF	6	5	5
BP	13	13	13
LAD	4	2	2
EBA	2	2	2
DH	6	1	1
LPP	2	2	2



**Figure 2: DIF showing pemphigus vulgaris with intercellular deposition of IgG and C3**



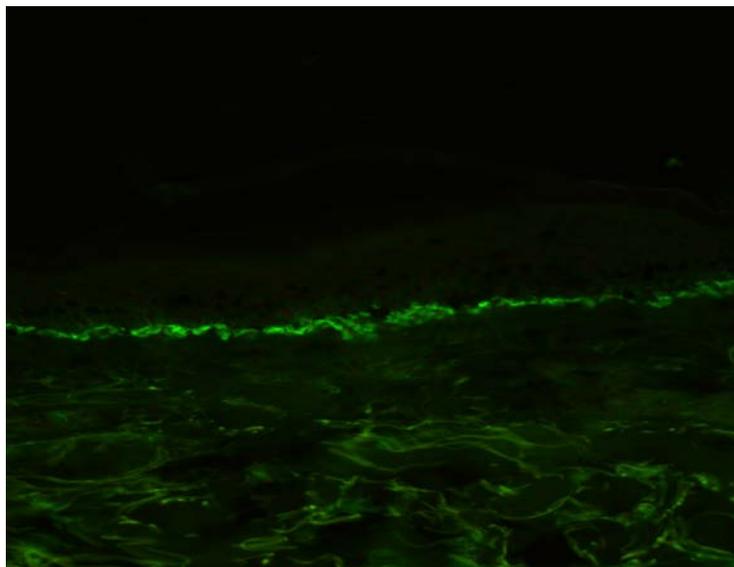
**Figure 3: DIF showing pemphigus foliaceus with subcorneal intercellular space deposition of IgG and C3**



**Figure 4: DIF of bullous pemphigoid showing linear deposition of IgG in the basement membrane zone**



**Figure 5: DIF showing linear deposits of IgA along dermoepidermal junction**



**Figure 6: DIF showing LPP with subepidermal bulla subepidermal bulla and IgG, C3 deposits in granular pattern at BMZ**

#### IV. DISCUSSION

Clinically, all immunobullous disorders may not present with classical morphology and distribution of the lesions. Presentation may vary depending on the severity of the lesions and prior treatment received for the disease. Intraepidermal group of disorders include pemphigus vulgaris and pemphigus foliaceus and subepidermal group of disorders are bullous pemphigoid, linear IgA disease, epidermolysis bullosa acquisita and lichen planus pemphigoidus.<sup>1</sup>

Subepidermal diseases show overlapping histopathology findings and hence it necessitates the use of an additional diagnostic procedure to confirm the diagnosis. DIF demonstrates the immunoglobulin and complement deposited within the skin

biopsy specimen and can differentiate the type of immunobullous disorder depending on the type of immune deposits and the pattern of deposition.

Male to female ratio in this study was 1:2 which was comparable to other studies done by Shamim et al.<sup>3</sup> Trunk and extremities were the frequently involved sites in most cases and this was similarly noted in a study done by Shafi et al.<sup>4</sup> In the current study, Pemphigus ( 38% ) group of disorders was the most common immunobullous disorder and PV ( 26% ) was the most common subtype followed by PF (12% ) and this was in accordance with several other studies.<sup>5,6,7,8</sup> Oral lesions were evident in 4 patients with PV and was absent in all the cases of PF. Nikolsky sign was positive in 14 ( 73.68% ) of the cases, in corroboration with other studies.<sup>9</sup>

All cases of PV ( 100% ) showed a suprabasal bulla with acantholytic cells on histopathology.<sup>10,11</sup>

On DIF, all PV ( 100% ) patients showed IgG deposition in intercellular space and C3 deposition in intercellular space in 84% of the cases.<sup>7,12,13</sup>

All cases of PF (100% ) showed a subcorneal bulla on histopathology and DIF showed IgG deposition in the intercellular space.<sup>10</sup>

BP is most commonly seen in the elderly with the age of onset in their 5<sup>th</sup> to 7<sup>th</sup> decade of life. In the present study, BP occurred in 13 patients. BP classically presented with tense bullae over an erythematous base and itching was their most common associated symptom. It was the most common subepidermal bullous disorder observed in this study.<sup>14,15</sup> The histopathological findings of a subepidermal bullae with eosinophils in the bulla cavity was also demonstrated by Nishioka K et al.<sup>16</sup> DIF findings of a linear deposition of IgG and C3 along the BMZ was consistent with the clinical diagnosis in all cases of BP (100% ). 2 cases clinically diagnosed with pemphigus showed features consistent with BP on histopathology and immunofluorescence.

Out of 4 cases, we arrived at a final diagnosis of LAD in 2 cases (4% ) showing features of a subepidermal bulla and a neutrophil rich infiltrate with DIF showing linear IgA deposition at BMZ and 1 case showed histopathological and DIF consistent with BP.<sup>17,18,19</sup>

2 cases of EBA were reported of which only 1 showed a positive correlation on histopathology and DIF. In our study, only 1 out of 6 biopsy proven cases of DH showed immunoglobulin deposits. Both the clinically diagnosed cases of LPP showed positive histopathology and DIF findings.

On analysis, out of 50 cases, 39 ( 78% ) cases of immunobullous disorders showed a positive correlation between clinical, histopathological and DIF findings. In the remaining 11 cases, the clinical diagnosis was different from that of histopathology and DIF pattern. A clinically diagnosed case of pemphigus and a case of LAD, were later confirmed to be BP with a positive histopathological and DIF correlation. Similar observations such as classical flaccid bullae in pemphigus and tense bullae in BP were described by Khandari et al.<sup>20</sup>

Pemphigus vulgaris with bullae involving only the oral mucosa maybe a sign of early involvement of the disease. In such scenarios, histopathology and DIF helps at arriving at a final diagnosis.<sup>11</sup>

## V. CONCLUSION

Histopathology and direct immunofluorescence helps in classifying and diagnosing various immunobullous disorders with confusingly similar clinical picture. Individually, none of these methods are conclusive of the immunobullous disorder.

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# Automatic Detection and Classification of Diabetic Retinopathy Lesion Using Bag of Visual Words Model

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**Abstract**— Diabetic Retinopathy (DR) is a complication of diabetes that affects the eyes. It's caused by damage to the blood vessels of the light sensitive tissue at the back of the retina. The success rate of its curability solemnly depends on the early stage diagnosis or else it will lead to blindness. DR lesions are detected using Bag Of Visual Words (BoVW) model. Features are extracted using Speeded Up Robust Features (SURF). K-Means clustering is used for creating visual dictionary. Fisher vector encoding and Max pooling technique is used for creating Bag of Visual Words (BOVW). Finally SVM is used for lesion classification.

**Index Terms**— Bag of visual words, Diabetic retinopathy, Encoding, Lesion detectors, SURF, SVM, Visual dictionary.

## 1 INTRODUCTION

Due to modern living style, most of the people are getting affected with Diabetes. The World Health Organization report shows that 135 million people have diabetes and the number of people with diabetes will increase to 300 million by the year 2025. Diabetic Retinopathy (DR) is a most common Diabetic eye disease, which affects the eyes. It occurs due to damage in the capillaries of the light sensitive tissue at the back of the eye i.e. retina. Even if the person does not have Diabetic Retinopathy itself, diabetes will affect the vision. Rapid changes in blood sugar alter the shape of eye's lens, and the image on the retina will become out of focus. After blood sugar stabilizes, the image will be back in focus.

Normal Retinal Fundus image is shown in Fig. 1. Due to diabetic retinopathy characteristics of the blood vessels will change and different parts of the retina get damaged. This creates lesions such as microaneurysms, exudates, and hemorrhages as shown in Fig. 2. During the initial stage, most people do not notice any change in their vision. This stage is called Non Proliferative Diabetic Retinopathy (NPDR). As the disease progresses, Non Proliferative Diabetic Retinopathy move into the advanced proliferative stage. ie called Proliferative Diabetic Retinopathy (PDR).

Without timely treatment, these new blood vessels can bleed, cloud vision, and destroy the retina. Non Proliferative Diabetic Retinopathy shows up as Cotton Wool pots or as Superficial Hemorrhages. It should be monitored with regular checkups otherwise it leads to blindness.

The development of a Automatic Diabetic Retinopathy Detection system that identifies different DR related lesions has been described using a bag-of-visual-words model (BOVW) based upon visual dictionaries [9], [12]. Bag of Words (BOW) is a popular approach which transforms local image descriptors into image representations that are used in classification. To date, a number of encoding techniques such as Soft Assignment [10], Approximate Locality constrained Soft Assignment, Sparse Coding [3] have been developed. It is

showed that recently developed Fisher vector encoding [1] technique outperforms the existing encoding technique.

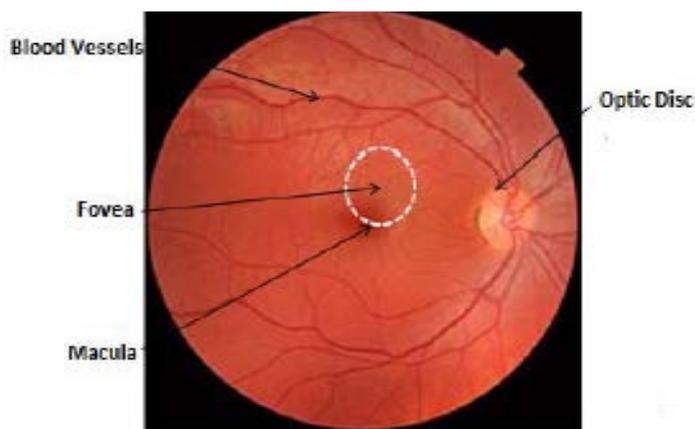


Fig. 1. Normal Retinal Fundus Image

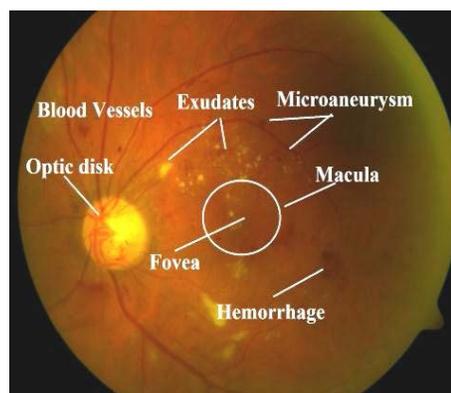


Fig.2. Retinal Fundus Image Containing DR Lesions

## 2 PROPOSED METHODOLOGY

(1)

### 2.1 Proposed Diabetic Retinopathy Lesions Detection Scheme

The proposed DR Lesion detection scheme comprises of three main steps namely Feature extraction, Bag of Visual Words creation and SVM based classification. Diabetic Retinopathy Lesions are detected using a Bag of Visual Words (BoVW) model. This model works by detecting a large number of feature vectors around points of interests in the images and assign these vectors to visual words based on visual dictionary. Fig. 3. shows the process of detecting the DR lesions. Features in DR affected images and normal images are extracted using Speeded Up Robust Features. Clustering is done using K-Means Clustering Algorithm for creating a visual dictionary, representing the normal images and the images with lesions. After creating the visual dictionary, Fisher Vector Encoding technique is used to create the BoVW features, which feeds a 2 class SVM [9] classifier.

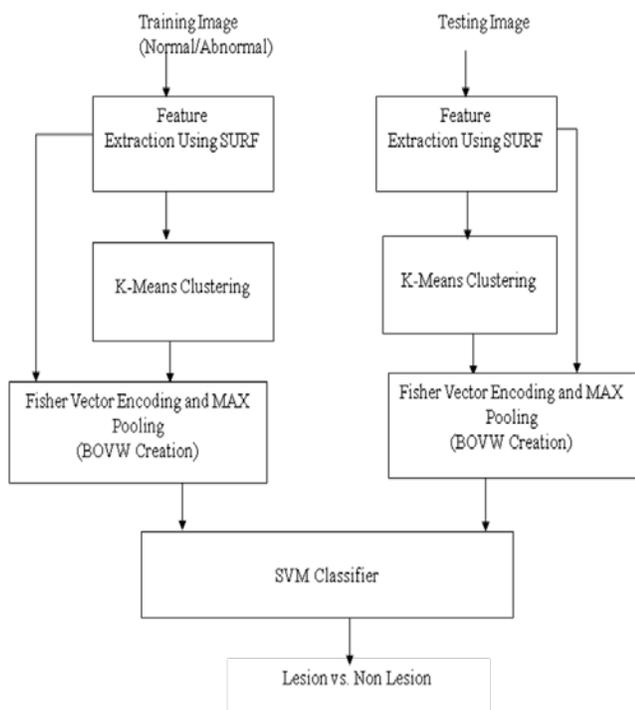


Fig.3. Proposed Lesion Detector

### 2.2 Feature Extraction

#### 2.2.1 Speeded Up Robust Features (SURF)

Speeded Up Robust Features are used for feature extraction. Interest points are selected at different locations in the image, such as corners, blobs. The important property of an interest point detector is its repeatability.

#### Integral Image

The entry of an integral image  $I_{\Sigma}(x)$  at a location  $x = (x, y)$  represents the sum of all pixels in the input image  $I$  within a rectangular region formed by the origin and image coordinates  $(x, y)$ . It is given as

$$I_{\Sigma}(X) = \sum_{i=0}^{i \leq x} \sum_{j=0}^{j \leq y} I(i, j)$$

For example, the summation of the shaded region in input image can be calculated using Integral image.

1	2	2	4	1
3	4	1	5	2
2	3	3	2	4
4	1	5	4	6
6	3	2	1	3

Fig.4. Input Image

Every pixel in an integral image is the summation of the pixels above and to left of it. Once the integral image has been computed, it takes three additions to calculate the sum of the intensities over any rectangular area. The summation of the shaded region in input image Fig.4 can be calculated using four reference integral values of the rectangular region in the corresponding integral image shown in Fig.5. The calculation becomes  $46 - 22 - 20 + 10 = 14$ . It subtracts the regions above and to the left of the shaded region. The area of overlap is added back to compensate for the double subtraction

0	0	0	0	0	0
0	1	3	5	9	10
0	4	10	13	22	25
0	6	15	21	32	39
0	10	20	31	46	59
0	16	29	42	58	74

Fig.5. Integral Image

#### Hessian Matrix

Hessian matrix is a square matrix of second order partial derivatives of a function. SURF uses a Hessian based blob detector to find the interest points. For a Given a point  $X = (x, y)$  in an image  $I$ , the Hessian matrix  $H(X, \sigma)$  in a point  $X$  at scale  $\sigma$  is defined as

$$H(X, \sigma) = \begin{bmatrix} L_{xx}(x, \sigma) & L_{xy}(x, \sigma) \\ L_{xy}(x, \sigma) & L_{yy}(x, \sigma) \end{bmatrix} \quad (2)$$

$L_{xx}(X, \sigma)$  is the convolution of Integral image with the second derivative of the Gaussian kernel.

$$L_{xx}(X, \sigma) = I(x) * \frac{\partial^2}{\partial X^2} g(\sigma) \quad (3)$$

Determinant of the Hessian matrix is used to select the scale. A 9x9 Gaussian kernel is used.

**Orientation Assignment**

Sliding window of size  $\pi/3$  is shown in Fig. 6. Sliding window of size  $\pi/3$  is used to find the orientation of interest point along the scale. Haar wavelet responses in x and y direction within a circular neighbourhood of radius 6s around the interest point is calculated. The wavelet response in x and y direction is referred as dx and dy respectively. The horizontal and vertical responses within the window are summed. The two summed responses gives a local orientation vector. The largest such vector over all windows gives the orientation of the interest point.

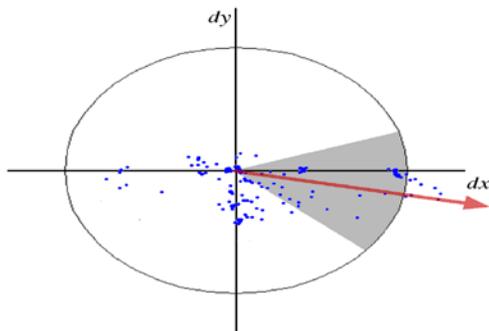
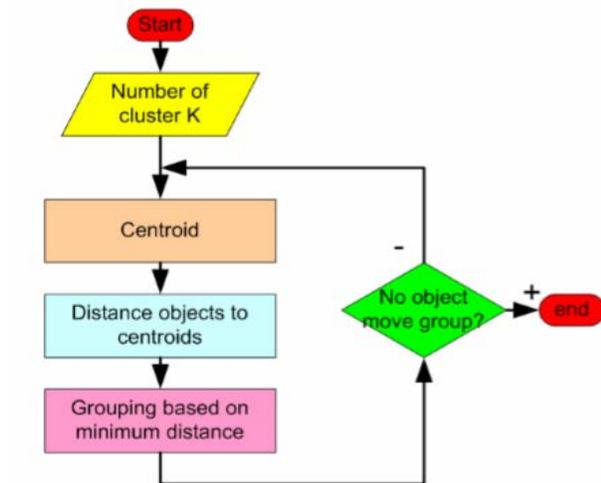


Fig. 6. Sliding Window

**SURF Descriptor**

The first step consists of constructing a square region centred around the interest points. The size of the square region is 20s. The region is split into 4x4 sub regions. For each sub region, Haar wavelet response is calculated at 5x5 regularly spaced sample points. The Haar wavelet response in x and y direction is referred as dx and dy respectively. |dx| and |dy| gives the polarity of the intensity changes. Four dimensional descriptor vector v is calculated for all sub regions using the equation (4).

$$V = (\sum dx, \sum dy, \sum |dx|, \sum |dy|) \quad (4)$$



Concatenating this for all 4 x 4 sub regions, gives a descriptor vector of length 64.

**2.2.2 Bag Of Visual Words Creation**

**a) K-Means Clustering**

The K-means algorithm is the most popular and one of the simplest clustering algorithm. It follows simple iterative steps to classify entire data set into some fixed number of clusters (assume k).

Fig. 7. K-Means Principle

**K-Means: Setup**

1. Initialize K cluster centers
2. It computes the Euclidean distance from each of the feature vector to cluster centre and assigns them to the cluster with the smallest distance
3. Recalculate the k new cluster centres as the Centroid
4. Repeat steps (2) and (3) until the convergence is reached.
5. Dissimilarity measure: Euclidean distance Euclidean distance is the distance between two points in Euclidean Space

The associated norm is called the Euclidean norm.

$$C(i) = \left\| x_i - m_k \right\|^2, \quad i = 1, \dots, N \quad (5)$$

$1 \leq k \leq K$

Where  $X_1, X_2, \dots, X_N$  is the vector of observation.  $C(i)$  is the cluster number.  $m_k$  is the cluster center. k-means algorithm classify each member of a given set of input data into given number of clusters. Fig.8. explains the concept of clustering. K-means Algorithm find the distances between samples and cluster centres. Based on the minimum distance it performs the clustering. First step distributes samples into the clusters, second step update cluster centers. Each sample is assigned to the cluster, which centre is the nearest in given metric. Updation of cluster centres is performed by computing arithmetic mean value of all the samples belonging to the cluster. These two steps are performed iteratively until no changes in position of the cluster centres.

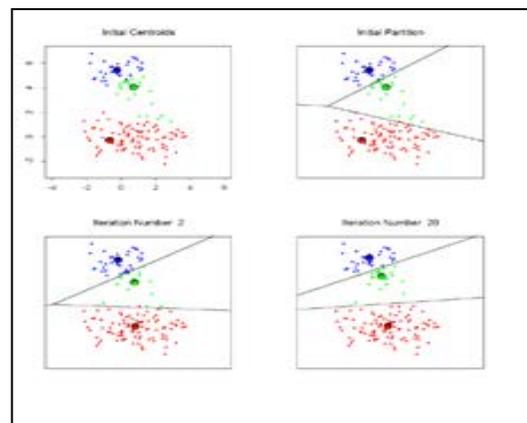


Fig .8.K-Means Clustering

**b) Coding and Pooling**

Visual dictionary is created using k-means clustering algorithm. Centroids of the clusters are used as the visual words in the dictionary. Once the Visual dictionary is created it can be represented as The size of the dictionary is 500.

$$C=C\{i\}, \text{ where } i=1,2,\dots,M.$$

M is the size of the dictionary, and the dictionary size is 500. The coding step creates the BoVW feature vector

**Fisher Vector Encoding**

FV uses Mixture of Gaussians as a dictionary. K components  $\theta=\theta_1,\theta_2,\dots,\theta_K=((w_1,m_1,\sigma_1)\dots(w_k,m_k,\sigma_k))$  are used each consisting of mixing probability, mean, and standard deviation. First and second order statistics are determined using the following equation.

$$\phi_k = (x - m_k) / \sigma_k, \quad \psi_k = \phi_k^2 - 1 \tag{6}$$

Concatenation of per cluster statistics forms the midlevel feature.

$$\phi = [\bar{\phi}_1^T, \dots, \bar{\phi}_K^T]^T \tag{7}$$

Where  $\Phi_k$  is given as

$$\bar{\phi}_k = \frac{p(m_k | x, \theta)}{\sqrt{w_k}} \begin{bmatrix} \phi_k \\ \psi_k / \sqrt{2} \end{bmatrix} \tag{8}$$

expression  $p(m_k | x, \theta)$  is the membership probability of mean  $m_k$  being selected given descriptor  $x$  and parameters  $\theta$ .

**Pooling**

Pooling is the process of aggregating several local descriptor encodings into a single representation. Pooling is typically achieved by either summing/averaging or by taking the maximum response. The pooling step takes place after the coding.

$$g:\{\alpha_j\}; \quad j=1,2,\dots,N. \tag{9}$$

$\alpha_j$  represents the codeword assigned to the local feature vector  $x_j$

**Max Pooling**

Max pooling [2] selects the largest value among the mid level features corresponding to visual words.

$$g(\{\alpha_j\})=Z \quad ; \quad Z_m = \text{Max}(\alpha_{mj}) \tag{10}$$

Z be the final Bag Of Visual Words (BOVW) vector representation, this will be given to the Support Vector (SVM) classifier. The encoded output is finally given to the SVM for classification.

**2.2.3 Support Vector Machine (SVM)**

Support Vector Machine is a powerful methodology for solving

problems in non linear Classification. Support vector machine (SVM) is used when data has exactly two classes. Principle of SVM is given in Fig .8. SVM classifies data by finding the best hyper plane that separates all data points of one class from those of the other class. The best hyper plane for an SVM means the one with the largest margin between the two classes. Margin is the maximal width of the slab parallel to the hyper plane that has no interior data points. Support vectors are the data points that are closest to the separating hyper plane. These points are on the boundary of the slab. '+' indicate data points of type 1, and '-' indicate data points of type -1.

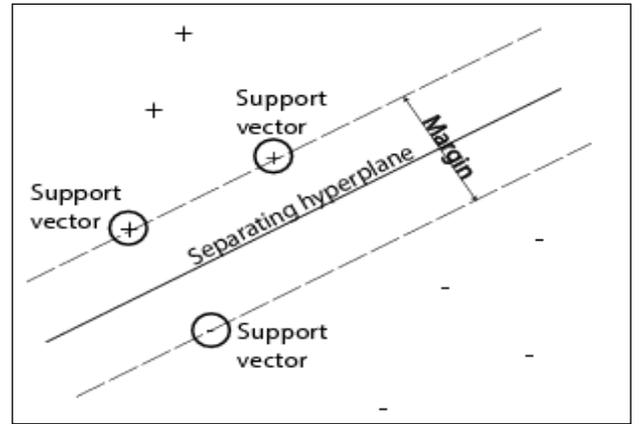


Fig.9. SVM principle

1) Mathematical Formulation

The data for training is a set of points  $x_i$  along with their label  $y_i$ .  $y_i = '1'$  or  $'-1'$ .

The equation of a hyper plane is

$$(w^T x_i + b) = 0 \tag{11}$$

$w$  is called the weight vector and  $b$  is the bias.

Assume that all data is at least distance 1 from the hyper plane, then it follows the two constraints given below for a training set  $\{(x_i, y_i)\}$

$$(w^T x_i + b) \geq 1 \quad \text{if } y_i = 1 \tag{12}$$

$$(w^T x_i + b) \leq -1 \quad \text{if } y_i = -1 \tag{13}$$

SVM classifies the given data points into two groups. The data points greater than '1' are classified into one type of class and the data points less than '-1' are classified into another class.  $y_i$  represents label of each class.

The best solution for  $w$  and  $b$  enables a classification using the following equation.

$$f(x_i) = \text{sign}(w^T x_i + b) \tag{14}$$

The given data point is classified into class 1 or class2 according to the equation (14)

### 3 PERFORMANCE MEASURE

SVM is trained using DR1 dataset and tested using DR2 dataset. The terms used to measure the test performance are true positive (TP), true negative (TN), false positive (FP), false negative (FN).

The performance measures are given by

$$\text{sensitivity} = \frac{\text{number of true positives}}{\text{number of true positives} + \text{number of false negatives}}$$

$$\text{specificity} = \frac{\text{number of true negatives}}{\text{number of true negatives} + \text{number of false positives}}$$

$$\text{Accuracy} = 2 \times \frac{\text{sensitivity} \times \text{specificity}}{\text{sensitivity} + \text{specificity}}$$

### 4 RESULTS AND DISCUSSION

To evaluate the performance of the proposed system, performance measures such as sensitivity, specificity and accuracy are calculated. Dataset DR1 is used for training and DR2 dataset is used for testing. Totally 250 Samples were taken from the dataset. 100 images are used for training and 150 images are used for testing. Then the SVM classifier is trained with training data set.

#### 4.1 Database

Two different datasets, DR1 and DR2, were used. It has 1077 retinal images with resolution of 640x480 pixels. Of which 595 images are normal and 482 images have at least one disease, 234 images contain hard exudates, 139 images contain drusen, 73 images contain cotton wool spots, 102 images contain Superficial Hemorrhages, 146 Deep Hemorrhages and 180 images contain red lesions.

Dataset DR2 has 520 images with resolution of 867x575 pixels. Among the 520 images, 300 are normal and 149 have at least one lesion, 79 images contain hard exudates, 98 images have red lesions, 50 images contain drusen and 17 images contain cotton wool spots.

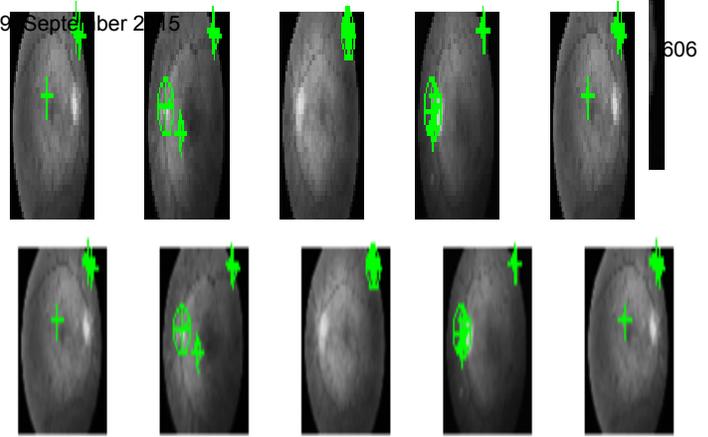


Fig.11. Interest points detection and Feature Extraction (Normal)

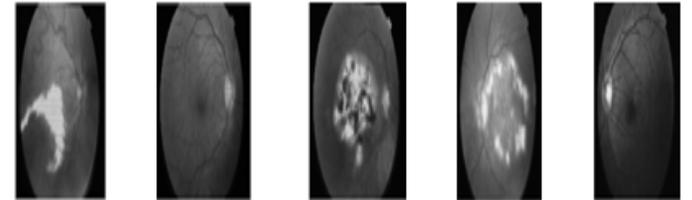


Fig.12. Input Image (Hard Exudates)

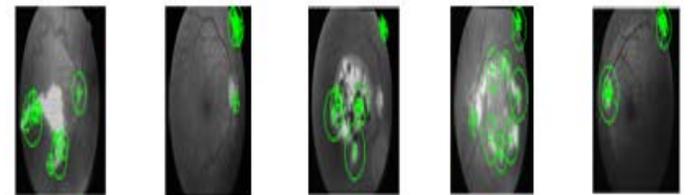


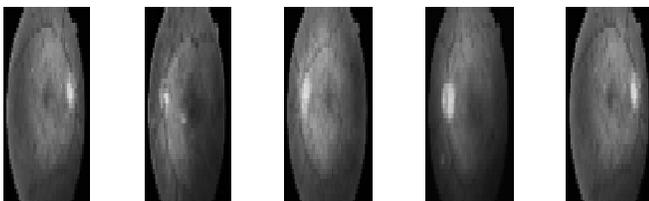
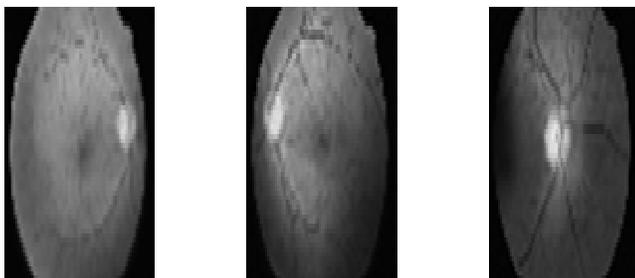
Fig.13. Interest points detection and Feature Extraction (Hard Exudates)

More number of features can be detected using SURF. SURF has less computational complexity than SIFT.

#### 4.3 Bag Of Visual Word Creation and Classification

K-Means Clustering is done for creating visual dictionary. The size of the dictionary is 500. Using fisher vector encoding BoVW features are created. Finally SVM classifier is used for classification, which will classify the image into normal and abnormal image based on the BoVW features. The images with lesions are abnormal and images without lesions are Normal.

TABLE 1	
ACCURACY COMPARISON BETWEEN SURF+ SOFT ASSIGNMENT ENCODING AND SURF+ FISHER VECTOR ENCODING TECHNIQUE	
	



Lesion Detectors	Specificity	Sensitivity	Accuracy
Hard Exudates	86.66	76.62	84.21
Drusen	64.50	81.81	72.09
Red Lesions	76.40	77.25	85.46
CottonWool Spots	79.40	72.15	78.23
Superficial Hemorrhages	63.60	74.57	75.20
Deep Hemorrhages	69.23	71.87	79.00

The Accuracy obtained for each Lesion Detector is given in Table 1.

TABLE 2

PERFORMANCE MEASURE USING SURF+ FISHER VECTOR ENCODING TECHNIQUE

The Results shows that Fisher vector Encoding technique gives better performance than soft Assignment Encoding.

From this Results It is found that Fisher vector Encoding technique gives high Lesion classification Accuracy.

Lesion Detectors	SURF+Soft Assignment Encoding (Accuracy %)	SURF+Fisher vector Encoding (Accuracy %)
Hard Exudates	75.50	84.21
Drusen	58.50	72.09
Red Lesions	65.99	85.46
Cotton Wool Spots	75.00	78.23
Superficial Hemorrhages	59.50	75.20
Deep Hemorrhages	68.00	79.00

## 5 CONCLUSION

Diabetic Retinopathy is caused by complications of diabetes mellitus, which eventually lead to blindness. It affects up to 80% of all patients who have diabetes for 10 years or more. SURF is used to detect the points of interest in the image and Features are extracted around interest points using SURF.K-Means clustering is done for creating visual dictionary. Fisher vector encoding technique and MAX pooling is used for creating Bag of Visual words. Features selected were passed into the support vector machine (SVM) classifier which classifies the images into normal and abnormal. Six Lesion detectors such as Hard Exudates, Drusen, Red Lesions, Cotton Wool

Spots, Superficial Hemorrhages and Deep Hemorrhages were considered. Performance Evaluation was done. The Results shows that Lesion classification Accuracy is improved using Fisher vector Encoding technique.

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# Antilithiatic Influence of *Butea monosperma* Lam and *Nigella sativa* Linn on Ethylene Glycol Induced Nephrolithiasis in Rats

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## ABSTRACT

The effect of aqueous extracts of dried seeds powder of *Butea Monosperma* plant and *Nigella Sativa* plant against Ethylene glycol induced renal calculi in albino wistar rats has been studied in this research. A renal calculus was induced in rats by ingesting 0.75% Ethylene glycol in drinking water for one month. Ethylene glycol treated rats showed significant high increase in the level of promoters such as calcium, phosphorous, Potassium, BUN and low concentration of inhibitors such as magnesium and citrate contents in the urine samples. Histopathological studies also confirmed the deposition of calcium oxalate crystals in kidneys. Separate oral administration of *Butea Monosperma* aqueous suspension to one group of Ethylene glycol induced urolithic rats and *Nigella Sativa* aqueous suspension to another group of Ethylene glycol induced urolithiatic rats (2g/kg body wt/day upto one month) had reduced the concentration of calcium, oxalate, BUN, Creatinine, Phosphorous, and diminished the crystals deposition in the kidneys. The result of the present study confirmed that *Butea Monosperma* aqueous extracts and *Nigella Sativa* aqueous extracts can be used as curative agent for urolithiasis.

**Keywords:** Urolithiasis, *Butea Monosperma*, *Nigella Sativa*, Unani Medicinal Plants,

## INTRODUCTION

Urinary calculi or kidney stone formation is considered as one of the ancient major disorder related to Urinary system. It is estimated that 12% of world population experiences renal stone disease 70% in male and 40% in female. However the treatment present in modern medical system such as Lithotripsy, Kidney Dialysis and Surgical operations are either too costly or not without side effects and does not shows the 100% efficacy & the re-occurrence is common. Hence the search for antilithiatic drugs from natural sources such as plants has assumed greater importance nowadays, People since from ancient times are taking benefit from the nature for curing many number of diseases. The Indian plants are constantly being explored for possible antilithiatic effects (Jha U et al 2011). The present study was designed to investigate the antilithiatic activity of such two selected plants they are *Nigella sativa* and *Butea monosperma*. These two plants were selected based on the claim from local practitioners, & Ethnobotanists.

*Nigella sativa* also known as Black cumin (Krishna jirige) has been used from centuries in Unani medicinal system throughout the Middle East, India and Northern Africa. It is an annual flowering plant with pale blue flowers that belongs to Rannunculaceae family. The fruits of this plant contain angular black seeds, the seeds are considered to be the most valuable part contributing beneficial health effects. *Nigella sativa* as a natural remedy has been documented to possess numeric therapeutic values, including antibacterial, antioxidant, antifungal, antiparasitic, and antiasthmatic property (Aljabre, et al, 2005. Randhawa et al, 2005). The seeds of this plant are also used to cure diabetes, tumour, hypercholesterolemia, hypertension, inflammation, and gastrointestinal disorders (Tasar, et al, 2012; Terzi, et al, 2010; Meddah et al, 2009; Nagi and Almakki, 2009. Ghannadi et al. 2005).

*Butea monosperma* also known as flame of forest is a wild, medium sized tree, belongs to the family Fabaceae. It is locally called as Palas, found in western and central part of India, Burma and few Asian countries. It is a medium sized tree grows upto 20-40 feet height with crooked branches and large trifoliolate leaves, large orange colour flower giving the appearance of "Flame of Forest" its pods are flat and with single seed. In literature, the *Butea monosperma* is known for several properties. The flowers are widely used by tribals and local practitioners in the treatment of Hepatic disorders, Viral Hepatitis, Antihepatotoxic, Antimplantation, Hypoglycemic, Urinary disorders, Diuretics, Kidney stone etc. Every part of the plant has its own medicinal importance (M V Patil,

Shubhangi pawar, and D A Patil, 2006). The seeds are also used in the treatment of bleeding piles, urinary stones, abdominal troubles, intestinal worms, etc (Anil kumar and Krishanu samanta 2012).

## MATERIALS AND METHODS

Male albino wistar rats weighing 35-40gms were purchased from Luqman pharmacy college, Gulbarga. They were housed in well-ventilated cages maintained in air conditioned laboratories with 12 hours dark/ 12 hours light cycles. They were fed with standard diet purchased from VRK Nutritions, Pune. They had free access to drink water. The animals were maintained in these conditions for one week before the experimental session starts. This study was approved by the Animal Ethical Committee and was carried out according to these guidelines.

## ANTILITHIATIC ACTIVITY

The Experimental animals were divided into five groups of six animals each designated as G-1, G-2, G-3, G-4 and G-5. The animals of G-1 were fed with normal food and water only and the animals of this group served as the control. The G-2 animals received Cystone 4.5mg/100gm body weight orally along with the 0.75% of Ethylene glycol for one month and served as the standard (+vecontrol). The animals of G-3 received only 0.75% Ethylene glycol (stone inducer) in drinking water and served as negative control. The animals of G-4 received the 0.75% of Ethylene glycol in drinking water along with the aqueous extract of Plant-1 i.e. *Nigella Sativa Linn* (200mg kg<sup>-1</sup> body weight /daily) upto one month. The animals of G-5 received the 0.75% of Ethylene glycol in drinking water along with the aqueous extract of Plant-2 i.e. *Butea Monosperma Lam* (250mg kg<sup>-1</sup> body weight /daily) upto one month. The below mentioned Table No.1 clearly shows the experimental design.

## EXPERIMENTAL PROTOCOL

Table No.1 showing experimental design

Sex of animals	Sl/no	Drug administration
Females	Group-1	No administration of drugs except standard food and water.
Males	Group-2	Standard +ve control (0.75% Ethylene glycol in drinking water+Cystone 4.5mg/100gm)
Males	Group-3	Negative control (0.75% Ethylene glycol in drinking water) serve as stone inducer.
Males	Group-4	Aqueous extract of Plant-1 <i>Nigella Sativa</i> (200mg kg <sup>-1</sup> body weight /24hrs) + 0.75% Ethylene glycol in drinking water.
Males	Group-5	Aqueous extract of Plant-2 <i>Butea Monosperma</i> (250mg kg <sup>-1</sup> body weight /24hrs) + 0.75% Ethylene glycol in drinking water.

## Relative weights of the Animals

All the experimental animals were divided into five groups of four animals each, the four animals of each group were named as Head(H), Body(B), Tail(T), and Head body(HB) by marking on there body with marker for convinieny, before giving the doses every day throughout the experimental session the animals of all five groups were weighed and there weights were tabulated in Table No 2.

## Relative weights of the kidneys

At the end of 30 days, the animals were mild anaesthetized and sacrificed by cervical decapitation. The Kidneys of all the five Groups were removed and weighed; the mean weights of the kidneys of four animals of every group were tabulated in the Table No.3. Immediately after weighing, kidneys were quickly dissected into ice cold saline. They were trimmed free of connective tissue for further Histopathological studies.

## Measure of Urinary pH and total urinary output

During the experimental session of one month the urine samples of each individual group were collected at regular intervals of one week to observe and compare the variations in the pH of urine samples and total urinary output of each group with respect to

the positive and negative standard groups, the observed pH values are tabulated in Table No.4. and measured Urinary output of all the five groups in ml is tabulated in Table No.5.

### Biochemical assays

The Urine and Blood samples were collected from all the five groups separately in sterile glass containers and were subjected to analyze Calcium, Magnesium, Phosphorous, Potassium, Uric acid, Creatinine, and Proteins in urine samples. BUN and Proteins in the blood samples. The results were tabulated in below mentioned Table No. 6

### Histological assays

The tissue pieces taken from the kidney of the rats fixed by neutral buffered formalin (10%) and subsequently embedded in paraffin. The sections of 5µm thickness trimmed with the help of microtome machine were stained by Haematoxylin and Eosin to study the histopathological changes and calcium oxalate crystal depositions.(Fig : 1)

### Total number of Calcium Oxalate Deposits in 10 microscopic fields of kidney slices

The total number of calcium oxalate (Caox) crystals depositions in 10 microscopic fields individually of each group was calculated by observing the kidney sections under stereomicroscope to observe the changes in the size of crystals, along with the microscopic observation of kidney sections, the urine samples of all the five groups collected at the last day of experimental session were also examined to see the presence of any crystals. The results are tabulated in Table No 7.

### Results

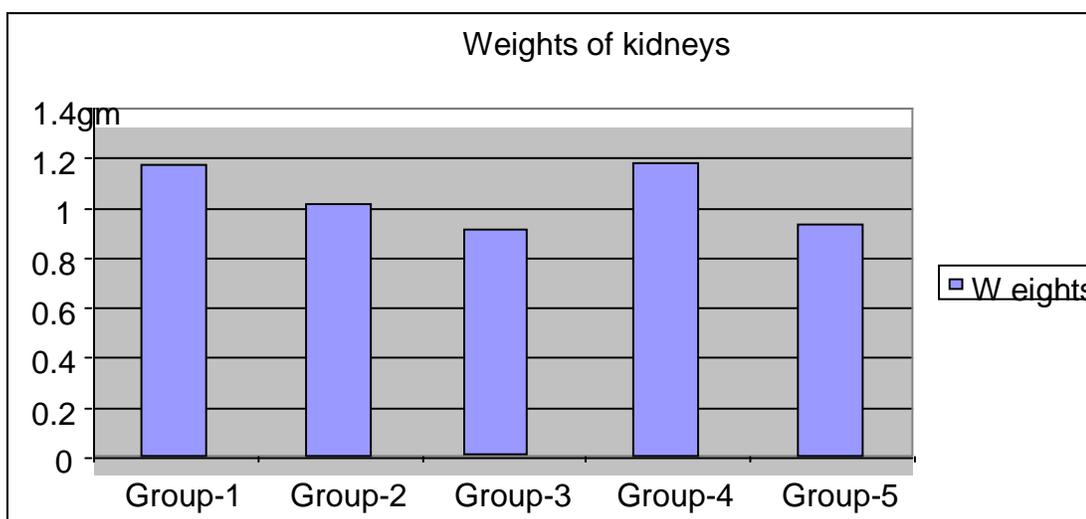
**Table no. 2: showing Weights of Animals in Grams from 1<sup>st</sup> day to 30<sup>th</sup> day**

		1 <sup>st</sup> day	10 <sup>th</sup> day	20 <sup>th</sup> day	30 <sup>th</sup> day
Control	H	50	80	125	140
	B	48	75	128	145
	T	47	79	126	138
	HB	51	80	125	142
Standard	H	50	80	95	130
	B	46	65	105	140
	T	47	70	100	130
	HB	42	60	80	110
-ve control	H	45	67	102	125
	B	46	69	105	130
	T	48	71	75	90
	HB	50	73	60	70
N.S.E	H	55	80	125	125
	B	50	68	95	145
	T	46	80	120	110
	HB	40	55	85	115
B.M.E	H	55	70	130	150
	B	65	71	115	120
	T	45	75	115	150
	HB	48	80	120	95

All the experimental animals were divided into five groups of four animals each, the animals were named as Head(H), Body(B), Tail(T), and Head body(HB) for conviniency, before giving the doses every day throughout the experimental session the animals of all five groups were weighed, It was observed that the body weights of all the five groups was increasing, but at the same time the weights of control group and standard group was increasing at very faster rate, the body weights of 4<sup>th</sup> group i.e *Nigella sativa* aqueous extract treated group and 5<sup>th</sup> group i.e *Butea monosperma* aqueous extract treated group were found near to standard group with slight variations. Whereas very less increase in the body weight of Ethylene glycol treated group was observed.

**Table No .3 : Comparison of Weights of kidneys of all the five groups on the last day of Experiment after dissection.**

	Groups	Weights of kidneys	Mean weights
Normal	Group-1	1.260	1.173±0.06
		1.020	
		1.240	
Standard	Group-2	1.020	1.015±0.03
		1.010	
		1.015	
Induction	Group-3	0.970	0.910±0.01
		0.850	
		0.910	
Plant-1	Group-4	1.150	1.182±0.02
		1.160	
		1.140	
Plant-2	Group-5	1.055	0.936±0.04
		0.860	
		0.895	



At the end of the study, the weight of the kidneys was comparatively lower in Group C i.e negative control compared with Group A control, and Group B i.e positive control .The administration of Aqueous extract of *Nigella sativa* in Group D at equivalent dose of 200 mg/kg (Group D). Increased the weight of kidneys in this Group. The administration of Aqueous extract of *Butea monosperma* in group E at equivalent dose of 250mg/kg (group E). Increased the weight of kidneys. The Table No.3 clearly shows actual weights of kidneys of all the five groups after the completion of experimental session.

**Table No. 4: Showing pH of Urine sample**

	7 <sup>th</sup> day	14 <sup>th</sup> day	21 <sup>st</sup> day
Group-1	3.4	3.9	4.2
Group-2	3.3	3.7	4.1
Group-3	3.0	2.6	3.7
Group-4	3.2	3.7	4.0
Group-5	3.1	2.9	3.9

The ph of urine samples observation at regular interval of every one week showed that during the first week the pH values of all the five groups were similar to one another and near to the pH three, but the pH value of negative control group was drastically

decreased during the second week as well as third week, the pH values of 4<sup>th</sup> group i.e *Nigella sativa* aqueous extract treated group and 5<sup>th</sup> group i.e *Butea monosperma* aqueous extract treated group were found near to standard group with slight variations.

**TABLE : 5 DETERMINATION OF URINARY OUTPUT IN ml/24 hrs**

Days	Group-1	Group-2	Group-3	Group-4	Group-5
1	9.2	9.1	8.7	9.7	8.6
7	9.7	8.6	9	10	9.4
14	10.4	9.9	9.1	10.4	10.2
21	10.3	11.1	9.3	10.8	11.4
28	12.1	12.5	9.5	11.2	12.1

In urinary output determination control rats (Group-1) did not show any significant variations from 1<sup>st</sup> day - 30<sup>th</sup> day, In all the groups considerably there was increase in the urinary output, but less increase in the urinary output of negative control from (8.7ml-9.5ml), moderate increase in the standard group(9.1ml-12.5ml), in *Nigella sativa* group-4(9.7ml-11.2ml), in *Butea monosperma* group-5(8.6ml-12.1ml).

**Table No. 6: BIOCHEMICAL ANALYSIS**

SL/ NO	URINARY EXCRETION LEVEL	GROUP-1	GROUP-2	GROUP-3	GROUP-4	GROUP-5
1	CALCIUM	4.58±0.03	10.89±0.04	0.460±0.03	6.10±0.04	2.95±0.02
2	MAGNESSIUM	1.65±0.01	0.02±0.01	1.22±0.01	0.91±0.01	0.67±0.01
3	POTASSIUM	4.21±0.01	5.36±0.03	0.03±0.01	4.68±0.04	3.82±0.11
4	URIC ACID	13.12±0.02	12.43±0.03	11.09±0.01	13.56±0.01	12.55±0.01
<b>SERUM ANALYSIS</b>						
5	BUN	1.48±0.04	2.29±0.02	15.26±0.03	1.89±0.05	0.43±0.01
6	PROTEINS	2.20±0.01	4.49±0.01	1.91±0.01	2.94±0.02	3.21±0.01
7	Ph OF Urine sampes	4.2	3.7	4.1	4	3.8

**Determination of Urinary Calcium in mg/24hrs**

The Biochemical analysis of various elements in the urine and serum of animals at the end of experimental session was carried out. The level of calcium estimated in the 3<sup>rd</sup> Group i.e negative control Ethylene treated group was fallen to 0.460±0.063, whereas in the 1<sup>st</sup> control group it was 4.58±0.03, in the Cystone treated positive control 2<sup>nd</sup> group it was 10.89±0.04 and in the *Nigella sativa* aqueous extract treated 4<sup>th</sup> group 6.10±0.04 and *Butea monosperma* aqueous extract treated 5<sup>th</sup> group 2.95±0.02. The values of 4<sup>th</sup> and 5<sup>th</sup> groups were found very near to control group and positive control group. The excretion of calcium through urine may reduce the risk of calcium getting deposited in the kidney for the formation of Calcium oxalate stones.

**Determination of Urinary Magnesium in mg/24hrs**

The level of magnesium estimated in the urine sample of 3<sup>rd</sup> Group i.e negative control Ethylene treated group was increased up to 1.22±0.01, whereas in the 1<sup>st</sup> control group it was 1.65±0.01, in the Cystone treated positive control 2<sup>nd</sup> group it was 0.02±0.01 and in the *Nigella sativa* aqueous extract treated 4<sup>th</sup> group 0.91±0.01 and *Butea monosperma* aqueous extract treated 5<sup>th</sup> group 0.67±0.01. The values of 4<sup>th</sup> and 5<sup>th</sup> groups were found very near to control group and positive control group. The magnesium is considered as inhibitor for stone formation, increase in its production and its level in the urine sample is a good sign and indication that the induced drug or extract is effective in the inhibition of stone formation.

**Determination of Urinary Potassium in mg/24hrs**

The level of Potassium estimated in the urine samples of 3<sup>rd</sup> Group i.e negative control Ethylene treated group was fallen to 0.03±0.01, whereas in the 1<sup>st</sup> control group it was 4.58±0.03, in the Cystone treated positive control 2<sup>nd</sup> group it was 10.89±0.04 and in the *Nigella sativa* aqueous extract treated 4<sup>th</sup> group 6.10±0.04 and *Butea monosperma* aqueous extract treated 5<sup>th</sup> group 2.95±0.02. The values of 4<sup>th</sup> and 5<sup>th</sup> groups were found very near to first control group and second positive control group. The

excess of potassium if it is continuously getting excreted through urine the risk of potassium getting deposited in the kidney for the formation of stone decreases upto some extent.

**Determination of Urinary Uric acid in mg/24hrs**

The level of uric acid estimated in the 3<sup>rd</sup> Group i.e negative control Ethylene treated group was fallen to 11.09±0.01, whereas in the 1<sup>st</sup> control group it was 13.12±0.02, in the Cystone treated positive control 2<sup>nd</sup> group it was 12.43±0.03 and in the *Nigella sativa* aqueous extract treated 4<sup>th</sup> group 13.56±0.01 and *Butea monosperma* aqueous extract treated 5<sup>th</sup> group 12.55±0.01. The values of 4<sup>th</sup> and 5<sup>th</sup> groups were found very near to control group and positive control group. The excretion of uric acid and its presence in urine samples is the indication that both the plant samples are effective in reducing the uric acid concentration in the kidneys and eliminating it through urine.

**Determination of BUN (Blood Urea Nitrogen) in mg/24hrs**

On 30th day after 2 hours of last dose, animals were anaesthetized. Blood was collected from orbital venous plexus in non-heparinized tubes and centrifuged at 2000 rpm for 20 min to obtain serum, which was used for further analysis. The level of BUN estimated in the 3<sup>rd</sup> Group i.e negative control Ethylene treated group was increased to 15.26±0.03, whereas in the 1<sup>st</sup> control group it was 1.48±0.04, in the Cystone treated positive control 2<sup>nd</sup> group it was 2.29±0.02 and in the *Nigella sativa* aqueous extract treated 4<sup>th</sup> group 1.89±0.05 and *Butea monosperma* aqueous extract treated 5<sup>th</sup> group 0.43±0.01. The values of 4<sup>th</sup> and 5<sup>th</sup> groups were found very near to first control group and second positive control group. Decrease in its level in both treated groups i.e 4<sup>th</sup> and 5<sup>th</sup> group is the indication of decrease in its toxicity in the blood.

**Table 7 Total number of caox Deposits in 10 microscopic fields of kidney slices**

Groups	No of Deposition
Group-1	NIL
Group-2	7.00±0.58
Group-3	29.67±0.88
Group-4	5.67±0.33
Group-5	3.67±0.33

Microscopic observation of rat bladder urine revealed that urine of the control group rats was more or less devoid of any crystals whereas, in the sections of Ethylene Glycol treated group 'C' the number of depositions in 10 microscopic fields were 29.67±0.88 which was significantly higher than group 'B'(Positive control) 7.00±0.58. In group 'D'(Nigella sativa) 5.67±0.33 & in group 'E'(Butea monosperma) 3.67±0.33, the number of deposits were significantly lower than group 'C'. However both the extracts were able to decrease the number of crystal deposits in kidneys. Therefore the beneficial action of both the extracts on human kidneys can be suggested without any side effects, toxicity and also an alternative treatment to chemical drugs.

**Histopathological analysis**

Analysis of Haematoxylin and Eosin stained kidney sections also supported the serum and urine biochemistry results, showing normal structure and architectural intactness without any apparent damages in control group rats and there were no calcium oxalate deposits or other abnormalities in the nephron segments. In positive control group B, deposits were composed of only one or two polygonal crystals depositions. In negative control group C the number of deposits were exceeding from nine to ten, which was significantly higher than control group A. Interestingly, similar to first control group there was no or only one to two crystals depositions were observed in *Nigella sativa* seeds extract treated group-4 and *Butea monosperma* seeds extract treated group-5

Fig 1.a

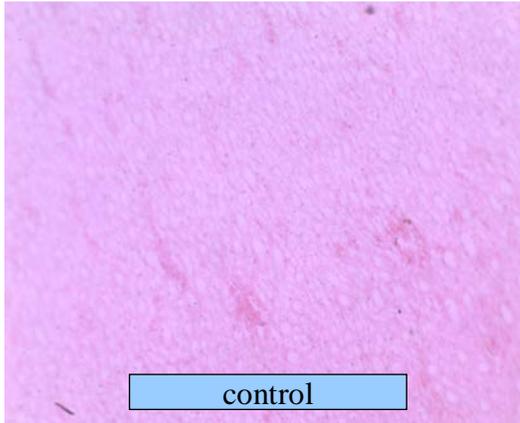


Fig 1.b

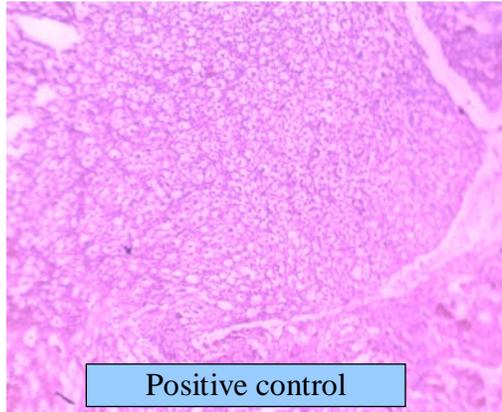


Fig 1.c

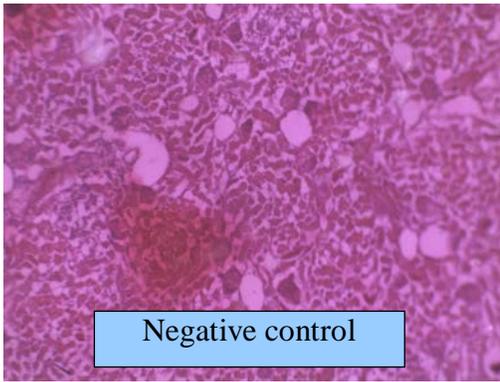


Fig 1.d

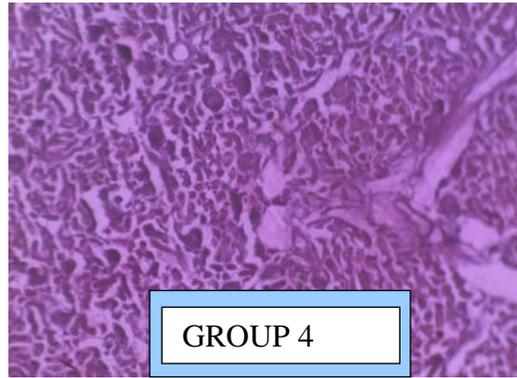


Fig 1.e

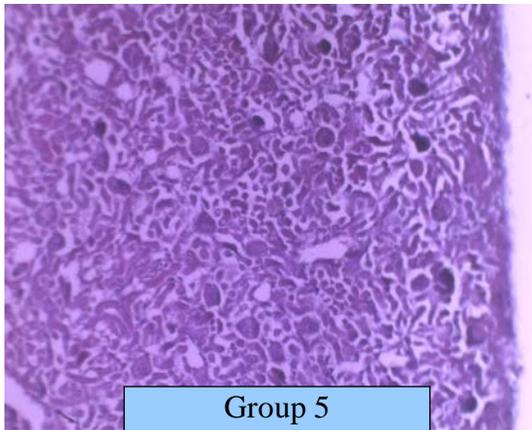


Figure : 1.a Normal structure of kidney

Figure : 1.b Section of kidney showing one calculi deposition

Figure : 1.c Section of kidney showing eight to nine calculi depositions

Figure : 1.d Section of kidney showing two to three calculi depositions

Figure : 1.e Section of kidney showing two to three calculi depositions reduced in size.

## DISCUSSION

Ethylene glycol is the dihydroxy alcohol derivative of ethane. It is utilised in antifreeze solutions, coolants, glass cleaners, cosmetics, paints etc. The characteristics of ethylene glycol are clear, colourless, sweet-tasting liquid. When ethylene glycol is metabolised by the body, it produces four toxic metabolites they are glycoaldehyde, glycolate, glycolic acid, and glyoxylate. All of this metabolites may cause destruction of the tissue that primarily form calcium oxalate crystal deposition and metabolic abnormalities, especially a high anion gap metabolic acidosis, lactic acidosis, and hypocalcemia. The Oxalic acid combines with calcium to form calcium oxalate crystals, which deposits in the kidneys. This can result in Hypocalcemia, Hematuria, proteinuria, increased creatinine and renal failure. (A' Liyaturo Rosyidah and sri widyarti. 2013).

The results of present study clearly indicates that aqueous extracts of *Nigella sativa* seeds and *Butea monosperma* seeds, showed comparable activity to that of cystone in terms of inhibiting the formation of calcium oxalate precipitate. The reduction of stone forming constituents in urine and there decreased kidney retention reduces the solubility product of crystallizing salts such as calcium oxalate and calcium phosphate, thus aqueous extract of both the plants could be further analysed and characterised for its active compound and mechanism involved in it, this study could lead to a new drug for the patients with urolithiasis.

Thus, this study provides a basis for utility of aqueous extracts of *Nigella sativa* seeds and *Butea monosperma* seed in the treatment of renal and urinary calculi and it is in accordance with earlier study by Mousa-Al-Reza Hadjzadeh *et al.* 2007 and put forth the possibility of use of *Nigella sativa* seeds as the therapeutic agent to treat urolithiasis. The seeds of *Butea monosperma* in accordance with the review of *Butea monosperma* by Firdaus Rana and Mazumder Avijit *et al.* 2012.

The study of the urinary chemistry with respect to the stone-forming minerals will provide a good indication of the risk of stone formation. In the present study, observed Hypocalciuria in ethylene glycol induced urolithic rats might be a factor favouring the nucleation and precipitation of calcium oxalate

## CONCLUSION

Kidney stone disease has afflicted humankind since ancient times and can persist, with serious medical consequences, throughout a patient's lifetime. In addition, the incidence of kidney stones has been increased in most societies in the last five decades, especially in association with economic development. In spite of tremendous advances in the field of medicine, there is no truly satisfactory drug for the treatment of urolithiasis. Recently, there is with increasing evidence that many healthy natural food and medicinal herbal and supplements have the potentials to solve the problem of eradicating many number of diseases related to mankind. The Aqueous seeds extract of *Nigella sativa* and *Butea monosperma* were able to reduce the growth of urinary stones, decreased the number of calcium oxalate depositions and restored the structure of kidneys in rats. Therefore, the beneficial action of these both the plants may be suggested. However, further studies must clarify the mechanism.

In conclusion, The presented data indicated that administration of aqueous extract of *Nigella sativa* and *Butea monosperma* seeds powder to rats prevented urolithiasis induced with Ethylene glycol and reduced the growth of calcium oxalate stones, reduced the number of stone deposits, both the extracts were found effective in reducing the renal tissue injury, decreasing the crystal size, thus can simply be swept by urine and helps in restoring normal kidney architecture and weights of the kidneys. In this comparative study it was found that the *Nigella sativa* aqueous extract and *Butea monosperma* aqueous extract results were very near to standard drug i.e cystone, In comparison to both the plant extracts *Nigella* was very near to standard and *Butea* was near to *Nigella* but both were very far from the -ve control results. Further, experimental and clinical studies are required to elucidate the chemical constituents of the extracts and mechanism responsible for the pharmacological activities. This study has supported the folk information, and claim regarding antiurolithiatic activity of both the plants *Butea monosperma* (Ethnomedicines) and *Nigella Sativa*. (Al Tib Al Nabvi)

The number of caox deposits in 10 microscopic fields of kidney slices in group 'C' was  $29.67 \pm 0.88$  which was significantly higher than group 'B'(Positive control)  $7.00 \pm 0.58$ . In group 'D'(Nigella sativa)  $5.67 \pm 0.33$  & in group 'E'(Butea monosperma)  $3.67 \pm 0.33$ , the number of deposits was significantly lower than group 'C'. However both the extracts were able to decrease the number of crystal deposits in kidney's .Therefore the beneficial action of both the extracts on human kidneys can be suggested without any side effects, toxicity and also an alternative treatment to chemical drugs.

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# Steady state and transient Brillouin gain in narrow band-gap magnetized semiconductors

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**Abstract:** Using the hydrodynamic model of semiconductor plasmas, a detailed analytical investigation is made to study both the steady-state and the transient Brillouin gain in narrow band gap magnetized one-component centrosymmetric semiconductor viz. n-InSb under off-resonant laser irradiation. Using the fact that origin of stimulated Brillouin scattering (SBS) lies in the third-order (Brillouin) susceptibility ( $\chi_B^{(3)}$ ) of the medium, we obtained an expression of the threshold pump electric field ( $E_{th}$ ), the resultant gain coefficients (steady-state as well as transient  $g_{B,TB}$ ) and optimum pulse duration ( $\tau_p$ ) for the onset of SBS. The application of a strong magnetic field not only lowers  $E_{th}$  but also enhances  $g_{B,TB}$ . The carrier heating by the intense pump modifies the electron collision frequency and hence the nonlinearity of the medium which in turn enhances  $g_{B,TB}$  significantly. The Brillouin gain is found to be maximizing when the generated acoustic wave suffers no dispersion in the medium. The enhanced  $g_{TB}$  can be greatly used in the compression of scattered pulses.

**Index Terms:** Stimulated Brillouin scattering, Semiconductor plasmas, Carrier heating, Narrow band gap semiconductor

## I. INTRODUCTION

Following the advent of lasers, nonlinear optics (NLO) has emerged as a multidisciplinary subject of great breadth and richness, attracting the interest of researchers in basic as well as applied fields. The subject area covered by NLO can be divided into two broad categories: (i) steady-state NLO effects, and (ii) coherent transient optical effects. A large number of NLO effects (parametric interactions, stimulated scatterings and their applications to parametric amplifiers and oscillators in the phenomena like optical phase conjugation etc.) occur as a consequence of either cw laser operation or with lasers having pulse durations much longer than the dephasing or recombination times of the medium. Such NLO phenomena can be broadly defined as steady-state NLO effects. Moreover, sufficient large interaction times allow the control of light with light and therefore, all optical signal processing phenomena fall into the class of steady-state NLO effects. The origin of such mechanisms in the crystals lies largely in the presence of free-carrier states and the photo-generation of carriers. The study of transient coherent optical effects viz., optical nutation, and free induction transparency has become a very important area of research in the recently developed subfield of coherent optical spectroscopy. These effects arise when the material response to an incident intense laser light field is slower than the rate of variation of light intensity. In other words, if the pump pulse duration is much smaller than the dephasing time of the resonant excited state,

the medium can keep in memory the light induced coherence for some time after the switching off of the excited pulse.

Out of the several NLO effects, the nonlinear scattering of laser radiation in gaseous and solid state plasmas aroused a great deal of interest in the past few years [1-5] on account of the fact that the absorption of laser radiation in plasma greatly depends on these processes. When an intense light beam interacts with an active medium, strong optical amplification of the scattered wave occurs at Stoke's shifted frequency. Such phase coherent processes are called stimulated scattering processes. Amongst these, the study of stimulated Brillouin scattering (SBS) in solids has been the subject of intensive investigations (both theoretical and experimental) due to its manifold technological applications in a wide range of optical communication and optoelectronics applications. Some of these are: distributed fiber optic Brillouin sensors, laser induced fusion, pulse squeezing and optical phase conjugation (OPC) [6]. In laser-induced fusion experiments, SBS is of great concern because it can significantly redirect the pump energy away from the target and thus adversely affects the energy absorption [7]. It is, therefore, desirable to minimize SBS process in these experiments. For OPC, SBS is preferred over other stimulated scattering processes because it initiates at low threshold pump intensity, suffers negligible frequency shifts and offers high conversion efficiency [8]. In this method, the incident wave serves as both the pump for inciting the nonlinear process and distorted wave to be conjugated. Il'ichey [9] has reported that the OPC-SBS conversion efficiency can be expressed in terms of parameters of the scattering medium and excitation intensity. Using a frequency doubled Nd: YAG laser as a pump and Rhodamine 6G as a Brillouin medium, it was experimentally demonstrated that OPC-SBS reflectivity is maximum only at a specific intensity of an incident pump beam [10]. The combination of SBS and four-wave mixing (FWM), termed Brillouin-enhanced four-wave mixing (BEFWM), has recently received great attention as it can yield phase conjugate signals with extremely high reflectivity [11].

Various aspects of SBS and its consequent instabilities have been investigated in gaseous plasmas [1, 2, 12, 13]. But the practical utilization of semiconductors drew the attention of many solid-state physicists to examine the role of semiconductors in the areas such as spectroscopy, lasers, device fabrication etc. Moreover, in the search for optical memories and switching elements, one found that the optical properties of these materials change strongly when electrons are excited optically. The electrical properties of semiconductors lie in between those of metals with nearly free electrons and insulators with tightly bound electrons. This intermediate situation makes semiconductors attractive

as nonlinear devices in electronics as well optics because their properties can be influenced easily by fields, compositions and micro-structuring. Hence, the supremacy of semiconductors as active media in laser communication, modern optoelectronic devices, optical computing [14, 15] and all optical signal processing [16] is unquestionable and hence the understanding of the mechanisms of transient effects in these crystals appears to be of fundamental significance.

SBS is caused by coherent interaction of an intense pump, scattered and acoustic waves in a medium. The internally generated acoustic and scattered waves propagate along specific directions and amplify when the intensity of pump beam exceeds a threshold value [17]. The origin of SBS lies in the third-order optical susceptibility of the medium, also known as Brillouin susceptibility ( $\chi_B^{(3)}$ ). The steady-state and transient Brillouin gain coefficients ( $g_{B,TB}$ ) being directly dependent upon  $\chi_B^{(3)}$ , an enhancement in Brillouin gains is possible if one can achieve larger  $\chi_B^{(3)}$  in the nonlinear medium. Recently, one of the present authors [18] have shown keen interest in the application of an external magnetic field to enhance remarkably  $\chi^{(3)}$  in III-V semiconductors. In the recent past, a significant amount of research work on SBS and its consequent instabilities in magnetized doped semiconductors have been reported by several groups [19-23]; the theoretical predictions and experimental measurements are far apart [24]. Several experiments, with short laser pulses of low intensity, suggest that SBS starts below the theoretically estimated threshold value, whereas some experiments with high-intensity radiation reveal that SBS signal levels saturate at much lower values than their theoretically predicted values. In crystalline solids, there always exists a thermally excited acoustic wave (AW) which can scatter the incident light of any arbitrary intensity and gives rise to spontaneous Brillouin scattering. However, when the pump intensity reaches a certain threshold value, it induces electrostrictive AW that gives rise to SBS. The interaction of this intense pump with carriers in a semiconductor results in an appreciable increase in the carrier temperature due to their high mobility, low effective mass, long free path and slow rate of energy transfer to the lattice.

Literature survey reveals that no schematic attempt has so far been made to explore the influence of carrier heating on SBS process in narrow band-gap magnetized semiconductors. In the present paper, by using a hydrodynamic model of semiconductor plasma, we intend to study the influence of the pump-induced carrier heating on the steady-state and transient gain coefficients of the Brillouin mode. The stimulus for the present study stems from the fact that the carrier heating by the pump can remarkably modify the nonlinearity of the medium and hence the related phenomena. In the wake of high-power lasers, such an investigation becomes even more important because it may lead to a better understanding of the scattering mechanisms in solids and gaseous plasmas and thus may prove to be a step forward towards filling the gap between theory and experimental observations. The ambient temperature of the crystal is assumed to be maintained at 77 K. The semiconductor is assumed to be immersed in a strong magnetic field, which may appreciably lower the SBS threshold and hence may enhance the Brillouin gain coefficient.

## II THEORETICAL FORMULATIONS

This section deals with the theoretical formulation of complex effective third-order (Brillouin) susceptibility  $\chi_B^{(3)}$ , and there from the steady-state and transient Brillouin gain coefficients  $g_{B,TB}$  for the Stokes component of the scattered electromagnetic wave in a Brillouin active medium. We consider the propagation of a hybrid pump wave

$$\vec{E}_0 = (E_{0x}\hat{i} + E_{0y}\hat{j})\exp[i(k_0x - \omega_0t)] \quad (1)$$

in a homogeneous electrostrictive n-type III-V semiconductor viz. n-InSb embed in a uniform static magnetic field  $\vec{B}_s = B_{0x}\hat{i} + B_{0z}\hat{k}$  in a direction making an angle  $\theta$  with the x-axis, as shown in Fig. 1.

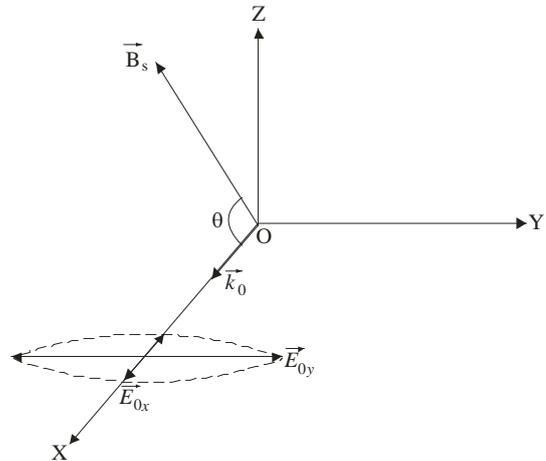


Figure 1: Geometry of SBS in magnetic field.

The authors have chosen this particular field geometry because most of the reported cases correspond to the propagation of a pump wave exactly parallel to the applied magnetic field. Such an exact parallel propagation may not be experimentally feasible. Moreover, the electric field of the pump considered is either perpendicular or parallel to the propagation directions. This, again, is not the case in realistic situations [25]. For a finite solid state plasma,  $\vec{E}_0$  must have components that are both parallel and perpendicular to the propagation direction. Thus the most realistic case (that the authors have considered here) is to consider a hybrid mode propagating obliquely to the external magnetic field.

According to the classical description of SBS, the intense pump ( $\omega_0, k_0$ ) induces electrostrictive force and drives an AW ( $\omega_a, k_a$ ) in the medium. This AW in turn plays the role of an induced density-modulated grating for the pump and gives rise to Brillouin scattered light ( $\omega_1, k_1$ ). Thus the pump light, acoustic and the scattered light waves can couple with one another in an electrostrictive medium. In favourable conditions, a significant growth of both the AW and scattered light waves is possible at the expense of the pump intensity, provided the pump intensity exceeds the threshold value.

The equation of the generated AW in an electrostrictive medium is given by

$$\frac{\partial^2 u(x,t)}{\partial t^2} - \frac{C}{\rho} \frac{\partial^2 u(x,t)}{\partial x^2} + 2\Gamma_a \frac{\partial u(x,t)}{\partial t} = \frac{\gamma}{2\rho} \frac{\partial}{\partial x} [(E_e)_x (E_1^*)_x], \quad (2)$$

where  $\vec{E}_e = \vec{E}_0 + (\vec{v}_0 \times \vec{B}_s)$  represents the effective electric field which includes the Lorentz force  $(\vec{v}_0 \times \vec{B}_s)$  in the presence of external static magnetic field  $\vec{B}_s$ , in which  $\vec{v}_0$  being the oscillatory fluid velocity of an electron of effective mass  $m$  and charge  $e$  at pump frequency  $\omega_0$ ;  $u(x,t) = u \exp[i(k_a x - \omega_a t)]$  is the lattice displacement.  $C$ ,  $\rho$ ,  $\Gamma_a$  and  $\gamma$  are the elastic constant, material density, phenomenological damping parameter and electrostrictive coefficient of the medium, respectively.  $E_1$  is the space charge electric field. The term on the right-hand side of Eq. (2) is the driving force per unit material density and originates from the electrostrictive mechanism. In hydrodynamic approximation ( $kl = 1$ ;  $k$  the wave number, and  $l$  the carrier mean free path), we consider electrons are mobile carriers while holes are at rest due to their heavy mass. The condition implies that the sound wavelength is much greater than the average distance the electron travels between collisions so that the motion of the carriers under the influence of the external field is averaged out.

The other basic equations of the analysis are:

$$\frac{\partial \vec{v}_0}{\partial t} + \vec{v}_0 \cdot \nabla \vec{v}_0 + \left( \vec{v}_0 \cdot \frac{\partial}{\partial x} \right) \vec{v}_0 = \frac{e}{m} \vec{E}_e \quad (3)$$

$$\frac{\partial \vec{v}_1}{\partial t} + \vec{v}_1 \cdot \nabla \vec{v}_1 + \left( \vec{v}_0 \cdot \frac{\partial}{\partial x} \right) \vec{v}_1 + \left( \vec{v}_1 \cdot \frac{\partial}{\partial x} \right) \vec{v}_0 = \frac{e}{m} [\vec{E}_1 + \vec{v}_1 \times \vec{B}_s] \quad (4)$$

$$\vec{P}_{es} = -\gamma \vec{E}_e \frac{\partial u}{\partial x} \quad (5)$$

$$\frac{\partial n_1}{\partial t} + n_e \frac{\partial v_1}{\partial x} + n_1 \frac{\partial v_0}{\partial x} + v_0 \frac{\partial n_1}{\partial x} = 0 \quad (6)$$

$$\frac{\partial E_1}{\partial x} = -\frac{n_1 e}{\epsilon} + \frac{\gamma E_e}{\epsilon} \frac{\partial^2 u}{\partial x^2} \quad (7)$$

Eqs. (3) and (4) represent the carrier motion under the influence of the pump ( $\vec{E}_0$ ), scattered ( $\vec{E}_1$ ) and static magnetic ( $\vec{B}_s$ ) fields;  $\vec{v}_0$  and  $\vec{v}_1$  are the zeroth and first-order electron fluid velocities. Here  $v$  the momentum-transfer collision frequency of electrons. In Eq. (5),  $\vec{P}_{es}$  is the electrostrictive polarization produced due to modulation of the dielectric constant of the medium under the electrostrictive action of the pump. Eq. (6) is the continuity equation of the electrons, in which  $n_e$  and  $n_1$  are the equilibrium and perturbed electron densities, respectively. The strong space-charge  $\vec{E}_1$  developed due to migration of charge carriers under the influence of the pump and magnetic fields is determined from Poisson equation [Eq. (7)]. Here  $\epsilon$  is the dielectric permittivity of the medium expressed as  $\epsilon = \epsilon_0 \epsilon_L$ ;  $\epsilon_0$  and  $\epsilon_L$  are the free-space permittivity and lattice dielectric constant of the medium, respectively.

### 2.1. Total induced current density

The interaction of the pump with the electrostrictively generated AW produces an electron density perturbation, which in turn drives an electron-plasma wave and induces nonlinear current density in the medium. In a doped semiconductor, the equation of this electron-plasma wave is obtained by using the standard approach [26]. Differentiating Eq. (6) with respect to time and using Eqs. (3) and (7), one gets on simplification,

$$\frac{\partial^2 n_1}{\partial t^2} + v \frac{\partial n_1}{\partial t} + \bar{\omega}_p^2 n_1 - \frac{n_e \gamma k_a^2 u^*}{\epsilon} \frac{\bar{\omega}_p^2}{\omega_p^2} \vec{E} = -ik_1 n_1 \vec{E} \quad (8)$$

where  $\vec{E} = \frac{e}{m} (E_e)_x$ ,  $\bar{\omega}_p^2 = \omega_p^2 \left( 1 - \frac{v^2 + \omega_{cx}^2}{v^2 + \omega_{cz}^2} \right)$ ,

$\omega_p = [n_e e^2 / m \epsilon]^{\frac{1}{2}}$  (electron-plasma frequency) and

$\omega_{cx,z} (= e B_{sx,z} / m)$  are the components of the electron cyclotron frequency  $\omega_c (= \sqrt{\omega_{cx}^2 + \omega_{cz}^2})$ . We neglect the

Doppler shift under the assumption that  $\omega_0 \gg v \gg k_0 \cdot v_0$ .

The process of SBS may also be described as the annihilation of a pump photon and simultaneous creation of one scattered photon and one induced phonon. From this viewpoint, the conservation of energy and momentum requires that  $\hbar \omega_0 = \hbar \omega_1 + \hbar \omega_a$  and  $\hbar k_0 = \hbar k_1 + \hbar k_a$ . These relations are commonly termed as phase-matching conditions and determine the frequency shift and direction of propagation of the scattered light. By assuming a long interaction path for the interacting waves we may consider the resonant Stokes component ( $\omega_1 = \omega_0 - \omega_a$ ,  $k_1 = k_0 - k_a$ ) only, and neglect the off-resonant higher-order component [27]. Moreover, for a spatially uniform pump  $|k_0| = |k_a|$  we

may assume  $|k_a| = |k_1| = k$  (say). The perturbed electron density produced in the medium will have two components, which may be recognized as fast and slow components. The fast component ( $n_f$ ) corresponds to the Stokes component of the scattered light and varies as  $\exp[i(k_1 x - \omega_1 t)]$ ; whereas the slow component ( $n_s$ ) is associated with the AW and varies as  $\exp[i(k_a x - \omega_a t)]$  such that  $n_1 = n_f + n_s$ . Using the phase matching conditions and rotating wave approximation, the coupled wave equations for  $n_f$  and  $n_s$  are obtained from Eq. (8) as:

$$\frac{\partial^2 n_f}{\partial t^2} + v \frac{\partial n_f}{\partial t} + \bar{\omega}_p^2 n_f - \frac{n_e \gamma k^2}{\epsilon} \frac{\bar{\omega}_p^2}{\omega_p^2} u^* \vec{E} = -ik \bar{E} n_s^* \quad (9a)$$

and

$$\frac{\partial^2 n_s}{\partial t^2} + v \frac{\partial n_s}{\partial t} + \bar{\omega}_p^2 n_s = -ik \bar{E} n_f^* \quad (9b)$$

Eqs. (9a) and (9b) indicate that the pump couples the generated AW and Stokes component of the scattered light with each other in an electrostrictive medium. Thus it is obvious that the presence of the pump field is the fundamental necessity for SBS to occur. The coupled wave equations are solved and are simplified for  $n_s$ , which is given by

$$n_s = \frac{n_e \gamma^2 k^2 \bar{\omega}_p^2 (E_e)(E_1)_x}{2\rho \epsilon \omega_p^2 (\delta_a^2 + 2i\Gamma_a \omega_a)} \left[ 1 - \frac{(\delta_1^2 + iv\omega_1)(\delta_2^2 - iv\omega_a)}{k^2 \bar{E}^2} \right]^{-1} \quad (10)$$

where  $\delta_a^2 = \omega_a^2 - k_a^2 v_a^2$ , in which  $v_a = \sqrt{C/\rho}$  is the acoustic velocity in the medium;  $\delta_1^2 = \bar{\omega}_p^2 - \omega_1^2$  and  $\delta_2^2 = \bar{\omega}_p^2 - \omega_a^2$ .

From the above expression, it is clear that  $n_s$  depends upon the input pump field. The density perturbations thus produced affects the propagation characteristics of the generated waves.

The resonant Stokes component of the current density may be obtained from the relation:

$$J_{cd}(\omega_1) = n_e e v_{1x} + n_s^* e v_{0x} \tag{11}$$

which yields

$$J_{cd}(\omega_1) = \frac{\varepsilon \bar{\omega}_p^2 (v + i\omega_1)}{\omega_1} E_{1x} + \frac{\gamma^2 k^2 \bar{\omega}_p^2 (v + i\omega_1) \left| \left( \frac{r}{E_0} \right)_x \right|^2 (E_1)_x}{2\rho \omega_0^2 (\delta_a^2 - 2i\Gamma_a \omega_a)} \left[ 1 - \frac{(\delta_1^2 - i v \omega_1)(\delta_2^2 + i v \omega_a)}{k^2 \bar{E}^2} \right]^{-1} \tag{12}$$

The first term of Eq. (12) represents the linear component of the induced current density while the second-term represents the nonlinear coupling amongst the three interacting waves via the nonlinear current density.

### 2.2. Threshold pump amplitude and effective Brillouin susceptibility

To begin with, let us treat the induced polarization  $P_{cd}(\omega_1)$  as the time integral of the current density  $J_{cd}(\omega_1)$ , then one gets

$$P_{cd}(\omega_1) = \int J_{cd}(\omega_1) dt = \frac{-J_{cd}(\omega_1)}{i\omega_1} \tag{13}$$

Using Singh et al. [28], we obtain the nonlinear induced polarization using perturbed current density

$$P_{cd}(\omega_1) = \frac{b\gamma^2 k^2 \bar{\omega}_p^2 (\omega_0 \delta_a^2 + 2v\Gamma_a \omega_a + 2i\Gamma_a \omega_a \omega_0) \cos^2 \phi}{2\rho \omega_1 \omega_0^2 (\delta_a^4 + 4\Gamma_a^2 \omega_a^2)} \times \left[ 1 - \frac{(\delta_1^2 - i v \omega_1)(\delta_2^2 + i v \omega_a)}{k^2 \bar{E}^2} \right]^{-1} \left| \left( \frac{r}{E_0} \right)_x \right|^2 (E_1)_x \tag{14}$$

where  $b = \frac{(\omega_0^2 - \omega_{cx}^2)^2 + 4v^2 \omega_0^2}{(\omega_0^2 - \omega_c^2)^2 + 4v^2 \omega_0^2}$ , and  $\phi$  is the inclination of pump electric field with  $x$ -axis.

From the above relation we can determine the nature of the threshold for the onset of SBS process by setting  $P_{cd}(\omega_1) = 0$ .

This condition yields,

$$E_{th} = \frac{m}{ek} \frac{\delta_1 \delta_2 (\omega_0^2 - \omega_c^2)}{[(\omega_0^2 - \omega_{cx}^2) \cos \phi + v \omega_{cx} \sin \phi]} \tag{15}$$

This equation reveals that  $E_{th}$  is strongly influenced by the material parameters ( $n_e, v$ ), the magnetic field ( $\omega_c$ ) and the geometry ( $\theta, \phi$ ) of the magnetic and pump fields.

In addition to the polarization  $P_{cd}$ , the system should also possess electrostrictive polarization  $P_{es}$ , arising due to the interaction of the pump wave with the AW generated in the medium. This is due to the fact that the scattering of light from the AW affords a convenient means of controlling the frequency, intensity and direction of an optical beam. This type of control makes possible a large number of applications involving the transmission, display and processing of information. The electrostrictive polarization is obtained from Eqs. (2) and (5) as:

$$P_{es}(\omega_1) = \frac{b\gamma^2 k^2 (\delta_a^2 + 2i\Gamma_a \omega_a) \cos^2 \phi}{2\rho (\delta_a^4 + 4\Gamma_a^2 \omega_a^2)} \left| \left( \frac{r}{E_0} \right)_x \right|^2 (E_1)_x \tag{16}$$

Thus, the total polarization induced at the Stokes component for a pump amplitude well above the threshold value is given by:

$$P(\omega_1) = P_{cd}(\omega_1) + P_{es}(\omega_1)$$

$$= \frac{b\gamma^2 k^2 \cos^2 \phi}{2\rho (\delta_a^4 + 4\Gamma_a^2 \omega_a^2)} \times \left[ (\delta_a^2 + 2i\Gamma_a \omega_a) + \frac{\bar{\omega}_p^2 (\omega_0 \delta_a^2 + 2v\Gamma_a \omega_a + 2i\Gamma_a \omega_a \omega_0)}{\omega_1 \omega_0^2} \right] \left| \left( \frac{r}{E_0} \right)_x \right|^2 (E_1)_x \tag{17}$$

Now it is well known that, the origin of SBS process lies in that component of  $P(\omega_1)$  which depends on  $\left| \left( \frac{r}{E_0} \right)_x \right|^2 (E_1)_x$ . The corresponding effective third-order susceptibility (also known as Brillouin susceptibility  $\chi_B^{(3)}$ ) is given by:

$$\chi_B^{(3)} = \chi_{es}^{(3)} + \chi_{cd}^{(3)} = \frac{b\gamma^2 k^2 \cos^2 \phi}{2\rho (\delta_a^4 + 4\Gamma_a^2 \omega_a^2)} \times \left[ (\delta_a^2 + 2i\Gamma_a \omega_a) + \frac{\bar{\omega}_p^2 (\omega_0 \delta_a^2 + 2v\Gamma_a \omega_a + 2i\Gamma_a \omega_a \omega_0)}{\omega_1 \omega_0^2} \right] \tag{18}$$

Here, the higher-order contributions like  $\chi^{(5)}, \chi^{(7)}, \dots$  are neglected because the susceptibility rapidly converges with respect to the pump amplitude  $E_0$ .

### 2.3. Carrier heating and modified nonlinearity

To incite SBS, the fundamental requirement is to apply a pump field above the threshold value. When this high-intensity pump traverses a high mobility semiconductor, the carriers acquire momentum and energy from the pump and as a result they (here electrons) acquire a temperature ( $T_e$ ) somewhat higher than that of the lattice ( $T_0$ ). This field-dependent rise in the electron temperature, in turn, modifies the electron collision frequency (ECF) through the relation [29]:

$$v = v_0 \left( \frac{T_e}{T_0} \right)^{1/2} \tag{19}$$

where  $v_0$  is the ECF in the absence of the pump, i.e. at  $T_e = T_0$ . The temperature ratio ( $T_e/T_0$ ) can be readily obtained from energy balance equation in the following manner.

The power absorbed per electron from the pump may be obtained as [30]:

$$\frac{e}{2} \text{Re} \left[ v_{0x} \cdot E_e^* \right] = \frac{be^2 v_0 \cos^2 \phi}{2m\omega_0^2} \left| \left( \frac{r}{E_0} \right)_x \right|^2 \tag{20}$$

where the asterisk denotes the complex conjugate while Re stands for the real part of the quantity concerned. The  $x$ -component of  $v_{0x}$  used in the above relation may be evaluated from Eq. (3).

Following Conwell [31], the power dissipation per electron in collisions with the POP may be expressed as:

$$\left( \frac{\partial \epsilon}{\partial t} \right)_{diss} = \left( \frac{2k_B \theta_D}{m\pi} \right)^{1/2} e E_{PO}(x_e)^{1/2} K_0 \left( \frac{x_e}{2} \right) \times \exp \left( \frac{x_e}{2} \right) \frac{\exp(x_0 - x_e) - 1}{\exp(x_0) - 1} \tag{21}$$

where  $x_{0,e} = \frac{\hbar\omega_l}{k_B T_{0,e}}$ ;  $\hbar\omega_l$  is the energy of the POP and is given by  $\hbar\omega_l = k_B \theta_D$  and  $\theta_D$  is the Debye temperature of

the crystal.  $E_{PO} = \frac{meh\omega_l}{h^2} \left( \frac{1}{\epsilon_\infty} - \frac{1}{\epsilon} \right)$  is the field of POP scattering potential;  $\epsilon$  and  $\epsilon_\infty$  are the static and high frequency dielectric permittivities of the medium, respectively.  $K_0(x_e/2)$  is the zeroth-order Bessel function of the first kind.

In steady-state, the power absorption per electron from the pump is just equal to the power lost in collisions with POP. For moderate heating of the carriers, equations (19) and (20) yield

$$\frac{T_e}{T_0} = 1 + \alpha |E_0|^2, \tag{22}$$

where

$$\alpha = \frac{be^2 v_0 \tau \cos^2 \phi}{2m\omega_0^2}, \tag{23a}$$

in which

$$\tau^{-1} = \left( \frac{2k_B \theta_D}{m\pi} \right)^{1/2} e E_{PO} K_0 \left( \frac{x_0}{2} \right) \frac{x_0^{1/2} \exp(x_0/2)}{\exp x_0 - 1}. \tag{23b}$$

Thus the modified ECF may be obtained as:

$$v = v_0 \left( 1 + \alpha |E_0|^2 \right)^{1/2} \approx v_0 \left( 1 + \frac{1}{2} \alpha |E_0|^2 \right). \tag{24}$$

By incorporating this modified ECF in Eq. (17), one can obtain the third-order (Brillouin) susceptibility modified by the carrier heating as:

$$\begin{aligned} \chi_B^{(3)} &= [\chi_B^{(3)}]_r + i [\chi_B^{(3)}]_i \\ &= \frac{b\gamma^2 k^2 \cos^2 \phi}{2\rho\epsilon_0(\delta_a^4 + 4\Gamma_a^2 \omega_a^2)} \\ &\quad \times \left[ \left( \delta_a^2 + \frac{\bar{\omega}_p^2(\omega_0 \delta_a^2 + 2v_0 \Gamma_a \omega_a)}{\omega_0^2 \omega_1} \right) + 2i\Gamma_a \omega_a \left( 1 + \frac{\bar{\omega}_p^2}{\omega_0 \omega_1} \right) \right] + \Phi \end{aligned} \tag{25}$$

where subscripts  $r$  and  $i$  to the quantities represent the real and imaginary parts, respectively.  $\Phi = \frac{\alpha\epsilon_L \bar{\omega}_p^2 v_0}{2\omega_1^3}$  may be termed as ‘‘carrier heating parameter’’. It is also evident from the above equation that the carrier heating considerably influences  $\chi_B^{(3)}$  of the medium.

#### 2.4. Steady state and transient Brillouin gain coefficients of the Stokes component

The steady state-Brillouin gain coefficient of the Stokes component in the presence of a pump well above the threshold value is obtained as:

$$\begin{aligned} g_B(\omega_l) &= -\frac{k}{2\epsilon_L} [\chi_B^{(3)}]_i |E_0|^2 \\ &= -\frac{k}{2\epsilon_L} \left[ \frac{b\gamma^2 k^2 \Gamma_a \omega_a \cos^2 \phi}{\rho\epsilon_0(\delta_a^4 + 4\Gamma_a^2 \omega_a^2)} \left( 1 + \frac{\bar{\omega}_p^2}{\omega_1 \omega_0} \right) + \Phi \right] |E_0|^2 \end{aligned} \tag{26}$$

This relation can be used to study the dependence of  $g_B(\omega_l)$  on the material parameters, the field strength and their geometry, dispersion characteristics of the generated AW, etc. Due to the threshold nature of the stimulated scattering processes, in general, they start at high excitation intensity and therefore the pulsed lasers are often used in stimulated scattering experiments. One should therefore consider the time dependence of the output (i.e. transient solutions of the coherent scattering processes) in crystals irradiated by pulsed lasers. From Eq. (26), one may infer that a high-power laser

source is the only pump which yields large  $g_B(\omega_l)$ . Hence, the laser pump source for SBS should be either in the form of a pulse with a time duration of the order of  $\sim 10^{-9}$  s for the Q-switched lasers or in the form of a pulse train with an individual pulse duration  $\sim 10^{-12}$  s for mode-locked lasers. Since these time durations are comparable to or smaller than the acoustic phonon life time ( $\tau_a \approx \Gamma_a^{-1}$ ), under such circumstances the product  $g_B \Gamma_a$  is more natural gain parameter instead of steady-state gain coefficient  $g_B$  alone. This product gives an idea about compression of the Stokes pulse [32]. In addition, it is found that transient coherent scatterings are of significance in many experimental situations as well as in the study of transient gain not only in predicting the threshold pump intensity correctly for onset of coherent scattering but also in predicting the optimum pulse durations for which these instabilities can be observed. From the above discussion, it is clear that the stimulated scatterings should be dealt with under transient regime. Therefore, we will extend the above formulations to study the transient behavior of Brillouin medium by using the product of steady-state gain and phonon lifetime. To do so, we consider the pump pulse duration ( $\tau_p$ )  $\leq$  acoustic phonon lifetime ( $\tau_a$ ) and following Carman et al. [33], the transient gain of coherent scattering medium can be expressed as:

$$g_{TB} = (2g_B x \Gamma_a \tau_p)^{1/2} - \Gamma_a \tau_p; \Gamma_a \tau_p < g_B L, \tag{27}$$

where  $x$  is the interaction length.

Here, it is worth pointing out that the interaction length ( $L$ ) becomes very small for backward scattering because the Stokes pulse and the laser pulse travel in opposite directions and hence, their overlap region cannot exceed the length of the laser pulse; viz., for a typical pico-second pulse laser, the interaction length is of the order of a millimeter. Thus following Wang [34], for very short durations ( $\tau_p \leq 10^{-10}$  s) the interaction length should be replaced by  $c_1 \tau_p / 2$  (where  $c_1$  is the velocity of light in the crystal medium).

Consequently by making  $g_{TB} = 0$  in Eq. (27), we can obtain the threshold-pump intensity for the onset of transient SBS as:

$$I_{th} = \frac{\Gamma_a}{2G_B c_1}, \tag{28}$$

where  $G_B = g_B / I_p$  is the steady state Brillouin gain coefficient per unit pump intensity and  $I_p = (1/2)\eta\epsilon_0 c |E_0|^2$ .

Using  $\Gamma_a = 2 \times 10^{10} \text{ s}^{-1}$  and  $g_B = 5 \times 10^4 \text{ m}^{-1}$  at  $I_p = 3.55 \times 10^8 \text{ Wm}^{-2}$  for a centrosymmetric semiconductor-plasma and Eq. (28), we obtain the threshold value of pump intensity for the onset of Raman instability as  $10^6 \text{ Wm}^{-2}$ .

However, for comparatively long pulse duration ( $\tau_p \geq 10^{-9}$  s), the cell length can be taken equal to  $x$ , and under such circumstances, we find

$$g_{TB} = (\Gamma_a \tau_p)^{1/2} [ -(\Gamma_a \tau_p)^{1/2} + (g_B x)^{1/2} ]. \tag{29}$$

Using the above equation, we may obtain the optimum value of pulse duration  $\tau_{p,opt}$ , above which no transient gain could be achieved. This can be obtained by making  $g_{TB} = 0$ , which yields:

$$\tau_{p,opt} \approx \frac{g_B}{\Gamma_a} \tag{30}$$

The values of  $\tau_{p,opt}$  suggest that optimum pulse duration can be increased by increasing the pump intensity. A calculation for centrosymmetric semiconductor-plasma using the values given earlier and  $x = 10^{-4}$  m, gives  $\tau_{p,opt} = (7.5 \times 10^{-15} I_p)$  s.

### III RESULTS AND DISCUSSION

In order to establish the validity of the present model and to study SBS process, we have chosen a narrow band gap centrosymmetric crystal (n-InSb) at 77 K as the medium which is assumed to be irradiated by 10.6  $\mu$ m CO<sub>2</sub> laser of frequency  $\omega_0 = 1.78 \times 10^{14}$  s. The physical parameters chosen are [28]:

$$n_e = 10^{22} - 10^{24} \text{ m}^{-3}, \quad m = 0.0145 m_e \quad (m_e \text{ the free mass of electron}),$$

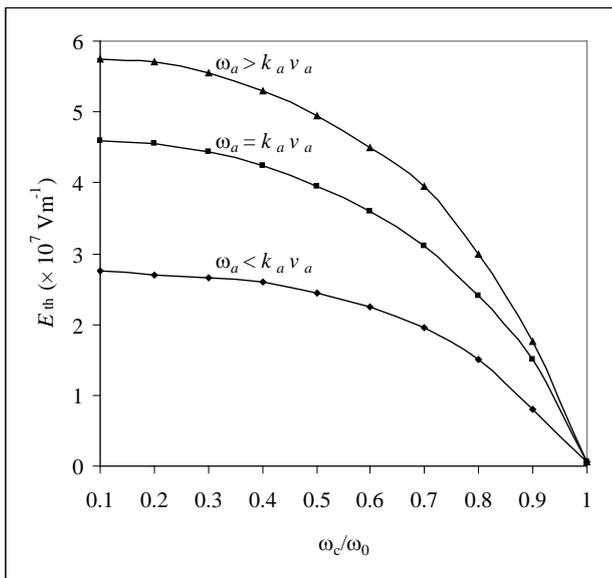
$$\varepsilon_L = 17.8, \quad \varepsilon_1 = 15.8, \quad \rho = 5.8 \times 10^3 \text{ kg m}^{-3},$$

$$\omega_a = 10^{11} \text{ s}^{-1}, \quad k = 10^6 - 10^9 \text{ m}^{-1}, \quad v_s = 4 \times 10^3 \text{ ms}^{-1},$$

$$\Gamma_a = 2 \times 10^{10} \text{ s}^{-1}, \quad \gamma = 5 \times 10^{-10} \text{ s}^{-1}, \quad \theta_D = 278 \text{ K},$$

$$\omega_c = 0.1 - 0.9 \omega_0.$$

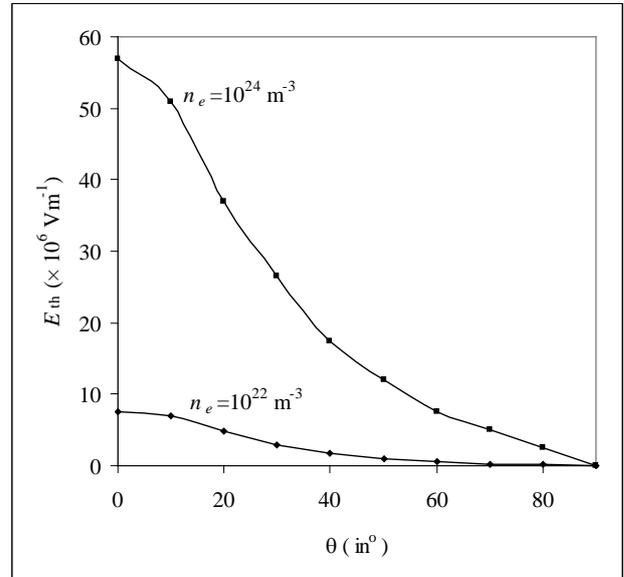
Using the material parameters given above, the nature of dependence of the threshold pump amplitude  $E_{th}$  on magnetic field strength (in terms of  $\omega_c/\omega_0$ ) with AW number  $k$  as a parameter [Eq. (15)] is investigated in the n-InSb crystal and is plotted in Fig. 2. In all the cases,  $E_{th}$  starts with a relatively high value ( $5.75 \times 10^7, 4.60 \times 10^7$  and  $2.75 \times 10^7 \text{ Vm}^{-1}$  for  $k = 2 \times 10^7, 2.5 \times 10^7$  and  $4 \times 10^7 \text{ m}^{-1}$  respectively) at  $\omega_c = 0.1 \omega_0$  and decreases continuously with increasing  $\omega_c$ . For strong magnetic field, when the medium becomes a magneto-plasma ( $\omega_c \approx \omega_0$ ),  $E_{th}$  becomes independent of  $k$  and the curves nearly coincide.



**Figure 2: Dependence of threshold pump amplitude  $E_{th}$  on magnetic field strength (in terms of  $\omega_c/\omega_0$ ) for  $k = 2 \times 10^7, 2.5 \times 10^7$  and  $4 \times 10^7 \text{ m}^{-1}$ . Here  $n_e = 10^{24} \text{ m}^{-3}, \omega_a = 10^{11} \text{ s}^{-1}, v_a = 4 \times 10^3 \text{ ms}^{-1}, \phi = \pi/6, \theta = \pi/4$ .**

Fig. 3 illustrates the dependence of  $E_{th}$  on the magnetic field inclination  $\theta$  for various carrier concentrations. In the presence of a longitudinal field ( $\theta = 0$ ), a heavily doped ( $n_e = 10^{24} \text{ m}^{-3}$ ) medium requires an order larger threshold field

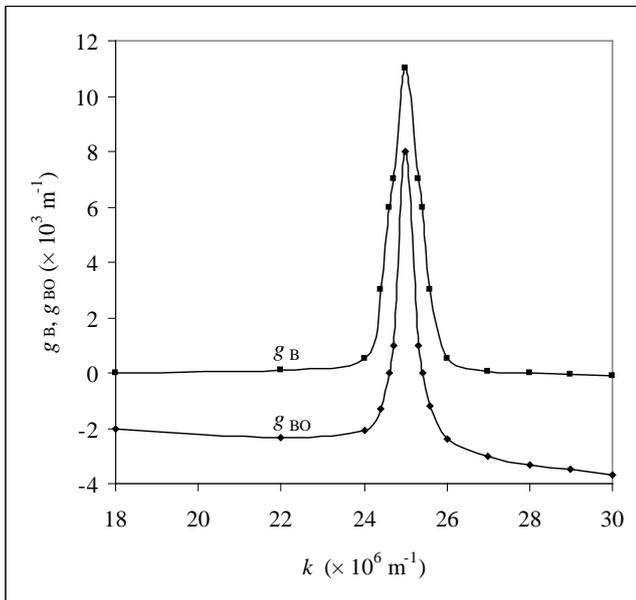
( $E_{th} = 5.7 \times 10^7 \text{ Vm}^{-1}$ ) in comparison with that of moderately doped ( $n_e = 10^{22} \text{ m}^{-3}$ ) medium ( $E_{th} = 7.5 \times 10^6 \text{ Vm}^{-1}$ ). However, as  $\theta$  increases  $E_{th}$  decreases and the gap between the  $E_{th}$  curves narrows down. For  $\theta \rightarrow 90^\circ$ ; the two curves approach each other which indicates that the presence of a transverse magnetic field makes  $E_{th}$  almost independent of carrier concentration.



**Figure 3: Dependence of threshold pump amplitude  $E_{th}$  on magnetic field inclination  $\theta$  for  $n_e = 10^{22}$  and  $10^{24} \text{ m}^{-3}$ .**

Here  $\omega_c = 0.9 \omega_0, k = 2.5 \times 10^7 \text{ m}^{-1}, \phi = \pi/6$ .

In Fig. 4, we present the influence of the AW number  $k$  on the steady-state Brillouin gain of the Stokes mode. Here  $g_B$  [Eq. (26)], and  $g_{BO}$  [Eq. (26) with  $\Phi = 0$ ] denote the steady-state gain coefficients with and without incorporating carrier heating by the pump, respectively. The gain coefficients are found to be very sensitive to the dispersion characteristics of the AW. In anomalous ( $\omega_a > k_a v_a$ ) and normal ( $\omega_a < k_a v_a$ ) dispersion regimes of the AW, the gain coefficient  $g_{BO}$  is negative (which signifies absorption of the Stokes mode) and decreases with increase in  $k$ , whereas gain coefficient  $g_B$  is small but positive and nearly remains constant. However, as we approach the dispersion-less regime ( $\omega_a \approx k_a v_a$ ); both  $g_B$  and  $g_{BO}$  increase very sharply, acquiring maximum values  $g_B = 1.1 \times 10^4 \text{ m}^{-1}, g_{BO} = 8 \times 10^3 \text{ m}^{-1}$  in the presence of a non-dispersive AW ( $\omega_a = k_a v_a$ ). The smallness of  $g_{BO}$  over  $g_B$  may be attributed to the increase in ECF [Eq. (24)] due to the carrier heating. This increase in ECF apparently results in an increase in energy transfer of the pump and Stokes mode and subsequently enhances  $g_B$  through the parameter  $\Phi$  [Eq. (26)].

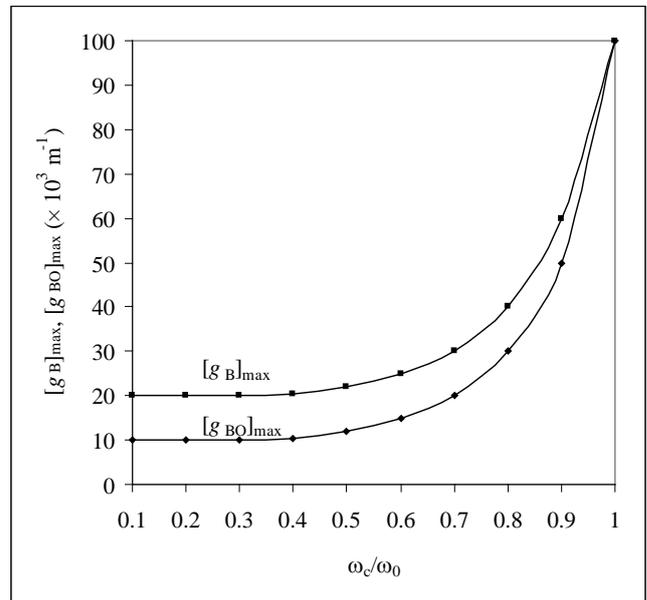


**Figure 4: Variation of Brillouin gain coefficients  $g_B$  and  $g_{BO}$  as a function of acoustic wave number  $k$ . Here  $E_0 = 2.5 \times 10^7 \text{ Vm}^{-1}$ ,  $n_e = 10^{24} \text{ m}^{-3}$ ,  $\omega_c = 0.9\omega_0$ ,  $\phi = \pi/6$ ,  $\theta = \pi/4$ .**

As Fig. 4 indicates, the steady-state Brillouin gain is very sensitive to the dispersion characteristics of the generated AW. In the presence of a dispersive AW, i.e. when  $\omega_a \neq k_a v_a$ ,  $g_B$  is very small because of the phase mismatch of the interaction waves. However, the presence of a non-dispersive AW significantly enhances the energy transfer from the pump to the Stokes mode and thus maximizes  $g_B$  which may be obtained from Eq. (26) as:

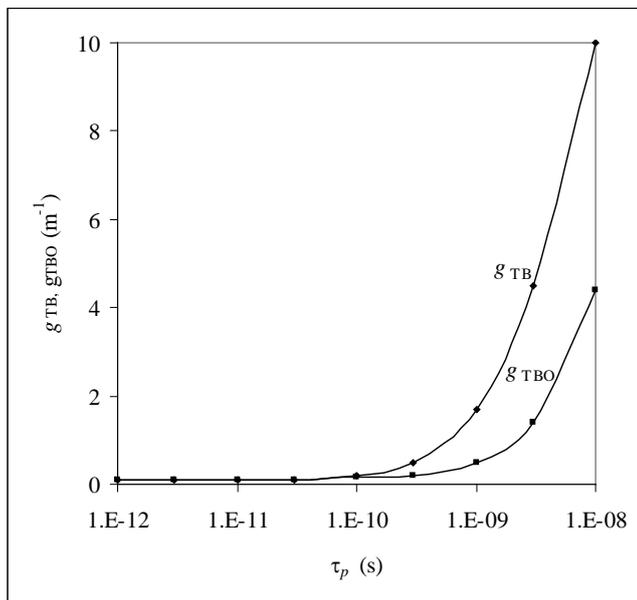
$$[g_B]_{\max} = \frac{k}{2\epsilon_L} \left[ \frac{b\gamma^2 k^2 \cos^2 \phi}{4\rho\epsilon_0 \Gamma_a \omega_a} \left( 1 + \frac{\bar{\omega}_p^2}{\omega_1 \omega_0} \right) + \Phi \right] |E|^2 \quad (31)$$

Fig. 5 depicts the effect of magnetic field on the  $[g_B]_{\max}$  and  $[g_{BO}]_{\max}$ . For weak magnetic fields ( $\omega_c = \omega_0$ ), both the gain coefficients are nearly constant but suddenly start increasing very sharply as  $\omega_c$  approaches  $\omega_0$ . This is due to the modulation of the parameter  $\bar{\omega}_p$  in Eq. (31) that results in large energy transfer from the pump to the generated waves. The carrier heating by the pump is found to modify the SSBG significantly particularly in the weak magnetic field regimes. However, a strong magnetic field  $\omega_c > 0.5\omega_0$  significantly influences the carriers and causes a considerable reduction in the parameter  $\Phi$  through  $\bar{\omega}_p$ . As a result, the curves corresponding to  $[g_B]_{\max}$  and  $[g_{BO}]_{\max}$  continue to come closer.



**Fig. 5: Variation of steady state Brillouin gain coefficients  $g_B$  and  $g_{BO}$  as a function of magnetic field strength (in terms of  $\omega_c/\omega_0$ ). Here  $E_0 = 2.5 \times 10^7 \text{ Vm}^{-1}$ ,  $k = 2.5 \times 10^7 \text{ m}^{-1}$ ,  $n_e = 10^{24} \text{ m}^{-3}$ ,  $\omega_c = 0.9\omega_0$ ,  $\phi = \pi/6$ ,  $\theta = \pi/4$ .**

Fig. 6 depicts the influence of pump pulse duration  $\tau_p$  on the transient Brillouin gain of Stoke's mode. Here  $g_{TB}$  [Eq. (29)], and  $g_{TBO}$  [Eq. (29) with  $\Phi = 0$ ] denote the transient Brillouin gain coefficients with and without incorporating carrier heating by the pump, respectively. To draw this behaviour, we have considered pulse durations in the range  $10^{-12} \leq \tau_p \leq 10^{-8} \text{ s}$  and pump field intensity  $I_p = 2 \times 10^9 \text{ W cm}^{-2}$ . The interaction length is the cell length  $x$  or  $c_1 \tau_p / 2$ , whichever is shorter. The gain coefficients are found to be vanishingly small at shorter pulse durations with  $\tau_p \leq 0.1 \text{ ns}$ . For further increase in  $\tau_p$ , transient gain coefficients increase very rapidly ( $g_{TBO} = 4.4 \text{ m}^{-1}$ ,  $g_{TB} = 10 \text{ m}^{-1}$ ). The enhancement in  $g_{TB}$  may be attributed to increase in ECF which results in an increase in energy transfer of the pump and Stokes mode and subsequently enhances  $g_{TB}$  through the parameter  $\Phi$  [Eq. (29)].



**Fig. 6: Variation of transient Brillouin gain coefficients  $g_{TB}$  and  $g_{TBO}$  as a function of pump pulse duration  $\tau_p$ . Here**

$$I_p = 2 \times 10^9 \text{ W cm}^{-2}, k = 2.5 \times 10^7 \text{ m}^{-1}, n_e = 10^{24} \text{ m}^{-3}, \omega_c = 0.9\omega_0, \phi = \pi/6, \theta = \pi.$$

Thus incorporation of carrier heating in the analysis not only makes our model realistic and the analysis more reliable but may also considerably minimize discrepancies between the experimental observations and theoretical predictions.

#### IV CONCLUSIONS

The present work deals with the analytical investigations of steady-state and transient Brillouin gain in narrow band-gap magnetized semiconductors duly shined by a pulsed 10.6  $\mu\text{m}$  CO<sub>2</sub> laser. The role of carrier heating by the pump has been examined at length. The detailed analysis enables one to draw the following conclusions:

1. The carrier heating by the pump appreciably enhances the ECF and hence transfers energy from the pump to the scattered light. As a result, the steady state as well as transient Brillouin gain coefficients are considerably enhanced. Thus, incorporation of carrier heating by the pump may help in reducing discrepancies between theory and experimental measurements. This may be an important step towards the appropriate interpretation of experimental measurements in solid and gaseous plasmas.
2. A significant reduction in the SBS threshold and enhancement of steady state and transient gain coefficients can be achieved by applying a strong magnetic field in the transverse direction. This is because it maximally influences the carriers and enhances the parameter  $\Phi$  appreciably by modifying the carrier parameter  $\bar{\omega}_p$ . As a result, the carrier current density induced polarization  $\hat{P}_{cd}$  is considerably increased.
3. A heavily doped narrow band-gap III-V semiconductor immersed in a transverse strong magnetic field yields maximum Brillouin gain when irradiated by a longitudinal pump, provided the generated AW has dispersion-less propagation in the medium.
4. Semiconductor plasmas duplicate gaseous plasmas as far as phenomena of waves and instabilities are concerned. From this viewpoint, semiconductors may be used as a

compact and convenient substitute for gaseous plasmas on account of their considerable ease of operation, liberty of manipulating the material parameters over a wide range, and lack of confinement problems. Thus, the present study may also be used to develop a clearer understanding of stimulated scattering mechanisms and their threshold values encountered in laser induced plasmas.

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# Quasi Injective Fuzzy G-Modules On $\mathbb{P}_r$

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**Abstract-** Representation theory (G-module theory) has had its origin in the 20<sup>th</sup> century. In the 19<sup>th</sup> century, groups were generally regarded as subsets of some permutation set, or of the set  $GL(V)$  of automorphisms of a vector space  $V$ , closed under composition and inverse. Here we consider  $\mathbb{P}_r$ , the periodic arithmetical functions (mod  $r$ ), define a fuzzy G-module on it and verify the quasi injective property of its summands.

**Index Terms-** Injectivity, quasi injectivity, fuzzy set, fuzzy G-module, fuzzy injectivity and quasi fuzzy injectivity.

## I. INTRODUCTION

In representation theory, we consider the embedding of a finite group into a linear group. Here we consider those finite groups, which can be embedded in a *finite linear group*. The *fuzzy set theory* was introduced by L.A. Zadeh[2] in 1965. Rosenfield[4] started fuzzification of algebraic structures. As a continuation of these works the concept fuzzy finite G-module was introduced and analysed by us in [5].

In this paper, we discuss injectivity and quasi injectivity of fuzzy G-modules. We introduce the G-module  $\mathbb{P}_r$  of periodic arithmetic functions mod  $r$  and discuss quasi injectivity in relation to it.

### 1. Preliminaries

**1.1. Definition [1].** Let  $G$  be a finite group,  $M$  be a vector space over  $K$  ( a subfield of  $\mathbb{C}$  ) and  $GL(M)$  be the group of all linear isomorphisms from  $M$  onto itself. A *linear representation* of  $G$  with representation space  $M$  is a homomorphism  $T : G \rightarrow GL(M)$ .

**1.2. Example.** Let  $F$  be a field,  $K$  be an extension field of  $F$  and  $a \in K$ . Let  $M = F(a)$ , the field obtained by adjoining ‘ $a$ ’ to  $F$ .

(i.e)  $M = F(a) = \{ b_0 + b_1 a + b_2 a^2 + \dots : b_i \in F \}$

Let  $G = \langle a \rangle$ , the cyclic group generated by ‘ $a$ ’. For  $j \in \mathbb{Z}$ , define  $T_j : M \rightarrow M$  by

$$T_j \left( \sum \beta_i a^i \right) = \sum \beta_i a^{i+j}$$

Then  $T_j$  is an isomorphism of  $M$  onto itself. Also the map  $T : G \rightarrow GL(M)$  defined by

$$T(a^j) = T_j, \forall j \in \mathbb{Z}$$

is a homomorphism and hence a linear representation of  $G$ .

**1.3. Definition [1].** Let  $G$  be a finite group. A vector space  $M$  over a field  $K$  is called a *G-module* if for every  $g \in G$  and  $m \in M$ , there exist a product ( called the *action of G on M* )  $m.g \in M$  satisfying the following axioms:

(i)  $m.1_G = m, \forall m \in M$  ( $1_G$  being the identity element in  $G$ )

(ii)  $m.(g.h) = (m.g).h, \forall m \in M; g, h \in G$ ; and

(iii)  $(k_1 m_1 + k_2 m_2).g = k_1(m_1.g) + k_2(m_2.g), \forall k_1, k_2 \in K; m_1, m_2 \in M; g \in G$

**1.4. Example.** Let  $G = \{1, -1\}$  and  $M = \mathbb{Q}(\sqrt{2})$ . Then  $M$  is a vector space over  $\mathbb{Q}$ , and under the usual addition and multiplication of the elements of  $M$ , we can show that,  $M$  is a G-module.

**1.5. Definition [6].** An *arithmetical function* is a complex-valued function defined on the set of positive integers.

For a positive integer  $r$ , an arithmetical function  $f$  is said to be *periodic (mod r)* if  $f(n+r) = f(n)$  for all  $n \in \mathbb{N}$

**1.6. Proposition.** Let  $\mathbb{P}_r$  denote the set of all periodic arithmetical functions (mod  $r$ ). Then  $\mathbb{P}_r$  is a complex vector space. Also  $\mathbb{P}_r$  is isomorphic to  $\mathbb{C}^r$ , the  $r$ -dimensional complex space

**Proof:** Given  $\mathbb{P}_r = \{ \text{functions } f : \mathbb{N} \rightarrow \mathbb{C} / f(n+r) = f(n) \text{ for all } n \in \mathbb{N} \}$

Define the operations addition and scalar multiplication in  $\mathbb{P}_r$  by

$$[f + g](n) = f(n) + g(n), n \in \mathbb{N}$$

$$[cf](n) = c f(n), c \in \mathbb{C}, n \in \mathbb{N}$$

Then  $\mathbb{P}_r$  is a complex vector space. It is an  $r$ -dimensional space and is isomorphic to  $\mathbb{C}^r$ . The set  $\{ \alpha_k = \frac{1}{r} \sum_{n=1}^r \alpha_k(n) e^{2\pi i kn/r} : k = 1, 2, \dots, r \}$  is a basis of  $\mathbb{P}_r$ , where  $\alpha_k \in \mathbb{P}_r$  is defined by  $\alpha_k(n) = \exp\left(\frac{2\pi i kn}{r}\right)$ .

**1.7. Remark.** Let  $G = \{1, -1\}$  or  $G = \{1, -1, i, -i\}$ . Then the vector space  $\mathbb{P}_r$  is a G-module.

**1.8. Definition[3]** Let  $M_1, M_2, \dots, M_n$  be vector spaces over a field  $K$ . Then the set  $\{ m_1 + m_2 + \dots + m_n : m_i \in M_i \}$  becomes a vector space over  $K$  under the operations

$$(m_1 + m_2 + \dots + m_n) + (m_1' + m_2' + \dots + m_n') = (m_1 + m_1') + (m_2 + m_2') + \dots + (m_n + m_n')$$

$$\alpha(m_1 + m_2 + \dots + m_n) = \alpha m_1 + \alpha m_2 + \dots + \alpha m_n; \alpha \in K, m_i, m_i' \in M_i$$

It is called the *direct sum* of the vector spaces  $M_1, M_2, \dots, M_n$ . It is denoted by  $\bigoplus_{i=1}^n M_i$ .

**1.9. Example.** The set  $\mathbb{Q}(\sqrt{2}, \sqrt{3})$  is the field obtained by adjoining the real numbers  $\sqrt{2}, \sqrt{3}$  to  $\mathbb{Q}$ . Then we have  $\mathbb{Q}(\sqrt{2}, \sqrt{3})$

is a vector space over  $\mathbf{Q}$  and the set  $\{1, \sqrt{2}, \sqrt{3}, \sqrt{6}\}$  is a basis for  $\mathbf{Q}(\sqrt{2}, \sqrt{3})$  over  $\mathbf{Q}$ . Let  $M_1 = \mathbf{Q}$ ,  $M_2 = \mathbf{Q}(\sqrt{2})$ ,  $M_3 = \mathbf{Q}(\sqrt{3})$  and  $M_4 = \mathbf{Q}(\sqrt{6})$ . Then  $\mathbf{Q}(\sqrt{2}, \sqrt{3}) = \bigoplus_{i=1}^4 M_i$ .

**1.10. Remark.** The  $G$ -module  $M = \mathbb{P}_r$  can be expressed as the direct sum of  $r$   $G$ -submodules as follows:

We have observed that  $\mathbb{P}_r$  is a complex vector space. It is an  $r$ -dimensional space and is isomorphic to  $\mathbf{C}^r$ . The set  $\{\alpha_k = \frac{1}{r^2} \varepsilon_k : k = 1, 2, \dots, r\}$  is a basis of  $\mathbb{P}_r$ , where  $\varepsilon_k \in \mathbb{P}_r$  is defined by  $\varepsilon_k(n) = \exp\left(\frac{2\pi i k n}{r}\right)$ . Then  $\mathbb{P}_r = \bigoplus_{i=1}^r M_i$ , where  $M_i = \mathbf{C}\alpha_k$ .

**1.11. Definition[1].** A  $G$ -module  $M$  is *injective* if for any  $G$ -module  $M^*$  and any  $G$ -submodule  $N$  of  $M^*$ , every homomorphism from  $N$  into  $M$  can be extended to a homomorphism from  $M^*$  into  $M$ .

**1.12. Example.** Let  $G = \{1, -1, i, -i\}$  and  $M = \mathbf{C}$ , which is a vector space over  $\mathbf{C}$ . Then  $M$  is a  $G$ -module with respect to trivial action. Also, except the zero  $G$ -submodule, no proper subset of  $\mathbf{C}$  becomes a  $G$ -module.

Let  $M^*$  be any other  $G$ -module. Then following are some prominent cases of  $M^*$ :

- (i)  $M^* = \{0\}$
- (ii)  $M^* = \mathbf{C}^n$  ( $n \geq 1$ ) or  $M^*$  a  $G$ -submodule of  $\mathbf{C}^n$
- (iii)  $M^* =$  Space of all functions from any set  $S$  into  $\mathbf{C}$
- (iv)  $M^* = \mathbf{C}^{m \times n} =$  Space of all  $m \times n$  matrices over the field  $\mathbf{C}$  or a  $G$ -submodule of  $M^*$

Let  $N$  be a  $G$ -submodule of  $M^*$  and  $\varphi : N \rightarrow M$  be a homomorphism.

*Case(i) :* Here  $N = M^* = \{0\}$ , and so  $0 = \psi : M^* \rightarrow M$  extends the homomorphism  $\varphi$ .

*Case(ii) :* Since  $\mathbf{C}^n$  is  $n$ -dimensional, then  $\text{Dim.} M^* = k \leq n$ . Let  $\text{Dim.} N = m$  and let  $\{\alpha_1, \alpha_2, \dots, \alpha_m\}$  be a basis of  $N$  such that  $\{\alpha_1, \alpha_2, \dots, \alpha_m, \alpha_{m+1}, \dots, \alpha_k\}$  is a basis of  $M^*$ . Then

$$N = \mathbf{C}\alpha_1 \oplus \mathbf{C}\alpha_2 \oplus \dots \oplus \mathbf{C}\alpha_m \quad \text{and}$$

$M^* = \mathbf{C}\alpha_1 \oplus \mathbf{C}\alpha_2 \oplus \dots \oplus \mathbf{C}\alpha_m \oplus \mathbf{C}\alpha_{m+1} \oplus \dots \oplus \mathbf{C}\alpha_k$ . The map  $\psi : M^* \rightarrow M$  defined by  $\psi(c_1\alpha_1 + \dots + c_m\alpha_m + \dots + c_k\alpha_k) = \varphi(c_1\alpha_1 + \dots + c_m\alpha_m)$  is a homomorphism which extends  $\varphi$ .

*Case(iii) :* Here  $M^* = M_1 \oplus M_2$ , where  $M_1$  is the  $G$ -submodule of  $M^*$  consisting of all odd functions and  $M_2$  is the  $G$ -submodule of  $M^*$  of all even functions. Then as in (ii), there exists a homomorphism  $\psi : M \rightarrow M^*$ , which lifts  $\varphi$ .

*Case(iv) :* Since  $\mathbf{C}^{m \times n}$  is an  $mn$ -dimensional vector space over  $\mathbf{C}$ ,  $\text{Dim.} M^* \leq mn$ , and so as in (ii), there exists a homomorphism  $\psi : M \rightarrow M^*$ , which lifts  $\varphi$ . Similarly for any  $G$ -module  $M^*$  and any  $G$ -submodule  $N^*$  of  $M^*$ , every homomorphism  $\varphi : N^* \rightarrow M$  can be extended to a homomorphism  $\psi : M^* \rightarrow M$ . Therefore  $M$  is an injective  $G$ -module.

**1.13. Definition[1].** Let  $M$  and  $M^*$  be  $G$ -modules. Then  $M$  is  *$M^*$ -injective* if for every  $G$ -submodule  $N$  of  $M^*$ , any

homomorphism  $\varphi : N \rightarrow M$  can be extended to a homomorphism  $\psi : M^* \rightarrow M$ .

**1.14. Proposition[5].** Let  $M = M_1 \oplus M_2$ , where  $M_1$  and  $M_2$  are  $G$ -submodules of  $M$ . Then  $M$  is injective if and only if  $M_1$  and  $M_2$  are both injective.

**Proof:** Let  $M$  be injective. Let  $M^*$  be a  $G$ -module and  $N$  be any  $G$ -submodule of  $M^*$  and let  $\eta : N \rightarrow M_1$  be a homomorphism. Since  $M$  is injective, there exists a homomorphism  $\eta' : M^* \rightarrow M$ . Let  $\pi : M \rightarrow M_1$  be the projection map. Then  $\eta'' = \pi \circ \eta' : M^* \rightarrow M_1$  is an extension of  $\eta$ . Therefore  $M_1$  is injective. Similarly we can show that  $M_2$  is injective.

Conversely suppose  $M_1$  and  $M_2$  are injective. Let  $M^*$  be a  $G$ -module and  $N$  be any  $G$ -submodule of  $M^*$  and let  $\eta : N \rightarrow M$  be a homomorphism. Let  $\pi_1$  and  $\pi_2$  be the projections of  $M_1$  and  $M_2$  respectively. Since  $M_1$  and  $M_2$  are injective, the mappings  $\pi_1 \circ \eta : N \rightarrow M_1$  and  $\pi_2 \circ \eta : N \rightarrow M_2$  can be extended to homomorphisms  $\eta_1 : M^* \rightarrow M_1$  and  $\eta_2 : M^* \rightarrow M_2$  respectively. Define  $\eta_3 : M^* \rightarrow M$  by  $\eta_3(m) = \eta_1(m) + \eta_2(m)$ ,  $\forall m \in M^*$ .

Then  $\eta_3$  is a homomorphism. Also for every  $m \in M$ ,  $\eta_3(m) = \eta_1(m) + \eta_2(m) = \pi_1 \circ \eta(m) + \pi_2 \circ \eta(m) = \eta(m)$ . Therefore  $\eta_3$  extends  $\eta$  and hence  $M$  is injective. ■

**1.15. Proposition[5].** Let  $M$  and  $M^*$  be  $G$ -modules such that  $M$  is  $M^*$ -injective. If  $N^*$  is a  $G$ -submodule of  $M^*$ , then  $M$  is  $N^*$ -injective and  $M$  is  $M^*/N^*$ -injective.

**Proof:** Since  $N^* \subseteq M^*$  and  $M$  is  $M^*$ -injective, it is obvious that  $M$  is  $N^*$ -injective.

Let  $X^*/N^*$  be a  $G$ -submodule of  $M^*/N^*$  and  $\varphi : X^*/N^* \rightarrow M$  be a homomorphism. Let  $\pi : M^* \rightarrow M^*/N^*$  be the canonical map and  $\pi' = \pi|_{X^*}$ . Then  $\varphi \circ \pi' : X^* \rightarrow M$  is a homomorphism. Since  $M$  is  $M^*$ -injective  $\exists$  an extension  $\theta : M^* \rightarrow M$  of  $\varphi \circ \pi'$ . Then  $\theta(N^*) = \varphi \circ \pi'(N^*) = \varphi(\pi'(N^*)) = \varphi(0) = 0$ . Therefore  $\text{Ker.} \pi$  is a  $G$ -submodule of  $\text{Ker.} \theta$  and so  $\exists$  a map  $\psi : M^*/N^* \rightarrow M$  such that  $\psi \circ \pi = \theta$ . Also for any  $x \in X$ ,  $\psi(x+N^*) = \psi(\pi(x)) = \theta(x) = (\varphi \circ \pi')(x) = \varphi(x+N^*)$ . Therefore  $\psi$  extends  $\varphi$ . Hence  $M$  is  $M^*/N^*$ -injective. ■

**1.16. Example.** Let  $M^* = \mathbf{R}^n$ . This is  $n$ -dimensional vector space over  $\mathbf{R}$ . Let  $\{\alpha_1, \alpha_2, \dots, \alpha_k, \dots, \alpha_n\}$  be a basis for  $M^*$ . Then  $M^* = \mathbf{R}\alpha_1 \oplus \mathbf{R}\alpha_2 \oplus \dots \oplus \mathbf{R}\alpha_n$ .

Let  $M = \mathbf{R}$  and  $G$  be any finite multiplicative subgroup of  $\mathbf{R}$ . Then both  $M^*$  and  $M$  are  $G$ -modules. Let  $N$  be any  $G$ -submodule of  $M^*$  and  $\varphi : N \rightarrow M$  be a homomorphism.

- (i). If  $N = \{0\}$ , then  $\varphi = 0$ , then  $\psi = 0 : M \rightarrow M^*$  extends  $\varphi$ .
- (ii). If  $N = \mathbf{R}\alpha_j$  ( $1 \leq j \leq n$ ).

Then  $\psi : M \rightarrow M^*$  defined by

$$\psi(c_1\alpha_1 + \dots + c_j\alpha_j + \dots + c_n\alpha_n) = \varphi(c_j\alpha_j)$$

is a homomorphism which extends  $\varphi$ .

(iii).  $N = \bigoplus_{j=1}^k \mathbf{R}\alpha_j$  ( $k \leq n$ ), then  $\psi : M \rightarrow M^*$  defined by  $\psi(c_1\alpha_1 + \dots + c_k\alpha_k + \dots + c_n\alpha_n) = \varphi(c_1\alpha_1 + \dots + c_k\alpha_k)$  extends  $\varphi$ . Therefore  $M$  is  $M^*$ -injective.

**1.17. Definition[1].** A  $G$ -module  $M$  is *Quasi-injective* if  $M$  is  $M$ -injective.



**2.9. Definition[5].** Let  $M$  be a  $G$ -module and  $\mu$  be a fuzzy  $G$ -module on  $M$ . Then  $\mu$  is **quasi-injective** if

- (i)  $M$  is quasi-injective
- (ii)  $\mu(m) \leq \mu(\psi(m))$ ,  $\forall \psi \in \text{Hom}(M, M)$  and  $m \in M$ .

**2.10. Remark.** Let  $M$  be a quasi-injective  $G$ -module. Then the functions  $\mu: M \rightarrow [0, 1]$  defined by (i)  $\mu(x) = t$ ,  $\forall x \in M$  and

- (ii)  $\mu(x) = 1$ , if  $x = 0$   
 $= t$ , if  $x \neq 0$ , where 't' is a fixed element in  $[0, 1]$ , are quasi-injective fuzzy  $G$ -modules on  $M$ .

**2.11. Example.** The  $G$ -module  $M$  in example 1.16 is quasi-injective. On this  $M$ , if we define a function  $\mu$  as in remark 2.10, then  $\mu$  is quasi-injective.

**2.12. Proposition[5].** Let  $M$  be a  $G$ -module over  $K$  and  $M = \bigoplus_{i=1}^n M_i$ , where  $M_i$ 's are  $G$ -submodules of  $M$ . If  $v_i$  ( $1 \leq i \leq n$ ) are fuzzy  $G$ -submodules on  $M_i$ , then  $v: M \rightarrow [0, 1]$  defined by

$$v(m) = \bigwedge \{v_i(m_i) : i=1, 2, \dots, n\}, \text{ where } m = \sum_{i=1}^n m_i \in M$$

is a fuzzy  $G$ -module on  $M$ .

**Proof:** Since each  $v_i$  is a fuzzy  $G$ -module on  $M_i$ , for every  $x, y \in M_i$ ,  $g \in G$  &  $a, b \in K$ , we have

$$\begin{aligned} v_i(ax+by) &\geq v_i(x) \wedge v_i(y) \text{ and } v_i(gx) \geq v_i(x) \\ \text{Let } x &= \sum m_i, y = \sum m_i' \in M \text{ and } a, b \in K, \text{ then} \\ v(ax+by) &= v(\sum(a m_i + b m_i')) \\ &= \bigwedge \{v_i(a m_i + b m_i') : i=1, 2, \dots, n\} \\ &= v_i(a m_i + b m_i'), \text{ where } 1 \leq i \leq n \\ &\geq v_i(m_i) \wedge v_i(m_i') \\ &\geq v(x) \wedge v(y) \end{aligned}$$

Also for  $g \in G$  and  $x = \sum m_i \in M$ ,

$$\begin{aligned} v(gx) &= v(\sum g m_i) = \bigwedge \{v_i(\sum g m_i) : i=1, 2, \dots, n\} \\ &= v_j(g m_j), \text{ for some } j \\ &\geq v_j(m_j) \\ &\geq v(x) \end{aligned}$$

Therefore  $v$  is a fuzzy  $G$ -module on  $M$  ■

**2.13. Remark.** In the above proposition, if  $v_i(0)$  are all equal then we have  $v(0) = \bigwedge \{v_i(0) : i=1, 2, \dots, n\} = v_i(0)$ , for all  $i$ .

**2.14. Definition[5].** The fuzzy  $G$ -module  $v$  on  $M = \bigoplus_{i=1}^n M_i$ , in the proposition 2.12 with  $v(0) = v_i(0)$  for all  $i$ , is called the **direct sum** of the fuzzy  $G$ -modules  $v_i$  and is denoted by  $v = \bigoplus_{i=1}^n v_i$ .

**2.15. Example.** Let  $G = \{1, -1\}$  and  $M = \mathbb{C}$  over  $\mathbb{R}$ . Then  $M$  is a  $G$ -module. We have  $M = M_1 \oplus M_2$ ,

where  $M_1 = \mathbb{R}$ ,  $M_2 = i\mathbb{R}$ . Define  $v: M \rightarrow [0, 1]$  by

$$\begin{aligned} v(x+iy) &= 1, \text{ if } x = y = 0 \\ &= 1/2, \text{ if } x \neq 0, y = 0 \\ &= 1/3, \text{ if } y \neq 0 \end{aligned}$$

Then  $v$  is a fuzzy  $G$ -module on  $M$ . Also the mappings  $v_1: M_1 \rightarrow [0, 1]$  defined by

$$\begin{aligned} v_1(x) &= 0, \text{ if } x = 0 \\ &= 1/2, \text{ if } x \neq 0 \end{aligned}$$

and  $v_2: M_2 \rightarrow [0, 1]$  defined by

$$\begin{aligned} v_2(y) &= 0, \text{ if } y = 0 \\ &= 1/3, \text{ if } y \neq 0 \end{aligned}$$

are fuzzy  $G$ -modules on  $M_1$  and  $M_2$  respectively and  $v = v_1 \oplus v_2$  ■

**2.16. Theorem[5].** Let  $M$  be a  $G$ -module such that  $M = \bigoplus_{i=1}^n M_i$ , where  $M_i$ 's are  $G$ -submodules of  $M$ . Let  $v_i$ 's be fuzzy  $G$ -modules on  $M_i$  and let  $v = \bigoplus_{i=1}^n v_i$ . Let  $\mu$  be any fuzzy  $G$ -module on  $M$ . Then  $\mu$  is  $v$ -injective if and only if  $\mu$  is  $v_i$ -injective, for all  $i$ .

**Proof:** ( $\Rightarrow$ ) Assume  $\mu$  is  $v$ -injective. Then

- (i)  $M$  is  $M = \bigoplus_{i=1}^n M_i$ -injective and
- (ii)  $v(m) \leq \mu(\psi(m))$ , for all  $\psi \in \text{Hom}(M, M)$ .

To prove that  $\mu$  is  $v_i$ -injective, for  $1 \leq i \leq n$ . (i.e. to prove (a)  $M$  is  $M_i$ -injective and (b)  $v_i(m_i) \leq \mu(\psi(m_i))$ , for all  $\psi \in \text{Hom}(M_i, M)$ )

*Proof of (a):* Since  $M_i$  is a  $G$ -submodule of  $M$ , from proposition 1.15, it follows that  $M$  is  $M_i$ -injective.

*Proof of (b):* Let  $\psi \in \text{Hom}(M_i, M)$  and let  $m_i \in M_i$ , so  $m_i = 0+0+\dots+0+m_i+0+\dots+0$ . Then  $v(m_i) = v(0+0+\dots+0+m_i+0+\dots+0) = v_1(0) \wedge v_2(0) \wedge \dots \wedge v_i(m_i) \wedge \dots \wedge v_n(0) = v_i(m_i)$

Since  $M$  is  $M$ -injective,  $\exists$  an extension  $\phi: M \rightarrow M$  of  $\psi$ ; and hence for each  $m_i \in M_i$ ,

$$\begin{aligned} v_i(m_i) &= v(m_i) \\ &\leq \mu(\phi(m_i)) \quad [\text{by (ii)}] \\ &\leq \mu(\psi(m_i)) \end{aligned}$$

Thus  $v_i(m_i) \leq \mu(\psi(m_i))$ , for all  $\psi \in \text{Hom}(M_i, M)$

Therefore  $\mu$  is  $v_i$ -injective for all  $i$  ( $1 \leq i \leq n$ ).

( $\Leftarrow$ ) Assume  $\mu$  is  $v_i$ -injective for all  $i$  ( $1 \leq i \leq n$ ).

To prove  $\mu$  is  $v$ -injective. (i.e. to prove (c)  $M$  is  $M$ -injective and (d)  $v(m) \leq \mu(\psi(m))$ , for all  $\psi \in \text{Hom}(M, M)$ ).

*Proof of (c):* Let  $N$  be a  $G$ -submodule of  $M$  and  $\phi: N \rightarrow M = \bigoplus_{i=1}^n M_i$  be a homomorphism. Then we have three cases;

- (1)  $N$  is a  $G$ -submodule of  $M_i$  for some  $i$
- (2)  $N = M_i$ , for some  $i$
- (3)  $N = \bigoplus_{i=1}^m M_i$ , where  $m \leq n$

*Case(1).*  $N$  is a  $G$ -submodule of  $M_i$ , for some  $i$ : Since  $M$  is  $M_i$ -injective,  $\exists$  an extension  $\psi: M_i \rightarrow M$  of  $\phi$ . Then  $\eta: M \rightarrow M$  defined by  $\eta(m) = \psi(m_i)$ , where  $m = \sum_{i=1}^n m_i \in M$  is a homomorphism and  $\eta|_{M_i} = \psi$ . So  $\eta|_N = \psi|_N = \phi$ , and therefore  $\eta$  extends  $\phi$

Case(2).  $N = M_i$ , for some  $i$ : The function  $\eta$  obtained as in case (1) with  $\psi = \varphi$  is an extension Case(3). If  $N = \bigoplus_{i=1}^n M_i$ , where  $m \leq n$ : Then the mapping  $\eta: M \rightarrow M$  defined by  $\eta(m) = \varphi(\sum_{i=1}^n m_i)$ , where  $m = \sum_{i=1}^n m_i \in M$  is a homomorphism and  $\eta$  extends  $\varphi$ .

Thus in all the cases,  $\eta: M \rightarrow M$  extends  $\varphi$ ; and hence  $M$  is  $M$ -injective.

*Proof of (d)*: Let  $\psi \in \text{Hom}(M, M)$  and  $m \in M$ . Then  $m = \sum_{i=1}^n m_i$ , where  $m_i \in M_i$ , for each  $i$   
 $\therefore v(m) = v(\sum_{i=1}^n m_i)$   
 $= \wedge \{v_i(m_i) : i=1,2,\dots,n\}$   
 $\leq v_i(m_i)$ , for all  $i$  (1)

Since  $\mu$  is  $v_i$ -injective for every  $i$ ,  
 $v_i(m_i) \leq \mu(\psi_i(m_i))$ , where  $\psi_i = \psi|_{M_i}$  (2)  
 $\therefore v_i(m_i) \leq \mu(\psi(m_i))$  for all  $i$  (3)

From (1) and (3),  $v(m) \leq v_i(m_i) \leq \mu(\psi(m_i))$ , for all  $i$   
 $\therefore v(m) \leq \wedge \{\mu(\psi(m_i)) : i=1,2,\dots,n\}$   
 $\leq \mu(\psi(m_1) + \psi(m_2) + \dots + \psi(m_n))$ , since  $\mu$  is a fuzzy  $G$ -module  
 $\leq \mu(\psi(m_1 + m_2 + \dots + m_n))$   
 $\leq \mu(\psi(m))$ , since  $m = \sum_{i=1}^n m_i$

Thus,  $v(m) \leq \mu(\psi(m))$  for all  $\psi \in \text{Hom}(M, M)$ . Hence  $\mu$  is  $v$ -injective ■

**2.17. Theorem.** Let  $M_1$  and  $M_2$  be  $G$ -submodules of a  $G$ -module  $M$  such that  $M = M_1 \oplus M_2$ . If  $M$  is quasi-injective, then  $M_i$  is  $M_j$ -injective for  $i, j \in \{1, 2\}$ . Further if  $v_i$ 's are fuzzy  $G$ -modules on  $M_i$  ( $i=1, 2$ ) such that  $v = v_1 \oplus v_2$  and if  $v$  is quasi-injective, then  $v_i$  is  $v_i$ -injective for  $i, j \in \{1, 2\}$ .

**Proof:** Assume that  $M = M_1 \oplus M_2$  is quasi-injective. Then by proposition 1.15,  $M$  is  $M_j$ -injective for  $j=1, 2$ . Also it follows from proposition 1.14,  $M_i$  is  $M_j$ -injective for  $i, j \in \{1, 2\}$ . This proves the first part of the theorem.

Now assume that  $v$  is quasi-injective. Then (i)  $M$  is  $M$ -injective and (ii)  $v(m) \leq v(\psi(m))$  for all  $\psi \in \text{Hom}(M, M)$ .  
 First to prove  $v_1$  is  $v_2$ -injective (i.e., to prove (a)  $M_1$  is  $M_2$ -injective and (b)  $v_2(m_2) \leq v_1(\psi(m_2))$  for all  $\psi \in \text{Hom}(M_2, M_1)$  and  $m_2 \in M_2$ ).

*Proof of (a)*: From (i), we have  $M$  is  $M$ -injective. Hence it follows from the first part of the theorem that  $M_1$  is  $M_2$ -injective.

*Proof of (b)*: Let  $\psi \in \text{Hom}(M_2, M_1)$ . Consider the inclusion homomorphism  $\varphi: M_1 \rightarrow M_1 \oplus M_2 = M$ . Then  $\varphi^1 = \varphi \circ \psi: M_2 \rightarrow M_1 \oplus M_2 = M$  is a homomorphism. Since  $M$  is  $M$ -injective,  $\exists$  an extension  $\varphi^1: M \rightarrow M$  of  $\varphi^1$ , so that  $\varphi^1|_{M_2} = \varphi^1$ . (1)  
 Since  $\varphi^1 \in \text{Hom}(M, M)$ , from (ii),  $v(m) \leq v(\varphi^1(m))$  for all  $m \in M$  (2)

Since  $M = M_1 \oplus M_2$ , if  $m_2 \in M_2$ , then  $m_2 = 0 + m_2 \in M_1 \oplus M_2 = M$

$\therefore$  From (2), we get  
 $v(m_2) \leq v(\varphi^1(m_2))$  (3)  
 Also,  $v(m_2) = v(0 + m_2)$   
 $= v_1(0) \wedge v_2(m_2)$   
 $= v_2(m_2)$  (4)

From (1),  
 $\varphi^1(m_2) = \psi^1(m_2) = \varphi(\psi(m_2)) = \psi(m_2)$ .  
 Therefore,  $v(\varphi^1(m_2)) = v(\psi(m_2))$   
 $= v(\psi(m_2) + 0)$   
 $= v_1(\psi(m_2)) \wedge v_2(0)$   
 $= v_1(\psi(m_2))$  (5)

From (3), (4) and (5),  
 $v_2(m_2) \leq v_2(\psi(m_2))$ , for all  $\psi \in \text{Hom}(M_2, M_1)$   
 Therefore  $v_1$  is  $v_2$ -injective.

Similarly we can show that  $v_2$  is  $v_1$ -injective.  
 Now to prove  $v_1$  is  $v_1$ -injective.

From (i) we have,  $M$  is  $M$ -injective. Hence, from the first part of this theorem, we get,  $M_1$  is  $M_1$ -injective. Now, let  $\psi \in \text{Hom}(M_1, M_1)$  and let  $\varphi: M_1 \rightarrow M$  be the inclusion homomorphism. Then  $\varphi \circ \psi: M_1 \rightarrow M$  is a homomorphism. Since  $M$  is  $M$ -injective,  $\exists$  an extension  $\varphi^1: M \rightarrow M$  of  $\varphi \circ \psi$ , so that  $\varphi^1|_{M_1} = \varphi \circ \psi$ . Since  $\varphi^1 \in \text{Hom}(M, M)$ , from (ii), we get  
 $v(m) \leq v(\varphi^1(m))$ ,  $\forall m \in M$   
 $\therefore v(m_1) \leq v(\varphi^1(m_1))$ ,  $\forall m_1 \in M_1$  (6)

If  $m_1 \in M_1$ , then we have  
 $v(m_1) = v(m_1 + 0)$   
 $= v_1(m_1) \wedge v_2(0)$   
 $= v_1(m_1)$  (7)  
 Also,  $\varphi^1(m_1) = (\varphi \circ \psi)(m_1) = \varphi(\psi(m_1)) = \psi(m_1) \in M_1$   
 $\therefore v(\varphi^1(m_1)) = v(\psi(m_1))$   
 $= v(\psi(m_1) + 0)$   
 $= v_1(\psi(m_1)) \wedge v_1(0)$   
 $= v_1(\psi(m_1))$  (8)

From (6), (7) and (8), we get  
 $v_1(m_1) \leq v_1(\psi(m_1))$ , for all  $\psi \in \text{Hom}(M_1, M_1)$ .

Therefore  $v_1$  is  $v_1$ -injective. Similarly we can show that  $v_2$  is  $v_2$ -injective.  
 This completes the proof ■

**2.18. Corollary.** Let  $M = \bigoplus_{i=1}^n M_i$  be a  $G$ -module, where  $M_i$ 's are  $G$ -submodules of  $M$ . If  $M$  is quasi-injective, then  $M_i$  is  $M_j$ -injective for  $i, j \in \{1, 2, \dots, n\}$ . Also if  $v_i$ 's are fuzzy  $G$ -modules on  $M_i$ 's such that  $v = \bigoplus_{i=1}^n v_i$  and if  $v$  is quasi-injective, then  $v_i$  is  $v_i$ -injective for every  $i$  and  $j$  ■

**2.19. Theorem.** If the  $G$ -module  $M = \bigoplus_{i=1}^r P_i$  is quasi-injective, then  $M_i$  is  $M_j$ -injective for  $i, j \in \{1, 2, \dots, r\}$ . Also any fuzzy  $G$ -module  $v$  on  $\bigoplus_{i=1}^r P_i$  is quasi injective, then the corresponding summands  $v_i$ 's are also quasi injective for every  $i$  ■

**Proof:** The first part is clear from the preceding corollary.  
 We have the set  $\mathbf{B} = \{e_k = \sum_{i=1}^r e_{ki} : k = 1, 2, \dots, r\}$ , a basis for  $M$ . Then from the theorem 2.4, the function  $v: M \rightarrow [0, 1]$  defined by

$$\begin{aligned}
 v(c_1\alpha_1+c_2\alpha_2+\dots+c_r\alpha_r) &= 1, \text{ if } c_i=0 \text{ for all } i \\
 &= 1/2, \text{ if } c_1 \neq 0, c_2=c_3=\dots=c_r=0 \\
 &= 1/3, \text{ if } c_2 \neq 0, c_3=c_4=\dots=c_r=0 \\
 &= 1/4, \text{ if } c_3 \neq 0, c_4=c_5=\dots=c_r=0 \\
 &\dots\dots\dots \\
 &\dots\dots\dots \\
 &= 1/r-1, \text{ if } c_{r-2} \neq 0, c_{r-1}=c_r=0 \\
 &= 1/r, \text{ if } c_{r-1} \neq 0, c_r=0 \\
 &= 1/r+1, \text{ if } c_r \neq 0
 \end{aligned}$$

is a fuzzy G-module on  $M = P_r$ . Then for each i, the function  $v_i : M_i \rightarrow [0,1]$  defined by

$$\begin{aligned}
 v_i(c_i\alpha_i) &= 1, \text{ if } c_i=0 \\
 &= 1/i + 1, \text{ if } c_i \neq 0
 \end{aligned}$$

are fuzzy G-modules on  $M_i$  and from the preceding theorem  $v_i$  is  $v_i$ -injective for every i and j. So  $v_i$ 's are quasi injective for every i. ■

### III. CONCLUSION

We have discussed injectivity and quasi injectivity of fuzzy G-modules, in some detail, and have constructed some structure revealing examples. We have also introduced a new G-module  $P_r$  of periodic analytic functions mod r and proved that it is the direct sum of r specific G-submodules (remark 1.9). It is proved

that  $P_r$  has infinitely many fuzzy G-modules on it. In theorem 2.19, we have proved that, if  $P_r$  is quasi injective, then each  $M_i$  is  $M_j$  injective, where  $M_i$  and  $M_j$  are summands in  $P_r$ .

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# Factors Influencing Growth of Small Scale Spinning Units

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**Abstract-** Spinning is the process of converting cotton or manmade fibre into yarn. India enjoys a strong production base of wide range of fibres from natural fibres like cotton, jute, silk and wool to synthetic, man-made fibres like polyester, viscose, nylon and acrylic. No other country except China has such a diverse base in textile fibres. Small scale, non-integrated spinning, weaving, finishing and apparel making enterprises comprise the major part of the Indian textile industry. Tamilnadu is one of the few States that adopts the strategy of industrial growth with emphasis on small scale industries. The small scale industries form the backbone of textile industry, so any measure taken by the Government to strengthen the textile industry should focus on the capacity building of these small scale industries.

**Index Terms-** Level of growth, Small Scale units and Factors

## I. INTRODUCTION

Small scale, non-integrated spinning, weaving, finishing and apparel making enterprises comprise the major part of the Indian textile industry. The structure of Indian textile industry is entirely different from the structure of major textile producing countries. The Government policy of favoring labour intensive, small scale industries is the main reason for the unique structure of the industry.

Spinning is the process of converting cotton or manmade fibre into yarn. India enjoys a strong production base of wide range of fibres from natural fibres like cotton, jute, silk and wool to synthetic, man-made fibres like polyester, viscose, nylon and acrylic. No other country except China has such a diverse base in textile fibres. Thus, availability of wide range of fibres coupled with close linkage with culture, Indian textile industry is able to produce variety of products suited to the varying needs and preferences of the consumers. Industrial delicensing and liberalization policies accelerated the growth of spinning units. The spinning sector is reasonably modernized when compared to other sectors of the textile industry

Tamilnadu is one of the few States that adopts the strategy of industrial growth with emphasis on small scale industries. Tamilnadu at 15.1 per cent, accounts for the largest number of Micro, Small and Medium Enterprises (MSMEs) established and

run in the State. To stimulate further industrial development the Government of Tamilnadu has announced the New Industrial Policy 2007 with the objective of reviving micro, small and medium enterprises in the State to become competitive in the global market. Tamilnadu's MSME Policy announced in 2008 aimed at sustaining the growth rate of the sector over 10.0 per cent. It also aimed at promoting 10 lakh direct and indirect employment during the Eleventh Five year plan period. Recently, the State Government has launched Rs. 50 crore Tamilnadu Cotton Cultivation Mission to boost the production of cotton in the State. Under this mission, atleast 3.70 lakhs acres will be brought under Cotton Cultivation in 2014-15, and ultimately the cultivation will be expanded to 6 lakh acres in that next five years. Definitely, the measure taken by the Government if successfully implemented will make the State self sufficient in cotton production.

The small scale industries form the backbone of textile industry, so any measure taken by the Government to strengthen the textile industry should focus on the capacity building of these small scale industries. Again these small scale industries are concentrated in a particular area, and so various clusters are formed across the country. The powerloom units are concentrated in clusters like Surat, Bhiwandi, Malegaon, Erode, and Salem. The knitwear units are concentrated in Ludhiana and Tiruppur. The home furnished clusters are concentrated in Kannur, Karur and Panipet. Bangalore, Chennai and Delhi have emerged as apparel manufacturing clusters, while Guntur and Indore are famous for ginning and processing activity. Coimbatore and Madurai are known for cotton spinning clusters. The researcher has selected 132 small scale spinning units in Coimbatore district for the study purpose.

## II. GROWTH INDEX

The growth of the sample units has been measured with the help of growth index. For measuring the growth, five components namely – value of production, value of sales, amount of working capital, number of workers employed and contribution by the unit to the Government were identified. The percentage of the growth is calculated by applying the formula,

Average value of each component from 2008 – 2012

Value of each component in the base year (2007 – 08)

X 100

The percentage of growth for each component is calculated and scores are awarded. Each component is awarded a maximum score of 20 thus, the total score comes to 100 (20 scores X 5 components). The scores obtained by the sample units have been converted into an index called 'Growth Index' and the overall mean and standard deviation have also been calculated. Based on the growth index the sample units have been divided into three groups as units with low, medium and high level of growth. In order to classify the units into three such groups, mean and standard deviation have been made use of. Accordingly by adding standard deviation with mean value and the units which scored above this value were categorized as 'high level growth units'. The standard deviation was subtracted from the mean value and the units which scored below this value were categorized as 'low level growth units'. The sample units whose score is between these two values were categorized as 'moderate level growth units'. The classification at the end revealed that 24 units are high level growth units, 24 units are low level growth units and 84 units come under moderate level growth.

**III. FACTORS INFLUENCING LEVEL OF GROWTH**

The success of an enterprise depends on the personal qualities of the entrepreneur and this plays a vital role in case of small scale units. In addition to the personal characteristics of the entrepreneur, there are some other factors that influence the growth of a business, such as location of the unit, production and purchase policy followed, type of products produced, and quality of the work force etc,

Men, Material, Machine, Money are the four important 'M's that are required to run a business unit successfully. The researcher has attempted to analyse the significant role played by the employees of the sample units towards its success. Some important aspects of this resource such as labour turnover, housing facility, canteen facility, transport facility, Regularity in sharing Views with Employees and Seeking Opinion from Subordinates have been selected. Analysis of variance (ANOVA) and 't' has been used to find out whether the mean growth index of various sample units differ significantly. Chi – square test has been employed to ascertain the association that exists between the selected attributes and the level of growth of units. The levels of confidence chosen are five and one per cent for all the tests

**Results of F/t test**

**i) Labour Turnover and Growth Index**

Labour turnover is the biggest problem faced by any business unit and it is a hindrance to the growth of the unit.

**Table 1  
 Labour Turnover and Growth Index**

	Labour Turnover			Total
	High	Moderate	Low	
<b>Numbers</b>	40 (30.30)	68 (51.52)	24 (18.18)	<b>132</b>
<b>Growth Index</b>	32.70	25.47	38.33	<b>30</b>

**F Value = 4.048\***

It can be seen from the Table that the average growth index of those units with low labour turnover is high and the average growth index of those units with moderate labour turnover is low. Since the calculated F value (4.048) is greater than the table value at five per cent level (3.066), it can be inferred that there is a highly significant difference in the mean index of units which differ among themselves in labour turnover.

**II) Housing Facility and Growth Index**

Business units provide a few facilities to their employees in addition to their remuneration. Employees may be provided with rent free accommodation or a accommodation at a subsidized rate by an organization to reduce labour turnover.

**Table 2  
 Housing Facility and Growth Index**

	Housing Facility		Total
	Provided	Not Provided	
<b>Numbers</b>	84 (63.64)	48 (36.36)	<b>132</b>
<b>Growth Index</b>	33.62	23.67	<b>30</b>
<b>Total</b>	<b>132</b>	<b>30.00</b>	

**t Value 2.705 \*\***

\*\* Significant at one per cent level

It is clear from the table that the average growth index of those units which provide housing facility to their employees is high and it is low for those units which do not provide this facility. As the calculated 't' value is greater than the table value at one per cent level of significance, it can be said there is a significant difference in the mean growth index of units which are classified on the basis of housing facility provided.

**III) Canteen Facility and Growth Index**

An organization may run a canteen where food is provided to the employees at subsidized rate. The units are classified into two groups as units which provide canteen facility and units which do not provide this facility.

**Table 3  
 Canteen Facility and Growth Index**

	Canteen Facility		Total
	Provided	Not Provided	
<b>Numbers</b>	88 (66.67)	44 (33.33)	<b>132</b>
<b>Growth Index</b>	28.89	32.23	<b>30</b>

**t Value 0.868**

In the first group there are 88(66.70%) units which provide canteen facility to the workers. Their average growth index is 28.89. The units which do not provide canteen facility to their workers are grouped in the second category; their average growth index is 32.23. As the calculated 't' value is less than the table value at five per cent level of significance, it can be inferred that there is no significant difference in the mean growth index of units which are classified on the basis of canteen facility

**IV) Transport Facility and Growth Index**

A spinning unit employs workers belonging to the same area or coming from nearby places. In this situation it has to provide transport facility to the workers to reduce unexpected absenteeism. The units are classified into two groups as units which provide transport facility and units which do not provide this facility

**Table 4  
 Transport Facility and Growth Index**

	Transport Facility		Total
	Provided	Not Provided	
<b>Numbers</b>	62 (46.97)	70 (53.03)	<b>132</b>
<b>Growth Index</b>	28.48	31.34	<b>30</b>

**t Value 0.786**

It could be seen from the table that the average growth index is high for those units which do not provide transport facility to their workers and is low for those units which provide this facility to their workers. Hence, it could be inferred that transport facility is not associated with growth. As the calculated 't' value is less than the table value at five per cent level of significance, it can be said that there is no significant difference in the mean growth index of units which are classified on the basis of transport facility provided.

**V) Regularity in sharing Views with Employees and Growth**

If an organization follows democratic leadership policy it will give opportunity to its workers to share their views with the management. This approach of the top level management will develop a cordial relationship between the workers and management which will facilitate growth of the unit. This opportunity may be offered regularly or occasionally while other organizations will not provide this opportunity to its workers.

**Table 5**  
**Regularity in sharing Views and Growth Index**

	Regularity in sharing Views			Total
	Regularly	Occasionally	Never	
<b>Numbers</b>	74 (56.06)	52 (39.39)	6 (4.55)	<b>132</b>
<b>Growth Index</b>	26.35	34.85	33.00	<b>30</b>

**F Value = 2.674**

It can be inferred from the table that the average growth is high for those units which provide opportunity to its employees to share their views occasionally and it is low in case of units which give opportunity to its employers to share their views regularly. As the calculated F value is less than the table value at five per cent level of significance it could be said that there is no significant difference in the mean growth index of the units which are classified on the basis of opportunity given to workers to share their views.

**VI) Seeking Opinion from Subordinates and Growth**

An organization may hold consultation with the subordinates before implementing any policy decision. This approach will encourage the workers to work enthusiastically towards the goal of the organization.

**Table 6**  
**Seeking Opinion from Subordinates and Growth Index**

	Regularity in Seeking Opinion from Subordinates			Total
	Regularly	Occasionally	Never	
<b>Numbers</b>	62 (46.97)	54 (40.91)	16 (12.12)	<b>132</b>
<b>Growth Index</b>	26.35	33.46	32.44	<b>30</b>

**F Value = 1.830**

It is clear from the table that the level of growth index is high with those units which hold consultation with employees occasionally and it is low with those units which regularly consult their employees before taking any policy decision. As the calculated F value is less than the table value at five per cent level of significance, it can be inferred that there is no significant difference in the mean growth index of the sample units which are classified on the basis of management approach towards subordinates.

**Results of CHI-SQUARE TEST**

The table given below gives the results of  $\chi^2$  test

**Table 7**  
**Results of  $\chi^2$**

Factors	Calculated $\chi^2$ Value	Table Value		Degrees of freedom	Results
		5%	1%		
Labour Turnover	<b>20.114</b>	<b>9.488</b>	<b>13.277</b>	4	Associated
Housing Facility	<b>6.679</b>	<b>5.991</b>	<b>9.210</b>	2	Associated
Canteen Facility	<b>9.429</b>	<b>5.991</b>	<b>9.210</b>	2	Associated
Transport facility	<b>3.050</b>	<b>5.991</b>	<b>9.210</b>	2	Not Associated
Regularity in sharing views	<b>17.638</b>	<b>9.488</b>	<b>13.277</b>	4	Associated
Seeking opinion from the subordinates	<b>7.837</b>	<b>9.488</b>	<b>13.277</b>	4	Not Associated

From the above table it is clear that human resources factors such as labour turnover, housing facility, canteen facility and regularity in sharing views with employees are associated with the growth of the units whereas the transport facility and seeking opinion from the subordinates are not associated with growth of the sample units.

#### IV. SUGGESTIONS

The main challenge faced by the spinning mills in this region is non-availability of skilled labour. The workers employed in the mills are mostly technically untrained and so their productivity is affected. As per the SIMA release, the average attrition rate in textile mills is 30 per cent to 60 per cent and in case of small scale units it is 30 per cent. The widening skill gap and high attrition rate can be reduced if the following measures are taken.

a) The mills should develop a healthy retention plan which includes offering annual incentive, providing prerequisites such as rent free accommodation, food at a subsidized rate and transportation facility to workers to commute from their home to work place and vice versa.

b) The working condition of the mills should be improved. The mills should make arrangements for ventilation, exhaust fans to exclude dust and fumes. Basic hygienic facilities, health and safety measures as mentioned in the Factory Act 1948 should be provided.

c) The manpower requirement is estimated to be six to seven lakhs workers in Tamilnadu, Andhra Pradesh and Karnataka. This can be achieved by offering Textile Technology Programmes to the students. The internship training programmes may be offered to final year students of Textile Technology. A separate Institutional Training Institute (ITI) for textiles should be started in Coimbatore to train the students and make them employable.

#### V. CONCLUSION

The findings of the study reveals that out of six variables selected for the study purpose the variables that influenced the growth of the spinning units are Labour Turnover, Housing Facility, Canteen Facility and Regularity in sharing views with employees. This shows that the spinning units should give more attention to the human resources of the organisation. Efforts should be taken by the units to improve their working condition. The organization should provide more perquisites to the workers and encourage them to participate in managerial decision making.

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# Coherent Optical – OFDM using 64QAM to high data rates 1.60 Tb/s over 4500 km

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**Abstract-** Coherent optical orthogonal frequency division multiplexing (CO-OFDM) system with dense wavelength division multiplexing (WDM) was analyzed to reach high data rates of 1.60 Tb/s over 4500 km single mode fiber (SMF).

1.60Tb/s signal was generated by multiplexing 16 OFDM signals with 100 Gb/s for each signal. The system performance has been studied by measuring optical signal to noise ratio (OSNR) of each WDM channel, bit error rate (BER) and signal to noise ratio (SNR). It was found that as the BER decreased both OSNR and SNR was increased.

**Index Terms-** Orthogonal frequency division multiplexing OFDM, WDM, BER , OSNR.

## I. INTRODUCTION

Orthogonal Frequency Division Multiplexing (OFDM) has grown to be the most popular communications systems in high speed communications, (OFDM) is a multicarrier transmission technique, which divides the bandwidth into many carriers and uses the spectrum much more efficiently by spacing the channels much closer together. (OFDM) has great interest due the possibility to expand to higher level modulation formats and to realize next generation active optical networks [1]. one OFDM symbol is composed of a set of subcarriers, and each of them is modulated by an information symbol with its corresponding Quadrature and in-phase component. This is very similar to subcarrier multiplexing technique, except that subcarriers in OFDM overlap to maximize the spectral efficiency [2]. The Coherent optical orthogonal frequency-division multiplexing (CO-OFDM) has been extensively studied because of its advantages such as high spectral efficiencies, low required sampling rates, and flexible bandwidth scalability and allocation.

(WDM) is an optical multiplexing technique used currently in core and Metropolitan (metro) optical networks to help to increase system capacity. WDM provides an efficient means of utilising the large optical bandwidth available from a single optical fiber by transmitting multiple wavelengths with a given frequency separation [3]. OOFDM uses different subcarriers to send low rates in parallel data streams. The M-array Quadrature Amplitude Modulation (QAM) is used to modulate the subcarriers before being transported on a high frequency microwave carrier [4].

## II. SYSTEM DESIGN

WDM CO-OFDM system was simulated and studied using an OptiSystem V.13.0.2 simulation tool. The system consists of three main parts: CO-OFDM Tx (Transmitter), optical fiber link and CO-OFDM Rx (Receiver).as shown in Figure (1) In the WDM system, 8 channels with 50 GHz channel spacing were used to support 16 OFDM bands, each with 100 Gbits/s bit rate to reach 1.6 Tbits/s data rate.

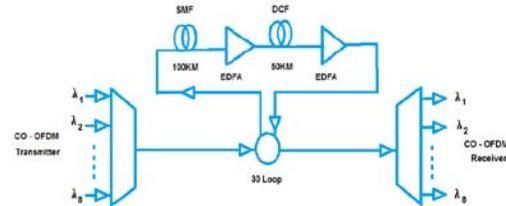


Figure (1). WDM CO-OFDM system

The global parameter of the system design is shown in table (1)

Table 1: Global Parameters

Sequence length	65536 Bits
Samples per bit	4
Number of samples	262144
Symbol rate	2.5e+009 symbols/s

### A. CO-OFDM transmitter part

The bit stream was generated by an Pseudo Random Binary Sequence (PRBS) generator and mapped using 64-QAM encoder. The resulting signal was modulated using OFDM modulator as shown in Figure (2),

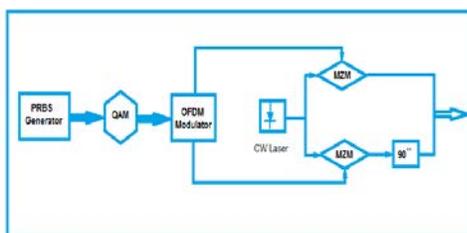


Figure (2). CO-OFDM transmitter block diagram

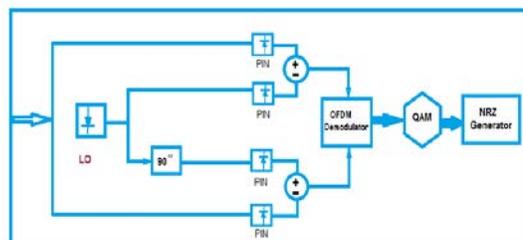


Figure (4). CO-OFDM Receiver block diagram

The OOFDM parameter is shown in Table 2.

Table 2: OFDM Modulator Parameters

Maximum possible subcarriers	1024
Number of prefix points	16
Average OFDM power	100 dBm
Subcarrier locations	512-1024

B. Optical part

The optical link consists of 30 spans of 100 Km SMF , with a dispersion coefficient of 17 ps/nm/Km and Dispersion Compensation Fiber (DCF) of 50 Km with a -80 ps/nm/Km coefficient in each span as shown in Figure (3).

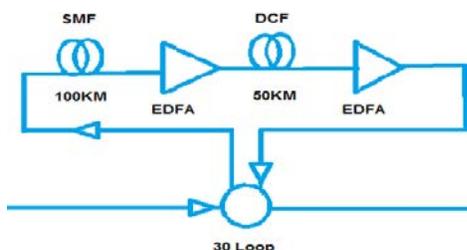


Figure (3). Schematic of Optical Link

C. CO-OFDM Receiver part

To recover the I/Q component of the OFDM signal, two pairs of balanced PIN photodetectors and Local Oscillator lasers were used , The balanced detectors perform the I/Q optical to electrical detection and help perform the noise cancellation , after that the balanced detectors demodulated the resulting signal using the OFDM demodulator with similar parameters as the OFDM modulator. The parameters of the LO are shown in table (3), After the signal is fed into a 64-QAM decoder, the BER was calculated as shown in Figure (4).

Table (3): Parameters of the LD

Parameter	Value
Frequency	193.1 THz
power	0 dBm
Line width	0.1 MHz
Initial phase	0

III. RESULTS AND DISCUSSION

Figure (5) shows measurement the RF spectrum analyzer after low pass Roll off filter, where the power of the RF is approximately 32 dBm, the carrier frequency of the signal is 12.4 GHz.

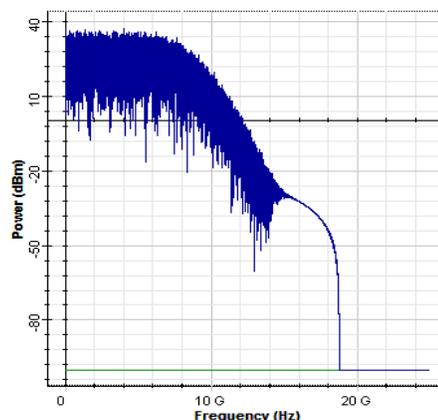


Figure (5) RF spectrum transmitter

Figure (6) shows the RF spectrum after 4500 Km SMF. The power of the RF is increase to -38.96 dBm, and carrier frequency is 12.4 GHz , The OSNR is 42.7 dB and SNR is 46.75 dB .

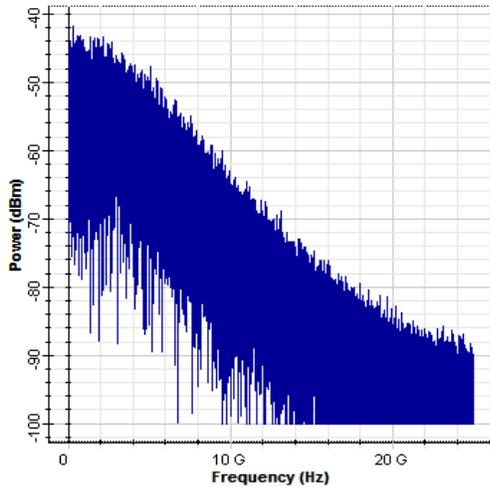


Figure (6) RF spectrum receiver

After the optical combiner the Spectrum of the signals from 193.08 THz to 194.12 THz with 50 GHz of channel space for 100 Gb/s in figure (7)

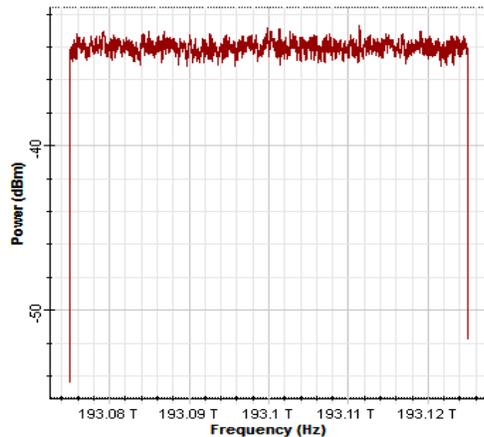


Figure (7) Optical spectrum analyzer transmitted signal

Figure (8) shows the received constellation diagram of 64 - QAM digital modulator to high data rates 1.050 Tb/s over 3600 km.

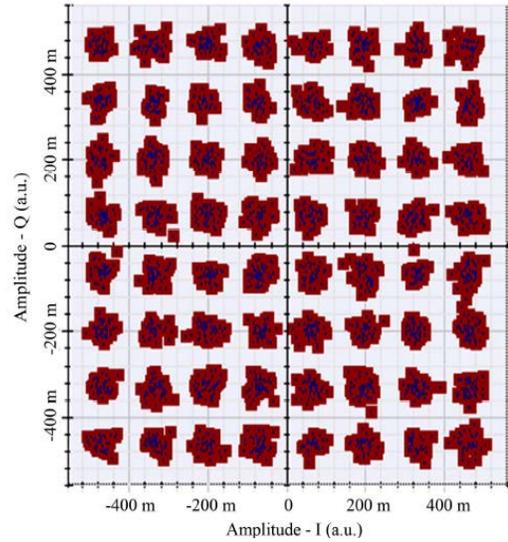


Figure (8) constellation diagram

Figure (9) shows the received constellation diagram of 64 - QAM digital modulator to high data rates 1.60 Tb/s over 4500 km.

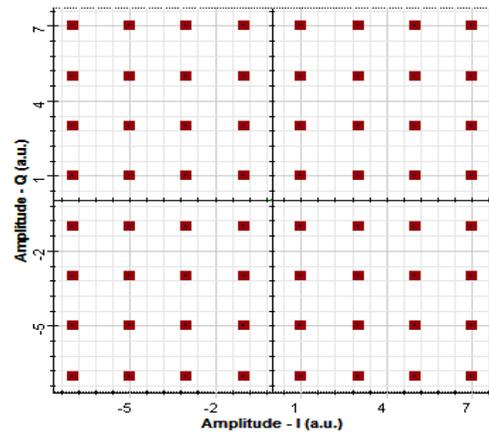


Figure (9) constellation diagram

Figure (10) shows the BER comparison OSNR and it is clear that as OSNR increase the BER decrease , the OSNR is 11.64 dB for 50 Gb/s and 12.43 for 100 Gb/s at BER=10<sup>-14</sup>

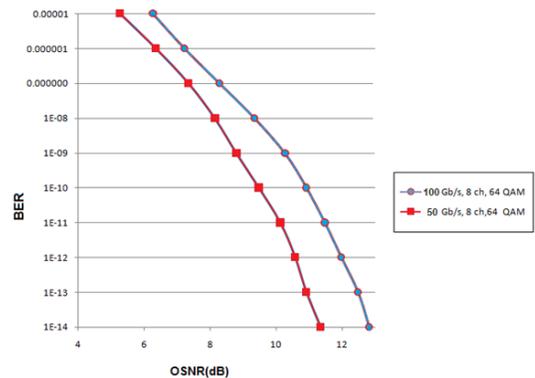
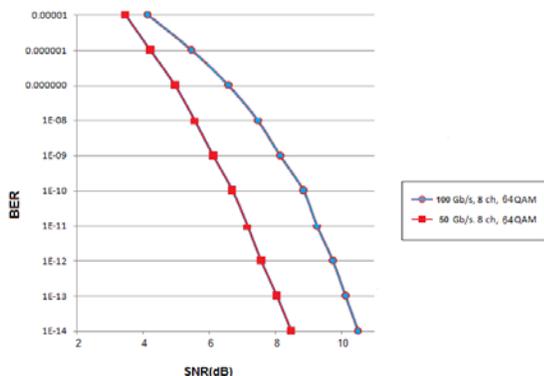


Figure (10) BER comparison OSNR for 50 Gb/s and 100 Gb/s

Figure (11) shows the BER comparison SNR and it is clear that as SNR increase the BER decrease , the SNR is 8.47 dB for 50 Gb/s and 10.32 for 100 Gb/s at BER= $10^{-14}$



**Figure (11) BER comparison SNR for 50 Gb/s and 100 Gb/s**

#### IV. CONCLUSION

In this study, the structure of WDM systems is studied by using Co-OFDM. The simulation was designed by 8 WDM channels spaced at 50 GHz, and 16 OFDM signals, each with 100 Gbits/s bit rate to produce 1.6 Tbits/s . it note the results has a good performance according to the BER ,OSNR and SNR values , the system showed a clear constellation diagram of 64-QAM at receiver, compared with others simulation study Optical-OFDM using 64 QAM over 3600km and the obtain BER  $10^{-12}$  .

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# RMG: Prospect of Contribution in Economy of Bangladesh

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**Abstract-** The southern Asian country of Bangladesh, bordered by India and Myanmar, has a population of approximately 164 million people. The Bangladesh economy has grown an average of six percent a year over the last 6 years and almost 12% of Bangladeshi GDP in 2009 and 2010 and employs approximately four million people. The export-oriented Bangladeshi garment manufacturing industry has boomed into a \$22 billion dollar a year. The Bangladeshi textile and garment manufacturing sector is fuelled by young, urbanizing, workers many of whom are women. With the majority of production destined for U.S. and European markets, Bangladesh's ready-made garment industry now accounts for approximately 78% of total exports, second only to China as the world's largest apparel exporter. Ready-Made Garment (RMG) industry has provided enormous opportunities to Bangladeshi women to work outside the home for wages. It is opined in the literature that this change has contributed and increased emphasis on poverty reduction through employment. The development of Garments Industry is considered as the priority area in the development policy in Bangladesh. The young entrepreneurs are engaged in varied form of small and medium scale garments industry which comprises of products. This study is conducted to analyze the contribution and prospects of Readymade Garments Industry in Bangladesh. The findings of this paper show that Bangladesh has a great opportunity to earn a great foreign currency through developing readymade garments industry and contribute economic development.

**Index Terms-** Readymade garments, History, economic contribution, and prospect.

## I. INTRODUCTION

The situation of socio-economic condition of Bangladesh was critical in the first three decades after independence. Domestic resource mobilization was highly inadequate compared to investment requirements. The government resorted to deficit financing, money supply increased rapidly, and inflation rates were high. The balance of payment position was unstable. The situation was aggravated through rapidly rising import prices and deterioration in the terms of trade. For these reasons, Bangladesh has been dependent on foreign aid for financing development programs and for filling up large fiscal and external deficits. Faced with a situation of growing population, limited land and poor resource base and declining growth in agriculture severely constrained by a host of socio-economic factors, Bangladesh is hard pressed to rapidly expand employment opportunities outside

agriculture. Against this backdrop, the urgent need to adopt and implement an export oriented, and employment intensive industrialization strategy. The outcome of the post-war industrialization efforts have reaffirmed conventional wisdom- the key to the possibilities of rapid industrialization and sustained growth lies in the pursuance of a globally competitive industrialization strategy dictated by the dynamic comparative advantage of the economy (Bakht, 1993). In such a context, a least developed, resource poor, labor surplus country like Bangladesh, garment industry has been playing a vital role for the emancipation of socio- economic condition through employment and foreign earnings and acting as driving force in the economic development.

The garment industry particularly has played a pioneering role in the development of industrial sector of Bangladesh. Though it took a rather late start i.e. in 1976 but it soon established its reputation in the world market within a short span of time. Resultantly, garment is now one of the main export items of the country. Besides, enriching the country's economy it has played a very crucial role in alleviating unemployment.

Increasing per capita gross domestic product (GDP), favorable balance of payment position, export earnings, increasing competitiveness and poverty reduction through creation of employment opportunities are the prime objectives of trade liberalization in Bangladesh (Raihan, 2007). RMG industry is the number one beneficiary of trade reforms and has been expanding rapidly since the late 1970s. Though this industry contributed only 0.001 per cent to the country's total export earnings in 1976, its share increased to about 79.33 percent of those earnings in 2008-09 (BGMEA, 2010). Most of the RMG factories are situated in Dhaka, Chittagong, Narayangong, Dhaka Export Processing Zone (EPZ), Chittagong EPZ and Gazipur industrial area.

In the above background, an attempt has been made in the paper to overview the garment industry in Bangladesh in order to assess its role in the socio economic development of Bangladesh.

## II. LITERATURE REVIEW

Several authors have analyzed aspects of the garment industry in Bangladesh. Of the various aspects of the industry, the problems and the working conditions of workers have received the greatest attention.

The Bangladesh Planning Commission under the Trade and Industrial Policy (TIP) project also commissioned several studies on the industry. Hossain and Brar (2004) consider some labor-related issues in the garment industry. Quddus (2006) presents a

profile of the apparel sector in Bangladesh and discusses some other aspects of the industry. Islam and Quddus (2006) present an overall analysis of the industry to evaluate its potential as a catalyst for the development of the rest of the Bangladesh economy. Paul-majumder (2007) found that demand for weekly holiday is a major reason for worker's unrest during 2006. It is observed that the workers are engaged in work for all most all days. Abdin M. J. (2008) in his journal "Overall Problems and Prospects of Bangladeshi Ready- Made Garments Industries" focused on labor unrest in RMG sector and provide some solution regarding this problem. Sultana S. and et al (2011) presents results from a survey of "Likely Impacts of Quota Policy on RMG Export from Bangladesh: Prediction and the Reality" which indicates that despite the concern and fear of negative impact on in the aftermath of quota removal of RMG sector in Bangladesh appears with positive trends along with the substantial increasing rate of export amount, the number of jobs and industries and GDP's growth. In 2010, the sector keeps around 20 percent GDP growth of the country. In another study, Ferdous R. (2012) found that the reason behind the labor unrest is the absence of legal and institutional arrangements to ensure labor rights in the RMG sector. Many of the garments factories in Bangladesh are alleged not to comply with the Labor Law and ILO conventions. The main reason for labor unrest is inadequate wages of the workers. Islam M. S, and Ahmad (2010) identified that conveyance, lunch bill and enhancement of casual leave, increase of monthly minimum wages from tk. 1662 to tk. 5000; low house rent and better supply of water and gas are the reasons for the labor unrest in the ready-made garment industry of Bangladesh. In another study, Mirdha R. U. (2012) found that the rumor, fear of job loss, jhoot business, case with police stations, fear of shutdown of factories, arrears, checking at entry point and identity cards, pay hike and discrimination in grades, bad relation with workers and mid level management, provocation by locally influential people and international conspirators and some NGOs, fear of police and role of industrial police, sudden order cut by international buyers, production in piece rate, accommodation and higher house rent, lack of motivational training program, inflation etc. are also the reasons for labor unrest in ready-made industry of Bangladesh.

The readymade garment sector in Bangladesh is a multi-billion-dollar manufacturing and export industry. With about 4.4 million workers employed in the sector, about 80 percent of whom are women, the growth of the garment industry has far-flung implications for the economy. The RMG sector alone does export worth \$21.5 billion a year, which is 79 percent of the total export earnings of our country. Given the dominance of the sector in the overall economy, any sort of vulnerability and threat to this sector should be a matter of concern. So rather than basking in glory we should concentrate on retaining sustainable growth and competitive edge.

Over the last three decades, our apparel industry has achieved a phenomenal growth due to policy support from the government, dynamism of the private sector entrepreneurs and extremely hardworking workers. Now the number of RMG units is more than 5,000 and export earnings have reached \$22 billion with more than one hundred countries using 'made in Bangladesh' knit garments and woven products.

A McKinsey survey also tells us that the potential for the garment industry is promising. McKinsey forecasted export-value growth of 7-9 percent annually within the next ten years, so the market will be double by 2015 and nearly triple by 2020. There are several external factors that have been playing an important role in facilitating the growth of the sector. One of these crucial factors is gradual reduction in China's bulk production due to labor shortages and higher wages, which also contribute to a decline in its appeal in the apparel realm. Moreover, China is now interested in manufacturing products that require greater skills, better technology and more investment in advanced equipment.

According to a survey conducted by McKinsey in 2001, 86 percent of the chief purchasing officers in leading apparel companies in Europe and the US planned to decrease levels of sourcing in China over the next five years because of declining profit margins and capacity constraints, and their next preferred sourcing destination is Bangladesh. They viewed Bangladesh as the next hot spot for sourcing in the RMG market. So Bangladesh is expected to gain much from the changed scenario in the global apparel market.

Another key prospect for growth of our garment industry lies in the size of the global apparel market, which is gradually growing bigger. According to a recent report, the global apparel market will cross the \$2 trillion mark by 2025 from the current value of \$1.1 trillion. So there is a great opportunity for us to further penetrate the global apparel market and boost our export earnings.

Despite the epic growth of our industry and its bright prospects, challenges are still there. However, we always believe that challenges can be turned into opportunities if they are addressed with steely determination and pragmatic steps and such instances are galore in our history.

One of the biggest challenges currently facing our garment industry is to make our factories safer and ensure better working conditions for millions of garment workers. The Tazreen fire and Rana Plaza collapse have brought the issue of workplace safety to the fore. The accidents have caused a paradigm shift within the industry. Following the unfortunate incidents a number of initiatives have been taken to improve building and fire safety in the industry.

Platforms such as Alliance, Accord and National Plan of Action have been formed and all are working sincerely to make every factory safer and compliant. Moreover, the factories which were established in an unplanned way and housed in converted and shared buildings have started relocating to purposely-built buildings. Moreover, an initiative has been taken to set up an industrial park to relocate the non-compliant garment factories.

A total of 67 inspectors have already been appointed who will monitor workplace safety at garment factories and recruitment of more inspectors is in the process. However, ensuring workplace safety at all garment factories is a gigantic task and will take time to accomplish it. But we believe the government of Bangladesh with the support of global brands and international development partners, will be able to ensure the safety of the industry and maintain the momentum of socio-economic development in the country.

Another challenge for our RMG industry is to ensure workers' rights. The government of Bangladesh has amended the

Labour Law 2006 in July 2013 making it more favourable for ensuring workers' rights, including the right to freedom of association and collective bargaining.

The legal requirements for trade union formation are more flexible now. The number of trade unions at the garment factories has increased significantly in recent times. Besides, the government promptly takes steps to investigate any complaint of violation of labour rights.

The huge expansion of the garment industry has reinforced the need for development of infrastructure, which is quite a big challenge for us. Ensuring energy and power supply to the industry has also appeared as a major challenge. Skilled workforce is a prerequisite for the development of an industry. But unfortunately we have a shortage of skilled workforce, especially at mid-management level, as we do not have sufficient number of vocational institutes and textile universities though our industry has started its journey in the early 1980s.

There is no best alternative but to improve productivity in order to compete in the global market since the prices of garments in the world market have gone down to such an extent that there is hardly any scope for a further decrease in the price level. Keeping the fact in mind due emphasis should be put on developing the skills of our workers. Practically saying one word that describes our garment sector is 'resilience'. Even after many external and internal challenges, we have come out successful and still going strong. This sector has such strong foundations that a few mishaps cannot and will not take the glory away.

The president of Bangladesh Garment Manufacturers and Exporters Association (BGMEA) was said:

We may have had disruption in our supply chain but still we met our shipments and deliveries, though they have cost more than usual but at least we kept our words. No one can deny our commitment that buyers have enjoyed all these years by importing from us. Unfortunate incidences happened but with time and effort we can avert such incidents. It is good to see that even during our difficult time in the wake of Tazreen and Rana Plaza tragedy, buyers have not lost their confidence in us and they are still supporting.

The RMG industry has the potential to grow more in the coming years. With tangible support from our government, buyers and all other organisations concerned, we can reach heights. But with dreams in the eyes of millions of Bangladeshis, achieving that feat may not be impossible.

### III. OBJECTIVES

This study on garment industry as a driving force for the socio economic development of Bangladesh demands examination and evaluation of multidimensional aspect of garment sector and its impact on the socio-economic condition of Bangladesh. In such context, the main objective of the study is to examine, evaluate and analyze the some important aspect of garment industry in Bangladesh. In order to materialize the main objective, the following specific aspects of garment industry in Bangladesh have been studied, evaluated, examined and analyzed:

To study and evaluate the growth and development of garment industry in Bangladesh;

To examine the contribution of garment industry to the national economy of Bangladesh;

To study the trend of garment product development and its composition in order to analyze the product portfolio and its diversification;

To study the present market composition for the Bangladeshi garment product vis-à-vis market diversification;

To identify the RMG contribution of the economy of Bangladesh

To identify the prospect of the readymade garments sector and develop some overcome strategies

### IV. METHODOLOGY

This study is followed exploratory research design based on quantify and qualitative research approach. Whereas qualitative research is an unstructured, exploratory research methodology based on small samples intended to provide insight & understanding of the problem setting (Malhotra and Dash, 2010). This research focused on different methods and least square method of trend analysis is one of them. Data required for this quantitative and qualitative analysis were collected from primary sources and secondary sources like, face to face interview, project contract and records, Data and information from secondary sources were collected by consulting various relevant journals, studies conducted by various donor and development agencies, Bangladesh export statistics published by Export Promotion Bureau and Bangladesh Bank, Economic review of Bangladesh, annual reports of BGMEA and the publication of WTO. The information published in the different newspapers and websites in recent times have been consulted in order to present the recent labor unrest situation in garment sector. The collected data and information were then processed, tabulated and analyzed to present the findings in a logical and objective manner. This study mainly focused on three aspects: firstly, trend analysis & contribution in economy and secondly, prospect of the sector and finally recommend some strategies. For trend and contribution analysis, three parameters such as factory, workers and export are considered. The contribution and prospect of this sector are gathered through face to face interview with the chief executive body and management level people. Further to make the study more broad based & informative this research conducted informal interview with an expert in this area. This expert is the consultant, project development, Infrastructure Investment Facilitation Company (IIFC). Materials of the paper were presented systematically for analytical purpose & also to draw inference there from.

### Rationale of the study

This paper will be significant for stakeholder's like- public sectors, private sectors, policy makers, analysts etc for gathering knowledge regarding readymade garments sector in Bangladesh. In light of the objectives of the study, the paper has been designed to examine some important aspects of garment industry in Bangladesh.

V. ANALYSIS & FINDINGS

In the field of industrialization, role of textile industry is found very prominent in both developed and developing countries. Economic history of Britain reveals that in the 18th Century the cotton mills of Lancashire in Britain ushered in the first industrial revolution of the world. Moreover, during the last 200 years or more many countries of the world have used textile and clothing industry as an engine for growth and a basis for attaining economic development (Ahmed, 1991). Over the past few years garment industry is found to have played such an important role in the process of industrialization and economic growth.

As an export oriented country, Bangladesh largely depends on the ready-made garment exports for its export earnings. The country has been rapidly expanding in this sector since its liberation. Bangladesh's share of the global garment market has been growing (Asian Development Bank, ADB). The country is the second largest exporter to the European Union. It also has a significant market share in United States market. Bangladesh started to get the benefit of Generalized System of Preferences (GSP) from January 2011. But because of some massive accidents in the garment factories, Bangladesh is now under

suspension of getting the benefit of Generalized System of Preferences (GSP). This situation can also influence European Union to suspend Bangladesh from getting duty free access to its market. Garment exports of Bangladesh totaled \$21.5 billion up to June, 2013 which is thirteen percent higher than the previous year (Reuters, July 9, 2013). The positive growth in the garment sector is the result of some positive government measures to reform the industry. The government took some initiatives to improve the working conditions of the garment industry after the collapse of Rana Plaza factory complex which killed more than one thousand workers. Table 01 shows the growth rate of ready-made garment (RMG) of Bangladesh. It indicates that the growth rate of ready-made garment (RMG) was 10.57 percent in FY 2003-04 and 6.10 percent in FY 2004-05. Though the rate increased to 24.34 percent in FY 2005-06, it started to fall in the following years. Not only the growth rate of ready-made garment (RMG) decreased in the previous years, it became negative in FY 2008-09 which was an alarming situation for the country. Only after getting the benefit of General System of Preferences (GSP), the country succeeded to have a growth rate of 43.83 percent in FY 2010-11.

**Table 01: Ready-made Garment (RMG) Production of Bangladesh (in Million BD Taka)**

Year	2003-4	2004-5	2005-6	2006-7	2007- 8	2008-09	2009-10	2010-11
RMG	208604	221335	275206	321656	354475	239526	245296	352815
RMG growth rate	10.57%	6.10%	24.34%	16.88%	10.20%	(32.43%)	2.41%	43.83%

Source: Bangladesh Bureau of Statistics, BBS

**Analysis of Export-Import of Bangladesh**

Balance of payment of Bangladesh shows the summary of transactions between Bangladeshis and foreign residents (in US dollar) over a particular year. It consists of the current account and capital account. The current account shows the balance of trade which represents the difference between exports and imports of Bangladesh. If the value of exports is larger than the value of imports, then Bangladesh would have surplus trade balance. On the other hand, if the value of exports is lesser than the value of imports then Bangladesh would have deficit trade balance. Usually, Bangladesh experiences deficit trade as the

country seems to import more compared to export. The current account balance of payments of Bangladesh shows that Bangladesh is facing continuous trade deficit from FY 2004 to FY 2011 (Table 02). In FY 2004, the country had trade deficit of US\$ 2319 million which increased to US\$ 3297 million in FY 2005. Again, in FY 2010, the trade deficit of Bangladesh was US\$ 5155 million which increased to US\$ 7744 million in FY 2011 (Bangladesh Bank). These trade deficits resulted from larger growth of import of Bangladesh. The export of Bangladesh was also increasing in the previous years. But the import of Bangladesh increased at a higher rate compared to export.

**Table 02: Trade Balance of Bangladesh (in Million US\$)**

Fiscal Year	2004	2005	2006	2007	2008	2009	2010	2011	2012(p)
Export	7521	8573	10412	12053	14151	15581	16233	22592	23992
Import	9840	11870	13301	15511	19481	20291	21388	30336	31987
Trade Balance	-2319	-3297	-2889	-3458	-5330	-4710	-5155	-7744	-7995
Trade Status	Deficit	Deficit	Deficit	Deficit	Deficit	Deficit	Deficit	Deficit	Deficit

Source: Bangladesh Bank (p= Provisional)

The trade deficit of Bangladesh was increased by 42.15 percent during the period of FY2010-11 (Bangladesh Bank).

Though the export of Bangladesh increased during FY2004-11 but these increased levels of export failed to reduce the trade deficits of Bangladesh.

**Table 03: Import Growth Rate of Bangladesh (in percentage)**

Fiscal Year	2005	2006	2007	2008	2009	2010	2011	2012
Import	11870	13301	15511	19481	20291	21388	30336	31987
Growth rate	20.63%	12.06%	16.62%	25.59%	4.16%	5.41%	41.84%	5.44%

Source: Bangladesh Bank

The table 03 shows the growth rate of import of Bangladesh for the FY 2005-11. This table indicates that the growth rate of import was 20.63 percent in FY 2005 whereas it decreased to 12.06 percent in FY2006. Again, the growth rate was 5.41 percent in FY 2010. In FY 2011, the import growth rate of

Bangladesh increased at a rate of 41.84 percent which is the highest in the last seven years (Bangladesh Bank). But in FY 2012, the import growth rate of Bangladesh decreased to only 5.44%.

**Table 04: Export Growth Rate of Bangladesh (in percentage)**

Fiscal Year	2005	2006	2007	2008	2009	2010	2011	2012
Export	8573	10412	12053	14151	15581	16233	22592	23992
Growth rate	13.99%	21.45%	15.76%	17.41%	10.11%	4.18%	39.17%	6.20%

Source: Bangladesh Bank (p= Provisional)

The export growth rate of Bangladesh was 13.99 percent in FY 2005 whereas it was 21.45 percent in FY 2006. In FY 2010, the export growth rate of the country was only 4.18 percent which is simply the lowest if compared with the last seven years export growth rates. In FY 2011, the export growth rate increased again to 39.17 percent.

generation and in the provision of income to the poor. Nearly two million workers one directly and more than ten million inhabitants are indirectly associated with the industry (Ahmed and Hossain, 2006). The sector has also played a significant role in the socio-economic development of the country. In such a context, the trend and growth of garments export and its contribution to total exports and GDP has been examined the following table shows the position.

#### Contribution of Garments Industry to the Economy

Garments Industry occupies a unique position in the Bangladesh economy. It is the largest exporting industry in Bangladesh, which experienced phenomenal growth during last two decades. By taking advantage of an insulated market under the provision of Multi Fibre Agreement (MFA) of GATT, it attained a high profile in terms of foreign exchange earnings, exports, industrialization and contribution to GDP within a short span of time. The industry plays a key role in employment

**Table 05** shows the percentage of ready-made garment (RMG) contribution to Gross Domestic Product (GDP) of Bangladesh at current market price. It shows that the percentage of ready-made garments (RMG) contribution to Gross Domestic Product (GDP) was 6.26 in FY 2003-04 whereas the percentage was only 3.90 in FY 2008-09. In FY 2009-10, the percentage of ready-made garments (RMG) contribution to Gross Domestic Product (GDP) was 3.53 and in FY 2010-11, it was 4.48.

**Table 05: Percentage of RMG Contribution to GDP at Current Market Price ('000)**

Year	2003-4	2004-5	2005-6	2006-7	2007-8	2008-9	2009-10	2010-11
RMG	208	221	275	321	354	239	245	352
GDP at current market price	3329	3707	4157	4724	5458	6147	6943	7874
RMG percentage of GDP	6.26%	5.97%	6.62%	6.81%	6.49%	3.90%	3.53%	4.48%

Source: Bangladesh Bank and Bangladesh Bureau of Statistics, BBS

It is revealed from the Table 05 that the value of garment exports, share of garments export to total exports and contribution to GDP have been increased significantly during the

period from 2005-06 to 2007-08. The total garments export in 2005-06 is more than 68 times compared to garments exports in 1984-85 whereas total country's export for the same period has increased by 11 times.

This analysis suggests that Bangladesh needs to be very much perceptive about its readymade garment (RMG) export as any critical situation can affect the ready-made garment (RMG) export of the country adversely. The buyers of Bangladesh are now very much sensitive to the working environment of garment factories. They are now more concerned about the workers safety and living conditions. Recent incident at Rana Plaza factory complex (which killed more than one thousand workers) triggered the suspension of Generalized System of Preferences (GSP) from U.S.A. They are also demanding to increase the labor wage of Bangladesh though they are not suggesting increasing the price. There are also threats of the buyers to shift their demand for ready-made garment (RMG) from Bangladesh to countries like India, Philippines, Sri Lanka and Vietnam. Bangladesh has to improve the working conditions of the garment workers. Some recent crisis (fires and collapse in factories) experienced by the country is affecting negatively the foreign demand of ready-made garment (RMG) of Bangladesh.

#### VI. OPPORTUNITIES OF READY-MADE GARMENT (RMG) EXPORTS OF BANGLADESH

European Union is very good and large market for the ready-made garment (RMG) exports and Bangladesh has from January 2011, the country has been getting the benefit of the Generalized System Preference (GSP) which allows it to make unlimited exports of anything except arms to the European Union (The World Bank, 2012). Because of this, the growth rate of the second largest exporter of ready-made garment (RMG) positioned only after China. Sixty percent of European Union's imports are from Bangladesh. The country has also significant demand for its ready-made garment (RMG) to the United States, Australia, China, India, Turkey and other Asian and South American Countries. The country is getting orders for high quality products from the western countries.

Though Bangladesh is currently facing alarming situations in the garment factories, it could be the world's number one exporter of ready-made garment (RMG) if it could manage and take necessary steps to improve the situation. The country should try to retain the faith and confidence of the western buyers. Bangladesh has to ensure that the workers are getting the proper working environment and suitable labor wages. Also, the country has to introduce commercial management into the garment industry to ensure the credibility of the owners of the garment factories. Good logistic system has to be ensured by the government of Bangladesh. Only then it could continue to draw huge demand from the western countries.

#### VII. RECOMMENDATION

Bangladesh is an export oriented country which is hugely depending on ready-made garment exports for its earnings. The country has to expand its export if it wants to improve the economic growth rate. Bangladesh has to improve not only the exports of basic garments but also the exports of higher value garment and service exports. Bangladesh needs to be careful about its ready-made garment (RMG) exports as the country has

many competitors around the world. The country has been managing to get the orders from European Unions, United States, Australia, Canada, the People's Republic of China, India, Japan, Turkey and other emerging countries in Asia and South America. But the current suspension of Generalized System of Preferences (GSP) by the U.S. Government is going to affect the ready-made garment (RMG) export pattern of Bangladesh. Delaying in reviewing Generalized System of Preferences (GSP) will create a negative impact on the trade relation between U.S.A. and Bangladesh. American Federation of Labor and Congress of Industrial Organization (AFL-CIO) have filed a petition against access to tariff reduction facilities for Bangladesh on the basis of the country's failure to ensure labor rights. The buyers are concerned over the slow pace of infrastructural changes and the prevailing labor issue in Bangladesh.

Bangladesh now has to compete in the market without any preferences from the importers. This can affect the demands of the ready-made garment (RMG) of Bangladesh. The country has to improve the working condition of the labors along with the improvement in labor skill. Bangladesh has to bring back the confidence of the buyers by improving the labor conditions in garment industry.

Bangladesh has to enhance the air shipment capacity. Improvement in rail services will also be helpful in this regard. To improve the transparency and logistic system of the garment factories, the government should take initiative for commercial management. If Bangladesh can ensure these improvements, then it will be successful to increase the overall competitiveness around the world. Another challenge for ready-made garment (RMG) of Bangladesh is that the selling price of the garment products is decreasing over time. The buyers are not willing to increase the price; rather they are trying to buy the products at a lower price. If Bangladesh does not accept the low price the buyers might move to the other competitor countries like India, Sri Lanka, Philippines, Bhutan, Vietnam and other emerging countries. As the product price is low, the owners of the garment factories are paying very low wages to the labor which is now giving rise to many questions from the buyers. They are saying that many garment workers of Bangladesh are getting less than US dollar 2 a day and many of them are working in hazardous conditions. They are pressuring the government of Bangladesh to improve these situations. If Bangladesh cannot take appropriate actions regarding these issues, it might lose the buyers which would be very much shocking for the country's economy. Again, Bangladesh should keep in mind that the export of ready-made garment (RMG) is not going to be increased always at a high rate for an indefinite period. Someday in future the country might face a fall in the growth rate of ready-made garment (RMG) as the industry would become developed. So, Bangladesh should give concentration not only on the garment industry but also on other emerging industries of the country.

Government have some responsibility to improve the situation for the proper policy to protect the garments industries, solve the license problem, quickly loading facility in the port, providing proper environment for the work, keep the industry free from all kind of political problem and the biasness.

The RMG sector should focus on production and procurement of high quality raw materials within the country.

Government should use Public Private Partnership. This will in turn gives the nation an ample opportunity to add a significant amount with the national income.

Bangladesh labor productivity is known to be lower when it compared with of Sri Lanka, South Korea and Hong Kong. Bangladesh must look for ways to improve the productivity of its labor force if it wants to compete regionally if not globally. BKMEA has already introduced educational program on fashion designing. The various private university and training institution has already introduced various program regarding this issue.

The govt. should focus on separate route for the export and import activities. It may be high way, metro line, more cargo ship etc. The existence of sound infrastructural facilities is a prerequisite for economic development.

The development of infrastructure will avoid the problem of safety, unskilled worker, lead time, transportation problem and so on.

Make policies to overcome the problems the labor unrest in garment sector may be minimized.

### VIII. CONCLUSION

The Ready-Made Garments (RMG) industries take up a unique position in the Bangladesh economy. It is the largest exporting industry in Bangladesh, which experienced extraordinary growth during the last 25 years. By taking improvement of Multi Fiber Agreement (MFA) of GATT, the industry plays a key role in employment generation and in the condition of income to the poor. To remain successful, Bangladesh needs to remove the entire structural obstruction in the transportation facilities, telecommunication network, and power supply, management of seaport, utility services and in the law and order situation. The government and the RMG sector would have to jointly work together to maintain competitiveness in the global RMG market. Given the remarkable entrepreneurial initiatives and the dedication of its workforce, Bangladesh can look forward to advancing its share of the global RMG market.

Bangladesh has earned nearly \$21 billion in 2013-2014 by exporting garment products, mainly to Europe and the United States. This is about 75 percent of total export earnings of the country. It employs more than 4 million workers, most of whom are poor women. Whenever the country is criticized for its high level of corruption and confrontational politics, its garment industry is held up as a success story. The industry has continued to grow at a healthy rate of 20 percent. The reality is that this increase has been largely due to restrictions imposed on China by the Western nations. Bangladesh's exports are heavily concentrated in the RMG sector, which has been a main driver of growth and poverty reduction. The challenge is therefore to improve competitiveness, both in the RMG sector and economy wide, and diversify exports. Garment industry in Bangladesh has been facing multidimensional problems since its establishment. Acute power crisis followed by non tariff restriction, chronic labor unrest, lack of infrastructural facilities, inadequate supply of material and accessories, inability or lack of efforts to diversify the products and markets, irregularities relating to customs, bond, and shipping, financing and the like are the major problems hampering the production and increasing the cost of production significantly. Due to power shortage shipments are

sent through air, thereby increasing its cost. Unfortunately the government has not taken any step to improve the situation. On the other hand, people have been shot dead for demanding regular supply of electricity. In this context, it is still right time to devote all out efforts by the relevant agencies and authority as to expansion and solutions of numerous problems that it faces now. In fact a well designed plan with diversified product manufacture still provides opportunities to use this sector for socio economic development of Bangladesh. In such a context, it is suggested that appropriate and relevant government and nongovernmental authorities/agencies can take some strategic and effective measures which includes liberal bank loan facilities for reviving sick garment units and BMRE; development of primary textile subsectors for fulfilling the raw materials needs; arrangement for captive power supply for utilization of production and its continuation; adequate fiscal incentive for growing the sector; strategic arrangement or mechanism for quick resolution of labor dispute; creation of separate ministry for garment industry, establishment of cost reduction strategy and labor productivity cell to conduct various study in this field and other supportive policies relevant for the growth, development and survival of garment industry in Bangladesh. These may be helpful to overcome the problems and the contribution of garment industry towards socio economic development of Bangladesh will be improved and sustained through value addition.

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# Students' Emotional Learning and the Act of Public Speaking: Role of School Counsellors in Building Students' Confidence.

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**Abstract-** The very first day we enter school, through our secondary to tertiary institutions we would have to answer one question or another by speaking in class or through making presentations. How many students really are intelligent and have knowledge in their subjects but do not have the confidence to articulate them? School counsellors are particularly trained to undertake guidance and counselling in schools due to their specific knowledge, awareness and skills that other school professionals may not have to help students recognize their inherent social and emotional competencies. School counsellors are therefore to devote time and attention towards nurturing students' self and social emotional needs to help students gain the needed confidence to articulate themselves in school and in public.

**Index Terms-** Confidence; Public Speaking; School Counsellors; Self-Awareness & Social Awareness; Students Emotional Learning.

## I. INTRODUCTION

According to a report by Isaac Amoah Asare on Friday, 24 April 2015 on Ghana web, Edmund Duodu, President of Devine Mother and Child Foundation an NGO based in Koforidua, "called on the Ghana Education Service to strengthen its Guidance and Counselling Units in all Schools and build the confidence of pupils and students to report cases of abuse in schools." The story stated that, Edmund Duodu indicated that "the rate, at which sexual abuse and other forms of abuses are being recorded in schools, raises doubt about the effectiveness of Counselling and guidance units in public schools". Students are only not facing these forms of abuses but are going through self and social problems as basic yet as important as having confidence and speaking in public amongst others that warrant guidance and counselling.

From the very first day we enter school, through our secondary to tertiary institutions we would have to answer one question or the other by standing up and speaking or through making presentations. Again, after school through our working life, and even presidents and heads of states would have to make presentations at international assemblies and forums as the UN forum amongst others on behalf of their countries. How many students are confident enough to answer questions in class? How many of these students really are intelligent and have knowledge in their subjects but do not have the confidence to articulate them? And how many of these students for lack of confidence to

articulate themselves hide their inherent intelligence and for that matter do not attain their rightful positions in life because they cannot project themselves?

There are many reasons why students will have difficulty in articulating themselves in class or at public places. Some students actually understand what is being taught and understand what is expected of them but do not have the courage and confidence to speak out. Other students struggle academically and for that matter lack the confidence to answer in front of the whole group. These students may also just have the fear they may be wrong and for that matter answer incorrectly. It is for this reason, that educators most importantly school counsellors are called upon to use the students' emotional learning competences to build students overall success of which confidence is a crucial element. (Casel, 2008; Tengey & Ganu, 2015).

## II. SOCIAL AND STUDENTS EMOTIONAL LEARNING

According to Freedman, Jensen, Rideout and Stone-McCown (1998), the six seconds model of emotional intelligence outlines three stages of emotional intelligence advancement where children learn the eight emotional intelligence competencies that forms the three stages; know yourself, choose yourself and give yourself.

**Know Yourself:** The essential elements in knowing one's self are the knack to tag emotions and cultivate an emotional literacy. This competency necessitates practice in as much as we must work out to advance our reading and comprehension skills to become literate. Individuals must be "self-observers" in so as to collect forms of behaviour that have become a part of an individual's behaviour routine. An important aspect of this practice is Reflection. It is very essential to be able to discover types of behaviour and their leading circumstances. Stakeholders such as peers, a significant others, family, teachers, school counsellors amongst others should help an individual reflect on patterns of behaviour.

**Choose Yourself:** choice equates feelings of control for most individuals. Feeling in control raises confidence in individual's abilities and capabilities. It is vital that students feel that they have choices in their schools. A school that doesn't permit student-choice, shows or implies that students are not proficient. This can kill students' confidence.

Choice also helps in the improvement of Optimism, a significant emotional intelligence competency that allows student to feel that they have the ability to fight difficulties. Difficulties

and problems are part of life but the confidence, belief and certainty that it can be curtailed lies in the hope of optimism (Seligman, 1995). Intrinsic motivation is an emotional intelligence competency which helps grow when a student can accomplish, assess and learn from a choice made. Schools that permit students to make choices inspire students to think about the consequences of choices and prompt them to consider errors as opportunities and chances to learn assist students cultivate self-efficacy, optimism, and intrinsic motivation.

**Give Yourself:** Linking a drive that is associated with a student's goals provides the student with the intrinsic motivation to pursue those goals. Schools that encourage and inspire students to fix and meet goals and to comprehend why those goals were chosen by the student kindle this connection. Student fulfilment and contentment originates not only from good work done but also from the awareness that finishing the job fulfilled an inner satisfaction which is bigger and greater than the self.

A lot of schools in these modern times want students to accomplish a certain number of hours of community service. Community service learning model is one of the methods schools attempt to use to support students grow and improve on the emotional intelligence competency of following principled goals. Leadership jobs in institutions and organizations also permit students to examine and cultivate their skills in this arena. Also, improvement of the emotional intelligence competencies generates empathy for others that are essential for an individual's healthy emotional progress. According to Goleman, 1995, "Empathy shatters rigid ideologies and destroys stereotypes", Students who advance in the emotional intelligence competency of empathy appear as confident, natural leaders, win the respect of their schoolmates and teachers, augment their own advancement as individuals with a consideration of the productivity and variety in the world we dwell in.

### III. CATEGORIES OF STUDENTS' EMOTIONAL LEARNING COMPETENCES

Students' Emotional Learning (SEL) which other researchers term "Total child education" (Tenney & Ganu, 2015) can be defined as the way in which persons become socially and emotionally intelligent. A group of researchers like Zins, Bloodworth and others (2004) have defined SEL as "the process through which children enhance their ability to integrate thinking, feeling and behaving to achieve important life tasks". A non-profit body that promotes and offers leadership for high quality SEL programming and learning standards, The Collaborative for Academic, Social and Emotional Learning (CASEL) organizes five fundamental competencies connected to SEL. They are categorized as; self-awareness, self-management, social awareness, relationship skills and responsible decision making.

Self-awareness is the capability to precisely identify one's feelings and thinking processes and the way it impacts on behaviour. It comprises exactly evaluating one's strengths and weaknesses and having a well-grounded sense of confidence, hopefulness and positivity.

On the other hand, Self-management is the ability to control one's emotions or feelings, thoughts and behaviours efficiently in different situations (Casel, 2008). This includes handling stress,

regulating impulses, inspiring one self, and working at attaining and accompanying personal and academic goals.

Furthermore, Social awareness according to Casel (2008) is to be able to take the viewpoint of and empathize with other people from different and various backgrounds and cultures, to comprehend social and ethical norms for behaviour and to identify family, school and community possessions and supports.

Relationship Skills is the ability to create and sustain healthy and fulfilling relationships with various personalities and groups. Relationship skills comprise of communicating clearly, listening keenly, and co-operating, fighting unsuitable social pressure, talking about conflict practically, looking for and giving a helping hand when required (Casel, 2008).

More so, Responsible decision making is to be able to make productive and polite decisions about one's behaviour and social interactions centred on deliberation of ethical principles, safety misgivings, social norms, genuine assessment of concerns of different activities, and the well-being of one's self and of others. (SEL Competencies adapted from CASEL.org).

### IV. THEORETICAL FOUNDATIONS OF SOCIAL EMOTIONAL LEARNING

Student Emotional Learning is established on the positive youth development that calls for the essential requirements of youth to be seen by structuring upbringings or environments that inspire outcomes like school achievement, mutually compassionate relationships with adults and peers, problem solving, and community engagement (Catalano et al., 2004; Greenberg et al., 2003). Efforts to back positive youth development are different from those centred on limiting risk factors because they are to develop skills, build assets, and encourage flexibility to accomplishing positive outcomes (Catalano, Hawkins, Berglund, Pollard, & Arthur, 2002). Positive youth development interventions like as SEL programming typically use a skill-building, whole-child, total child process which is based on continuing things and not only on stopping problems (Catalano et al., 2004; Tenney & Ganu, 2015). Because Schools are purposely settings and environment that offer educational and developmental needs of youth, they are for that matter the influential objects for public and collective efforts to encourage positive youth development.

Bronfenbrenner in 1979, author of the Ecological systems theory posited that, the backgrounds and experiences of youth, for instance, school, form their development characteristics of school backgrounds that are linked to positive youth development comprise chances for empowerment and skill building. Catalano et al (2004) are of the opinion that the manifestation of helpful adults and peers aid in modelling students therefore emanating in their well-being and consistency.

Zigler and Bishop-Josef (2006) are researchers amongst others that are of the opinion that, the overall achievement of educational goal, school-based programming must meet two standards: (1) improve the social and emotional properties and learning of students through the curriculum, and (2) advance the quality of the environments in which academic, social, and emotional learning takes place. The effort for the education of the whole child or total child education to be prosperous will be determined by the extent to which learning takes place in

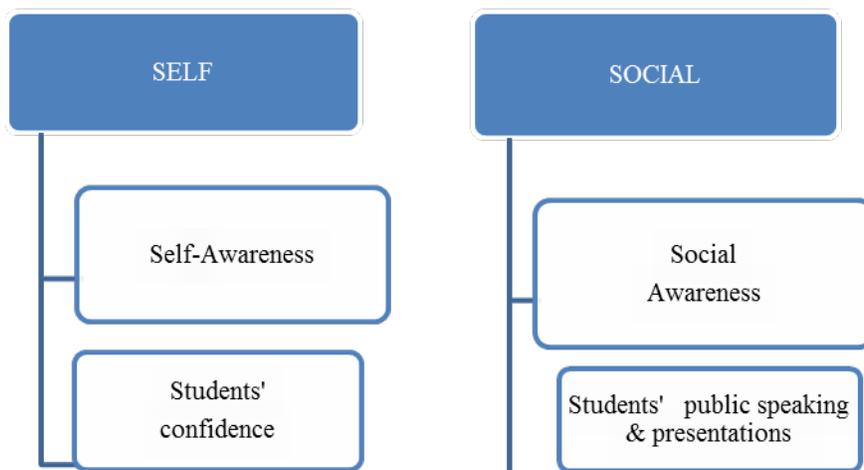
thoughtful, supportive, safe and enabling backgrounds and locations (Tenegy & Ganu 2015) which is profoundly embedded in the ecological systems and self-determination theories.

In lending more support to the theoretical foundations of SEL, the Self Determination theory states that, youth are most likely to flourish when in atmospheres that see to their social and emotional desires like undergoing important and cherished relationships, having confidence in their skills, and feeling liberated (Deci & Ryan, 1985). Students are most likely to succeed in school environments that nurture speaking, thoughtful, harmless and enabling relations (Battistich, Solomon, Watson, & Schaps, 1997; Tenegy & Ganu, 2015).

#### V. USE OF SEL COMPETENCIES IN BUILDING STUDENTS CONFIDENCE

Manswell Butty in 2001 posited that students need to be primarily cushioned with opportunities, encouragement, and assistance before they can participate in thinking, reasoning,

**An illustration is as follows presented below;**



#### VI. USE OF SELF-AWARENESS IN BUILDING STUDENTS' CONFIDENCE

The SEL spelt out five competencies as mentioned earlier on; self-awareness, self -management, social awareness, relationship skills and responsible decision making. Out of these competencies, self-awareness, borders directly on confidence (Casel, 2008). Self-awareness according to casel is to precisely identify one's emotions and thoughts and their effect on behaviour. Casel further on stated that, it includes correctly weighing an individual's strengths and limitations and retaining a well-informed sense of confidence and optimism.

Zins and colleagues classified a developmental outlook of each of these skills based on the grade level of students. In their classification, self-awareness includes identifying simple emotions for elementary students, scrutinising issues that accelerate their emotions for middle school students, and recognising how communication of emotions affects others for high school students. (Zins, Payton, Weissberg & O'Brien, 2007). It is therefore imperative that educators most especially school

making and taking sensible decisions. Majority of the problem is that educators, emphasis mostly on the classroom information and training than knowledge outside of the classroom (Anamuah-Mensah & Towse, 1995; Stevenson, 1995; Tenegy & Ganu, 2015). Students are therefore coming out of schools with very good grades yet lack the necessary knowledge to excel in the outside world. (Tenegy & Ganu, 2015). The fact that most of students' learning is classroom based, students seem to concentrate a lot on that thus neglecting the practical aspect. This leads to students not being confident and lagging behind in students' emotional learning. It is for this reason therefore that researchers are calling for educational institutions to call on educators particularly School counsellors (SCs) who are mandated to be advocates of total change through the provision of a developmental school counselling programme (ASCA, 2008; Tenegy & Ganu, 2015) to use SEL competences especially self and social awareness competences to help build students confidence.

counsellors take particular interest in shaping up students in their developmental stages. School counsellors' are particularly charged to take active role in students because, at the stage when students are developing self-awareness skills, they are mostly at the elementary stage. Students will mostly be in school and spend most of their time in school. They leave the care of their parents and spend majority of their time with other students from different walks of life and upbringing. This is the time they develop emotional skills and if not guided may not develop these skills adequately. It is therefore very crucial that school counsellors are available and easily accessible by students. It is also worth mentioning that, at the elementary level, students may not be aware of their strengths and limitations and for that matter, school counsellors should make the effort to reach out to them and help discover these inherent strengths whiles curtailing the limitations.

## VII. SOCIAL-AWARENESS COMPETENCE AND STUDENTS' PUBLIC SPEAKING

School counsellors are being called specifically to help build student overall success with students emotional learning (Teney & Ganu, 2015) and as discussed above, self-awareness is necessary mostly at the elementary stages of students development in helping build students confidence (Zins et al, 2007; casel, 2008). School counsellors are also called upon to help students develop their social awareness skills which lead students to be able to integrate well in social and in public settings. Zins and colleagues enumerated three levels of effective SEL programming, (i) formal and informal training in social and emotional skills all through the school practice, (ii) a safe school environment and atmosphere that provides social and emotional growth, (iii) and stakeholders who are leaders who are enthusiastically involved in SEL (Elias, Zins, et al., 1997) school counsellors are therefore called upon as stakeholders to use the SEL programming mentioned above to formally help students realize their social- awareness. If the self-awareness is attained successfully, students will identify their emotions and thoughts successfully which will impact on behaviour positively. This will also make students have a correct and true idea of their strengths and limitations and therefore obtaining self- confidence.

Social awareness is to be able to take the perception of and sympathize with others from various backgrounds and beliefs, to recognize social and ethical norms for behaviour and to identify family, school and community assets and supports. The identification of school comes to reality at this level because this is the stage that students transition from the elementary to the secondary and get to secondary schools. As per Zins and colleagues levels of effective SEL programming, a safe school environment and atmosphere is needed for students' social and emotional advancement. School counsellors amongst other stakeholders as educators are therefore to be vigilant in helping build students social and ethical norms. This is very imperative because most secondary schools in Ghana are boarding schools, which means students leave the care of their parents to these boarding schools. It is at this stage that students socialize with other students from different backgrounds and are forming and picking up attitudes. Students need to be confident to be able to discern right from wrong and also to articulate their views.

School counsellors are particularly trained to undertake guidance and counselling in schools due to their specific knowledge, awareness and skills that other school professionals may not have to help students recognize their inherent social and emotional competencies (Teney & Ganu, 2015) that will lead to building up their confidence levels and help them prepare towards the tertiary institutions. Most Students will continue their journey from the secondary schools to tertiary schools or institution where majority of them will be on their own. School counsellors who are stakeholders in students' education are therefore called to be actively involved in refining and modelling students' social and emotional competencies (Brackett et al. 2009). Most of the universities or tertiary institutions although have boarding facilities, school authorities are not very strict on students as they are strict when students are in secondary schools. For instance, a student needs to obtain permission to do everything in secondary school. On the other hand, students do not need any permission in tertiary institutions to go out and to

do other things. They leave on their own. Students come from different backgrounds and end up at schools and environments that are totally new to them. Some students especially those from the not so affluent communities (Teney & Ganu, 2015) end up not being able to fit or adjust into these institutions well.

School counsellors are therefore called to nurture and guide these students as they are under their care to adjust well before transitioning into the tertiary world where they are all by themselves and on their own. School counsellors should go the extra mile in making sure they pay particular attention to students by detecting maladaptive behaviours that may trickle or extend into their adult lives. If students' confidence is built at the elementary stage, they are able to transition from elementary stage to the secondary stage successfully. Students are well able to build their social and emotional competences adequately and are able to communicate well especially articulate themselves in public speaking. It is in their presentations that most of their societal, career and leadership skills are unearthed and discovered. Often more than not, most students are brilliant but because they lack confidence and public speaking skills, they end up not able to articulate their views and intelligence. It is one thing being taught how to make a presentation and another having the courage and confidence in doing it. Courage and confidence is built over time, from the elementary stage, through the secondary and mastered by tertiary stage or outside school. This goes beyond just reading about presentation skills from books. stakeholders most especially School counsellors are therefore to take a very keen interest and devote time and attention towards nurturing students self and social emotional needs to help students gain the needed confidence to able to articulate themselves in school and in public.

## VIII. CONCLUSION

There are many reasons students will have difficulty in articulating themselves in class or at public places. Some students actually understand what is being taught and understand what is expected of them but do not have the courage and confidence to speak out. Students' Emotional Learning (SEL) which other researchers term "Total child education" (Teney & Ganu, 2015), can be said to be the way in which persons become socially and emotionally intelligent. Student Emotional Learning is established on the positive youth development that calls for the essential requirements of youth to be seen by structuring upbringings or environments that inspire outcomes like school achievement, mutually compassionate relationships with adults and peers, problem solving, and community engagement. School counsellors are particularly trained to undertake guidance and counselling in schools due to their specific knowledge, awareness and skills to help students recognize their inherent social (social-awareness) and emotional (self-awareness) competencies that will lead to building up students' confidence levels which will also help boost their social and public speaking skills.

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# An Empirical Study for Competition Case between Iraqi Telecommunication Companies Using Game Theory

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**Abstract** - Telecommunication companies in Iraq are experiencing a huge competition in the market nowadays. Each company is striving to attract more customers through providing satisfactory and competitive services. In this study, Game Theory, which is one of the operational research modeling techniques is selected then used to evaluate performance of a number of telecommunication companies in Iraq after reconstruction. This research is set out to analyze the competition models of two leading telecommunication companies using Game Theory. Two local telecommunication companies based in Iraq; Asia Cell and Korek is used as a case study. Game theory methods are applied to provide some advices on how to maximize profits of the selected companies. This is enabled by studying the strategies (services) offered by each company, and formulating a payoff matrix of competition between these companies. The payoff matrix size is  $(9 \times 5)$  represented by (9) strategies adopted by Asia Cell Company, and (5) strategies adopted by Korek Company. The manual method shows that there is no saddle point for the payoff matrix. As there is no saddle point found for the payoff matrix, size of this matrix is reduced to  $(2 \times 3)$  to enable solving it using the graphical method. As a conclusion, Asia Cell should always use strategies of 8<sup>th</sup> (selling the International Line) and the 9<sup>th</sup> (selling the New Khalat Line), to get the expected optimal value (higher profit expected), is equal to  $v = 68053291$  ID. While, Korek should always use the 2<sup>nd</sup> (selling the Data Offers) and the 3<sup>rd</sup> (selling Diary Line) strategies to get the expected optimal value (which will bring less losses), is equal to  $v = 68053291$  ID. TORA package is used to provide results which are close to the manual solution method.

**Index Terms** - Operations Research, Game Theory, Telecommunication Industry, Payoff Matrix, Profit.

## I. INTRODUCTION

The general description of the business environment is the ability to compete. The reason behind this description is that the aim of a business is to increase profits by any means, taking into consideration the business ethics. Game theory is a collection of mathematical techniques that is used to study the interactive decision problems between more than rational player (here they are companies). Furthermore, it also assists in predicting the possible outcome of the interactive decision problem. As the Game theory emerged from the analysis of competitive scenarios, these interactive problems are called games and the participants are called players. These techniques are not limited to competitive situations and hence it can be applied to solve different real life problems not just those faced by the sport industry. However, game theory deals

with any problem in which each player's strategy depends on what other players do.

In this research game theory techniques will be practically applied to analyze the competition models of two leading telecommunication companies. This research aims at applying a number of Game Theory techniques to solve problems that are currently being faced by two Iraqi telecommunication companies. In order to deliver this aim, a number of objectives are set as follow:

- 1) Reviewing a number of related literatures in the area of Game theory and its applications in the telecommunication industry.
- 2) Applying game theory methods in practical way by formulating a payoff matrix of competition between the two companies (Asia Cell and Korek).
- 3) Investigating the strategies (services) available to use by each company, in an attempt to provide some advices to maximize the profits for both of them.
- 4) Understanding how players may be chosen to organize themselves in a game in order to get joint-maximizing profits.

## II. REVIEW OF GAME THEORY

The beginning of the Game Theory (GT) as a separate subject of study is dated back to the first half of the 20<sup>th</sup> century and it is connected with the development of mathematical aggregates theory and mathematical economy [1].

"At the end of the 1990s, a high-profile application of game theory has been the design of auctions. Prominent game theorists have been involved in the design of auctions for allocating rights to the use of bands of the electromagnetic spectrum to the mobile telecommunications industry. Most of these auctions were designed with the goal of allocating these resources more efficiently than traditional governmental practices, and additionally raised billions of dollars in the United States and Europe". [8, page 5]

Game theory is a bag of analytical techniques designed to assist in understanding the phenomena observed when decision-makers interact. The basic assumptions that underlie the theory are that decision-makers pursue well-defined exogenous objectives and take into account their knowledge or expectations of other decision-makers' behavior. The models of game theory are highly abstract representations of classes of real-life situations. A game is a description of strategic interaction that includes the constraints on the actions that the players can take and the players' interests, but does not specify the actions that the players do take. A solution is a systematic description of the outcomes that may emerge in a family of games [6].

"Game theory is a collection of techniques for predicting outcomes of a group of interacting agents where an action of a single agent directly affects the payoff of other participating agents". [5]

"The theory of games is basically concerned with strategic behavioral interactions as opposed to individual maximization, typically found in decision theory. Thus each participant attempts to maximize a function of which he/she does not control all variables". [3, page 63]

Game theory provides mathematical tools for modeling and analyzing interactive decisions. It considers players that represent decision-making firms or persons, and their possible actions and models their incentives by payoffs that the players want to maximize. The players may have different information about that state and about the actions taken by the other players [2].

Game theory and its applications in the telecommunication industry investigated by a number of researchers, for example, [7] analyses three oligarchs' co-competition in China mobile market by modified Cournot and Stackelberg Models in game theory, applying with business development data of 2G and 3G for verification. According to the verification and more oligarchs' co-competition game analyzing in the future, the conclusion is: on the basis of competition, the best choice for each oligarch is cooperation. Co-competing of the telecom operators can effectively configure all aspects of resources to produce more intelligent terminals, making the promotion of telecommunication industry progress, to some extent, can promote the development of artificial intelligence in mobile internet era.

Game theory provides a convenient framework to model and helps us to interpret the behavior of participants in such strategic interactions. Hence it can be applied to solve a wide variety of problems involving diverse areas such as industrial relations, markets, auctions, online retail, cold war, paying taxes, bargaining, elections, portfolio management, social interactions etc. Game theory could thus be viewed as a study of strategic decision making [10].

### III. GAME THEORY ASSUMPTIONS

In game theory (generally non-cooperative game theory) players usually make the following assumptions [4, 9]:

- 1) Each player has two or more well-specified strategies.
- 2) Every player has possible combinations of moves / strategy that lead to an optimum response (End-state like win, lose or draw) in a given game.
- 3) Each player has a specified payoff for each optimum response.
- 4) All players are rational; that is, each player, given the two moves/strategies, will choose that one that gives him/her the better payoff.

There are many fundamental definitions (terminologies) [4, 8]:

- 1) Player: each participant is called player.
- 2) Strategy: the decision rule by which a player determines his course of action is called a strategy.
- 3) Pure strategy: if a player decides to use only one particular course of action during every play, he is said to use a pure strategy.
- 4) Mixed strategy: if a player decides, in advance, to use all or some of his available courses of action in some fixed proportion he is said to use mixed strategy.
- 5) Payoff: it is the outcome of playing the game.
- 6) Payoff matrix: it is a table showing the amounts received by the player named at the left side after all possible plays of the game.

### IV. CHARACTERISTICS OF TWO-PERSON ZERO-SUM

The characteristics of two-person zero-sum games are [9, 11]:

- 1) There are two players (called the row player and the column player).
- 2) The row player must choose 1 of  $m$  strategies. Simultaneously, the column player must choose 1 of  $n$  strategies.
- 3) If the row player chooses his  $i^{\text{th}}$  strategy and the column player chooses his  $j^{\text{th}}$  strategy, then the row player receives a reward of  $a_{ij}$  and the column player loses an amount of  $a_{ij}$ . Thus, it is thought that the row player's reward is as if coming from the column player.

Such game is called a two-person zero-sum game, which is represented by the matrix. A two-person zero-sum game has the property that for any choice of strategies, the sum of the rewards to the players is zero. In a zero-sum game, every dollar that one player wins comes out of the other player's pocket, so the two players have totally conflicting interests [11].

In zero-sum games, the total benefit to all players in the game, for every combination of strategies, always adds to zero (more informally, a player benefits only at the expense of others). Games, as studied by economists and real-world game players, are generally finished in a finite number of moves. Pure mathematicians are not so constrained, and set theorists in particular study games that last for infinitely many moves, with the winner (or other payoff) not known until after all those moves are completed. The focus of attention is usually not so much on what is the best way to play such a game, but simply on whether one or the other player has a winning strategy [10].

### V. REDUCE GAME BY DOMINANCE

If no pure strategies exist, the next step is to eliminate certain strategies (rows and / or columns) by dominance. The principle of dominance stated that if one strategy of a player dominates over the other strategy in all conditions then the later strategy can be ignored [4, 11].

The concept of dominance is especially useful for the evaluation of two-person zero-sum, games where a saddle point does not exist. Generally, the dominance property is used to reduce the size of a large payoff matrix. The rule as follows:

- 1) If all the elements of a column (say  $i^{\text{th}}$  column) are greater than or equal to the corresponding elements of any other columns (say  $j^{\text{th}}$  column), then the  $i^{\text{th}}$  column is dominated by the  $j^{\text{th}}$  column and can be deleted from the matrix.
- 2) If all the elements of a row (say  $i^{\text{th}}$  row) are less than or equal to the corresponding elements of any other row (say  $j^{\text{th}}$  row), then the  $i^{\text{th}}$  row is dominated by the  $j^{\text{th}}$  row and can be deleted from the matrix.

### VI. MIXED STRATEGIES ( $2 \times 2$ GAME)

In case where, there is no saddle point and dominance has been game matrix, Arithmetic Method is used for finding optimum gamers. It consists of the following steps [4]:

- 1) Subtract the two digits in column 1 and write them under column 2, ignoring sign.
- 2) Subtract the two digits in column 2 and write them under column 1, ignoring sign.
- 3) Similarly proceed for the two rows.

These values are called oddments. They are the frequency players who must use their courses of action in their optimum strategy.

#### VII. MIXED STRATEGIES ( $2 \times M$ ) & ( $M \times 2$ )

The game of one player has only two courses of action while the other has more than two which is called ( $2 \times M$ ) or ( $M \times 2$ ) games. If these games do not have a saddle point or are reducible by the dominance method, it can be still solved by Algebraic Method and Graphical Method. Thus, co-operation between the two players would not occur [11].

#### VIII. RESEARCH POPULATION AND SAMPLE

The population of this research is all Iraqi's communication companies, where the researchers selected only two of them as a sample (Asia Cell and Korek) in Erbil. In order to obtain the required sampling data such as costs, the researchers have used different sources like; scratch cards sales, offered services, and also the profit related to the services. This has been implemented by: firstly, surfing the data available on the Internet through the websites of both companies. Secondly, by visiting many of authorized sales centers related to the two companies. In Erbil, there are 18 sales centers for Korek and 20 for Asia Cell. Only 15 from Korek and 18 from Asia Cell have accepted to provide the researchers with the required information.

#### IX. ASIA CELL TELECOM PACKAGES<sup>1</sup>

Asia Cell is a telecom company was founded in 1999 in Sulaymanya. In 2006, Asia Cell started working in Erbil. The subscribers were more than 1050000 as in figure (1). Asia Cell services are explained in the following:

- 1) Youth line: it is one of Asia Cells services; the price is 3000 ID (including 1200 ID free balance). It provides a discount in prices 0.25 ID/second from 12:00am to 8:00am, and for the other times it costs 1 ID/second and for a message between (9:00am – 12:00am) it charges 25 ID/SMS.
- 2) Gold line: Customers can buy it by 3000 ID with 1200 ID free credits. It costs 1 ID/second for normal call and 25 ID for a normal message.
- 3) Hala Line It is visitor's line and costs 4000 ID (Including 1000 Free Airtime). It charges 1 ID/second and for a normal message 25 ID.
- 4) Almas line: It offers a good discount in regular calls 50% discount after the 3<sup>rd</sup> minute of each call. In Asia cell network, it costs only 1 ID/second.
- 5) Hali Service for Friends and Family: By using this offer, customers can select 5 Asia cell numbers and make calls for only 1 ID/second.
- 6) Student line: For university students 50% free balance through 4 years, this can be used for data and voice.
- 7) Smart Line: Is available at all Asia Cell sell points with only 5000 ID.
- 8) International Lines: International calls to Turkey, China and India with up to 50% discount.

- 9) New Khalat lines: It provides calls to all local networks for just 1 ID/second.

#### X. KOREK TELECOM PACKAGES<sup>2</sup>

Korek telecom is a mobile company and was established in 16/8/2000. It has more than 2000 employees all over Iraq more than 500 of them in Erbil, as in figure (2). Korek services are described below:

- 1) Prepaid plan it started with Korek in 16/8/2001. This plan have 4500,000 subscribes but only 3700,000 of them use it because sim-cards are in market or unusable.
- 2) Data offers: It has 8 offers:
  1. Extra plus: Works for 30 days and costs 90000 ID. It provides internet service with 40 GB.
  2. Extra VIP: Works for 30 days and costs 60000 ID. It provides internet service with 20 GB.
  3. Extra: Works for 30 days and costs 40000 ID. It provides internet service with 10 GB.
  4. Alshabab: Works for 30 days and costs 30000 ID. It provides internet service with 7GB from 12:00 pm to 6:00 am for free.
  5. Monthly: Works for 30 days and costs 20000 ID. It provides internet service with 2 GB.
  6. Weekly 1000: Works for 7 days and costs 1000 ID. It provides internet service with 1000 MB.
  7. Weekly 500: Works for 7 days and costs 5000 ID. It provides internet service with 500 MB.
  8. Pay as you go: Works for 30 days and costs 0.60 ID/KB.
- 3) Diary line: was established in 2013, it has around 30000 subscribers and it charges 65 ID for a normal call and 25 ID for a normal message. This line work only for 15 days. For renewing, a customer should pay 1000 ID, 50 ID for a normal call and 20 ID for a normal message.
- 4) Bangladesh line was established in 2015 and it is only for international calls, the cost is 35 ID/second. This line is only for foreign workers in Iraq. It has around 3000 subscriber.
- 5) International caller to Korek: It started in 16/8/2001, and its cost depends on the contract between Korek and customers. It costs 3\$ for one minute and 0.225\$ for an international message.

#### XI. APPLING GAME THEORY METHOD ON KOREK AND ASIA CELL 1. SOLVING THE PROBLEM USING GRAPHICAL METHOD

The two competing companies in Iraqi local market (Asia Cell and Korek) have a usage rate in Erbil city which is presented in figures 1 and 2. Player [A] represents the rows of Asia Cell Company; it includes the 9<sup>th</sup> most important services (Strategies). While, player [B] represents the columns of Korek Company; it includes the 5<sup>th</sup> most important services.

From the original data and the authorized sales centers of the two companies, the researchers can get the payoff matrix below. The cells (A1 , B1) are explained as below:

When player A (Asia Cell) play strategy A1 (Youth line service), it has got a profit equals to (63302180 ID). Whereas player B (Korek) has got profit equals to (58801400 ID) when it plays strategy B1 (Prepaid plan service). This is explained as follows:

<sup>1</sup> <https://www.asiacell.com/pages.php?lang=&pid=47>

<sup>2</sup> <http://www.korektel.com/top-links/about-us>

- (A1 , B1) cell = A1 Profit – B1 Profit = 63302180 – 58801400 = 4500780 ID
- (A1 , B2) cell = A1 Profit – B2 Profit = 63302180 – 59317180 = 3985000 ID
- (A9 , B5) cell = A9 Profit – B5 Profit = 154223000 – 80241585 = 73981415 ID

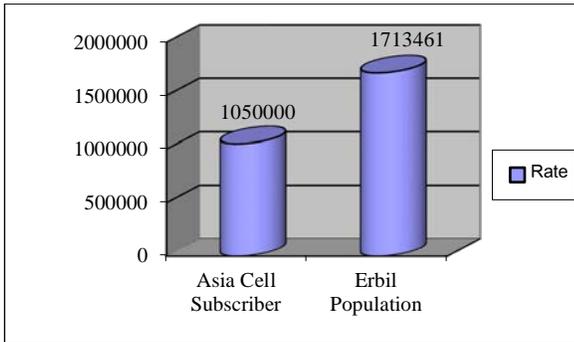


Figure 1: Asia Cell user rate in Erbil

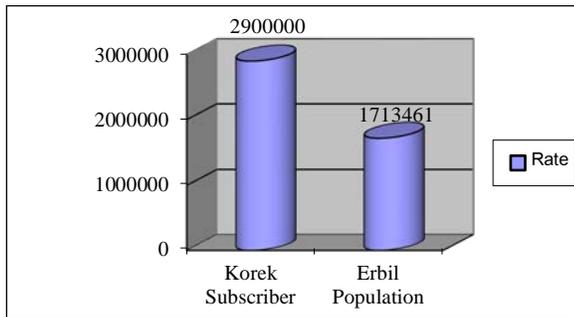


Figure 2: Korek user rate in Erbil

Now, the payoff matrix for the two companies can be set as follow in table (1).

**Step one:** Testing the existence of a saddle point:  
 $69060500 \neq 67745960$  No saddle point  
 $MaxiMin \neq MiniMax \rightarrow 67745960 \leq v \leq 69060500$

- 1) Selected strategies for each player:  $\frac{A}{9} \frac{B}{2}$ . This means that player [A] will choose the 9<sup>th</sup> strategy which will bring a profit of (67745960) ID, while player [B] will choose the 2<sup>nd</sup> strategy, which will bring less losses of (69060500) ID.

Since the matrix size is (9 × 5) the researchers try to reduce it as much as possible through applying the principle of control; to facilitate the process of obtaining the best solution.

- 2) Applying the principle of control for the payment matrix in table (1):
- Comparing rows [A] if all of rows values are less than or equal to the corresponding grade values in another row, the latest row can be deleted.
    - Comparing the values A1A2 → values A1 less than A2 corresponding, deleting A1 strategy for being controlled by A2 strategy.
    - Deleting A2 strategy for being controlled by A3 strategy.
    - Comparing A3A4 → value A2 less than A3 corresponding values; deleting A2 strategy for being controlled by A3 strategy.
    - Comparing A3A4 → values A3 less than A4 corresponding values; deleting A3 strategy for being controlled by A4 strategy.
    - Comparing A4A5 → does not work.
  - Comparing the columns [B] but in this case the biggest column will be deleted.
    - B1B2 → does not work.
    - B1B3 → does not work.
    - B1B4 → does not work.
    - B1B5 → values B5 is greater than the corresponding values of B1; deleting B5 strategy for being controlled by B1 strategy.
- And so on ...

The matrix has become (2×3) after downsizing i.e. only two rows (A8, A9) and three columns (B1, B2, B3). It cannot be reduced more using the principle of rate strategies.

**Step two:** Second trial to test the existence of a saddle point as in table (2). It can be noticed that there is no stability, and the game value is:  $67745960 \leq v \leq 69060500$ .

**Note:** The arithmetic method of payoff matrix cannot be applied because of the type the resulting matrix (2×3), so graphical method will be used to illustrate the work style of the method as such kind of arrays.

From table (2) it has been noted that the saddle point is not available and the resulting matrix is (2×3). Thus, graphical method will be applied as follows:

Table 1: Payoff matrix for the two companies

		[B] Korek Company					
		B1	B2	B3	B4	B5	Min. Row
[A] Asia Cell Company	A1	4500780	3985000	5011000	4150000	5950000	3985000
	A2	8039075	7037490	7371920	8001500	10011250	10011250
	A3	18620245	18318660	17953090	19552780	18950340	17953090
	A4	28535415	28233830	31887760	30950000	30112900	28233830
	A5	32054915	32253330	27868260	35052950	34005000	27868260
	A6	29658585	24357000	28991430	25451020	30567000	24357000
	A7	28798795	35497210	51131640	36925411	29970600	28798795
	A8	56262085	69060500	50594930	70091340	61120400	50594930
	A9	72047545	67745960	73380390	71050450	73981415	67745960 ← MaxiMin
A1	4500780	3985000	5011000	4150000	5950000	3985000	
A2	8039075	7037490	7371920	8001500	10011250	10011250	
A3	18620245	18318660	17953090	19552780	18950340	17953090	
A4	28535415	28233830	31887760	30950000	30112900	28233830	
A5	32054915	32253330	27868260	35052950	34005000	27868260	
A6	29658585	24357000	28991430	25451020	30567000	24357000	
A7	28798795	35497210	51131640	36925411	29970600	28798795	
A8	56262085	69060500	50594930	70091340	61120400	50594930	

- 1) Player [A] have two strategies A8, A9 and two possibilities item for them  $p_1, p_2$  respectively. Player [A] trying to increase profits by making the value of  $v$  is greatest.
- 2) The expected results for player [A] whether player [B] applied torrent free various strategies are as follows:
  - a) The expected value of the player [A] in case of a player [B] play the 1<sup>st</sup> strategy B1:  
(56262085)  $p_1 + (72047545) p_2 \geq v$
  - b) The expected value of the player [A] in case of a player [B] play the 2<sup>nd</sup> strategy B2:  
(69060500)  $p_1 + (67745960) p_2 \geq v$
  - c) The expected value of the player [A] in the case of a player [B] play the 3<sup>rd</sup> strategy B3:  
(50594930)  $p_1 + (73380390) p_2 \geq v$

Where  $p_1 \geq 0, p_2 \geq 0$ . Substitute  $p_2 = 1 - p_1$  in the above we get table (3).

Table 3: Free strategies for Korek Company

[B] free strategies for Korek	[A] expected value [outcome] for Asia Cell
1	$72047545 - 15785460 p_1$
2	$67745960 + 1314540 p_1$
3	$73380390 - 22785460 p_1$

Depending on drawing lines represented in table 1, the researchers can determine the optimal value of the game as shown in graphic formats figure (3). For the region (A, B, C, D, E) identified in bold, which was formed from the intersection of lines (2 & 3). It is also called Lower Envelope, where it represents the area of suitable solutions for Asia Cell Company [A]. It has been noted that point (B) represents MaxiMin match point, has been obtained from the intersection of the 2<sup>nd</sup> strategy with the 3<sup>rd</sup>. The way of getting the best value  $p_1^*$  is equal to (0.23379378), in addition to the value of the game ( $v^* = 68053291$ ).

$plot([72047545 - 15785460 x, 67745960 + 1314540 x, 73380390 - 22785460 x], x = 0..1, y = 0..70000000)$

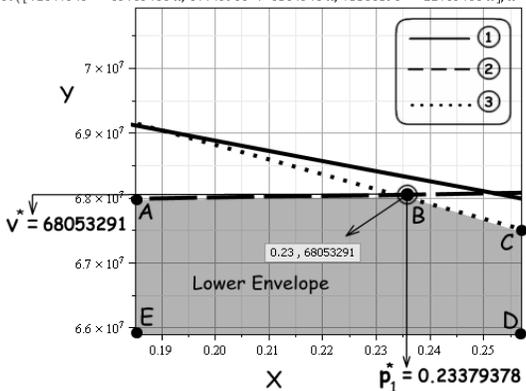


Figure 3: Area of optimal solutions to Asia Cell Company  
Source: Created by the researchers using Maple 11 program

Also the researchers can get the game value to substitute the optimal value  $p_1^*$  in intersecting lines that formed MaxiMin point (strategies 2 & 3 for Korek company) as shown in table (3):

$$v^* = \begin{cases} 67745960 + 1314540 p_1 = \\ 67745960 + 1314540 \times 0.23379378 = 68053291.28 \\ 73380390 - 22785460 p_1 = \\ 73380390 - 22785460 \times 0.23379378 = 68053291.18 \end{cases}$$

$$\therefore p_1 + p_2 = 1 \Rightarrow p_2 = 1 - p_1 = 0.76620622$$

Thus, the optimal strategy for player [A] which should always be used is the 8<sup>th</sup> and 9<sup>th</sup> with probabilities 0.23379378 & 0.76620622 respectively, to get the expected optimal value (higher profit expected) is equal to  $v = 68053291$  ID.

On the other hand, player [B] can compete with player [A] through the 2<sup>nd</sup> and the 3<sup>rd</sup> strategies that have formed MaxiMin point for player [A]. For this reason, the value of  $q_1$  will be equal to zero because the first strategy of the first line has not participated in determining MaxiMin point. And thus the equations are as follows:

$$\begin{aligned} \therefore q_2 + q_3 = 1 &\Rightarrow \therefore q_3 = 1 - q_2 \\ 56262085 q_1 + 69060500 q_2 + 50594930 q_3 & \\ 56262085(0) + 69060500 q_2 + 50594930 q_3 & \\ 18465570 q_2 + 50594930 \dots(1) & \\ 72047545 q_1 + 67745960 q_2 + 73380390 q_3 & \\ 72047545(0) + 67745960 q_2 + 73380390 q_3 & \\ - 5634430 q_2 + 73380390 \dots(2) & \end{aligned}$$

The expected values of player [B] as a result of the selection player [A] strategy for free, are shown in the table (4) below:

Table 4: The free strategies for Asia Cell Company

[A] free strategies for Asia cell	[B] expected value [outcome] for Korek
1	$50594930 + 18465570 q_2$
2	$73380390 - 5634430 q_2$

Where MiniMax point can be determined through the intersection above the upright as shown in figure (4). The solutions area (A, B, C, D, E) defined by the intersection of the upright, also called Upper Envelope, and represent possible losses area (area of possible solutions) for the player [B].

Since the player [B] always wants to reduce the large losses, they try to choose the strategies that make them move down direction pocket top area. Through drawing note that the lowest point in the top pocket area is the point (B) under which will get the optimal expected value as the MiniMax value of the game, including the determine the optimal value of  $q_2^*$  which is equal to (0.945454771), and the value of  $q_2^*$  (using the free strategies in table 4) can also be obtained as follows:

Table 2: Second trial for payoff matrix

		[B] Korek Company			
		B1	B2	B3	Min. Row
[A] Asia Cell Company	A8	56262085	69060500	50594930	50594930
	A9	72047545	67745960	73380390	67745960 ← MaxiMin
	Max. Col.	72047545	69060500	73380390	
		B1	B2 ↑ MiniMax	B3	Min. Row
	A8	56262085	69060500	50594930	50594930
	A9	72047545	67745960	73380390	67745960 ← MaxiMin

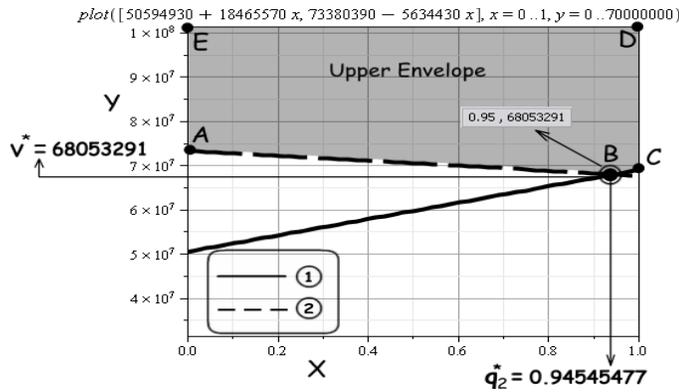


Figure 4: Area of optimal solutions to Korek Company  
Source: Created by the researchers using Maple 11 program

$$18465570q_2^* + 50594930 = -5634430q_2^* + 73380390$$

$$\therefore 24100000q_2 = 22785460 \Rightarrow \therefore q_2 = 0.945454771$$

Solving the above equation will provide the value of the probability of the 1<sup>st</sup> strategy  $q_2^*$  which is equal to (0.945454771), and the optimal probability for the 2<sup>nd</sup> strategy  $q_3^*$  as follows:

$$q_2^* + q_3^* = 1 \Rightarrow 0.94545771 + q_3^* = 1 \Rightarrow q_3^* = 0.054545228$$

Through the MiniMax point for player [B], which has been identified from the intersection of the lines in table (4); the researchers can substitute  $q_2^*$  in one of the equations straight cross, to obtain the optimum expected value as shown below:

$$v^* = \begin{cases} 18465570q_2^* + 50594930 = 68053291.26 \\ -5634430q_2^* + 73380390 = 68053291.27 \end{cases}$$

## 2. SOLVING THE PROBLEM USING TORA SYSTEM 7<sup>TH</sup> PACKAGE

This program has been provided by Hamdy A. Taha (2007) to solve many of the operations research models, including problems of (linear programming, transportation, game theory,...). The graphical method can be used in TORA to solve the research problem, where the steps have been introduced as follows:<sup>3</sup>

- 1) After entering the payoff matrix in table 5, we can select SOLVE Menu button, and then Graphical method:<sup>4</sup>

Table 5: Payoff matrix for player A

	B1	B2	B3
A1	0.56262085	0.69060500	0.50594930
A2	0.72047545	0.67745960	0.73380390

- 2) From (Select Output Format), determine the number of digits entered before and after the decimal point and then pressing (Go to Output Screen). Figure (5) shows the area of optimal solutions to Asia Cell Company and the final results for the game problem.

<sup>3</sup> A. T. Hamdy, "Operations Research: An Introduction", by Pearson Education, Inc., 8<sup>th</sup> edition, 2007.

<sup>4</sup> The maximum digit accepted by TORA program is 7 degrees, but all numbers in payoff matrix has 8 degree, so we divided each number in payoff matrix by  $10^{-8}$  to be acceptable and that will not effect on the original value.

- 3) Where it is noted that the point has been obtained from the first intersection of lines with MaxiMin represent the second match point, and through it the optimal value  $p_1^*$  is obtained which is equal to (0.2337938). In addition the value of the game ( $v^* = 0.6805329$ ) have been received.

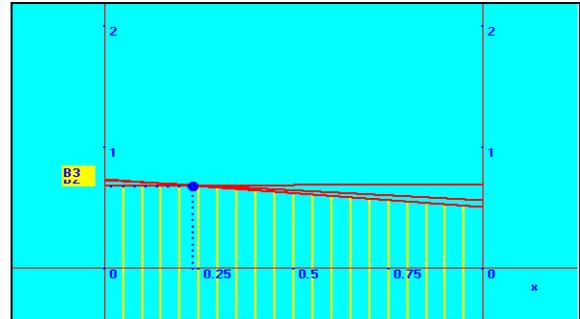


Figure 5: Area of optimal solutions to Asia Cell Company

Zero-Sum Game results:

Player A's expected payoffs:

Strategy B1:  $0.72047545 - 0.15785460x$

Strategy B2:  $0.67745960 + 0.01314540x$

Strategy B3:  $0.73380390 - 0.22785460x$

Optimal Solution: Value of the game = 0.68053291

Player A's mix:

Strategy A1: 0.23379378

Strategy A2: 0.76620622

Player B's mix:

Strategy B1: 0.00000000

Strategy B2: 0.94545477

Strategy B3: 0.05454523

## XII. CONCLUTIONS

This research has formulated a matrix of competition between Korek and Asia Cell telecom companies by studying the strategies used by each company. This has been accomplished by providing suggestions for each company related to using best strategies to maximize the profit. The payoff matrix size was (9x5) represented by 9 rows related to the strategies adopted by Asia Cell Company, and 5 columns related to the strategies adopted by Korek Company. The manual method show that there is no saddle point for the payoff matrix where: MaxiMin  $\neq$  MiniMax ( $69060500 \neq 67745960$ ). This means that the value of the game lies between:  $67745960 \leq v \leq 69060500$ . To solve this matrix the researchers have reduced it to two rows and three columns, using the principle of control and the same game value have been received. Here the arithmetic method of payoff matrix cannot be used because the resulting payoff matrix of type (2x3). So the graphical method was used. As a conclusion, it has been found that the optimal strategy for player [A] which should always be used is the 8<sup>th</sup> (selling the International Line) and 9<sup>th</sup> (selling the New Khalat Line) with probabilities 0.23379378 & 0.76620622 respectively from competition time to get the expected optimal value (higher profit expected) is equal to  $v = 68053291$  ID. While, the optimal strategy for player [B] which should always be used is the 2<sup>nd</sup> (selling the Data Offers) and 3<sup>rd</sup> (selling Diary Line) with probabilities 0.945454771 &

0.054545228 respectively from competition time to get the expected optimal value (which will bring less losses) is equal to  $v = 68053291$  ID. TORA package gave results close to the manual method for the two companies; this confirms the validity of the results that have been obtained.

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# Factors Affecting Capital Structure and Value Consumer Goods Company Listed in Indonesia Stock Exchange

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**Abstract:** This study aimed to analyze and understand the effect of firm size, tangibility of assets, liquidity, profitability, growth companies, the average value of the industry, risk, tax, financial limits and the influence of factors related to macroeconomic against the company's capital structure and to analyze and understand the influence the company's capital structure on firm value. This study uses secondary data, ie data collected from *Indonesian Capital Market Directory 2013 (ICMD 2013)* which includes data from 2007 to 2011 for the fundamental data of the company. The population of companies used in this study include *consumer goods* companies that have *gone public* and there BEI seen in this study met the criteria, namely: (a) shares of listed issuers and listed on the Stock Exchange during the period 2007 to 2011 and (b) Issuing financial statements during the period 2007 to 2011. Data were analyzed using *Classical Linear Regression Model (CLRM)*, or often also called the *Ordinary Least Square (OLS)*. Results of the analysis showed that : Variables company size, tangibility of assets, liquidity and value of the industry average positive and significant impact on the capital structure of the company. Variable profitability and the risk of a significant negative effect on the company's capital structure, variable growth of the company and the tax does not affect the company's capital structure. Variables company's capital structure and significant positive effect on the use values p ompany. Indicators payment of dividends, losses and rank the value of investments in financial constraints variable positive and significant impact on the capital structure of the company. Indicator gross domestic product and the discount on variable factors related to macroeconomic positive and significant impact on the capital structure of the company, while the inflation indicator is negative and significant effect on the company's capital structure.

**Keywords:** *Capital Structure, Corporate Values, Consumer Goods, Indonesia Stock Exchange*

## I. INTRODUCTION

In the realm of corporate finance, capital structure refers to the way a company finances its investments through a combination of equity, debt or *hybrid securities* (Ross et al, 2007) [1]. The capital structure of a company can therefore be viewed as a composition or structure liability companies within long.

Hatfield et al (1994) [2] further argued that the company's financial problems is whether indeed there is an optimal capital structure for the company. In this regard, it is actually the company in the long run can choose any shape desired capital structure, wherein the selection is based on the attitude of the company's management and investors as well as the conditions applicable to long term funding in the market.

Although various theories of capital structure since the introduction of *irrelevance theory* by Modigliani & Miller in 1958 has a lot to provide thoughts and views the fundamental research capital structure, the problem of main theories is that all of them can still be seen have not been able to integrate various aspects differs from capital structure into a single universal theory. Until today, especially, most of these theories only tested on a number of factors in a situation of debt and frictions or limited market circumstances. Therefore, we can define the first issue in the debate over capital structure as follows : *Academics have developed theories of capital structure which seeks to explain certain financial decisions of the company. However, most of these studies only analyze frictions are limited and only consider the important aspects especially of capital structure separately.*

The second problem that can author identification in the academic literature to date is associated with the analysis of the sample and the specific facts used in research regarding the company's capital structure decisions. In essence, it is a large number of empirical studies have analyzed with deep Which factors have an influence on corporate financing mix. Furthermore, basically the majority of empirical research, it makes the study results of Haris and Raviv (1991) [3] as a determinant of their debt and prove that the overall growth and profitability is inversely related to debt financing. Instead, factors such as the size of the company's debt, *tangibility*, *industry median debt ratios* and *expected inflation* has a positive impact on *leverage* as in the review by Frank and Goyal (2009) [4].

However, the problem of studies empirical previously, there are two. *That is the first, all of these studies analyzed a series of variables limited perceived impact on the capital structure decisions of the company. Secondly, the main problem of the whole discussion regarding capital structure previously mentioned is the fact that is uncontested that there is no specific relationship between the sample itself to the existence of theories of capital structure developed earlier.* In short, not yet available academic works that can provide in-depth study on various factors debts in order to understand the issues concerning the theory of capital structure which one can better explain the pattern of financing per industry in the real world and this is where the *novelty* or newness of this study later.

Descriptive data relevant to factors that debt becomes the determinant of the company's capital structure following the various industry sectors shows the presence of gap practical factors such debt, especially in terms of asset structure (2007-2008), profitability (2007-2008, 2008- 2009), the size of the company (2007-2008) on the capital structure as measured through DER.

**Table 1. Factors Affecting Debt Its Capital Structure Consumer Goods Company on the Stock Exchange (2007-2009)**

Factors Debt	2007	2008	2009
Sales Growth	0.43	0.03	0.18
Asset structure (measured by assets)	0.50	0.46	0.53
Profitability	5.63	5.86	5.55
Company Size	13.73	13.81	13.92
Capital Structure	2007	2008	2009
Debt-Equity Ratio (DER)	4.06	1.88	1.99

Source: Indonesia Stock Exchange (<http://www.jsx.co.id>, 2013)

Related to the above, the authors are interested in analyzing the capital structure issues in the context of *consumer goods* companies. Rationality authors chose this research object because *the consumer goods* company is one of the industries in Indonesia are currently still able to grow from year to year. *Consumer goods* companies that *go public* in Indonesia is growing rapidly, the company sold 30% of their total shares outstanding (held by the public) and a 70% stake still held by the founders (Hanafi, 2005) [5].

Furthermore, the main issue of the discussion about the capital structure until now is because no one has tried to combine the ideas and findings differ in the 55 years since the phenomenal results of Modigliani and Miller in 1958 into one study. In order to fill the gap, the authors are keen to identify theories of capital structure that plays a role in explaining the factors that influence the decision of debt capital structure and leverage a company that includes the type of *consumer goods* in Makassar Industrial Area.

If connected with the analysis of Modigliani and Miller who has given birth to two groups of flow of extensive research in the field of corporate finance, namely: (1) related to the effect of *leverage* on the company's risk and cost of capital in the short term, and (2) related to the company's capital structure optimal (which is a mix of debt and equity) in the long term, it can be said that this research is expected to contribute to the second stream of research that are more strategic.

## II. RESEARCH METHODS

This research study shaped survei that is explanatory. This study uses data *pooling*. Data were collected by survey data used in this research is secondary data, ie data collected from *Indonesian Capital Market Directory 2013 (ICMD 2013)* which includes data from 2007 to 2011 for the fundamental data of the company. In certain cases, where the desired data is not found in 2013. The population ICMD company used in this study include *consumer goods* companies that have *gone public* and contained in the Stock Exchange are: (1) PT Indofood Sukses Makmur, Tbk ; (2) PT Fastfood Indonesia Tbk; (3) PT Unilever Indonesia Tbk., (4) PT Ultra Jaya Milk Industry Tbk; (5) PT Sekar Laut, Tbk; (6) PT Gudang Garam Tbk ; (7) PT HM Sampoerna Tbk; and (8) of PT Kimia Farma Tbk, which is viewed meet the criteria of this research are: (a) shares of *listed* issuers and listed on the Stock Exchange during the period 2007 to 2011 and included in sector and manufacturing in the observation period 2007 to 2011; and (b) Issuing financial statements during the period 2007 to 2011 and published in the ICMD. To test this hypothesis series, we use the *Classical Linear Regression Model (CLRM)*, or often also called the *Ordinary Least Square (OLS)*.

## III. RESULTS

### Direct Impact Company size (X<sub>1</sub>) of the Capital Structure (Y<sub>1</sub>)

The effect of variable coefficients company size (X<sub>1</sub>) the capital structure (Y<sub>1</sub>) at 0,018 with t value of 112.897 with a standard error (SE) worth 0.000 at a significance level of 0.000. Coefficient It shows that the variable company size (X<sub>1</sub>) positive effect on capital structure (Y<sub>1</sub>). It means Increased the size of the company that p (X<sub>1</sub>), will be followed by an increase in capital structure (Y<sub>1</sub>) assuming other factors that affect the size of capital structure (Y<sub>1</sub>) is considered constant. Statistical value t effect of firm size (X<sub>1</sub>) the capital structure (Y<sub>1</sub>) amounted to 112.897 with a significance of 0.000 or below 0.05. This means that the size of the company (X-1) positive and significant impact on the capital structure (Y<sub>1</sub>).

### Influence Direct Tangibility Company Assets (X<sub>2</sub>) of the Capital Structure (Y<sub>1</sub>)

Coefficient effect of variable tangibility of assets of the company (X<sub>2</sub>) the capital structure (Y<sub>1</sub>) at 0.025 with t value of 5.297 with a standard error (SE) worth 0.005 at a significance level of 0.000. Coefficient It shows that the variable tangibility

of assets of the company ( $X_2$ ) positive effect on capital structure ( $Y_1$ ). It means Strengthening p tangibility that the company's assets ( $X_2$ ), will be followed by an increase in capital structure ( $Y_1$ ) assuming other factors that affect the size of capital structure ( $Y_1$ ) is considered constant. Statistical value t influence the company's assets tangibility ( $X_2$ ) the capital structure ( $Y_1$ ) amounted to 5.297 with a significance of 0.000 or below 0.05. This means the tangibility of assets of the company ( $X_2$ ) positive and significant impact on the capital structure ( $Y_1$ ).

#### **Influence Liquidity Direct Company ( $X_3$ ) of the Capital Structure ( $Y_1$ )**

Coefficient effect of variable the company's liquidity ( $X_3$ ) the capital structure ( $Y_1$ ) at 0.710 with t value of 25.371 with a standard error (SE) worth 0.028 at a significance level of 0.000. Coefficient It shows that the variable the company's liquidity ( $X_3$ ) positive effect on capital structure ( $Y_1$ ). It means Increased liquidity of the company that p ( $X_3$ ), will be followed by an increase in capital structure ( $Y_1$ ) assuming other factors that affect the size of capital structure ( $Y_1$ ) is considered constant. Statistical value t influence the company's liquidity ( $X_3$ ) the capital structure ( $Y_1$ ) amounted to 25.371 with a significance of 0.000 or below 0.05. This means that the company's liquidity ( $X_3$ ) positive and significant impact on the capital structure ( $Y_1$ ).

#### **Influence Direct Profitability of the Company ( $X_4$ ) of the Capital Structure ( $Y_1$ )**

The effect of variable coefficients the profitability of the company ( $X_4$ ) on the capital structure ( $Y_1$ ) at 0.016 with t value of 20.166 with a standard error (SE) worth 0.001 at a significance level of 0.000. Coefficient It shows that the variable the profitability of the company ( $X_4$ ) positive effect on capital structure ( $Y_1$ ). It means Increased profitability of the company that p ( $X_4$ ), will be followed by an increase in capital structure ( $Y_1$ ) assuming other factors that affect the size of capital structure ( $Y_1$ ) is considered constant. Statistical value t influence the profitability of the company ( $X_4$ ) on the capital structure ( $Y_1$ ) amounted to 20.166 with a significance of 0.000 or below 0.05. This means that the profitability of the company ( $X_4$ ) positive and significant impact on the capital structure ( $Y_1$ ).

#### **Influence Direct Company Growth ( $X_5$ ) of the Capital Structure ( $Y_1$ )**

Coefficient effect of variable the growth of the company ( $X_5$ ) the capital structure ( $Y_1$ ) at 0.001 with t value of 0.180 with a standard error (SE) worth 0.005 at significance level 0.857. Coefficient It shows that the variable the growth of the company ( $X_5$ ) positive effect on capital structure ( $Y_1$ ). It means that p Increased number growing proportion of the company ( $X_5$ ) will be followed by an increase in capital structure ( $Y_1$ ) assuming other factors that affect the size of capital structure ( $Y_1$ ) is considered constant. Statistical value t influence the growth of the company ( $X_5$ ) the capital structure ( $Y_1$ ) amounted to 0.180 with a significance of 0.857 or above 0.05. This means that the growth of the company ( $X_5$ ) no significant effect on the capital structure ( $Y_1$ ).

#### **Influence Direct Industrial Average value ( $X_6$ ) of the Capital Structure ( $Y_1$ )**

Coefficient effect of variable industrial average value ( $X_6$ ) the capital structure ( $Y_1$ ) at 0.026 with t value of 5.755 with a standard error (SE) worth 0.004 at a significance level of 0.000. Coefficient It shows that the variable industrial average value ( $X_6$ ) positive effect on capital structure ( $Y_1$ ). It means that p Strengthening industrial average value ( $X_6$ ), will be followed by an increase in capital structure ( $Y_1$ ) assuming other factors that affect the size of capital structure ( $Y_1$ ) is considered constant. Statistical value t influence the industry average value ( $X_6$ ) the capital structure ( $Y_1$ ) at 4 with a significance of 0.004 or below 0.05. This means that the average value of the industry ( $X_6$ ) positive and significant impact on the capital structure ( $Y_1$ ).

#### **Influence Direct Risk ( $X_7$ ) of the Capital Structure ( $Y_1$ )**

The effect of variable coefficients risk ( $X_7$ ) the capital structure ( $Y_1$ ) by -0.001 with t value of -2.385 with a standard error (SE) worth 0.000 at a significance level of 0.017. Coefficient It shows that the variable risk ( $X_7$ ) negatively affect capital structure ( $Y_1$ ). It means Increased risk that p ( $X_7$ ), will be followed by a deterioration in the capital structure ( $Y_1$ ) assuming other factors that affect the size of capital structure ( $Y_1$ ) is considered constant. Statistical value t influence the risk ( $X_7$ ) the capital structure ( $Y_1$ ) of -2.385 with a significance 0.017 or below 0.05. This means that risk ( $X_7$ ) positive and significant impact on the capital structure ( $Y_1$ ).

#### **Influence Direct Taxes ( $X_8$ ) of the Capital Structure ( $Y_1$ )**

Coefficient effect of variable tax ( $X_8$ ) the capital structure ( $Y_1$ ) at 0.003 with t value of 0.833 with a standard error (SE) worth 0.003 at significance level 0.405. Coefficient It shows that the variable tax ( $X_8$ ) positive effect on capital structure ( $Y_1$ ). It means Strengthening tax that p ( $X_8$ ), will be followed by an increase in capital structure ( $Y_1$ ) assuming other factors that affect the size of capital structure ( $Y_1$ ) is considered constant. T statistical value tax effect ( $X_8$ ) the capital structure ( $Y_1$ ) amounted to 0.833 with the significance of 0.405 or above 0.05. This means tax ( $X_8$ ) no significant effect on the capital structure ( $Y_1$ ).

### **EFFECT LIMITATION DIRECT FINANCIAL ( $X_9$ ) ON CAPITAL STRUCTURE ( $Y_1$ )**

#### **Influence Direct Dividend Payment Indicator ( $X_{91}$ ) of the Capital Structure ( $Y_1$ )**

Coefficient indicator influence the payment of dividends ( $X_{91}$ ) on the capital structure ( $Y_1$ ) at 0.416 with t value of 15.438 with a standard error (SE) worth 0.027 at a significance level of 0.000. Coefficient The indicator shows that the payment of dividends ( $X_{91}$ ) positive effect on capital structure ( $Y_1$ ). This indicates that companies that pay dividends tend to have a greater amount of compared leverage not companies that pay dividends. Value t statistical indicator dividend payment ( $X_{91}$ ) the

capital structure ( $Y_1$ ) amounted to 15.438 with a significance of 0.000 or below 0.05. This means the dividend payment indicator ( $X_{91}$ ) positive and significant impact on the capital structure ( $Y_1$ ).

#### **Influence Direct Losses indicator ( $X_{92}$ ) of the Capital Structure ( $Y_1$ )**

The coefficient of influence loss indicator ( $X_{92}$ ) the capital structure ( $Y_1$ ) at 0.378 with t value of 14.172 with a standard error (SE) worth 0.027 at a significance level of 0.000. Coefficient The indicator shows that the losses ( $X_{92}$ ) positive effect on capital structure ( $Y_1$ ). This indicates that companies experiencing losses tend to have more leverage than companies that are less losses. Value losses indicator t statistic ( $X_{92}$ ) the capital structure ( $Y_1$ ) amounted to 14.172 with a significance of 0.000 or below 0.05. This means a loss indicator ( $X_{92}$ ) positive and significant impact on the capital structure ( $Y_1$ ).

#### **Influence Direct Indicator Rating Value Investing ( $X_{93}$ ) of the Capital Structure ( $Y_1$ )**

Coefficient ranking indicators influence the value of investments ( $X_{93}$ ) on the capital structure ( $Y_1$ ) at 0.124 with t value of 5.710 with a standard error (SE) worth 0.022 at a significance level of 0.000. Coefficient The indicator shows that the rank indicator of investment value ( $X_{93}$ ) positive effect on capital structure ( $Y_1$ ). This indicates that the Company's investment value associated with a rating greater leverage than companies that do not have a rating value of an investment. Statistical value t rank indicator of investment value ( $X_{93}$ ) the capital structure ( $Y_1$ ) amounted to 5.710 with a significance of 0.000 or below 0.05. This means rank indicator of investment value ( $X_{93}$ ) positive and significant impact on the capital structure ( $Y_1$ ).

### **EFFECT VARIABLE DIRECT EFFECT MACROECONOMY ( $X_{10}$ ) ON CAPITAL STRUCTURE ( $Y_1$ )**

#### **Influence Direct Inflation Indicators ( $X_{101}$ ) of the Capital Structure ( $Y_1$ )**

Coefficient influence inflation indicator ( $X_{101}$ ) the capital structure ( $Y_1$ ) by -0.009 with t value of -3.819 with a standard error (SE) worth 0.002 at a significance level of 0.000. Coefficient It shows that the indicators of inflation ( $X_{101}$ ) negatively affect capital structure ( $Y_1$ ). It means that inflation is negatively connected with the amount of leverage of the company. Value inflation indicator t statistic ( $X_{101}$ ) the capital structure ( $Y_1$ ) reduction of the -3.819 With a significance of 0.000 or below 0.05. This means that the indicators of inflation ( $X_{101}$ ) a significant negative effect on the capital structure ( $Y_1$ ).

#### **Influence Direct indicator of Gross Domestic Product ( $X_{102}$ ) of the Capital Structure ( $Y_1$ )**

The coefficient of influence indicators of gross domestic product ( $X_{102}$ ) on the capital structure ( $Y_1$ ) at 0.105 with t value of 1.992 with a standard error (SE) worth 0.053 at a significance level of 0.046. Coefficient The indicators show that the gross domestic product ( $X_{102}$ ) positive effect on capital structure ( $Y_1$ ). It means that GDP growth is positively linked with the amount of leverage of the company. Statistical value t indicator of gross domestic product ( $X_{102}$ ) the capital structure ( $Y_1$ ) amounted to 1.992 with significance 0.046 or below 0.05. This means that the indicator of gross domestic product ( $X_{102}$ ) positive and significant impact on the capital structure ( $Y_1$ ).

#### **Influence Direct Discount Indicators ( $X_{103}$ ) of the Capital Structure ( $Y_1$ )**

The coefficient of influence of the discount indicator ( $X_{103}$ ) on the capital structure ( $Y_1$ ) at 0.020 with t value of 5.735 with a standard error (SE) worth 0.003 at a significance level of 0.000. Coefficient The indicator shows that the discount rate indicator ( $X_{103}$ ) positive effect on capital structure ( $Y_1$ ) It means that the discount rate is positively linked to the level of leverage of the company. The value of the discount indicator t statistic ( $X_{103}$ ) the capital structure ( $Y_1$ ) amounted to 5.735 with a significance of 0.000 or below 0.05. This means that the discount indicator ( $X_{103}$ ) positive and significant impact on the capital structure ( $Y_1$ ).

#### **Influence Direct Capital Structure ( $Y_1$ ) of the Corporate Value ( $Y_2$ )**

Coefficient effect of variable capital structure ( $Y_1$ ) to firm value ( $Y_2$ ) amounted to 0.830 with a t value of 5.131 with a standard error (SE) worth 0.162 at a significance level of 0.000. The coefficient indicates that the variable capital structure ( $Y_1$ ) positive effect on the company's value ( $Y_2$ ). This means that an increase in the proportion of capital structure ( $Y_1$ ), will be followed by an increase in the enterprise value ( $Y_2$ ) assuming other factors that affect the size of the company's value ( $Y_2$ ) is considered constant. Statistical value t influence capital structure ( $Y_1$ ) to firm value ( $Y_2$ ) amounted to 5.131 with significance of 0.000 or below 0.05. This means that the capital structure ( $Y_1$ ) and significant positive effect on firm value ( $Y_2$ ).

## **IV. DISCUSSION**

#### **Influence of Company Size against Capital Structure**

Testing the Effect of variable size companies on capital structure variables showed a positive and significant impact. The results support the view of *Trade-Off Theory*, that firm size is positively linked to the amount of *leverage* used by the enterprise. Meaning it can be argued that the larger a company, the lower they will face the risk of bankruptcy. The company is in accordance with the previous description that the phenomenon experienced in financial terms is known as "*too big to fail*" (TBTF) and therefore should maximize the benefits that can be gained from the tax savings involved in *gearing* besar. Results of this study supports studies conducted by Beck et al (2008) [6] later showed that company size has a significant role in the company's capital structure decisions. This was stated by Beck et al (2008) [6] after using the database of the results of a survey of the characteristics

of the company in 48 countries, in which the author proves that small companies use less external financing, other than the fact that small companies engaged in debt financing smaller.

### **Tangibility influence of Company Assets against Capital Structure**

Testing the Effect of the company's assets tangibility variable to variable capital structure showed a positive and significant impact. The results support the view of *Trade-Off* Theory, *tangible* assets that serve as collateral for debt financing that will reduce the *cost of financial distress* and enhances the capacity of the company's debt. Therefore, these three indicators of the company's assets, namely tangibility variable property, plant and equipment, inventories, and *accounts receivable* were used in this research direction is positif. The results of this study support the claim Jensen and Meckling (1976) [7] that the *agency Cost* of debt occurs when the company turned to more risky investments as *leverage* defined, other than after a shift of wealth from the *debtholder* to *equityholder*.

### **Effect of Liquidity The Company against Capital Structure**

Testing the Effect of the company's liquidity variable to variable capital structure showed a positive and significant impact. Results of this study support from the Theory of *Trade-Off* that the positive relationship between the first indicator of variable Company Liquidity (Cash Flow / Total Assets) with *leverage*. In other words, the more the amount of cash the company will lower the cost of a potential bankruptcy occurs, which in turn will allow the company to use more *leverage*. The results support the research of (Shleifer and Vishny, 1992; Sibikov, 2009) [8,9] which states that the existence of a positive relationship between current assets and *leverage*.

### **Influence of Corporate Profitability against Capital Structure**

Testing the Effect of the company's profitability variable to variable capital structure showed a positive and significant impact. The results support the view of *Trade-Off* Theory states that higher profitability will lead to an increase in leverage. A positive relationship is due to the fact that the company is able to generate profits (higher profitability) will be burdened by *the cost of financial distress* is lower, which also eventually make lower debt financing costs.

### **Effect of Company Growth against Capital Structure**

Testing pengaruh variable to variable growth of the company's capital structure showed no significant effect. The results of this study do not support the theory of *Trade-Off*, growth of assets and net income is positively linked with an increased leverage of the company. This is because the growth of the company, according to this theory will cause more and more companies large and hence lowers their chances of default, which in turn also lead to costs incurred when choosing financing through debt is also reduced. Results from this study are consistent with results obtained Kim & Berger (2008) [10], that there is no significant relationship between the variables of growth companies to variable capital structure.

### **Influence Industrial Average Value against Capital Structure**

Testing the Effect of variable average value of the industry to the capital structure variables showed a positive and significant impact. The results support the essence of the *Trade-Off* Theory which gives postulate that the company follows a specific capital structure targets (in this case the value of the average of industry leverage). Thus, according to this theory, there is a positive relationship between the first indicator of variable Value Industrial Average (Average Value of *Leverage* Industry) with the *leverage* of the company it self. Research supports research of Frank and Goyal (2009) [4], has shown that managers use the average value of the industry as a *benchmark* in order to *leverage* their company can adapt according to the industries in which the company they are.

### **Influence of Risk against Capital Structure**

Testing the influence of risk variables to variable capital structure showed a negative and significant impact. The results support the theory *Pecking-Order* stating that the company is deemed to be accumulating large cash holdings at the time of dealing with the level of earnings volatility. The Company therefore generally have the availability of internal funds were greater when exposed to the volatility of income suffered in order to avoid a situation that is not optimal investiasi (*underinvestment*) in the future. Therefore, according to this theory, there is also a negative relationship between risk and *leverage*. Empirical research of Fan et al (2008) [11] and Frank and Goyal (2009) [4] stated with reference to the theory of a *trade-off* static, that the decision between debt or equity should be based on the characteristics of companies that can be observed as a business risk as well as also the structure of assets, other than due to the fact that bank financing is generally depending on whether the loan can be secured by assets that are *tangible* (Storey, 1994; Berger and Udell, 1998) [12,13].

### **Effect of Tax against Capital Structure**

Testing the Effect of variable tax on capital structure variables showed no significant effect although the resulting direction is positive. This research results contrary to the *Pecking-Order* Theory. Which according to this theory, high corporate tax rates will reduce internal funds and thereby encouraging companies to take advantage of tax savings obtained as a result of using debt financing. This led to the theory of similar direction with the theory predictions previous *Trade-Off*, ie there is a positive relationship between the level of tax *leverage*. This result is contrary to the results of research Elliot et al (2008) [14], Delcours (2007) [15] and Bradley et al (1984) [16]. Where the results indicate a positive relationship.

## **LIMITATION OF FINANCIAL RELATIONS STRUCTURE OF CAPITAL**

### **Relationship Indicators Dividend Payment to Variable Capital Structure**

Testing relation to the dividend payout indicator of capital structure variables showed a positive and significant correlation. The results support the *pecking-order* theory, it is said to be a dividend increase the amount of debt financing that will be done by the company. This is because the relationship with the amount of dividend income produced by the company, in which the dividend thus becomes one of the causes of deficit financing. In other words, payment of dividends reduces the amount of internal capital and hence leading to increased internal financing. Therefore, according to the theory of pecking order, positive relationship between dividend and *leverage* was the one expected to occur.

### **Relationship Losses indicator to Variable Capital Structure**

Testing indicator relationship losses against capital structure variables showed a positive and significant correlation. The results of this study do not support the theory of a *trade-off*, it is known that in case the company suffered losses, then it will produce a negative relationship to *leverage*. This raises the cost of *financial distress* are higher and make the company does not need to protect its profits from taxes. The combination of the cost of higher *financial distress* and lack of benefits that can be gained from the tax savings (*tax shield*) ultimately leads to the use of leverage is lower.

### **Relationship Indicator Rating Value Infestation to Variable Capital Structure**

Testing rank indicator relationship infestations value to variable capital structure showed a positive and significant correlation. The results support the theory of a *trade-off*, then rank the value of the investment is linked to a lower bankruptcy costs and therefore make debt financing more attractive than equities. Therefore, this will lead to a positive relationship between *leverage* the investment value rankings. Based on this review, we can state that companies rated investment value associated have greater *leverage* than companies that do not have a rating value of an investment.

## **VARIABLE EFFECT OF MACRO ECONOMIC RELATIONS STRUCTURE OF CAPITAL**

### **Inflation Indicators relations to Variable Capital Structure**

Testing relation to the inflation indicator of capital structure variables showed a significant negative correlation. The results of this study do not support the *Trade-Off* Theory predicts that the positive effect of inflation on *leverage* decisions taken by the company. This is because according to this theory, tax considerations make financing through debt becomes a more attractive option at the time of inflation.

### **Relationship Indicators Gross Domestic Product to Variable Capital Structure**

Testing relation to the gross domestic product indicator of capital structure variables showed a positive and significant correlation. The results support the *Trade-Off* Theory predicts a positive impact on the GDP of *leverage* decisions taken by the company. This is because according to this theory, GDP being associated with the acquisition of a greater company profits and hence the theory predicts that a greater return would make debt financing more attractive through benefits resulting from greater tax savings as well.

### **Indicators relations Discount to Variable Capital Structure**

Testing relationships discounted indicator variable capital structure showed a positive and significant correlation. The results support the view *Agency theory* which predicts the existence of a positive relationship between the discount with *leverage*. *Free Cash Flow theory* and *Over-Investment Theory* gave similar predictions direction is a positive relationship between the discount rate to *leverage*. If the *interest* level has increased, the equity and debt the company will fall in value. In essence, the impact of an increased level of interest would be greater than the debt to equity ratio.

### **Effect of Capital Structure on Corporate Value**

Testing effect variable capital structure to the variable value of the company showed a positive and significant impact. This study supports *Leverage Signalling Theory* that there is a positive relationship between *leverage* the value of a company and their indicators are. In other words, companies whose capital structure or use greater leverage will have a higher value and higher value is seen as providing a positive signal to the external investor. The results support the findings from the Brigham and Houston (2009) mean that the financial structure (*financial leverage*) is a way of company assets financed. It is entirely the right side of the balance sheet, while the capital structure (*capital structure*) is a permanent expenditure financing company, which is mainly in the form of long-term debt, preferred stock / priority and ordinary share capital, but not all incoming short-term credit. So the capital structure of a company is only part of the financial structure

## **V. CONCLUSION**

1. Variable company size, tangibility of assets, liquidity, profitability and value of the industry average positive and significant impact on the capital structure of the company, otherwise variable risk significant negative effect on the company's capital structure.
2. Variables the growth of the company and the tax does not affect the company's capital structure.

3. Indicator payment of dividends, indicator losses and indicator Variable rank value of investments in financial constraints and significant positive effect on the company's capital structure.
4. Indicator gross domestic product and indicator discount on variable factors related to macroeconomic positive and significant impact on the capital structure of the company, otherwise indicator inflation negative effect.
5. Variables company's capital structure and significant positive effect on firm value.

## VI. SUGGESTION

1. Company policies related to capital structure issues must be considered carefully because it affects the value of the company. So to get the increased value of the company on an ongoing basis is suggested that the company is not overly restrict the use of leverage but also not too high in their use due to impact on improving the company's risk of capital charges to be incurred.
2. To get information about the tendency of companies to raise or lower the capital structure of debt (leverage) can be seen from the increase or decrease of the variable size of the Company, Tangibility Corporate Asset, Liquidity Company, profitability of the Company, Company Growth, Value Average Industry, Risk, Tax Limitation of Financial and Influence Macroeconomic against Capital Structure as has been concluded.

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# Quick Response in the Textile Industries

Lefayet Sultan Lipol

**Abstract-** The main aim of this paper is to find out the necessity of the QR in business, QR implementation [QRI], the relationship between QR and the supply chain, advantages and disadvantages of QR .This is a summary of the paper based on the book, Quick response- Managing the supply chain to meet the consumer Demand, by Bob Lowson, Russel king and Alan Hunter and some other articles. This article will try to find out the correct path and strategy to success in the production sector. We should gather more knowledge after the further study of different articles and this is the primary process. The article shows the advantages from which manufacturing could achieve: for instance-to improve planning, reduce stockholdings, increase production and improved communication. The producer needs to get the instant supply of the products in order to meet the customer new demand. This is the reason why one must have a good relationship and communication system with the whole production and delivery system. As well as he must have to concern about the transport system.

**Index Terms-** QR= Quick response, SKU= Stock Keeping Unit, SCM= Supply Chain Management, EDI= Electronic Data Interchange, PoS= Point of Sales, EPoS= Electronic Point of Sales, FMS= Flexible Manufacturing System, UPC= Universal Product Code, SCM= Shipping Container Marking, CAD= Computer Aided Design, CAM= Computer Aided Manufacture, AR= Autoregressive, CPFR= Collaborative planning, Forecasting and Replenishment, VANS= Value Added Networks, JIT= Just-in-time, VMI= Vendor Management Inventory, FMCG= Fast Moving Consumer Goods, ECR= Efficient Consumer Response, RFID= Radio Frequency Information Data, Benchmarking= Follow, JAN= Japanese Article Numbering, ASN= Advanced Shipping Notification, Cross-docking= direct delivery to customer from supplier, Stock out= inventory is finished, Markdown= Price reduction, win-win relationship, Lean & Agile, CIE= International Commission on Illumination, DC= Demand Chain, Lead-time, Modular system= is opposite to classical batch production, Metamorphosis= Transformation.

## I. INTRODUCTION

**T**rouble with traditional supply chain-volatile demands: different firms have various supply chain. Traditionally the whole supply chain took 18 months to deliver the products for a new season. But it is risky in different aspects like- Designer shows as a rule still take place one year ahead of its related season. But months before these designer shows, decisions have already to be taken on colours and fabrics. Of course, the concrete supply chain of the garments is much shorter. Moreover, there are huge differences in this respect within individual companies. The big company like ZARA, H&M can deliver their products to the customer within the 6 to 7 weeks. This is the reason why they can meet the customer various demand which is impossible for many companies in the world. But many companies in the fashion business claim that these are parasites of the fashion system, who take profit of the preparatory work of others, for example by copying their designs. To some extent this may be the case, but the major accomplishment of these fast moving firms is, of course ,to be found in their supply [or demand?] chains .In the eighties, the average lead-time in the apparel industry from raw materials to consumers was about 66 weeks. Of these, only 11 weeks were related to manufacturing, and 40 to warehousing and transit. It consisted of the various bureaucratic in the process. The final 15 weeks the garments were just waiting the store. Nowadays, 12-month lead-times still appear to be quite common. It is estimated that this lead to sale forecast errors of about 40 per cent. Shortening lead-time to nine months already reduces this error margin to 23 per cent. Through implementation of quick response, we can reduce the lead time to a great extent. Each additional shortening of the lead-time with three months leads to an additional reduction of this error margin only about 4 per cent. So, even at the beginning of the season it still is about 10 percent.

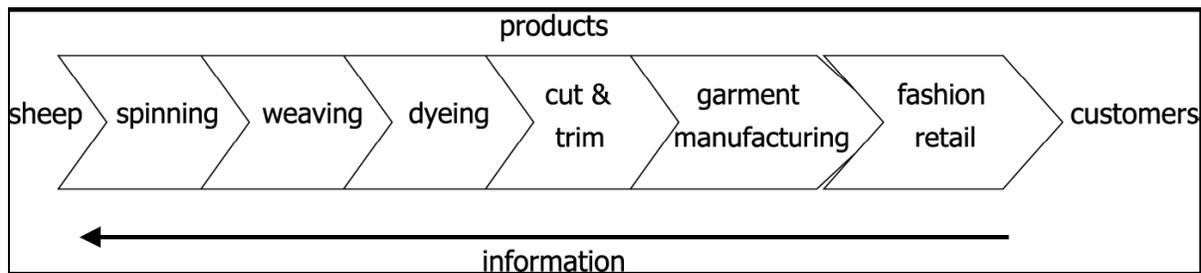


Figure 1: A traditional supply chain.

### 1.1. Quick response within the organizations: Backdrop, origin, status and outlook:

It was ten years since QR was thought as an improved path for trading in US textile. Since then it is a topic of great interest

in trade, articles have been written, seminars conducted, and talks given but very little have been achieved. But it was not accepted totally. The projected benefits of the QR in the industries are:

- Reduction in pipeline inventories.
- The greater possibility of garments designs and colours being acceptable to the consumer by moving styling closer to the sales date.
- The ability to re-calculate SKU demand at retail and make frequent reorder during the season, thus reducing stock outs and markdowns.
- Greater competitiveness for domestic producers facing increased level of imports.

Quick Response originated in the Textile and Clothing Industry of North America in the 1980's. With the growing complexity and volatility of demand many industries adapted this new strategic proposition to counter their challenges. The historical development of QR was articulated textile industry sponsored research programs by concentrating on the entire apparel pipeline. It was evident that the research revealed many intricacies related to the apparel supply chain due to revenue losses which catered successful development and implementation of QR into SCM.

QR manufacturing techniques further extended into a strategy and culture and as a whole fissured out from the pitfalls of the traditional economics of the apparel value chain smudged by forced markdowns, stock-outs or more precisely lost sales and inventory maintenance costs. Retail shrinkage, could also be considered as a major channel for revenue loss in the recent years. All these, set-up an analogy between lead time and its effects on sales forecasting errors. QR development and adoption was quite inevitable in this environment to achieve lead time and inventory reduction with better flow of information, precise qualities and flexible technologies – in accordance to the consumer's demand.

## II. DEFINITION AND CONCEPT

### 2.1. Lawson defines QR:

A state of responsiveness and flexibility in which an organization seeks to provide a highly diverse range of products and services to a customer or consumer in the exact quantity, variety and quality, and at the right time, place and price as dictated by real-time customer or consumer demand.

The description of the figure 2, QR in total the application that deals with the internet communication of sales data from the retailers to the vendor. Then the vendors within a short time supplying retailers the products needed to return the inventory in stores to level previously determined orders, may be point of sales data combined by the retailer and vendor. It is a diagram of the typical flow of merchandise data in a QR partnership between a retailer and a vendor. Consumers initiate the QR process as they communicate their needs and wants to the store through their purchases. Merchandise information, such as size, style, colour and brand are collected through scanning bar-codes. This information is sent to the vendor via electronic data interchange [EDI] rather than the typical process of remitting a purchase order. These sales data are compared with the inventory model for the store.

Production is ordered for the specific items needed to restore the inventory to the model's requirements. Notification of the expected shipping data is transmitted to the shipper and the retailer. Production orders are transmitted to the plant where the goods are produced. The merchandise is packed and shipped to the retailer. The cycle is complete when floor ready merchandise arrives at the store. The linkages of buyer and producer are must to implement the full process as well as they have a good relationship and unity. Otherwise the QR will not be successful.

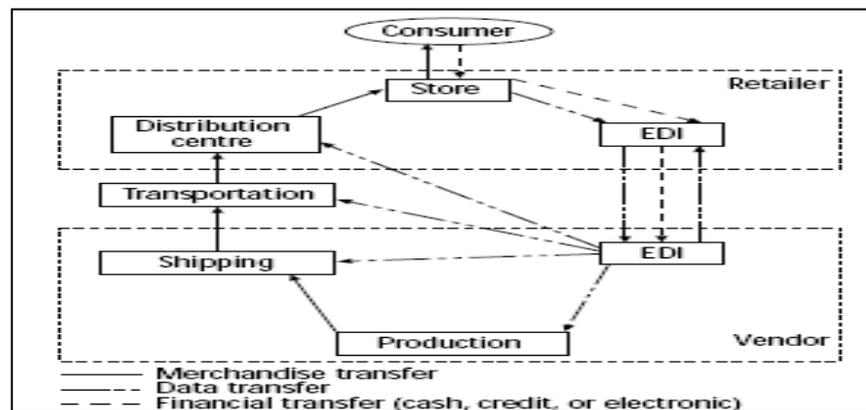


Figure 2: Merchandise and financial transfer with quick response.

## III. LEVERAGING QR

### Principal elements:

- Up-to-date technology- IT
- EDI
- VANS

- Partnership
- JIT [Just. in-time] Production and logistics.

### QR Implementation elements:

- POS tracking,
- FMS.

Now they are shortly described below:

### 3.1. Up-to-date technology [IT]:

Numerous technological developments are transforming systems in apparel manufacturing and retailing. As a result, relationships between suppliers and buyers are changing dramatically to the benefit of both. QR is only possible through the development of IT. Supply chain members may have implemented some IT systems, but virtual firms with high levels of QR will have implemented most of the following:

- EPoS equipment with UPC bar code scanning at the SKU level;
- EDI or the equivalent Internet system to exchange business documents such as purchase orders and other documentation;
- AR methods;
- Distribution centres to make merchandise floor-ready;
- Cross docking in central and regional distribution centres;
- Shipping container marking [SCM] labels;
- Smaller initial orders;
- CAD;
- CAM and CPFR.

### 3.2. EDI:

Electronic data interchange is the transmission of business data in structured format between firms who normally do business with each other. The data formats are based primarily on industry standards; these standards permit the sending firm and receiving firm to tailor the data transmission to their own needs. These predetermined formats enable the receiving firm to input the data directly into its own computer applications. Thus EDI supports inter-organisational systems, which transfer data automatically from a firm's computer system to the computer system of its supplier. Within a QR program EDI support sales forecasting system and automatic replenishment programme. Hammond [1993] has described this process. At the point of sale, the barcode on the garment is scanned and SKU is identified. EDI may be used to transmit this SKU information electronically to the appropriate apparel manufacturer, who makes sales forecast by SKU and determines the replenishment quantity required. If the retailers prefer to use its sales forecasting system, the point-of-sale are transferred to this system. The completed sales forecast are used as a basis for developing purchase orders, and then EDI is used to transmit the purchase orders to the manufacturer. In either case, electronic transmissions of the demand data or purchase order reduce both order cycle time and transaction costs.

### 3.3. VANS:

Different standards and ill-considered systems development has led to expense and incompatibility of QR along the entire supply chain pipeline. The existing sluggish corporate culture, adversarial partnerships and cost burdens, improper handling and transmission of information technology techniques and non-unification of the entire system under a common electronic platform as Value Added Networks [VANS] has in many ways hindered the full-fledged implementation of QR. The role of the value added networks has changed exponentially since the inception of quick response in 1985. At that time they were

looked as being only the telecommunication gateway for the trafficking if the EDI documents were not among several trading partners. These third party networks provided added value by offering retailers and manufacturers alike the ability to translate documents among various versions and computing platforms and transfer them rapidly than the traditional physical form of delivery. Rapidity of delivery collapsed order fulfillment cycle time and this was observed by many as the sector of QR.

### 3.4. Partnership:

Partnership and alliances are very important in the evolution of QR for creating supply chain synergy by elimination of all process duplications and infrastructures and achieve increased profitability, efficiency and market share. Special QM programs ensure active participation of all the agents in the pipeline with controlled QR element implementation. Bar-coding of merchandise is also quite essential. Proper transaction and inventory management is possible with strict compliance to standards like UPC [Universal Product Code] and NRF [National Retail Federation]. This helps in PoS scanning at the tear-off sections of the retails ensuring rapid communication.

If supply chain members and retailers develop partnerships and are able to participate through collaboration, planning, forecasting and replenishment [CPFR] then suppliers may reduce costs and build their brands, and retailers benefit from having lower stock holdings and fewer stock-outs. If the partnership is successful, the retailer may purchase and stock more of the manufacturer's goods.

### 3.5. JIT [Just-in-time] production and logistics:

In retailing, it is virtually impossible to plan or to schedule "production" – that is, the demand by consumers for specific merchandise, especially for individual stock-keeping units [SKUs]. JIT, one form of re-engineering, was used at the Nippon Wireless and Telegraph Company in Japan in the early 1960s. Since that time JIT concepts have been adopted by many other firms. Most applications of JIT have been in manufacturing in which production usually can be planned and scheduled, rather than in retailing, where it is impossible to determine the timing of individual sales transactions. In manufacturing, however, if JIT is used, materials used in production are not inventoried; rather, materials are scheduled for receipt only as needed. The underlying principle of JIT is to keep raw or semi-finished goods' inventories as low as possible, maintaining no stock except what is needed for immediate production. Raw materials or semi-finished goods are supplied to the JIT finished goods' manufacturer frequently and at short notice. Thus, the inventory investment necessary when using JIT is close to zero.

### 3.6. PoS Tracking:

The current position stands out with little changes in most of the areas. Improvements stand out in the form of reduction in inventories, improvement in pipeline management and manufacturing methods with a transition from the classic batch production method to flexible modular system. Significant changes have taken place with benefits in terms of higher customer responsiveness driven via PoS information. QR technologies and its elements like EDI, bar coding etc. are being increasingly adopted by the retailers and the manufacturers

however disappointing statistics are visible in the fields of automatic replenishment, use of re-ordering procedure and PoS data sharing. Dramatic expansion in PoS tracking in the recent years would also attribute to the development of QR with better inventory control, processing of re-orders, SKU management and cost reduction.

### 3.7. Flexible manufacturing system [FMS]:

QR must also be linked with the production system making it more flexible. FMS in the form of either modular production system or Vendor Managed Inventory [VMI] is essential to respond to the needs of QR ensuring minimum order lead-times, more productivity and effective utilization of resources. Though initial switching costs from traditional production to modular system is high, still this can be accounted as the benefits far outweighs the costs. Even the concept of VMI of maintaining finished goods inventory at a satisfactory level by the manufacturer ensures smaller inventory of goods for the retailers and shorter re-order times. Computer aided design [CAD] and Computer aided manufacturing [CAM], to enable the supply chain to become more efficient. In cutting and marker making, designing both of these machines has a great establishment. Along with rapid designing and product development process [using CAD system], process simulators and Line Balancing Decision Trainers – 3-Dimensional Concurrent Engineering could be followed to have complete system redesigning. It is exceedingly important to understand the product seasonality in considering the implementation of QR philosophies. Products could be 'Basic', 'Seasonal' or 'Fashion' depending upon their shelf life. Depending upon this these merchandise have different characteristics and hence QR requirements. 'Basic' products have marginal demand fluctuation throughout the year with steady requirement. This hardly caters the need to have QR responses for such products though the development of PoS tracking, inventory management and information transaction are quite essential to be implemented. For 'Seasonal' products, QR management becomes essential for organization with multi season assortments, especially during the re-order process. For single season goods, QR implementation is a bit difficult requiring spreading out of manufacturing schedule and inventory operations. However, for multi product lines, this is concurrently easier due to properly spaced product sales and inventory management requirements. For 'Fast Fashion' goods much of research and speculation is inevitable to correctly determine the strategies. QR is an essential requirement to streamline the design-, manufacturing- and logistics- processes to meet the rapid changing customer demand. Benchmarking is also a key requisite for full QR implementation required to change corporate mindset and gauge as according to standards.

#### IV. BUILDING THE INFRASTRUCTURE TO SUPPORT THE GROWTH

With the basic fashion category, the US-born QR concepts places much focus on the relationship between retailers and the manufacturers of the product. The building infrastructure to support the growth has been summarized by the under mentioned 3 points. [Giunipero ET al.2001]:

Stage1: Introduction of the basic QR technologies: -SKU level scanning, -JAN [Japanese Article Numbering] Barcode, - Use of EDI and use of standard EDI.

Stage2: Internal process reengineering via technological and institutional advancement.-Electronic communication for replenishment,-use of the cross-docking,-small amount of inventory in the system,-small order processing,-ARP [automatic replenishment program],

-JIT [Just-in-time] delivery,-SCM [shipping container marking].-and ASN [Advanced Shopping Notification].

Stage3: Information of a collective supply chain and win-win relationship:-real time sales data sharing,-stock out data sharing,-QR team meets with partnership,-MRP [Material resource Planning].

The model most appropriate for the garments sector has become a role model for QR Programme.

#### V. CURRENT POSITION OF QUICK RESPONSE IN DIFFERENT INDUSTRIES

The current position stands out with little changes in most of the areas. Improvements stand out in the form of reduction in inventories, improvement in pipeline management and manufacturing methods with a transition from the classic batch production method to flexible modular system. Significant changes have taken place with benefits in terms of higher customer responsiveness driven via PoS information. QR technologies and its elements like EDI, bar coding etc. are being increasingly adopted by the retailers and the manufacturers however disappointing statistics are visible in the fields of automatic replenishment, use of re-ordering procedure and PoS data sharing. Future of QR encompasses the need to develop both short- and long-term goals for future. Over the next 2-3 years it is essential to develop the role of VANS in resolving the QR supply chain problems through wider use of EDI, educational courses in the supply chain pipeline business issues, additional data processing and system integration etc. However the maturation and progression of QR paradigm over the successive years require change in mind set - metamorphosis from forecast driven to demand driven Pipeline. This caters sufficient extension of the strategy into a culture or philosophy through PoS systems to understand underlying trends, have flexible and rapid production techniques and demand-activated manufacturing. RFID [Radio frequency information data] is the new challenge in the field of quick response. As well as lean production is also important.

#### VI. FUTURE OF QUICK RESPONSE AND CHANGING THE FUTURE OF SUPPLY CHAIN

##### 6.1. Short term:

Short terms means we have to estimate the effect of the quick response in the supply chain for the 1-2 years that means for a short time. Over the next one to two years, the most pressing task for the industry will be to extend the use of EDI to all manufacturers as well as the smaller retail outlets and to forge better links with the textile producers and other suppliers to the garment industry. The role of the VANS may be the most pivotal

in resolving the QR supply chain's problems as they have the technical expertise to effect change among suppliers. The retail community has, in many respects, already relegated to the VANS the task of implementing EDI solutions among their trading partners. Also the competitive environment among the VANS has intensified as the trafficking of electronic documents has become a price-commodity business. The technologies among the VANS, although slightly different, offer similar speed of delivery in real time terms. Since the documents are non-proprietary in nature, no one VAN provides a particular benefit. Product differentiation among the VANS in the near future will be the delivery of "quality information products", as contrasted with speed of delivery: the VAN that can provide the most accurate information to its trading partners will have the strategic advantage. To accomplish this objective, which the VANS will need to maintain or gain share of market, will require more "ownership" of the supply chain. They will have to provide computer software solutions that add value to their information products by increasing the accuracy of the data as they are sequentially or concurrently processed, as well as permitting additional data processing and systems integration. In order for the VANS to implement these value added applications and satisfy their retail customers' needs for quality information products, they will need to change their present training approach to software and solutions to an educational approach. The former stresses how something, be it a product or a process, works, while an educational approach is more concerned with why the product or process exists and how it facilitates or enables improvement or innovation.

In all respects, the VANS, through their value added applications will need to champion ownership in the supply chain if the new coordinating technologies are not to open the door to a different kind of competitor who will use computers and telecommunications. Further, their job will not be complete until they streamline the interconnections, one to another. By this we mean that a manufacturer deals with retailers using different VANS and it should not be his job to sort out to whom he should send what. Already, some progress is being made in this area. Alongside the wider use of EDI must come improvements in the quality of the information being transmitted? UPC errors can be reduced or eliminated through use of such software packages as the bar-code director, now being offered by the major VANS. The reductions just beginning in retail inventories lead to a host of problems for both the short and the long term. We mention only one; that of balancing low retail inventories against desired customer service levels [the complement of stock outs] and supplier and DC lead times. This aspect of QR is not well retail profits. Textile producers and the better dye houses routinely measure the color of their fabrics and could supply CIE coordinates.

### 6.2. Long term:

The QR paradigm has become clearer, however, a number of initiatives have already been taken. The retailer, once he has worked out how to balance lead times, stock outs, and vendor lead times will start to examine the end-of-season markdown mix of seasonal goods, with its attendant margin loss, and install procedures for re-estimation of demand and the appropriate reorders. The problems associated with fashion merchandise,

while similar, are more complex and call for sophisticated analyses of fashion and color trends. These techniques have yet to be developed. While fashion is, almost by definition, impossible to forecast, we believe that certain underlying trends can be projected, but these projections will require extensive historical databases, and these are not yet being accumulated.

Successful manufacturers will be those making use of PoS data, which can anticipate seasonal demands, estimate shifts from buyer projections, and keep inventories to a minimum, while keeping their textile and other suppliers informed of their own requirements. This kind of juggling act will require very sophisticated software and innovative management. It will also call for flexible and rapid production techniques. It is in these areas that the manufacturer can add real value to his merchandise and tie himself more closely to his customer. This is the surest way to increase competitiveness than increasing the switching cost for the retailer. It is certain that computing costs and speeds will continue to improve and we will soon be at the point where a new aspect of the apparel business becomes possible on a broad scale. This will be a wider use of CAD, extended to include interactive designing of garments with the customer and the retail buyer. A second step will be inclusion of the garment design. In the price and sales catalogue, thus allowing sales preference data series to be established, and the possibility of true color and style forecasting to open up. So far, we have made little mention of the textile and fiber producers. This not an oversight, but reflects our belief that the prime imperative of the pipeline is to broaden and focus the UPC or EDI aspects of the pipeline. Given reliable PoS data and the manufacturer or retailer systems to make use of them, the industry will be in a position to tie into the very sophisticated up-stream systems capable of supporting demand-activated manufacturing. Until this happens, we believe the most important role these large and disciplined enterprises can play is partnering the VANS in their attempts to broaden acceptance of and compliance with EDI standards. However, there is another aspect to such teamwork: developing a financial infrastructure that will allow the small manufacturer invests in the software and services needed to participate fully in the EDI process. The EDI poses problems for many small companies.

## VII. QUICK RESPONSE AND VALUE CHAIN MANAGEMENT

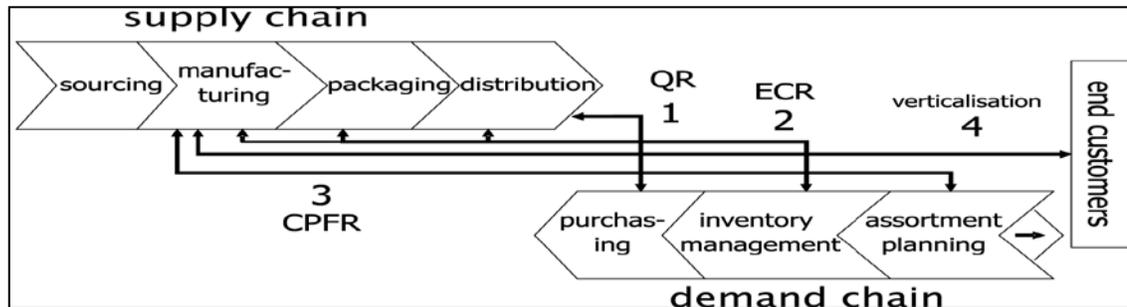
1. The first one is the connection between distributions and purchasing resembles the buyer and seller relationship.
2. Manufacturing, packaging or distribution with inventory management [e.g. based on the customer's POS sales data]. The manufacturer may offer to monitor carefully the customer's inventory levels in order to be able to fulfill future demand more efficiently. This may help these customers to reduce their inventory costs. Ideally, this has to be linked with knowledge about possible seasonal patterns in demand – even for basis apparel like jeans; there appear to be quite seasonal differences in sales patterns. This resembles more efficient consumer response.
3. Manufacturing with assortment planning. "By collaborating on the assortment determination in retailing, for example, the supplier and retailer look together at consumer demand categories that the supplier's products serve. Suppliers are also expected to use this collaboration to improve their

delivery performance”. This resembles CPFR: Collaborative Planning, Forecasting and Replenishment.

4. The supplier may go one step further and try to supply to the end consumer directly, as for example Dell has done in the field of computers. This is the path of verticalization, followed

by some manufacturers-retailers [like Zara], or designer-retailers with outsourced manufacturing. These different possibilities thus shift the “value offering point” of the suppliers ever more downstream in the demand chain. If supplier’s play this game intelligently, this may lead to win-win for both sides.

**Figure 3: Shifting the (value offering point) downstream in the demand chain.**



### VIII. DISCUSSION

Quick response is the communication or data transferring between the different factors of the business, from the retailers or the end customer to the vendors or the manufacturer through the QR implementing elements [for instance: Up-to-date Technology-IT, EDI, VANS, POS tracking, and RFID etc.]. Quick response has a great achievement in reducing the forecast error due to the shorter lead time, FMS, CAD/CAM, partnership and JIT production.

### IX. CONCLUSION

The big companies like- Zara and H&M are implementing the quick response and gaining the advantages. Quick response is an automatic choice for any trading company in the world. Because now a day’s people are very fashion concern and their style is changing rapidly because of modernization. So one need to change one’s production plan in different times of year. One can do this by assistance from the QR in different times of a selling season. But the total infrastructure should be active and dependable. In results, one can shine in this competitive business world.

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# Overvoltage Transient Analysis of Vacuum Circuit Breaker Switched Arc Furnace Installation

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**Abstract-** Frequent Switching of arc furnace in steel company causes a great effect on the insulation of arc furnace transformer winding which in turn may causes a shutdown of production for long periods of time. Therefore, it is necessary to study and analyze the causes of these outages and design an adequate protective device. In this paper the transient overvoltage resulted from vacuum circuit breaker switching arc furnaces of El-Delta for metal and steel company connected to the Egyptian distribution network is presented and discussed. The resulted overvoltage at the circuit breaker contacts can be as high as 3.0 p.u. While at the transformer terminals, the overvoltage reaches a high value, which can be as high as 2.44 p.u. A Fast Fourier Transform (FFT) analysis is used to analyze the overvoltage transients to determine the critical frequencies which must eliminated by the protective devices.

**Index Terms-** Switching Transients, ATP Simulation, Vacuum Circuit Breakers, arc Furnaces.

## I. INTRODUCTION

Switching transients associated with vacuum circuit breakers (VCB) have been observed for many years. With the widespread application of vacuum circuit breakers for transformer switching, recently this phenomenon has been attributed to a significant number of transformer failures [1].

It is well known that during switching of highly inductive loads like transformers, under specific conditions, multiple restrikes in the circuit breaker can occur. Multiple restrikes are fast voltage surges which proceed along the cable and reach transformer terminals. Because of different surge impedances at terminals, a wave reflection and absorption takes place.

Voltage oscillations which proceed toward windings are continuously superposed by new voltage waves from generated surges. Hence, voltage waveforms along the transformer winding within a particular time interval can have very different amplitude and rate of rise. Their oscillations contain a broad frequency range, i.e. from a few kHz up to a few MHz. This is unwanted phenomena, because it can causes deterioration and failure to the electrical equipment insulation [2].

Vacuum circuit breakers (VCB) have excellent interruption and dielectric recovery characteristics, and can interrupt the high frequency currents, which result from arc instability. The interruption of these high frequency currents leads to multiple reignitions at the breakers opening. Severe voltage escalations may occur under certain network conditions [3], especially when vacuum circuit breaker used to switch electric arc furnace transformers. This case rises in concern because of their inductive currents. High frequency transients and overvoltages are resulted when the vacuum breaker exhibits virtual current chop and multiple reignitions [4].

The overvoltage usually happen during switching on and switching off operations, that in this kind of application occur very frequently (up to one hundred times per day). Another important task of transformer protection devices is to prevent current re-striking when interrupting the circuit and the consequent voltage escalation phenomenon [5].

The purpose of this paper is to discuss the problem of switching transients concerning industrial electric arc furnace transformers, particularly regarding the eventuality of breaker re-striking during the switching operation.

## II. VACUUM CIRCUIT BREAKER MODELING

An overvoltage is generated across vacuum circuit breaker contacts when it interrupts current in arc furnaces circuit Due to the special properties of vacuum. The generated overvoltages are different nature than those generated in the same conditions by another types of circuit breakers (air, SF<sub>6</sub>, oil, etc.). When the contacts of a breaker open just before current zero, high frequency current transients will occur under certain network conditions. Vacuum circuit breakers have been modeled using an ideal controlled switch, as shown in figure (1).

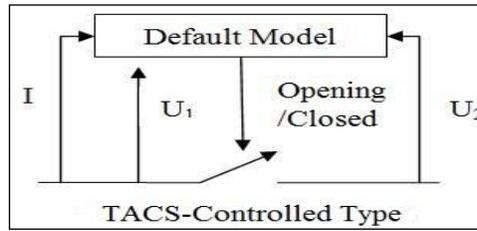


Figure (1) vacuum circuit breaker model

The Default Model of ATP-EMTP is used to generate opening or closed signal to TACS-Controlled Type 13 Switch. After each switching operation of VCB, the default Model judges and executes the next output signal by analyzing the current and two terminal voltages from the Type 13 Switch.

After the contacts of VCB are opened, the dielectric strength of vacuum gap will increase with the time, and a 'race' between the transient recovery voltage and the dielectric strength develops. If the increase of transient recovery voltage (TRV) is faster than the increase of dielectric strength, the re-ignition will occur and the default model will send a closed signal to Type 13 Switch. When the changing rate of HF current in zero point is smaller than the quenching capability of VCB, the default model will give an opening signal to Type 13 Switch and the high frequency HF current will be extinguished. If further re-ignitions occur, the above procedure will repeat until the dielectric strength could withstand the TRV [6].

A random event is taken for different switching operations of VCB, whereas the arcing time is the time between the contacts separation and instant of reaching the current to zero [3]. So, the opening time could be located at any point of one electrical period. In order to model the arcing time, the uniform distribution is used to generate random opening time in one electrical period. Then, the defined opening time is recorded in default model to calculate the arcing time [7].

The actual chopping current is not specified, however earlier research established different mean chopping levels for different load currents and contact material. In this paper, the mean chopping current is estimated according to the equation [7, 8]:

$$I_{ch} = (\omega \cdot i \cdot \alpha \cdot \beta)^q \tag{1}$$

Where  $\omega = 2 \cdot \pi \cdot f$

$i$  = amplitude of the 50 Hz current.

$\alpha = 6.2E^{-16}$  s

$\beta = 14.3$

$q = (1 - \beta)^{-1}$

The chopping current depends on the moment of breaker contacts separation. The closer the contact opens to current zero, the higher the chopping current. In this simulation the statistical nature of the chopping current is represented by a Gaussian distribution with 15% standard deviation from the calculated value of equation (1). The breaker current is assumed to be chopped immediately once the absolute value of the current exceeds the statistically determined value.

There are two breakdown mechanisms [7]; the first one is the breakdown of a cold gap, while the second one refers to a gap which has reignition. In the second mechanism the residual charge carriers exist near the cathode and the breakdown occurs at lower voltages. In this study, the cold gap breakdown is considered. In this mechanism the relationship between the value of dielectric strength and the time is linear; and the typical representation is shown by the following equation [9]:

$$V = A (t - t_{open}) + B \tag{2}$$

Where;  $t_{open}$  is the moment of contact separation and A, B are constants.

A re-ignition occurs when the TRV exceeds the dielectric strength of the breaker contacts. The actual frequency of the high frequency current associated with arc stability of the breaker is determined by a model comprising inductance and capacitance. This high frequency current will superimpose on the power frequency current. When the high frequency Current gets larger in magnitude than the power frequency current, it can force the current to zero at times other than those expected to occur normally with power frequency current. Most VCBs have the ability to quench this high frequency current and therefore the current may be quenched in one of its zero crossings at high frequency.

The rate-of-change of the current at a current zero determines whether or not there is a successful extinction. The high frequency quenching capability of typical vacuum circuit breakers is found in the range of several hundred A/μs [10]. This value can be a constant or a function of the time after contact separate as shown in equation (3):

$$\frac{di}{dt} = C (t - t_{open}) + D \tag{3}$$

Where  $t_{open}$  is the moment of contact separation. It is assumed that when the absolute value of the rate-of-change of the current at a current zero above the di/dt limit, arc extinction will not occur.

### III. OVERVOLTAGE TRANSIENT ANALYSIS

An actual case in Egyptian distribution network is used to analyze the voltage transients produced and choosing the convenient tools for overvoltage transients mitigation. El -Delta for metal and steel arc furnaces was used as a case study, where it is connected to Egyptian distribution network at a 11 kV bus feeds from bahteem station, and uses a  $\Delta/\Delta$  connected arc furnaces transformer rated 15MVA, 10.5kV/160V. The connected cable is a three core XLPE cable of 59m in length and having an inductance of 0.0283 mH. The no load current of the arc furnaces transformer is 17% and its leakage impedance is 18.8%. The arc furnaces transformer is switched by 1200-A vacuum circuit breakers. A single line diagram of the arc furnace bay is shown in figure (2). Each parameter in the equivalent model of the plant under study must be evaluated carefully, where the protection device parameters are strongly affected by the plant parameters [10, 11]. Figure (3) shows the arc furnace circuit modeling in ATP package.

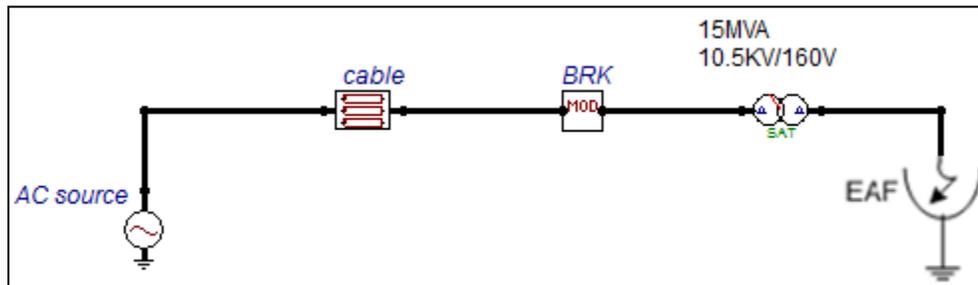


Figure (2) Single line diagram for El- Delta for metal and steel arc furnace.

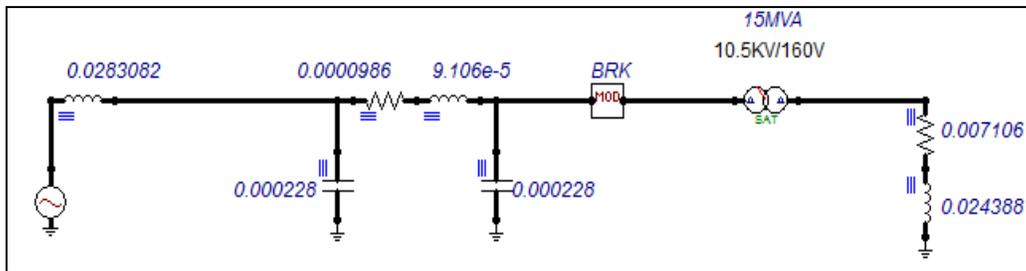


Figure (3) El-Delta for metal and steel Arc furnaces circuit in ATP simulation

According to equation (1), the chopping current is equal to about 4.79A. Initially, Rate of Raise of Dielectric Strength (RRDS) is set to 20V/ $\mu$ s and the quenching capability is set to 100A/ $\mu$ s. When the current reached to the chopping current value, the arc in the VCB becomes unstable and extinguished. At this moment, the current will sharply falls to zero, and VCB will be opened, a transient overvoltage will produce. The TRV across breaker contacts and the breaker current are shown in figure (4). It is observed that the first current zero has occurred in phase A. Due to the transient in phase A, high frequency currents have developed which flow through the other two healthy phases B and C. These high frequency currents have forced the power frequency current in phase A to reach zero value as shown in Figure (4). The power frequency current at this instant is 320A. This lead to TRV of 37.965 kV in phase A, which is equal to 2.44p.u. The induced overvoltage across circuit breaker contacts will lead to breaker failure. The voltage at the transformer is reached to 25.189 kV, which exceeds the BIL of the transformer winding (15 kV), and in turn will lead to a transformer insulation failure. The transformer voltage and current are shown in figure (5). This voltage will lead to transformer insulation failure after many cycles, which lead to transformer malfunction for long period of time. So, it is necessary to use surge arrester and RC suppressor to reduce the transient overvoltage to the permissible limit.

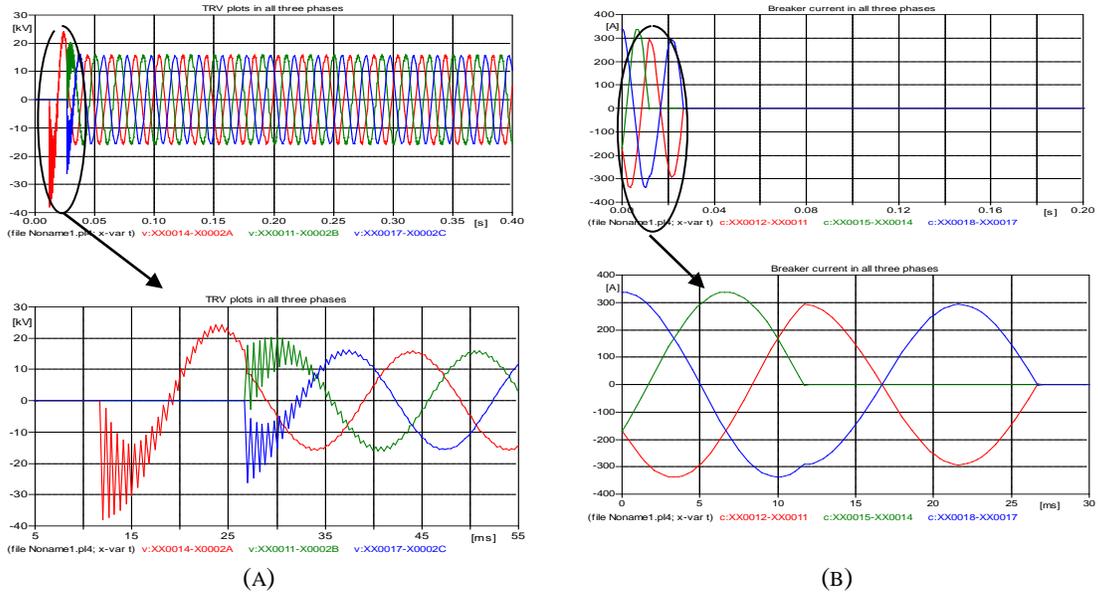


Figure (4) plots showing TRV across breaker contacts and breaker current

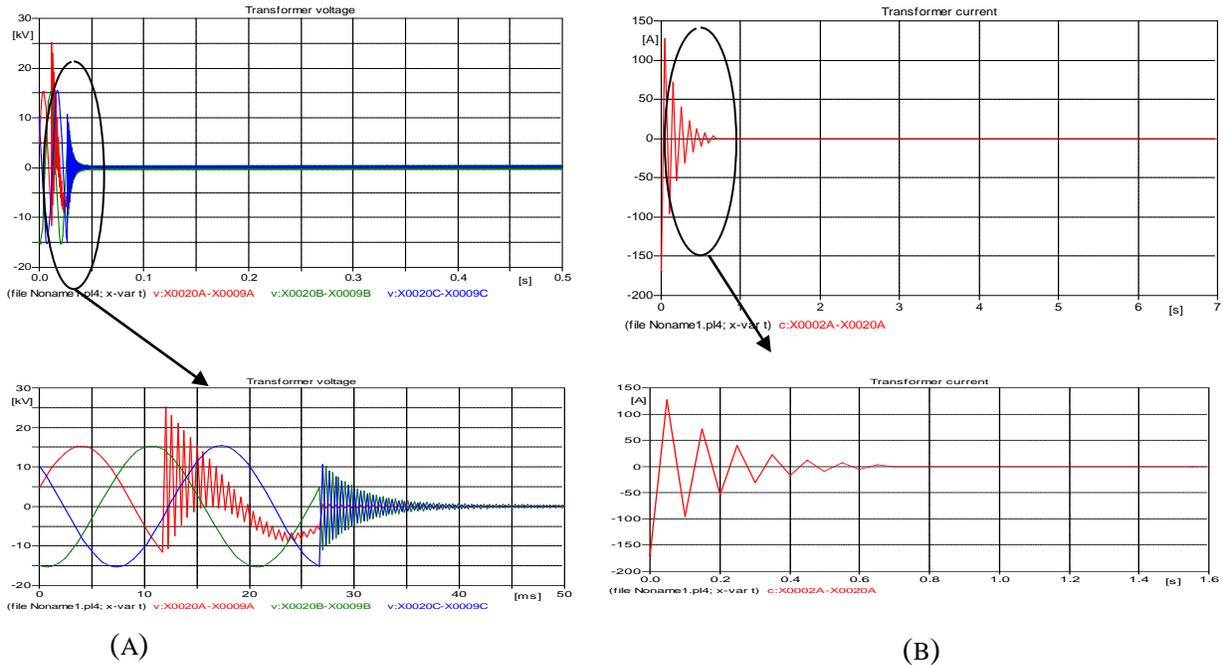


Figure (5) Voltage and current across the transformer.

#### IV. EFFECT OF ARCING TIME

The severity of such overvoltage depends on several factors e.g. the instant of interruption, the parameter of the vacuum circuit breaker etc. The interruption times are mostly random in nature [4]. Therefore, two different values are taking into account and the results are presented and discussed.

The arcing time is set to 600 $\mu$ s, RRDS is set to 20V/ $\mu$ s and the quenching capability is set to 100A/ $\mu$ s. The generated TRV across VCB contacts as a result of VCB switching is shown in figure (6). The results showed that a re-ignition occurs with such lower value of rate of rise of dielectric strength (RRDS). This result can be explained as follows; the generated transient overvoltage across the VCB is much faster than the RRDS of the circuit breaker, which leads to a re-ignition. Also, due to the lowest value of arcing time, the dielectric strength is not sufficient to withstand TRV, then a second re-ignition will occur which is interrupted successively. It is noticed that the first re-ignition occurred in phase A. The high frequency current superimposed on power frequency current of phase A is high enough to affect that of phase B via capacitive coupling between both phases. The sequence is repeated to phase C also, thus

all phases will suffer re-ignition. TRV produced is equal to 51.108kV which is equal 3p.u. This value is high enough to effect on vacuum circuit breaker and transformer insulation. Also, it is noticed that the transformer voltage is reached to 35.424kV, which is high enough to cause transformer insulation failure, which lead to malfunction of transformer. The overvoltage transients generated on the arc furnace transformer is shown in figure (7).

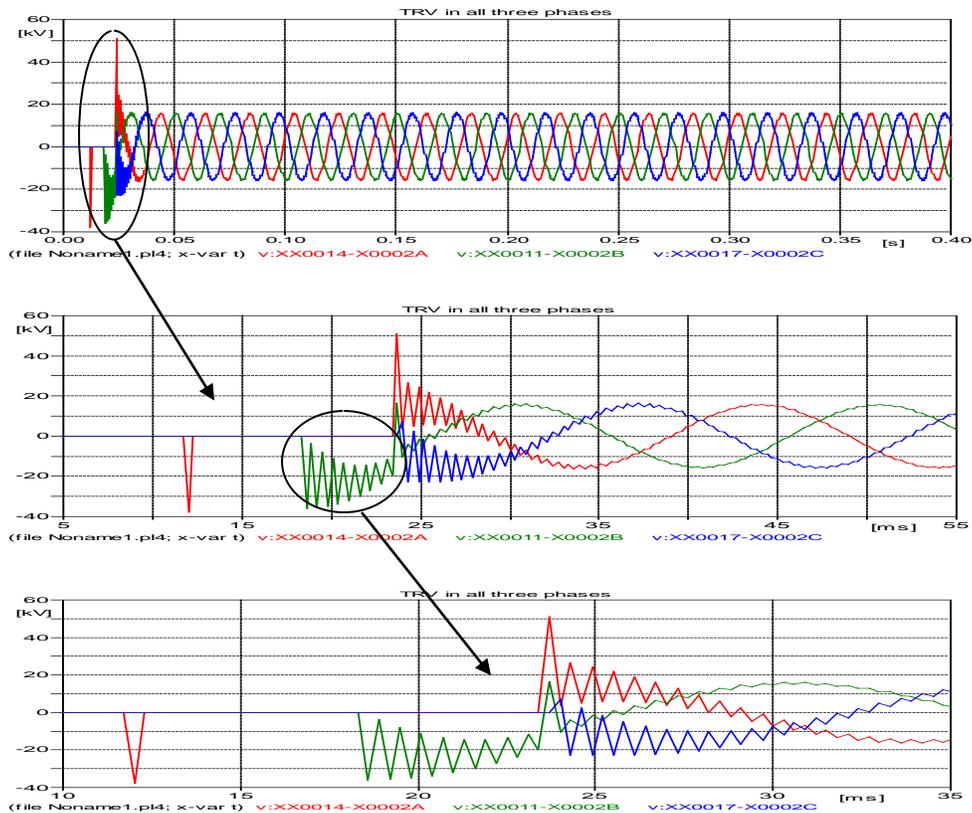


Figure (6) TRV across contact of vacuum breaker at arcing time=600 $\mu$ s (RRDS=20 V/ $\mu$ s, Quenching capability = 100A/ $\mu$ s).

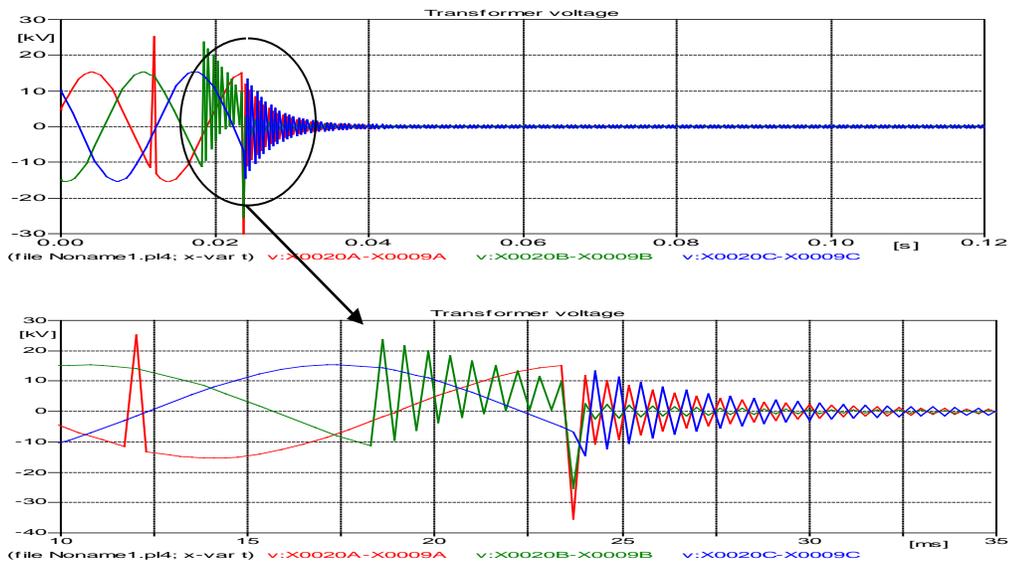


Figure (7) Transformer voltage at arcing time=600 $\mu$ s (RRDS=20 V/ $\mu$ s, Quenching capability = 100A/ $\mu$ s).

Now, the arcing time is set to 1600 $\mu$ s, RRDS is set to 20V/ $\mu$ s and the quenching capability is set to 100A/ $\mu$ s. The generated TRV across VCB contacts as a result of VCB switching is shown in figure (8).

The results showed that VCB is capable to interrupt the circuit successfully after the first re-ignition. This can attribute to the fact that, the RRDS is higher than the generated transient recovery voltage. The higher value of arcing time led to the fact that the high value of dielectric strength is sufficient to withstand TRV. It is noticed that the re-ignition firstly occurred in phase A. The high frequency current superimposed on the power frequency current of phase A, which can be high enough to effect on phase B via capacitive coupling between both phases. This sequence is repeated to phase C, thus all phase will suffer re-ignition. The TRV produced will be equal to 37.965kV which is equal 2.44p.u. This value is very high enough to effect on vacuum circuit breaker and transformer insulation. Figure (9) shows the overvoltage transients on the transformer windings. It is noticed that the transformer voltage reached to 25kV. This value is high enough to cause failure of transformer winding insulation, which leads to malfunction of arc furnace transformer.

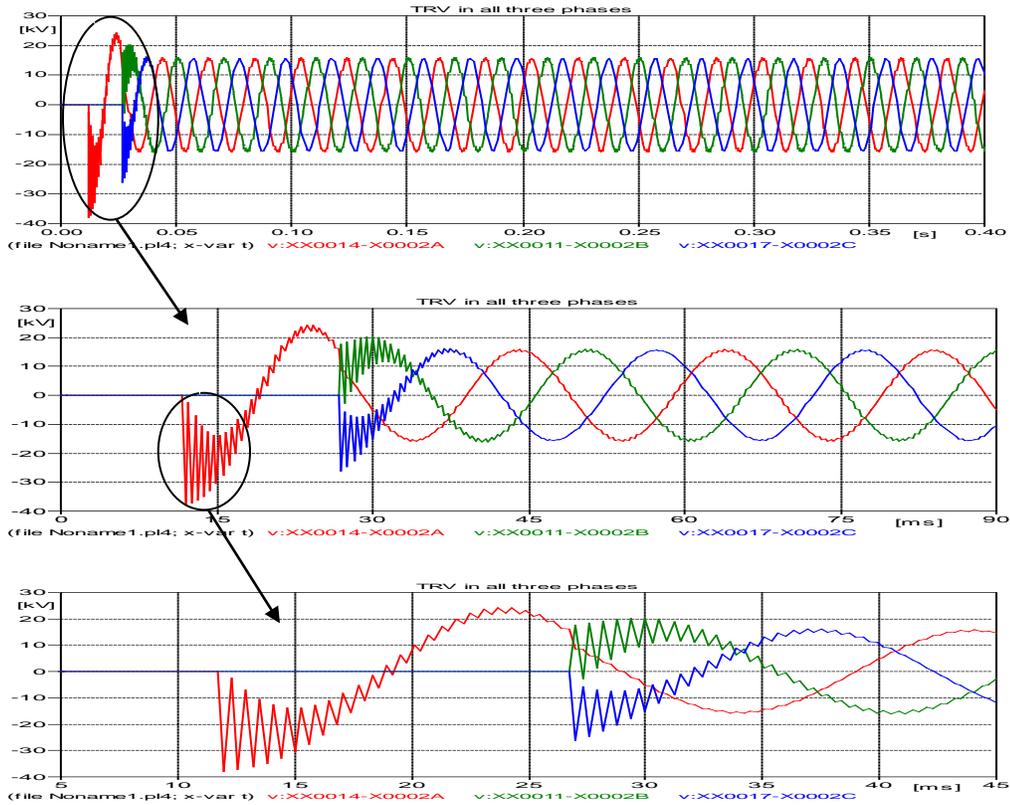


Figure (8) TRV across contacts of vacuum breaker at arcing time=1600 $\mu$ s (RRDS=20 V/ $\mu$ s, Quenching capability = 100A/ $\mu$ s).

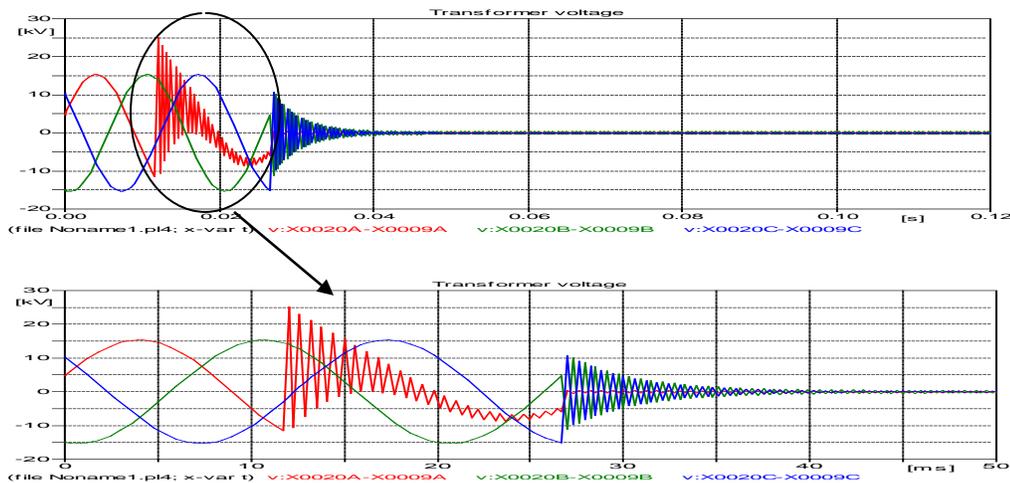


Figure (9) transformer voltage at arcing time=1600 $\mu$ s (RRDS=20 V/ $\mu$ s, Quenching capability = 100A/ $\mu$ s).

## V. HIGH FREQUENCY SPECTRUM ANALYSIS

Fast Fourier Transform (FFT) was used to analyze the overvoltage transient generated due to VCB switching processes in arc furnace circuit to determine the critical frequency which must be removed to protect the sensitive equipment.

Frequency spectrum analysis across the contacts of the VCB showed that the overvoltage transient occurs at the power frequency, shown in figure (10.a), while at the other frequencies the voltage approaches a zero value. Figure (10.b) shows that the peak value of the overvoltage transients at the arc furnace transformer, about 25kV, occurs at the power frequency; while a second overvoltage with a magnitude about 15 kV occurred at a frequency of 1650 Hz, which exceeds the acceptable limit. This TRV is unacceptable and indicates the need for an additional protective tool in addition to a surge arrester.

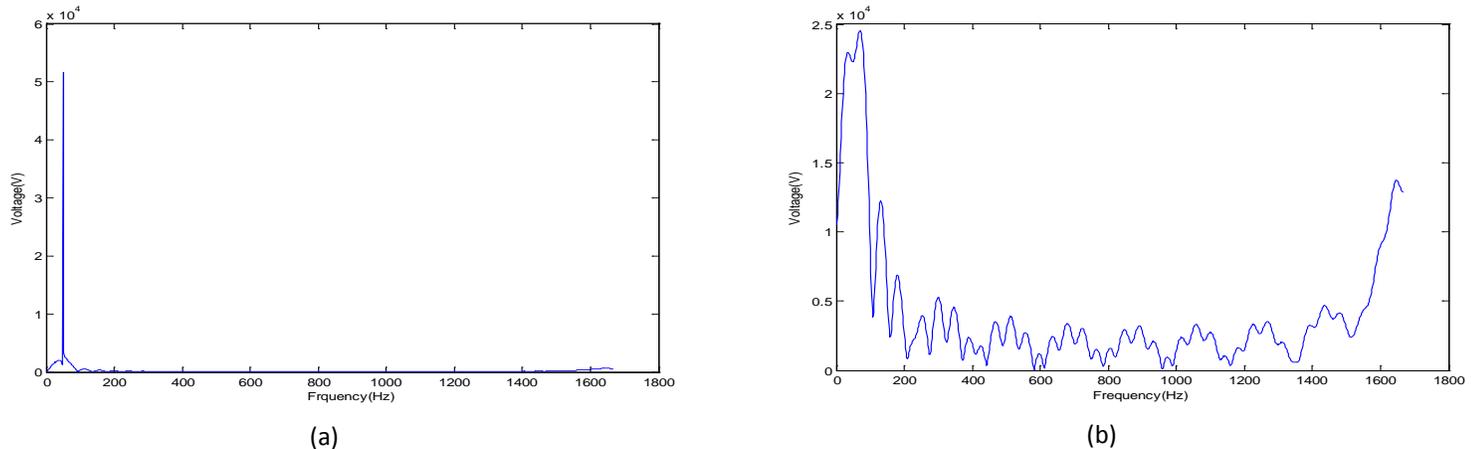


Figure (10) Frequency spectrum of phase voltage "B"  
(a) Across contacts of VCB (b) At the transformer

## VI. CONCLUSION

Digital simulation proved that severely degradation of an arc furnace transformer insulation of steel making factory as a result of overvoltages arising from VCB operation. The following points can be concluded from this study;

1. A transient recovery voltage and a high frequency current have developed across VCB. The TRV generated in phase A is about 2.44p.u., which lead to breaker failure. The voltage at the transformer is reached to 25.189 kV, which exceeds the BIL of the transformer winding, and in turn will lead to a transformer insulation failure.
2. The results showed that a re-ignition occurs with the lower value of rate of rise of dielectric strength (RRDS), i.e. 20V/ $\mu$ s.
3. Due to lowest value of arcing time, i.e. 600 $\mu$ s, the dielectric strength is not sufficient to withstand TRV, causes a second re-ignition to occur which is interrupted successively.
4. With using FFT, the peak value of the overvoltage transients at the arc furnace transformer, about 25kV, occurs at the power frequency; while a second overvoltage with a magnitude about 15 kV occurred at a frequency of 1650 Hz, which exceeds the acceptable limit.

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# Proposing mobile app for Buses information service using mobile technology

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**Abstract-** E-Governance facilities are used in number of Government projects to benefit the society, making government activities transparent and involvement of general public for acceptable decision in the country. The use of mobile make e-governance far easier as it is a handy tool and mobile technology is growing at a rapid speed, thus making e-governance easier. It is an innovative approach to implement e-governance. The paper introduces the features, technologies and design of the Android mobile device application, m\_businfoapp GPS mobile app to allow the commuter to know the exact location of the bus by feeding the required information like selecting a particular bus no. from the provided list of buses of that route. By estimating the arrival time of the bus, reduce the waiting time of the commuter at the bus stop. It will reduce the traffic which creates chaos especially at the peak time. This service will result in good revenue too. The proposed mobile app will give exact location of the bus at any instant and thus help the commuters to get ready with the information related to the bus on the mobile device which is a handy tool and available all time and at all places.

**Index Terms-** Mobile-app, m\_businfoapp, Google maps, GPS, E-governance.

## I. INTRODUCTION

The acceptance of mobile based applications in today's world is becoming easier as the resources or devices required are economical. Mobile device is the most economical device which one can buy to have internet access. Another advantage is that it is a handy tool and the launch of services by private operator provides facilities to not only urban but to rural part of the country too. There are number of applications provided which can be beneficial to individual and to the society as a whole. There are number of e-governance projects and services for the development of the nation. It provides information at any time and at any place. This tool makes the government more transparent and one can easily take advantage of the services provided by different departments.

There are many challenges and opportunities as discussed in [a]. Basic problems and acceptability are discussed in [b]. The use of facilities which are a part of e-governance benefitted not only urban but rural part of the country too. It strongly reflects the country's development [c].

There are number of operating system and programming languages used for developing mobile apps like Android(Java), iOS(Objective-C, Delphi), Windows Phone(Visual C#/C++), Blackberry 10(Java ME (Micro Edition)), Firefox OS(JavaScript,

JavaScript, CSS), Ubuntu Touch OS(Web-based: [HTML5](#), [CSS](#), [JavaScript](#) Native: [QML](#), [C](#), [C++](#)). This mobile application named m\_businfoapp is developed in MIT App Inventor 2(a Web-based visual development environment for novice programmers, based on MIT's Open Blocks Java library and providing access to Android devices' GPS, accelerometer and orientation data, phone functions, text messaging, speech-to-text conversion and lot more) and tested on both emulator ( by installing aiStarter) and android mobile set. Since this application is using GPS so we need to test on hand held android based device to get the location specifications.

## II. MOBILE-APPS DEVELOPMENT TOOLS: BRIEF OVERVIEW

### 1. MIT App Inventor / MIT App Inventor 2

App Inventor for Android is an open-source provided by Google and maintained by MIT(Massachusetts Institute of Technology). It has a graphical interface which assist beginner to create applications.

#### Characteristics of in MIT App Inventor 2:

- Visual blocks-based programming language, with Interface designer.
- .apk installer packaging option is available to install on the android enabled device directly. Emulator is also available.
- Limited debugging tools built into IDE but easy to learn for beginners
- Integrated Development Environment: Web-based interface designer, with connection to Java web-start program for blocks programming.
- Android devices are used Cross-platform deployment.
- No deployment tool costs.

### 2. Eclipse

Eclipse is an integrated development environment (IDE) which uses custom plug-ins offered by Android called ADT(Android Development Tools) and Android SDK. It can be used because Eclipse is an open source IDE and is easy to use and configure.

### 3. Android Studio BETA version

Android Studio Beta along with the Android SDK comprises of all the Android SDK Tools to design, test, and debug your mobile application running on Android. It requires a version of the Android platform to compile your application and a version of the Android system image to run your app in the

emulator. Android Studio is a new Android development environment based on IntelliJ IDEA.

Different options with operating system, programming language, IDE are available for developing mobile apps. Some of them are given in fig [1].

S.No.	Operating System	From	Programming Language	Development platforms,IDE
1	<a href="#">Android</a>	<a href="#">Google Inc.</a>	Java	<a href="#">Linux, Mac OS X Windows XP</a> or later. <a href="#">Eclipse, NetBeans</a> IDE also supports Android development via a plugin.
2	<a href="#">iOS</a>	<a href="#">Apple Inc.</a>	Objective-C, Delphi	Xcode
3	<a href="#">Windows Phone</a>	<a href="#">Microsoft</a>	Visual C#/C++	Visual Studio IDE
4	<a href="#">Blackberry 10</a>	Blackberry	Java ME (Micro Edition)	HTML 5 webwork, Theme studio
5	<a href="#">Firefox OS</a>	<a href="#">Mozilla</a>	JavaScript, JavaScript, CSS	Firefox browser, <a href="#">Firebug</a>
6	<a href="#">2.8 Ubuntu Touch OS</a>	<a href="#">Canonical Ltd</a>	<b>Web-based:</b> <a href="#">HTML5</a> , <a href="#">CSS</a> , <a href="#">JavaScript</a> <b>Native:</b> <a href="#">QML</a> , <a href="#">C</a> , <a href="#">C++</a>	Ubuntu SDK, Development requires Ubuntu Desktop 12.04 or higher, Free

**Fig[1]: Examples of some operating system, programming language, IDE mobile apps development.**

### III. LITERATURE REVIEW

The motivation behind the proposed solution is the existing e-governance service offered by different departments which are citizen centric as discussed in[d][e]. Android provides free and open source , providing an easy-to-use development kit containing flexible map display and control functions is discussed in[f]. Location based services offered by Google API can be used to find the current physical location. GPS software service provides mapping compatibility with Google maps. Network based provider or GPS can be used in location provider so that either of the services can contribute to detect the exact location.

Mobile Seva, innovative initiative launched by Department of Electronics & IT (DeitY), Govt of India under mobile governance to provide public services to the citizen over mobile phones and tablets. Mobile Seva aims to provide a one-stop solution to all Government Departments across the Nation for all their mobile-enablement needs. The National e-Governance Plan (NeGP), takes a holistic view of e-Governance initiatives across the country, integrating them into a collective vision, a shared cause. Around this idea, a massive countrywide infrastructure reaching down to the remotest of villages is evolving, and large-scale digitization of records is taking place to enable easy, reliable access over the internet. The ultimate objective is to bring public services closer home to citizens, as articulated in the Vision Statement of NeGP. The mobile verification system, the system of providing PDS benefits by using Aadhaar based online authentication is an app. e-governance scheme is the unique identity project Aadhaar.[g].

MEA(Ministry of External Affairs) with a view to provide mobile enablement of public services, has launched a Mobile Application mPassPort Seva to offer a wide variety of services to smartphone users such as Passport application status tracking, locating the Passport Seva Kendra (PSK) and general information on various steps involved in obtaining a Passport. This app is available on 3 platforms Android, IOS and Windows. Smartphone application warns people with vision disabilities of obstacles in their way to help them better navigate their environments.

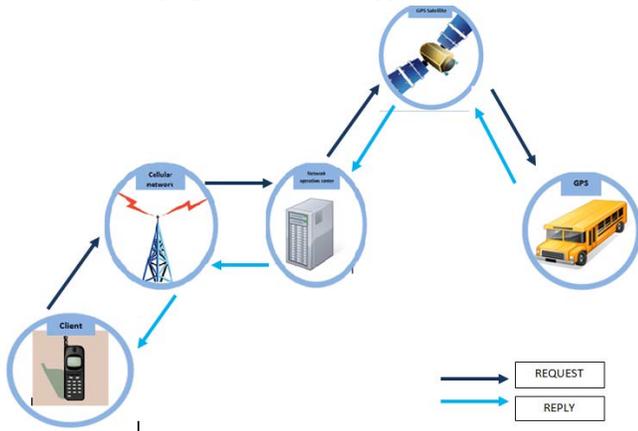
### IV. EXISTING SYSTEM CHALLENGES

The existing system of offline GPS installed in CTU is used to keep track on the movement of the bus and make the drivers more accountable. GPS unit with electronic mapping of the bus route and customized software is installed on one-fourth of CTU buses to keep check on whether the bus has follow its designated route, did it stop at all its scheduled bus stops, the timing at which it stopped and left the bus stop, etc., is stored in it through radio frequency as soon as the bus enters a depot. The reading of average and maximum speed at which the bus has been driven help curtails rash driving. It is also used on buses belonging to the Bangalore Metropolitan Transport Corporation (BMTC), Delhi Transport Corporation and some private operators. Since the timings at various stops will also be monitored the commuters will be greatly benefited not having to wait indefinitely for the buses. But there is a possibility that bus does not reach its defined stoppage due to some other reason like traffic chaos, etc. Our proposed mobile app will give exact location of the bus at any instant and thus help the commuters to

get ready with the information related to the bus on the mobile device which is a handy tool and available all time and at all places.

V. PROPOSED SYSTEM

Fig[2] and Fig[3] shows the basic working model and workflow of the proposed m\_businfoapp.



Fig[2] Model of m\_businfoapp

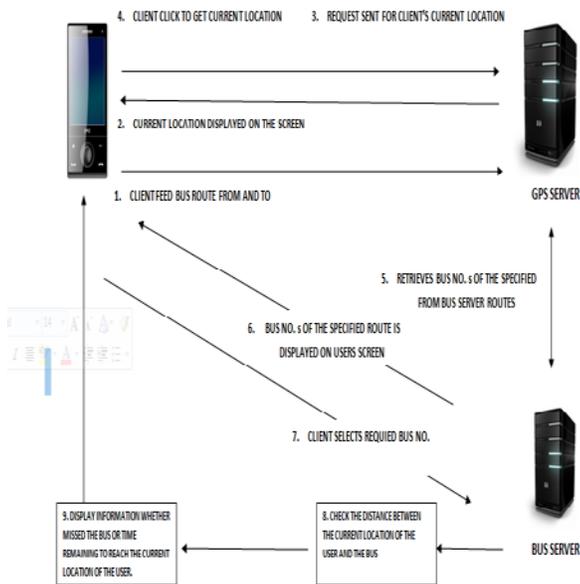


Fig.[3] Workflow of the proposed system

The various steps for the workflow of the proposed m\_businfoapp is given below:

- Step 1: Clients click the button to retrieve the current location (clients location)
- Step 2: Clients current location information is retrieved from GPS server.
- Step 3: Current location retrieved from the server & displayed on the users screen.
- Step 4: Client feed the start and end terminal of the bus.
- Step 5: GPS server retrieves the bus numbers of the required route from the bus server database.

Step 6: List of buses of the specified route will be displayed on the users screen from the bus server.

Step 7: Required bus will be selected.

Step 8. Current location of the selected bus will be displayed on Google map and distance is calculated to give estimated arrival time of the bus.

VI. IMPLEMENTATION

6.1 Tools used

The open source tool with graphical interface provided by Google MIT App Inventor for Android is used to develop this app. Tinydb is used as a database. LocationSensor is used to find the location with ActivityStarter. Android Emulator and Aqua Flash(Intex) mobile device is used to test the app.

6.2 Components

The proposed system consists of three components:

1. The mobile phone application (m\_businfoapp).
2. Bus Server
3. GPS Server

6.3 Algorithm

Algorithm:

Current\_Location [stores the current location of the user]

Time\_to\_reach [Estimate time to reach the stoppage]

Time\_to\_reach = Bus\_current\_location - Current\_Location

If Time\_to\_reach > 0

Display "Estimated time to reach your current location is:" + Time\_to\_reach

Else

Display "Missed the bus"

VII. CONCLUSION

The proposed solution is the existing e-governance service offered by different departments which are citizen centric. Android provides free and open source, providing an easy-to-use development kit. There are number of operating system and programming languages used for developing mobile apps like Android(Java), iOS(Objective-C, Delphi), Windows Phone(Visual C#/C++), Blackberry 10(Java ME (Micro Edition)), Firefox OS(JavaScript, JavaScript, CSS), Ubuntu Touch OS(Web-based: HTML5, CSS, JavaScript Native: QML, C, C++). Android mobile device application, m\_businfoapp GPS mobile app discuss in this paper allow the commuter to know the exact location of the bus by feeding the required information like selecting a particular bus no. from the provided list of buses of that route. By estimating the arrival time of the bus, reduce the waiting time of the commuter at the bus stop.

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# Pre and Post monsoon diversity of Chlorophycean algae in Mithi River, Mumbai

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**Abstract-** The Chlorophyceae is a large and diverse group of freshwater algae. They include members which are ecologically as well as scientifically important. They are also known to tolerate a wide range of environmental changes. The group usually occurs with a wide variety of other groups of algae in their natural habitat. A total of 18 genera have been observed during the study. The members of the group were found to be more in number in the post monsoon period as compared to the pre monsoon period.

**Index Terms-** Algae, Chlorophyceae, Diversity, Mithi River,

## I. INTRODUCTION

The algae form an important component of aquatic flora and play a vital role in maintaining proper equilibrium of abiotic and biotic components of aquatic ecosystem. Micro-algae have vast industrial and economic potential as valuable sources in pharmaceuticals, health foods and in bioremediation of industrial effluent. Algae are also used as biological indicators of water pollution (Subramanian., 1996; Handa and Jadhav, 2015). Algae are photosynthetic organisms that occur in most habitats, ranging from marine and freshwater to desert sands and from hot boiling springs to snow and ice. They vary from small, single-celled forms to complex multicellular forms. Chlorophycean members form the base of the food chain, they are directly or indirectly a good source of food for various animal groups (Rao, 1975). They are also a good source of oxygen for the aquatic life. It is a well-established fact that more than 75% of freshwater fishes feed on plankton at one or the other stage of their life-cycle (Jafri et al., 1999). The current study is undertaken with an objective to understand the presence of the Chlorophycean group of algae during pre and post monsoon periods.

## Materials and methods

### Area of Study

The Mithi River in Mumbai is one of the rivers which flows through the suburban areas of the city. It has also been a major storm water drain. The area of the river is within latitude 19° 00' to 19° 15' N and longitude 72° 45' to 73° .00' E. (NEERI, 2011). Currently, it is affected heavily due to anthropogenic activities.

### Collection of samples

The samples were collected from six stations along the river. The collection locations were narrowed down on basis of their accessibility and distance from the previous location. The

samples were collected in the Pre monsoon, i.e.; February to May and Post monsoon period, i.e. from October to January in 2014. The water was collected using glass wares that were thoroughly cleaned and dry sterilized at 160<sup>0</sup> C for 2 hours in a hot air oven before use. The samples were fixed in 4% formalin and brought to the laboratory immediately for further analysis.

## Observation and analysis of Algae

The samples were incubated till the appearance of good growth. The algal samples were observed under high magnification using binocular microscope (Labomed LP-Plan Achrom and Labomed SP-Achrom). Identification was restricted to Chlorophycean group. The algae were identified based on monographs (APHA, 2005; Prescott, 1964; Desikachary, 1959; Smith, 1950; Tiffany and Britton, 1952; Randhawa, 1959 and Prasad and Mishra, 1992). Five fields were observed for each of the three replicates. Each time the algae was observed and noted. The occurrence of particular group of organisms at different seasons was analyzed.

## Results and Discussion

A total of 18 genera from the Chlorophyceae group were observed. They belonged to different orders; Volvocales, Chlorococcales (Sphaeropleales), Ulotrichales, Chaetopherales and Zygnematales (Conjugales) (Table .1). Scenedesmus, Ulothrix, and Chlorella were found abundantly in pre and post monsoon periods. Populations of genus Staurastrum, Coelastrum, Micratinium, Chlamydomonas and Pediastrum were observed only in the post monsoon periods while; genus Selanstrum and Stigeocolonium were observed particularly in the pre monsoon periods. The populations of genus Ankistrodesmus, Closteriopsis, Closterium, and Chlorococcum were found during both time of the year, but they are reduced in number during the Pre monsoon period. Genus Nannochloris, Oocystis, Planktosphaeria and Zygnema were present in the Pre monsoon periods and reduced during the Post monsoon period.

The overall variety in population of the algae is higher during post monsoon periods than the pre monsoon periods (Table 2.). Similar results have also been derived in studies conducted on algae in West Garo hills, Meghalaya (Barman. et al, 2015). Related studies in this area have been carried out by many researchers with different algal communities (Singh and Chaudhary, 2011; Prasad et al, 1992; Kanetsuna, 2002; Mishra et.al, 2002 Keshri et al, 2013). Four new records of Chlorophycean algae have been found in the Khumbu Himalaya region, Nepal ( Ghimire et al, 2013)

**Table .1 Phytoplankton of Class Chlorophyceae observed in the Mithi River**

<b>CLASS : Chlorophyceae</b>	
<b>ORDER</b>	<b>GENERA</b>
Volvocales	Chlamydomonas
Chlorococcales (Sphaeropleales)	Chlorella, Pediastrum, Scenedesmus, Micratinium, Nannochloris, Chlorococcum, Closteriopsis, Coelastrum, Planktosphaeria, Ankistrodesmus, Oocystis and Selenastrum
Ulotrichales	Ulothrix
Chaetopherales	Stigeocolonium
Zygnemales(Conjugales)	Zygnema, Closterium, Staurastrum

**Table. 2: Variation in the presence of Algal population of Chlorophyceae**

<b>CHLOROPHYCEAE</b>		
<b>Genera</b>	<b>Pre Monsoon</b>	<b>Post Monsoon</b>
Ankistrodesmus	+	++
Chlorella	++	++
Closteriopsis	+	++
Closterium	+	++
Chlamydomonas	-	+
Chlorococcum,	+	++
Coelastrum	-	+
Micratinium	-	+
Nannochloris	++	+
Oocystis	++	+
Pediastrum	-	++
Planktosphaeria	++	+
Scenedesmus	++	++
Selenastrum	+	-
Staurastrum	-	+
Stigeocolonium	+	-
Ulothrix	++	++
Zygnema	++	+

(+) – Present, (++) – Common / Abundant, (-) – Absent

The heavy influx of water from the catchment areas during monsoons localizes the stagnant waters if any, in the course of the flow of the river created during the pre-monsoon periods. The post monsoon periods show a huge variety in the Chlorophycean group of algae, owing to the flow and abundance of water created during the monsoon periods. The peak of algal community although is different for each, most of the communities grow during the transitional periods from winters to summer. Apart from the seasonal changes, the anthropogenic activities affecting the quality of the water would show distinct changes in the algal communities according to its tolerance. The Mithi River flows from a diverse landscape beginning from a serene locale upstream to being a mixture of pollutants when it reaches the downstream areas. The pH of the river has ranged from 7.1 to 8.9 and temperature from 20.9° C to 32.7° C in different months of the year. The varieties in Chlorophycean members of algae are abundant during the postmonsoon periods

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# Assessment of Mineral Nutrient and Proximate Contents of *Gongronema Latifolia* Benth from Derived Savanna And Rainforest Zones of Nigeria

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**Abstract-** Assessment of mineral nutrient and proximate contents of *Gongronema latifolia* Benth was conducted in the derived savanna and rainforest zones of Nigeria. Ogoja, in Cross River State, and Abak, in Akwa Ibom State were chosen to represent the derived savanna and rainforest zones, respectively. Five (5) sampling units were chosen for collection of samples in each experimental site. Soil and leaf (*G. latifolia*) samples were collected from the study area. The contents of N, Na, Mg, and K in soils of rainforest zone were significantly ( $P < 0.05$ ) higher than those of the derived savanna zone. The contents of K, Mg, Na, P, Cu, and Zn in leaf samples of the test crop in rainforest zone were significantly ( $P < 0.05$ ) higher than those in the derived savanna zone. Similarly, the moisture, crude fat, ash and carbohydrate content in leaf of the test crop were comparatively ( $P < 0.05$ ) higher than those of the derived savanna zones. This study suggests that the nutritional potentials of this species is influenced by ecological factors, hence, can be enhanced by using appropriate cultural practices and environmental conditions for its growth and development.

**Index Terms-** Mineral nutrient, proximate, *Gongronema latifolia*, derived savanna, rainforest

## I. INTRODUCTION

*Gongronema latifolia* Benth belongs to the family Asclepiadaceae and is regarded as a non- wood forest product of west African origin<sup>9</sup>. It is a forest leafy vegetable that grows in the forests of South- Eastern Nigeria<sup>10</sup>. Its protein contents compares favourably with percent content reported for cowpea, green pea and fluted pumpkin leaves<sup>17;18</sup>. Chemical analysis of aqueous and ethanolic extracts of the species have been reported to contain hypoglycemic, hypolipidemic and antioxidative properties<sup>17;26;27</sup>. *G. latifolium* is commonly grown and utilized as leafy vegetables for soup preparation and for medicinal used in various parts of Nigeria, and even in Africa<sup>10;17</sup>. Medicinally, its extract have been used in the treatment of diabetes, hypertension and malaria<sup>10;19;25</sup>. Nutritionally, it is widely used as a spice for sauces, soups, and salads due to its sharp-bitter and sweet taste<sup>18</sup>. The nutritional compositions of dry leaves have been shown to be riched in both proximate and mineral nutrients. It grows in rainforest, deciduous and secondary forests and also in Mangrove and disturbed road side forest, at 900m altitude above sea level<sup>17;18</sup>. Considering the importance

of this species, it is sometimes cultivated for the purpose of availability and sustainability. Ogoja is characterized by areas of derived savanna, which occur in lowland parts with intensive forest degradation, while Abak is characterized by secondary forest vegetation. The major source of livelihood in the two areas is subsistence agriculture. Therefore, the evaluation of eco-physiological parameters of this species using two ecotypes becomes increasingly important in order to provide a baseline information for continuous domestication of the species.

## II. MATERIALS AND METHODS

**Study area:** This research was conducted in Ogoja and Abak, in Cross River and Akwa Ibom States, respectively. Ogoja and Abak represent the derived savanna and rainforest zones, respectively. Abak is located at coordinates of 4°33'N and 7°33'E. Akwa Ibom State has an Altitude of 106m AMSL (Above Mean Sea Level) with a mean annual minimum and maximum temperature of 23°C and 31.7°C, respectively<sup>2;11</sup>. The coordinates of Ogoja are 6°30'N and 8°40'E. Average precipitation of 3000mm occurs annually along the coastal areas of Cross River State with an ambient minimum and maximum temperature of 22.4°C and 33.2°C, respectively<sup>12</sup>, and Altitude of 32m (105ft)<sup>3</sup>.

### Collection of samples

Leaf samples of *Gongronema latifolium* were collected from the two (2) experimental sites (Ogoja and Abak). Five (5) sampling units were randomly chosen for collection of samples in each experimental site using completely randomized design. Similarly, soil samples were collected for assessment of soil chemical properties. The mean values of the five replicates reading were presented.

### Analysis of soil samples

Soil samples (0.15cm depth) were dried, crushed and sieved using 0.2mm sieve. The chemical properties were analysed using standard procedures<sup>4</sup>.

### Analysis of plant materials

Leaf samples of the test crop were harvested, rinsed with distilled water and dried. The leaf material of each sample was crushed into powdered form using pestle and mortar. Fine powdered sample was obtained by sieving the powder through a

0.002mm wire mesh. The samples were kept in small bottles for analysis. Standard methods of <sup>4;20</sup> were used for the analysis. Phosphorus was assayed spectrophotometrically by ammonium-Vanadate-molybdate method, potassium by using a flame photometer and other elements by atomic absorption spectrophotometer.

### Statistical analysis

Standard errors of the mean values were calculated and data were subjected to Analysis of variance (ANOVA) at 0.05% probability level <sup>13</sup>.

## III. RESULTS AND DISCUSSION

The chemical properties of experimental soil are presented in Table 1. The pH of the secondary forest and derived savanna soils were slightly acidic with a pH value of 5.40 and 5.01, respectively. Higher contents of phosphorus, nitrogen, magnesium, sodium and potassium were recorded in soils of rainforest zone than those of derived savanna zone. These values showed statistical ( $P < 0.05$ ) significance. The variation in the chemical properties of the two experimental soils may be attributed to differences in prevailing ecological conditions together with the cultural practices of a given site <sup>5;14</sup>. The soil is a medium for plant growth, hence its physico-chemical properties affect the nutrients availability, absorption as well as plant growth and development <sup>21;24</sup>.

Table 2 shows the mineral element in leaf samples of *G. latifolia* from the two experimental locations. The contents of potassium, magnesium, sodium, phosphorus, copper and zinc in leaf samples of the test crop in the rainforest zone were significantly ( $P < 0.05$ ) higher than those in the derived savanna zone. The disparity in contents of mineral elements between the two ecotypes examined in this study (Ca, K, Mg, Na, P, Pb, Cu, Zn and Fe) may be due to the overriding factor of pH which regulate the acidity and alkalinity of the soil medium, hence, affects the absorption of specific nutrients <sup>6;14</sup>. Variability in soil pH may be attributed to the ecological variation between the derived savanna and secondary forest habitat, respectively. Soil pH directly affects the solubility of many nutrients in soils for proper plant growth and development <sup>15;23</sup>. Therefore, the rate of accumulation of an ion in root cells and the entire plant is proportional to the external concentration of such ions, which ultimately affect the rate of synthesis of products and metabolic processes in plant <sup>1;7</sup>.

Table 3 shows the proximate composition of leaf samples of *G. latifolia* from the two experimental locations. The moisture, crude fat, ash and carbohydrate contents in leaf of the test crop were comparatively ( $P < 0.05$ ) higher than those of the derived savanna zone. The plant-soil-water interaction plays a major role in absorption of nutrients by plants <sup>1;16</sup>. The formation of nutritional components as well as biochemical attributes in plants is regulated by these physiological reactions <sup>22</sup>. The molecular basis of the cell play some crucial role in the formation of complex molecules such as carbohydrate, proteins, fat, etc. <sup>8;16</sup>.

**Table 1: Chemical properties of experimental soil**

Sampling Site	Rainforest	Derived Savanna
Parameters		
pH	5.40 ± 0.21	5.01 ± 0.34
Available-P (mg/100g)	7.29 ± 0.36	4.42 ± 0.39
Total- N (%)	1.64 ± 0.16	0.17 ± 0.06
Organic C (%)	2.06 ± 0.12	3.02 ± 0.15
Ca (mg/100g)	2.63 ± 0.30	3.04 ± 0.46
Mg (mg/100g)	2.16 ± 0.14	1.27 ± 0.33
Na (mg/100g)	3.24 ± 0.20	0.16 ± 0.04
K (mg/100g)	1.22 ± 0.10	0.26 ± 0.02

Mean ± standard error of 5 replicates

**Table 2: Mineral element in leaf samples of *Gongronema latifolia* from the two experimental locations**

Sampling Site	Rainforest	Derived Savanna
Parameters (mg/kg)		
Calcium	79.25 ± 0.23	86.52 ± 0.42
Potassium	256.14 ± 0.19	248.36 ± 0.33
Magnesium	56.66 ± 1.18	47.21 ± 0.39
Sodium	121.35 ± 1.10	116.02 ± 1.10
Phosphorus	32.21 ± 0.34	27.07 ± 0.73
Lead	0.24 ± 0.03	0.30 ± 0.02
Copper	1.08 ± 0.10	1.02 ± 0.06
Zinc	11.21 ± 0.22	9.03 ± 0.28
Iron	0.20 ± 0.02	0.32 ± 0.02

Mean ± standard error of 5 replicates

**Table 3: Proximate composition in leaf samples of *Gongronema latifolia* from the two experimental locations**

Sampling Site	Rainforest	Derived Savanna
Parameters (%)		
Moisture	11.08 ± 0.27	11.02 ± 0.23
Crude protein	18.29 ± 0.30	20.46 ± 0.14
Crude fibre	9.02 ± 1.24	9.64 ± 0.22
Crude fat	6.17 ± 1.20	6.02 ± 1.07
Ash	11.36 ± 0.49	11.17 ± 0.34
Carbohydrate	126.21 ± 0.27	120.30 ± 0.63

Mean ± standard error of 5 replicates

## IV. CONCLUSION

This study shows that *G. latifolium* leaf has the nutritional potentials for use as a source of food nutrient for the teaming population. However, nutrient contents of the species is influenced by ecotype. Therefore, appropriate cultural practices and suitable environmental conditions are required for optimum nutritional composition of the species.

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# Elemental and Proximate Contents of *Amaranthus Hybridus* L. in Soil Supplemented with Cassava Peel of Varied Time Treatment

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**Abstract-** Studies were conducted to examine the elemental and proximate contents of *Amaranthus hybridus* L. in soil supplemented with cassava peel of varied time treatment. Compost were prepared by mixing sectioned cassava peels with 2kg of sandy-loam soil and maintained for 1, 2, 3, 4, 5 and 6 weeks alongside a control (0) containing 2kg of sandy loam soil without cassava peel. The contents of Ca, P, K, Na, and Mg significantly ( $P < 0.05$ ) increased with increase in composting time of cassava peel. Similarly, higher contents of Ca, P, K, Na and Mg were recorded in leaf of *A. hybridus* in treatment with higher composting time of cassava peel compared to treatments with lower composting time and the control. The leaf proximate contents in *A. hybridus* significantly ( $P < 0.05$ ) increased with increase in the composting time of cassava peel. This result suggests that a longer duration of composting time is necessary for optimum biodegradation, increased nutrients contents and reduced inhibitory substances in cassava peel manure.

**Index Terms-** Elemental, proximate, soil, *Amaranthus hybridus*, cassava peel.

## I. INTRODUCTION

Organic manure is indispensable to the nutrients enhancement of the soil because of its immense value in supplying nutrients slowly in the soil<sup>6</sup>. Organic manure increases the fertility and productivity of soils by providing all the nutrients that are required by plants but in limited quantities, maintains soil carbon to nitrogen ratio, improves the soil physical, chemical and biological properties, and increases the water holding capacity of the soil<sup>12;21</sup>. Composting is strategically designed to convert organic substrate aerobically by microorganisms into carbon dioxide, water, minerals, and stabilized organic matter. It is characterized by a solid stage fermentation process of microbial degradation and mineralization<sup>5;18</sup>. It requires a regulated environmental condition such as moisture, aeration and temperature for optimum microbial degradation<sup>9;23</sup>. Cassava peels consist of cellulose, hemicelluloses and lignin, hence it is a nutrient supplements. *Manihot esculenta* Crantz, from which the cassava peels were generated, is a global stable economic and food crop<sup>25</sup>. *Amaranthus hybridus* L. belongs to the family Amaranthaceae, and is known to be domesticated prehistorically in the highlands of tropical and subtropical America<sup>4;20</sup>. It is an erect, glabrous or hairy plant with alternate simple leaves and

flowers that are borne in axillary clusters or in terminal ears or panicles<sup>11;20</sup>. The nutritional value and yield of its grains compares favourably with maize and other true cereals, while the leaf and young plants are consumed as vegetables in soups and often gathered as potherbs<sup>2;3;11</sup>. The excessive reliance on chemical fertilizers and the negligence shown to the conservation and utilization of organic nutrient sources have caused the exhaustion of soil of its nutrient reserves and led to soil health problems not conducive to achieving consistent increase in agricultural production<sup>17;21</sup>. Therefore, this research was conducted to assess the nutrient profiles of the test crop in soil treated with cassava peels of varied composting time.

## II. MATERIALS AND METHODS

### Germination Study:

Cassava peels were obtained from *Manihot esculenta* Crantz from Abak Local Government Area of Akwa Ibom State. Cassava peels were dried and further sectioned into tiny particles of about 0.50cm. Compost was prepared by mixing the sectioned cassava peels with 2kg of sandy-loam soil obtained from Abak Local Government Area of Akwa Ibom State, Nigeria, and stacked into a heap of 1.50m height and 1.50m base width and left to compost for 1, 2, 3, 4, 5 and 6 weeks, with regular turnings every 2 days. The moisture content was maintained at 68- 70%. Each treatment was transferred into a perforated polybag. A control (0) was set up containing 2kg of sandy loam soil without cassava peel. Five (5) seeds of *A. hybridus* were sown in each polybag and after germination were thinned down to 3 seedlings per bag. Each treatment was replicated 5 times using completely randomized design. The experimental set up was maintained at a mean minimum temperature of 22.44°C and a mean maximum temperature of 33.07°C, under natural light condition for eight (8) weeks.

### Analysis of Soil Samples:

Top soils of 0-15 cm depth were collected from the study site, Abak Local government Area of Akwa Ibom state, Nigeria. Soil chemical properties were analysed using standard procedures of<sup>13</sup>.

### Analysis of Plant Samples:

Leaf samples of *Amaranthus hybridus* were harvested at the end of the experiment (8 weeks), and thoroughly washed with water. Leaf samples were rinsed with distilled water, kept in polybags and oven dried to a constant weight at 60°C. The dried

leaf samples were macerated to powder form using pestle and mortar and kept in sample bottles for analysis. Mineral and proximate content in leaf samples were determined using standard methods <sup>7;13</sup>.

**Statistical Analysis**

Standard errors of the mean values were calculated for the separate readings and data were subjected to analysis of variance (ANOVA) according to the method of <sup>16</sup>.

**III. RESULT AND DISCUSSION**

Table 1 shows the chemical properties of experimental soil before application of cassava peel. The experimental soil was slightly acidic with a pH of 5.40. Abak, the study area is a tropical environment with its characteristic low nutrients contents and strong acidity, which is attributed to high rainfall and consequently leaching of basic cations out of the root zone of soils <sup>17;19</sup>.

Table 2 shows the chemical properties of experimental soil with cassava peels conditioned for varying duration of time. The contents of calcium, phosphorus, potassium, sodium and magnesium in the experimental soils significantly ( $P < 0.05$ ) increased with increase in composting time of cassava peel. These values were relatively higher than that of the control (0) treatment. Nutrients are released during aerobic decomposition of organic manure <sup>1;24</sup>. The released nutrients together with temperature effects have been identified as contributory factors in the biodegradation of cassava peels by microorganisms <sup>14;22</sup>. Dead plant tissues tend to undergo decay and are transformed into microbial cells and a vast heterogenous body of carbonaceous compounds <sup>21</sup>. Therefore, microbial metabolism are enhanced due to the available carbonaceous compounds which leads to increased soil organic matter <sup>8</sup>.

The leaf mineral nutrients contents of *A. hybridus* in soil supplemented with cassava peels conditioned for varying duration of time are presented (Table 3). The high mineral nutrient contents in treatment with higher composting time of cassava peel may be attributed to the conversion of the secondary products in carbon sources for optimum metabolic processes in the test crop. Organic manure plays an important role in supplying the readily plant minerals and in providing better soil conditions <sup>6;23</sup>. Reduction in leaf mineral nutrient content at lower duration of composting time may be due to exhaustion of nutrients in the growth medium and accumulation of growth inhibiting metabolites. Processing and decomposition of cassava peel have been shown to reduce the cyanogenic glucoside to relatively insignificant levels <sup>9;15</sup>.

Table 4 shows the leaf proximate contents of *A. hybridus* in soil supplemented with cassava peel conditioned for varying duration of time. Higher values of moisture, ash, fat, crude

protein, crude fibre and carbohydrate were recorded at higher duration of composting time. Complex molecules such as carbohydrate and proteins play some crucial roles in the body of plants. Enzymes activities and protein synthesis as well as various metabolic processes have been shown to be regulated by nitrogen and carbon <sup>10;22</sup>. The digestion of cellulose and hemicellulose together with the nutrient composition from the organic manure enhance the formation of secondary products <sup>9;24</sup>.

**Table 1: Chemical properties of experimental soil before application of cassava peel**

Parameters	Content
pH	5.40 ± 0.21
Organic matter (%)	2.20 ± 0.43
Total nitrogen (%)	1.24 ± 0.55
Available phosphorus (%)	0.97 ± 0.02
Calcium (mg/100g)	5.30 ± 0.13
Magnesium (mg/100g)	3.52 ± 0.16
Sodium (mg/100g)	2.02 ± 0.10
Potassium (mg/100g)	1.70 ± 0.25

Mean ± standard error from 5 replicates

**Table 2: Chemical properties of experimental soil with cassava peels conditioned for varying duration of time**

Duration (wks)	0	1	2	3	4	5	6
Mineral Element (g/kg)							
Ca	5.72 ± 0.27	6.63 ± 0.34	6.72 ± 0.12	7.07 ± 0.56	7.25 ± 0.26	7.43 ± 0.43	7.54 ± 0.31
p	0.99 ± 0.43	20.12 ± 0.25	25.17 ± 0.46	25.32 ± 0.24	25.56 ± 0.33	30.65 ± 0.41	30.72 ± 0.10
K	2.83 ± 0.17	5.26 ± 0.20	5.43 ± 0.35	6.64 ± 0.15	7.43 ± 0.07	7.84 ± 0.12	9.13 ± 0.27
Na	2.23 ± 0.33	3.20 ± 0.16	3.17 ± 0.20	4.14 ± 0.34	4.30 ± 0.25	5.20 ± 0.42	5.85 ± 0.36
Mg	3.40 ± 0.97	4.27 ± 0.63	4.32 ± 0.36	4.40 ± 0.33	4.52 ± 0.18	5.17 ± 0.23	5.32 ± 0.46

Mean ± standard error from 5 replicates

**Table 3: Leaf mineral nutrient contents of *Amaranthus hybridus* in soil supplemented with cassava peels conditioned for varying duration of time**

Duration (wks)	0	1	2	3	4	5	6
Mineral Element (mg/100g)							
Ca	32.12 ± 0.28	40.27 ± 0.53	42.14 ± 0.13	47.66 ± 0.77	50.42 ± 0.16	54.20 ± 0.26	60.32 ± 0.20
Na	4.08 ± 0.53	6.92 ± 0.35	8.20 ± 0.20	10.41 ± 0.64	10.83 ± 0.10	11.06 ± 0.45	12.20 ± 0.63
K	42.81 ± 0.24	56.21 ± 0.74	57.34 ± 0.43	59.17 ± 0.30	60.22 ± 0.36	62.08 ± 0.29	62.96 ± 0.27
Mg	180.20 ± 0.22	221.36 ± 0.36	221.70 ± 0.69	223.10 ± 0.26	227.41 ± 0.54	228.05 ± 0.43	230.10 ± 0.13
P	20.47 ± 0.66	28.21 ± 0.43	29.04 ± 0.29	31.46 ± 0.36	32.07 ± 0.47	33.02 ± 0.19	33.67 ± 0.39

Mean ± standard error from 5 replicates

**Table 4: Leaf proximate contents of *Amaranthus hybridus* in soil supplemented with cassava peels conditioned for varying duration of time**

Duration (wks)	0	1	2	3	4	5	6
Mineral Element (%)							
Moisture	15.78 ± 0.23	22.32 ± 0.32	25.20 ± 0.43	27.43 ± 0.31	30.09 ± 0.45	42.30 ± 0.21	46.07 ± 0.80
Ash	10.33 ± 0.42	12.24 ± 0.65	12.39 ± 0.32	12.67 ± 0.22	13.04 ± 0.46	13.93 ± 0.86	14.62 ± 0.21
Fat	9.02 ± 0.12	10.20 ± 0.33	10.47 ± 0.46	11.26 ± 0.54	12.30 ± 0.68	12.56 ± 0.35	12.90 ± 0.66
Crude protein	17.24 ± 0.18	20.07 ± 0.23	21.52 ± 0.56	22.46 ± 0.47	23.07 ± 0.63	24.10 ± 0.28	25.20 ± 0.16
Crude fibre	4.37 ± 0.10	6.02 ± 0.19	7.21 ± 0.43	7.80 ± 0.52	8.01 ± 0.09	8.21 ± 0.33	8.30 ± 0.26
Carbohydrate	5.20 ± 0.31	7.32 ± 0.45	10.24 ± 0.32	12.56 ± 0.13	12.87 ± 0.44	15.06 ± 0.31	21.09 ± 0.43

Mean ± standard error from 5 replicates

#### IV. CONCLUSION

This study showed that regular recycling of organic wastes in the soil is the most efficient method of maintaining optimum levels of soil organic matter and agricultural productivity.

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# Thermal Performance Evaluation of Spiral Solar Air Heater

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**Abstract-** The depletion of fuel sources leads to energy crisis is serious and burning issue. The alternative energy is always better option and out of available resources like solar energy, wind energy and biomass; but compare to wind energy and bio mass solar energy is always better option because solar energy is the easiest source to extract useful energy in terms of availability in ample amount. The objective of present work is to develop spiral solar air heater and performance will be check using K type thermocouple.

**Index Terms-** Alternative energy, Solar Energy, Spiral Solar Air Heater

## I. INTRODUCTION

Situation in energetic become more acute with every year. With increase of manufacturing, increases both need for heat as well as for electrical energy. It is well known that great amount of total consumed energy is produced in way of combustion of several fossil fuels: solid, liquid and gaseous. As known fossil fuels are expensive, require for a stockroom, combustion of them makes pollution of the atmosphere and resources of fossil fuels in the nearest future will run away. These are reasons why an alternative energy sources are becoming more and more charismatic. Latvia is not rich in natural energy sources - approximately 70 % of them have to be imported. Solution of this problem is focusing to an alternative energy sources. Like an alternative energy sources in Latvia it is possible to use: biomass, biogas, waterpower, wind energy, geothermal heat and solar radiation. Solar radiation for water heating widely worldwide is used. In A lot of constructions of solar devices worldwide are known and each one of them is efficient in some specific locations and weather conditions.

Solar energy can be used by three technological processes: chemical, electrical and thermal. Chemical process, through photosynthesis, maintains life on earth by producing food and converting CO<sub>2</sub> to O<sub>2</sub>. Electrical process, using photovoltaic converters, provides power for spacecraft and is used in many terrestrial applications. Thermal process can be used to provide much of the thermal energy required for solar water heating and building heating. Another one form of converted solar radiation is mechanical energy as wind and water steams.

## II. SOLAR AIR HEATER [1]

Air systems are indirect water heating systems that circulate air via ductwork through the collectors to an air-to-liquid heat exchanger. In the heat exchanger, heat is transferred to the potable water, which is also circulated through the heat exchanger and returned to the storage tank. The main advantage of the system is that air does not need to be protected from freezing or boiling, is non-corrosive, and is free. The disadvantages are that air handling equipment (ducts and fans) need more space than piping and pumps, air leaks are difficult to detect, and parasitic power consumption is generally higher than that of liquid systems.

### Types of Solar Air Heaters

1. Classification According to Air Channel Flow Configuration
  - Single Flow Single Pass
  - Double Flow Single Pass
  - Single Flow Double Pass
  - Single Flow Recycled Double Pass
2. Classification According to Air Channel Design
  - Flat Plate
  - Extended Surface Assisted
  - Porous Media Assisted

TabishAlam, R.P.Saini, J.S.Saini [2] investigated the effect of different turbulators on heat and flow characteristics of air heater ducts winglet were used in air heaters and found suitable to create turbulence to increase the heat transfer rate; however, substantial increase in pressure drop has been observed. Therefore, the design of the vortex generator is found to be a very critical task which needs attention to minimize the pressure drop through ducts.

Anil SinghYadav, ManishKumarThapak [3] studied the effect of artificial roughness in the duct of solar air heater performance and concluded that is an effective technique to enhance the rate of heat transfer to fluid flow in the duct of a solar air heater.

Ebru Kavak Akpınar, Fatih Kocyiğit [4] performed the experimental investigation on effect of different obstacles on thermal performance of solar air heater. In the present study, four solar air collectors were tested and a comparison was made among them on the basis of first and second law efficiencies. It was shown that the efficiency of the solar air collectors depended

significantly on the solar radiation, surface geometry of the collectors and extension of the air flow line.

A.A. El-Sebaei, H. Al-Snani [5] studied effect on performance of solar air heater by various coating on absorber plate. To improve the heater performance, effect of using absorber plates coated with various selective coating materials on the heater performance was also investigated. The best performance was achieved using nickel–tin as a selective coating material with a daily average of the instantaneous efficiency of 0.46.

Rene Tchinda [6] focused on thermal behavior of solar air heater with compound parabolic concentrator with mathematical model for computing thermal performance of solar air heater with cpc having a flat one sided absorber plate and in experimentation consider the effect of air mass flow rate, the wind speed and the collector length investigated.

The present work related to study of copper tube shape on the thermal performance of solar air heater.

### III. EXPERIMENTAL SET UP

In the present experimental setup following parts are used

1. ½ inch copper pipes with 20 gauge of sheet of 1 m length.
2. ½ inch spiral copper pipes with 20 gauge of sheet of 1.5' diameter approximately.
3. 2 mm thick MS sheet with 1m X 0.5 m X 0.05m as solar heater (Straight Tube).
4. 2 mm thick MS sheet with 0.35m X 0.5 m X 0.05m as solar heater (Spiral).
5. Plain glass with above mention size and 3 mm thick
6. K type thermocouple
7. Digital Temperature indicator
8. Variable Blower Speed



**Fig 1 Spiral Solar Air Heater**



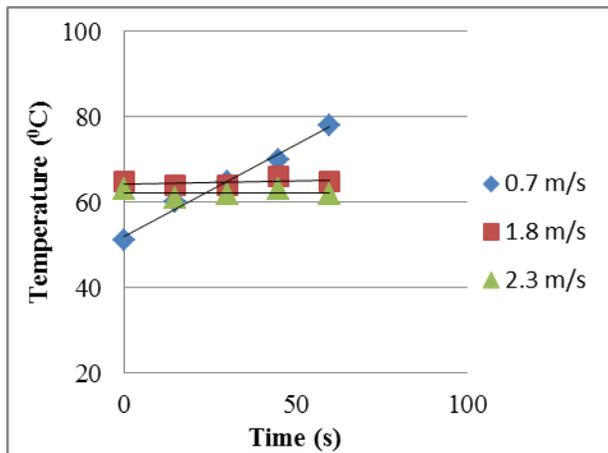
**Fig 2 Spiral Coil**

### IV. RESULT AND DISCUSSION

#### Experimental Procedure

First of arrange the experimental set up in north south position and then connect the blower with set up using speed control electrical circuit and arrange three thermocouples out of two one at inlet and other at outlet and one on the body to measure temperature at different locations; set the blower at different speed using position of blower at position 4, 5 and 6.

Time (in)	T1 (°C)	T2 (°C)	T3 (°C)
<b>Low Velocity (0.7 m/s)</b>			
0	42	76	51
15	42	80	60
30	42	90	65
45	42	90	70
60	42	92	78
<b>Medium Velocity (1.8 m/s)</b>			
0	44	90	65
15	44	87	64
30	44	86	64
45	44	88	66
60	44	86	65
<b>High Velocity (2.3 m/s)</b>			
0	43	82	63
15	43	83	61
30	43	84	62
45	43	83	63
60	43	84	62



At low velocity of air rise in temperature is high may be because of high retention period and more turbulent in the flow and as velocity increases the temperature rise reduces and rise in temperature in low range

#### V. CONCLUSION

The spiral solar air heater is compact and efficient and its performance is better at low velocity of air.

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# Cutaneous vasculitis: An etiological and clinicopathological study

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**Abstract- Background:** Cutaneous vasculitis has varied clinical manifestations. Skin is involved in both small vessel vasculitis and medium vessel vasculitis. Skin biopsy is the gold standard for the diagnosis of cutaneous vasculitis. Based on histology, vasculitis can be classified on the size of vessels affected and the dominant immune cell mediating the inflammation. Along with histopathology, other investigations like complete hemogram and serology are needed to make an etiological diagnosis.

**Objectives:** 1. To study the different patterns of cutaneous vasculitis along with their underlying etiologic factors  
2. To assess the clinicopathological correlation.

**Materials and methods:** A retrospective study over a period of 3 years from July 2011 to July 2014 was conducted. Histopathologically diagnosed cases of cutaneous vasculitis were included in the study and analyzed with the clinical details and investigations.

**Results:** Out of 56 patients, 35 patients had idiopathic cutaneous small vessel vasculitis (CSVV) and 10 patients had urticarial vasculitis. Purpura was the most common cutaneous manifestation, seen in 41 patients. Histologically the most common pattern observed was leukocytoclastic vasculitis, seen in 32 of cases.

**Conclusion:** The workup of patients with cutaneous vasculitis includes detailed history, clinical examination, skin biopsy and other investigations to rule out multisystem involvement. Follow up is essential as cutaneous manifestation may be the early indication of serious systemic involvement.

**Index Terms-** Leukocytoclastic vasculitis, cutaneous vasculitis

## I. INTRODUCTION

Vasculitis is the inflammation of blood vessel wall. It has a wide range of clinical manifestations. It can range in severity from a self-limited single-organ disorder to a life-threatening disease with the prospect of multiple-organ failure.<sup>1</sup> It may be a primary disorder or a presenting sign of primary systemic vasculitis such as Polyarteritis nodosa (PAN), Wegener's granulomatosis (WG), Churg Strauss syndrome (CSS) or secondary to drugs, infections or systemic diseases such as connective tissue disease (CTD) and malignancy.<sup>1,2</sup>

Based on the size of the vessel wall affected, cutaneous vasculitis is classified as small vessel vasculitis (SVV), medium vessel vasculitis (MVV) and large vessel vasculitis. Skin is affected in both SVV and MVV. Cutaneous vasculitides are usually characterized histologically by leukocytoclastic changes. Their histology shows infiltration of neutrophils within and around blood vessel walls, leukocytoclasia (degranulation and

fragmentation of neutrophils leading to the production of nuclear "dust"), fibrinoid necrosis of the damaged vessel walls, and necrosis, swelling and proliferation of the endothelial cells.<sup>3</sup>

Clinical manifestations of cutaneous vasculitis occur when small and/or medium vessels are involved. Small vessel vasculitis can present as palpable purpura, urticaria, pustules, vesicles, petechiae, or erythema multiforme-like lesions. Signs of medium vessel vasculitis include livedo reticularis, ulcers, and subcutaneous nodules.<sup>4</sup>

The classification of vasculitis is controversial with no generally accepted classification system. The classification system of the American College of Rheumatology (ACR) and of the Chapel Hill Consensus Conference (CHCC) have gained wide acceptance. Classification system of ACR of 1990 is based on clinical, histological and disease history while that of CHCC is based solely on histopathology.<sup>5,6</sup>

Although there is a multitude of causes of cutaneous vasculitis, most of the cases are idiopathic.<sup>4</sup> The frequency of each of the cause is variable depending upon the epidemiological difference and prevalence of infections. Histopathology can be significantly variable and several overlapping features are seen between SVV and MVV.

There are only few studies from India on cutaneous vasculitis. This study was undertaken to evaluate the etiological factors and clinicopathological association with clinical lesions in patients with cutaneous vasculitis.

## II. MATERIALS AND METHODS

The medical records of histopathologically proven cases of cutaneous vasculitis over a period of 3 years from July 2011 to July 2014 were analyzed at the Department of Dermatology, Father Muller Medical College, Mangalore, Karnataka, India. Age, sex, clinical history, possible etiologic factors, associated conditions and examination details of all the patients were recorded. A detailed perusal of the recorded history was done regarding the duration of vasculitis, constitutional and systemic symptoms, infections, drug intake, food allergy, malignancy, collagen vascular disease and any other coexisting systemic disorder. The investigative profile of each patient was noted. Histopathological re-evaluation of the skin biopsies stained with haematoxylin and eosin stain was done and findings were recorded. The diagnosis of cutaneous leukocytoclastic vasculitis was confirmed in the patients by the presence of an inflammatory infiltrate predominantly constituted by neutrophils, nuclear fragmentation, extravasation of RBCs and necrosis of dermal vessel walls.

## RESULTS

Table 1 shows age distribution of the patients where minimum age was 11 years and maximum age was 63 years with mean age of  $34 \pm 12.12$  years. There were 32(57.14%) females and 24 (42.85%) males.

Minimum duration of disease was 2 days and maximum 90 days with more than 75% of the patients giving history of sudden onset of the symptoms. About 78.57% cases had a rapid progression of disease.

Aggravating factors included, drugs in 17.8% cases, exercise in 16%, and trauma and water exposure in 1.7% each. History of drug intake was present in 9 (30%) patients. The drugs associated with vasculitis were NSAIDs in 4 (40%) cases, antibiotics, antidiabetics and homeopathic drugs in 2 cases each.

Table 2 shows the symptoms of the patients where 30 (53.5%) patients had developed pain, 22 (39.3%) itching, 16 (28.5%) burning sensation. Constitutional symptoms such as fever was present in 13 (23.2%), arthralgia in 10 (17.8%) and myalgia in 8 (14.2%) of the patients. Systemic symptoms such as abdominal pain was present in 7 (12.5%), cough in 6 (10.7%), hematuria in 4 (7.1%), paresthesia in 3 and oral ulcers in 1 of the patients. The involvement of body parts of the patients showed 56 (100%) of lower extremity, 8(14.2%) of upper extremity, 6 (10.7%) of trunk and generalized 4 (7.1%) involvement.

The morphology of lesion of the patients were 73% of palpable purpura (figure 1), more than 58% of petechiae, 35% of plaques, 28.5% papules, more than 16% ulcers, 28.5% vesicles and less than 10% pustules and necrosis. The most common combination of lesions was purpura and petechiae which was 18(32%)(figure 2)

Table 3 shows laboratory tests done in the patients. ESR was raised in 12(21%) of the patients, anemia was found in 4(7.14%) of the patients. Leukocytosis was found in 3 of the patients. Albuminuria and hematuria in urine examination was found in 2 patients each. ANA was positive in 1 patient. Renal function tests and liver function tests were normal in all patients.

Histopathological and direct immunofluorescence findings are shown in Table 4. Leukocytoclastic vasculitis (figure 3) was the most common pattern seen in 32 (57.1%) patients whereas lymphocytic vasculitis (figure 4) was noted in 22 (39.2%), granulomatous and eosinophilic vasculitis in 1 patient each.

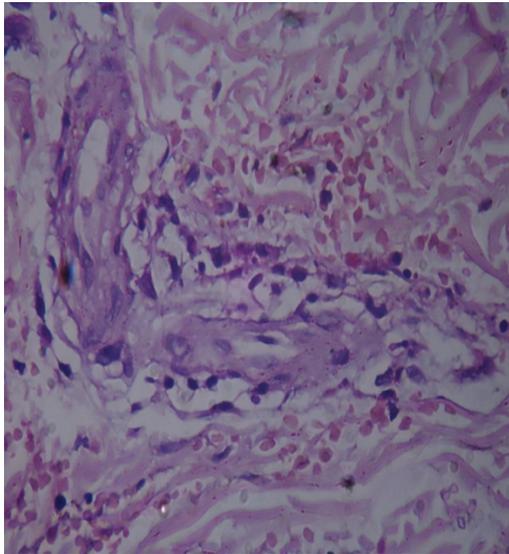
Out of 56, DIF was done on 10 patients. Among them 6 (10.7%) had IgA and C3 deposits and 3 (5.3%) had fibrin and C3 deposit. No deposition was found in 1 case.



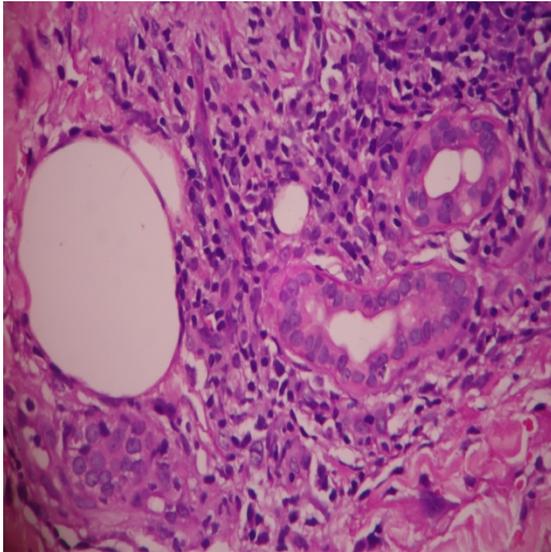
**Figure 1: Palpable purpura**



**Fig 2: purpura and petechiae**



**Figure 3: leukocytoclastic vasculitis showing fibrinoid necrosis**



**Figure 4: lymphocytic vasculitis showing lymphocytic infiltration.**

<b>Table 1: Demographic and clinical characteristics of study population (n=56)</b>	
<b>Age(years)</b>	
Minimum	11
Maximum	63
Mean age	34±12.12
<b>Sex, n (%).</b>	
Male	24(57.14%)
Female	32(42.85%)

<b>Mode of onset, n (%)</b>	
Sudden	42(75%)
Insidious	14(25%)
<b>Duration of disease(days)</b>	
Minimum	2
Maximum	90
Mean	32±10.14
<b>Progression of disease, n (%)</b>	
Rapid	44(78.57%)
Slow	12(21.42%)
<b>Aggravating factors, n (%)</b>	
Drugs	10(17.86%)
Exercise	9(16.07%)
Trauma	1(1.78%)
Exposure to water	1(1.78%)
<b>Drug history, n (%)</b>	
Present	10(17.86%)
Absent	46(82.14%)
<b>Drugs used, n=10(%)</b>	
NSAIDs	4(40%)
Antibiotics	2(20%)
Antidiabetics	2(20%)
Homeopathic medications	2(20%)

<b>Table 2:Symptoms, morphology and distribution(n=56)</b>	
<b>Presenting symptoms</b>	
Pain	30(53.58%)
Itching	22(39.3%)
Burning	16(28.57%)
<b>Constitutional symptoms</b>	
Fever	13(23.21%)
Arthralgia	10(17.85%)
Myalgia	8(14.28%)
<b>Systemic symptoms</b>	

Abdominal pain	7(12.5%)
Cough	6(10.71%)
Hematuria	4(7.14%)
Paresthesia	3(5.35%)
Oral ulcer	1(1.7%)
<b>Morphology of lesions</b>	
Palpable purpura	41(73.21%)
Petechiae	33(58.92%)
Plaques	20(35.71%)
Papules	16(28.57%)
Vesicles and bullae	16(28.57%)
Ulcers	9(16.07%)
Urticarial lesions	9(16.97%)
Pustules	1(1.7%)
Necrosis	1(1.7%)
<b>Combination of lesions</b>	
Purpura and petechiae	18(32.14%)
Purpura, papules and petechiae	12(21.42%)
Purpura and ulceration	10(17.85%)
Others	16(28.57%)
<b>Sites affected</b>	
Lower extremities	56(100%)
Upper extremities	8(14.28%)
Trunk	6(10.71%)
Generalised	4(7.14%)

Table 3: Laboratory parameters	n(%)
ESR	12(21%)
Anemia	4(7.14%)
Leukocytosis	3(5.35%)
Albuminuria	2(3.57%)
Hematuria	2(3.57%)
ANA	1(1.7%)

Table 4: Histopathological and DIF findings	
Leukocytoclastic vasculitis	32(57.14%)
Lymphocytic vasculitis	22(39.28%)
Granulomatous vasculitis	1(1.7%)
Eosinophilic vasculitis	1(1.7%)
<b>Immunoreactants (n=10)</b>	
IgA and c3	6(10.71%)
Fibrinogen and c3	3(5.35%)
No deposit	1(1.7%)

Table 5: Histopathological feature	
Inflammatory infiltrate	56(100%)
Leukocytoclasia	30(53.5%)
Endothelial cell swelling	28(50%)
Dermal edema	26(46.4%)
RBC extravasation	20(35.7%)
Fibrinoid necrosis	15(26.7%)
Fibrin deposition	9(16%)

Table 5 shows the histopathological features in the slides examined. Inflammatory infiltrate was seen in all cases (100%). The second most common finding was leukocytoclasia, seen in 30(53.5%) of the slides, followed by endothelial cell swelling in 28(50%), dermal edema in 26(46.4%). Fibrin deposition was seen only in 9(16%) of the slides

Table 6: Clinical diagnosis	no	Histopathological diagnosis	No
HSP	6	Leukocytoclastic vasculitis	6
Urticarial vasculitis	10	Leukocytoclastic vasculitis	10
CTD	1	Leukocytoclastic vasculitis	1
PAN	2	Lymphocytic vasculitis	1
Eosinophilic vasculitis	1	Eosinophilic vasculitis	1
Idiopathic CSSV	35	Leukocytoclastic vasculitis	25
		Lymphocytic vasculitis	9
		Granulomatous vasculitis	1

Table 6 shows the clinicopathological correlation between clinical and histopathological diagnosis. Among the cases of HSP, leukocytoclastic vasculitis was seen histologically in all 6 patients. All 10 cases of urticarial vasculitis showed leukocytoclastic vasculitis on histopathology. Among the 35 cases of idiopathic CSSV, 25 cases show leukocytoclastic vasculitis, 9 cases showed lymphocytic vasculitis and 1 case showed granulomatous vasculitis

### III. DISCUSSION

Cutaneous vasculitis is a poorly understood entity due to its varied clinical manifestation and its overlap with various infections, connective tissue disorders and malignancies. In this study, history, clinical features, and various laboratory tests were recorded and analysed to reach a clinical diagnosis of cutaneous vasculitis. An attempt was also made to categorize the disease entities seen. Our study confirms various established facts regarding cutaneous vasculitis.

The medical records of a total of 56 patients were analyzed, their age ranged from 11 years to 63 years with mean age of 34±12.12 years. Males and females were almost equally affected in our study. A study by Leelavathi et al<sup>7</sup> showed age range of

13-93 years and mean age was 36.5 years, with equal occurrence among males and females, which was similar to our study.

In our study history of aggravating factors were identified in 21 (37.5%) patients; among them drugs, 10 (47.8%), exercise, 9 (42.8%), trauma and water exposure were the listed factors. In a study by Chowdhury et al,<sup>8</sup> drugs(30%), exercise(26%) were the aggravating factors. In another study by Sais et al,<sup>9</sup> exercise (30.5%) was the main aggravating factor of cutaneous vasculitis. These results are similar to our findings.

The duration of lesions ranged from 2 to 90 days. We found that in most of the cases, the onset of disease was sudden (75%) and the progression of disease was rapid (78%). This is similar to the study by Chowdhury et al.<sup>8</sup>

Pain was the most common presenting symptom in our study, present in 53% of the patients. This was followed by itching in 39.3%, burning sensation in 28.57% of the patients. Constitutional symptoms such as fever were present in 23.21%, arthralgia in 17.8% and myalgia in 14.2 % of the patients. Systemic symptoms such as abdominal pain was present in 12.5%, cough in 10.7% of the patients. This is similar to study by Chowdhury et al<sup>8</sup> where pain was present in 86% of the patients.

Several types of cutaneous lesions were seen in our patients. Palpable purpura was the most common type of lesion found in 73% of the patients. Petechiae were the second most common type of lesions found in 58% of the patients. All the patients had involvement of lower limbs. These findings are similar to the reports by Chowdhury et al<sup>8</sup> who found palpable purpura in 43.3% of their patients, petechiae in 58% of the patients. Also, in another study by Gupta et al,<sup>10</sup> 86% of skin lesions were palpable purpura. In studies by Chowdhury et al<sup>8</sup> and Alexander et al,<sup>11</sup> 100% patients and 38% patients respectively had involvement of lower limbs, similar to our study.

Histopathological slides were re-examined in all cases which showed leukocytoclastic vasculitis in 57% of the cases, where predominant finding was leukocytoclasia. Lymphocytic vasculitis was seen in 39% of the cases. These findings are similar to studies by Gupta et al<sup>10</sup> where 72% cases of leukocytoclastic small vessel vasculitis were found in their patients and study by Chowdhury et al<sup>8</sup> where leukocytoclastic vasculitis was seen in 70% and lymphocytic vasculitis in 27% of their patients.

ESR was raised in 12(21%) of the patients, anemia was found in 4(7.14%) of the patients. Leukocytosis was found in 3 patients. Albuminuria and hematuria in urine examination was found in 2 patients each. ANA was positive in 1 patient. These findings are similar to study by Gupta et al<sup>10</sup> where 20% of the patients had elevated ESR, anemia was seen in 8% and leukocytosis 12% of their patients.

In our study, idiopathic Cutaneous small vessel vasculitis (CSVV) was found in 35(62.5%) cases, urticarial vasculitis in 10(17.8%) of the patients and HSP in 6(10.7%) of the patients. We found 10 (17.85%) of our cases were drug induced. Causes of vasculitis were undefined in 35 (62.5%) of our patients. In a study by Alexander et al<sup>11</sup> 78% cases were idiopathic, this was similar to our study. However, our findings differ from a study by Chowdhury et al<sup>8</sup> where in etiology was not defined in 46.7% of their patients.

#### IV. CONCLUSION

Although the relatively benign condition of primary cutaneous small vessel vasculitis is the commonest type encountered in adults, a wide spectrum of clinical associations and laboratory anomalies have been observed. Based on our data, work-up for patients with cutaneous vasculitis including clinical history and examination, skin biopsy, haemogram, ANA, routine biochemical profile, and urine examination is recommended. Lastly, careful follow-up of these patients is necessary as cutaneous manifestations might be just the forme fruste of serious systemic disease.

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# Evaluation of Land Suitability for Agriculture under Irrigation at Khartoum North, Sudan

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**Abstract-** This study focused on genesis, classification, land suitability and land suitability evaluation for agriculture under irrigation and crop suitability of some soils of the River Nile terraces at Khartoum North, Sudan. Three river terraces comprising nine profiles were selected to cover the physiographic positions. Qualitative evaluation was carried out by means of parametric method. The capability index (Ci) was calculated by a weighted average for the upper 100 cm of the soil profile for slope class, texture, soil depth, calcium carbonate status, salinity/alkalinity, and drainage. The results revealed that the soil of the physiographic unit 1(first terrace) was suitable for agriculture (S2) due to limitations of soil texture and moderately drainage, while the unit 2 and 3(second and third terraces respectively) were slightly suitable (S3) due to limitations of poorly drainage (low infiltration rate) and texture (clay). The slope, soil depth, CaCO<sub>3</sub> and salinity and alkalinity were not considered as limiting factors in all study area.

**Index Terms-** Land suitability, River Nile terraces, qualitative evaluation, parametric method, capability index.

## I. INTRODUCTION

The Sudan located within the zone where the hazards of land degradation are great. Total area of 65 million hectares, located between latitude and longitude (32° 52' 16.48"E, 14° 24' 05.65"N) and latitude and longitude (32° 8' 1.48"E, 15° 9' 33.48"N), extending across the Country from east to west has been decertified or degraded land (DECARP, 1974). Availability of irrigation leads to land use change as well as intensive cropping system. Improper use of irrigation water has resulted in environmental degradation of natural resources that leads to decline in the productivity of land resources and deterioration of land quality for its future use (Suresh et al., 2002). With the increase of demand for land, land evaluation has become more important as people strive to make better use of the limited land resources. Land evaluation is the process of assessment land performance for specified purposes (Rossiter, 1996).

Sys et al., (1991) suggested a parametric system in order to evaluate land suitability for irrigation. The system was based on

the standard granulometrical and soil physio-chemical properties. According to their system, the factors influencing the soil suitability for irrigation can therefore be subdivided in the following four groups: physical properties determining the soil-water relationship in the soil such as permeability and available water content; chemical properties interfering with the salinity/alkalinity status such as soluble salts and exchangeable Na; drainage properties and environmental factors such as slope. In Sudan limited number of studies and fulfillments were made to assess the irrigation potential based on the physical land and water resources (Kevie and El-Tom, 2004). Small scale studies conducted on soils of the country seem to be inappropriate in providing basic soil information that can help to make decision on proper utilization of resources. The soils of the River Nile terraces are used for agricultural production to meet the demands of the densely population capital. However, the selection of crops cultivated is erratic and traditional. Therefore, there is a real need for scientific and sound strategy to put these soils in their optimal use to the best interest of the farmers as well as the population of the capital. Therefore, the objective of this study was to determine the land suitability of the study area for irrigation purpose by using the parametric evaluation system.

## II. MATERIALS AND METHODS

### Study area and soil sampling:

The study area is located in the northeastern part of Khartoum North, Sudan between the River Nile at El Khogalab village and extending eastwards till the piedmont plain (Fig. 1). According to Van der Kevie (1973), the study area falls within the semi desert zone. The average annual rainfall varies from 100-225 mm. Mean maximum temperature of the hottest months May and June is 40 and 42°C, respectively. Mean minimum temperature of the coldest month (January) is 13-16°C. The dominant vegetation of the study area are *Capparis deciduas* and *Acacia seyal*. According to the Soil Taxonomy (2014), the soils of the study area belong within Entisols and Aridisols orders.

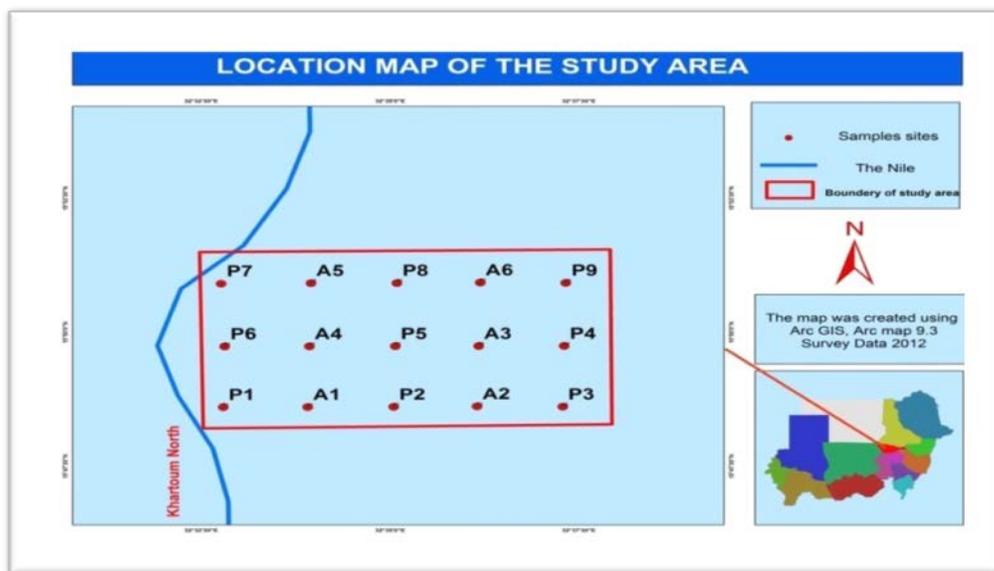


Figure (.1): The study area and sites of the soil samples.

Nine soil profiles were chosen to represent the different terraces of the River Nile at Khartoum North, Sudan. Profiles 1, 6 and 7 represent the very recent (first terrace) Nile terrace soils. Profiles 2, 5 and 8 represent the succeeding terrace soils (second terrace), while profiles 3, 4 and 9 are the intermixing of the alluvial plain and the piedmont.

**Soil analysis and land evaluation procedure:**

The particles-size distribution of the soil samples as refer to soil texture was determined by the hydrometer method (Soil Survey Staff, 2004). The electrical conductivity was determined in the saturated soil paste extract using a conductivity meter Model (Jenway 4510 U.S. Salinity Lab Staff, 1954). The exchangeable sodium percentage was calculated according to the formula: % ESP = {Exch Na<sup>+</sup>}\*100/CEC. Soil calcium carbonate was measured by the calcimeter method, according to Nelson (1982). The effective soil depth, drainage, and the slope were measured directly at the field. To evaluate the land suitability for irrigation the parametric evaluation system of Sys *et al.*, (1991) was applied, using soil and land characteristics. These characteristics concern environmental factors, drainage properties, soil physical and chemical properties. They are rated and used to calculate the capability index for irrigation by the formula: A\*B/100\*C/100\*D/100\*E/100\*F/100

Where: Ci: capability index for irrigation, A: rating of soil texture, B: rating of soil depth C: rating of CaCO<sub>3</sub> status, D: salinity/alkalinity rating, E: drainage rating, and F: slope rating. According to the results of measured land index in parametric method suggested by Sys *et al.* (1991) lands having indexes >80 are in S1 (very suitable); 60-80 are in S2 (moderate suitable); 40-60 are in S3 (marginal suitable); 30-45 are in N1 (currently not suitable); and <30 are in N2 (permanently not suitable).

**III. RESULTS AND DISCUSSION**

Table 1 summarizes the classification of some soils of the study area. According to the American system of soil

classification (Soil Survey Staff, 1975), the soils of the first terrace (unit 1) belong to the order Entisols due to absence of pedogenic horizons. While the soils of unit 2 and 3 (second and third terraces respectively) belong to the order Aridisols due to lack available water of most time for plant growth and presence of cambic subsurface horizon.

Table 1: Classification of some soils of the study area

Unit No.	Profile No.	Coordinates (UTM)		Classification
		X	Y	
1	1	451437	1747982	Fine loamy, mixed, active (non calcareous), hyperthermic, Typic, Torrifluvents
2	5	457440	1747997	Fine, mixed, active (non calcareous), hyperthermic, Entic, Haplocambids
3	7	453478	1750070	Fine, superactive mixed, (non calcareous), hyperthermic, Typic, Haplocambids

The definitive evaluation of land suitability for agriculture under irrigation by using parametric methods is given in Tables 2 and 3. According to the capability (or suitability) index (Ci), it is evident that the unit 1 which covered about 25% of the total area is considered to be suitable for irrigation, while the large portion of the study area –

**Table 2: Capability index value and suitability classes of the study area**

Unit	Profile	Slope	Texture	Soil depth	CaCO <sub>3</sub>	Salinity & alkalinity	Drainage	Capability index	Suitability classes
1	1,6,7	100	90	100	100	100	80	76.00	S2
2	2,5,8	95	85	100	95	95	75	54.66	S3
3	3,4,9	95	85	100	85	95	70	45.64	S3

**Table 3: Area coverage and percentage of the three land units**

Land unit	Location	Suitability classes	Area (ha)	(%)
1	First terrace	S2	400	25.00
2	Second terrace	S3	700	43.75
3	Third terrace	S3	500	31.25
Total			1600	100

(unit 2 and 3) which covered about 1200 ha (75% of the total area) is considered as being slightly suitable. This might be due to limitation of texture (clay) and drainage (low infiltration rate). These results agreed with Mustafa *et al.*, (2013) who studied the land evaluation of University of Khartoum. They found that factors such as slope, soil depth, drainage and salinity and alkalinity were not considered as limiting factors for land suitability evaluation for irrigation.

Kevie and El-Tom (2004) developed a manual for land suitability evaluation for agriculture with practices in Sudan. They reported that there was no highly suitable (S1) area for irrigation. And most of the areas were classified as almost unsuitable (N1) for irrigation purposes. The most limiting factors were physical parameters such as slope, soil texture and soil depth.

#### IV. CONCLUSION

The study revealed that the soil of the three units of the study area were deep, non saline (with exception of few pockets in the second and third terraces which were saline), non alkaline and slightly calcareous. Applied of parametric evaluation system revealed that 75% of the study area found as slightly suitable, while 25% considered as suitable for agriculture under irrigation. The most important factors that considered as limiting factors in the study area included soil texture and drainage.

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# Effect of Three Levels of NPK Fertilizer on Growth Parameters and Yield of Maize-Soybean Intercrop

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**Abstract-** Field experiments were conducted at the Teaching and Research Farm, University of Agriculture, Makurdi to determine the effect of three levels of NPK fertilizer on growth parameters and yield of maize-soybean intercrop. The experimental design consisted of two factors: cropping system at two levels (sole and intercrops) and NPK fertilizer at three levels (0, 150 and 300 kg/ha of NPK 20:10:10). The treatments were laid out in a Randomized Complete Block Design (RCBD) in a split plot arrangement and replicated three times. The cropping systems were assigned to the main plots while the fertilizer levels were in the sub plots. A composite soil sample was obtained from a plough layer (0-15 cm) at the beginning and at the end of the experiment and analyzed for particle size distribution, pH, organic carbon, total nitrogen, available phosphorus and exchangeable cations [ $Mg^{2+}$ ,  $Ca^{2+}$ ,  $Na^{+}$  and  $K^{+}$ ] as well as cation exchange capacity (CEC). Data collected for the yield and growth parameters of maize and soybean were subjected to the Analysis of Variance (ANOVA) after which significant means were separated using Least Significant Difference (LSD) at  $p < 0.05$ . From the results, application of fertilizer significantly ( $p < 0.05$ ) increased the growth parameters and yield of the component crops in both seasons. Increasing the quantity of NPK fertilizer resulted in significant increase in the yield and growth parameters of maize and soybean in both years. Intercropping resulted in yield advantage in 2013 and 2014 showing 35 % and 26 % land saved respectively. Also, from the results and productivity advantage obtained from the intercropping, the effect of different rates of NPK fertilizer on the growth and yield of maize and soybean intercrop deserve further investigation using higher fertilizer rates.

**Index Terms-** Three Levels of NPK Fertilizer, Yield, Maize-Soybean Intercrop and Growth Parameters

## I. INTRODUCTION

Maize is a major staple food of the people and a very important constituent of animal feed that had led to an increase in its utilization resulting in the huge demand to expand production through intercropping (Ayoola and Makinde, 2007; Awe and Abegunrin, 2009). Soybean on the other hand is among the major industrial and food crops grown in every continent. The crop can be successfully grown in many states of Nigeria using low agricultural input (Dugje *et al.*, 2009). Also, it has been found to be agronomically compatible with other common arable crops (Raji, 2007).

In the guinea savanna agro-ecology of Nigeria, the commonest crop mixtures practiced involve cassava, okra, sorghum, maize and yam as major food crops in all possible combinations, with each other, with little or no attention given to legumes in the combinations. Cereal-legume mixtures have been adjudged the most productive form of intercropping since the cereals may benefit from the nitrogen fixed in the root nodules of the legumes in the current year (Undie *et al.*, 2012). Intercropping soybean with maize was found suitable under fertilizer combinations but data on the nutrient requirements in intercropping system is very scanty (Adeniyani and Ayoola, 2007).

Responses of soybean and maize to N and P have been documented in soybean growing areas of Nigeria but little has been done to establish the scale of macro (N, P and K) and micronutrient (Zn, Mo) deficiencies. Similarly, little effort has been made in research to establish the best nutrient management strategies in maize-soybean intercrop under variable soil conditions as a way of improving maize/soybean production and productivity (Mbah *et al.*, 2007). Though, a number of studies have been conducted on mono-cropped maize and soybean as affected by fertilizer rates, documented information on the optimum productivity of maize and soybean under intercropping systems in Makurdi is scanty, hence the need for this enquiry. The objective of the study is to determine the effect of three levels fertilizer on growth parameters and yield of maize-soybean intercrop with a view to identify the appropriate NPK fertilizer level (s) that will give optimal growth parameters and yield of maize-soybean intercrop in the study area.

## II. MATERIALS AND METHODS

The experiment was conducted during 2013 and 2014 cropping seasons at the Teaching and Research Farm of the University of Agriculture, Makurdi-Nigeria. The study location falls within the Southern Guinea Savanna Zone of Nigeria with mean rainfall of 1, 250 mm per annum and temperature of 25-30 °C. The site had not been cultivated for about two years. It is located between latitude 7°40'N to 7°53'N and longitude 8°22'E to 8°35'E at an elevation of 97 m above mean sea level and with a slope of 4 %. The soil is classified as Typic Ustropepts (USDA) (Fagbemi and Akamigbo, 1986). TGX 1485 – 1D variety of soybeans was sourced from the International Institute for Tropical Agriculture (IITA) Ibadan, Nigeria. Also the maize variety used (TZESR – W) was sourced from the same institute.

## Experimental treatments and design

The trial consisted of two factors: cropping system at two levels (sole maize, soybean and intercropping) and NPK fertilizer at three levels (0 kg/ha, 150 kg/ha and 300 kg/ha of NPK 20:10:10) and were laid out in a split plot in RCBD with cropping system occupying the main plots and fertilizer levels at sub plots and were replicated thrice. The experimental area was cleared manually using cutlass. Thereafter it was ploughed, harrowed and demarcated into experimental units. Each plot was measured 4 m x 4 m = 16 m<sup>2</sup>. Soybean and maize seeds were sown the same day after seed treatment with apron-plus.

Manual weeding was carried out at 3 and 8 weeks after planting (WAP). Fertilizer application was done at 3 WAP by band placement on sole crop soybean / sole crop maize and maize-soybean intercrop in alternate rows. Maize was harvested when the cobs were dry. Further sun-drying of the maize cobs was done before shelling. Soybean was harvested later, when the leaves had turned yellow and pods sufficiently dried.

### Soil Data Collection and Analysis

A composite soil sample was obtained from a plough layer (0-15 cm) at the beginning and at the end of the experiment according to the treatments for routine analysis to see if there

$$LER = \frac{\text{Intercrop yield of maize}}{\text{Sole crop yield of maize}} + \frac{\text{Intercrop yield of soybean}}{\text{Sole crop yield of soybean}}$$

Percentage Land Saved = 100-1/LER x 100

Where LER is equal to 1.0, it means that there is no advantage to intercropping over sole crop. LER above 1.0 shows an advantage to intercropping while number below 1.0 shows a disadvantage in intercropping.

## III. RESULTS AND DISCUSSION

### Pre-Planting Soil Analysis

The pre-planting soil analysis (Table 1) indicates a poor soil fertility status that requires fertilizer application to replenish nutrients taken out from the soil through crop harvest and to supplement nutrients to boost yields (Olatunji and Ayuba, 2012). The total N before planting in the two cropping seasons (0.06 and 0.08 %) falls below the optimum value of 0.150 % (Agboola, 1975). Similarly, the values of SOM (1.56 and 1.64 %) for the two cropping seasons were below the average range of 2.5- 2.6 % considered for good crop growth (Prasad and Singh, 2000) in the study area. The results of the pre-planting soil analysis thus indicated that soil amendment was required in line with earlier observation by Agboola (1975) who reported that farmers in Africa requires adequate soil amendment for good crop production as a result of low inherent soil fertility.

### Effect of Fertilizer Rates on the Growth Parameters and Yield of Maize

Maize yield and growth parameters increased with increased application of NPK fertilizer in both seasons (Table 2). Higher yield components of maize were recorded under sole cropping compared to intercropping indicating that crops in sole plots suffered less from competition. The implication of this finding is that the nutrient requirements of soybean and maize in the intercropping system were higher than the nutrient need of the sole crops as Baker (1979) and Mbah *et al.*, (2007) reported that

was a change in the soil properties after the experiment for both cropping seasons. The soil samples taken from each plot according to treatment and the composite were analyzed at NICANSOL Soil Testing Laboratory of the University of Agriculture, Makurdi, for particle size distribution, pH, Organic Carbon, Total Nitrogen, Available phosphorus and exchangeable cations [Mg<sup>2+</sup>, Ca<sup>2+</sup>, Na<sup>+</sup> and K<sup>+</sup>] as well as Cation Exchange Capacity (CEC) using standard analytical procedures.

### Maize/Soybean Data Collection and Analysis

Data were collected for the yield parameters of maize for both cropping seasons. These include cob length, cob diameter, weight of 100 seeds, number of cobs per plant and grain yield while that of soybean include number of pods per plant, number of seeds per pod, weight of 100 pods, weight of 100 seeds and grain yield.

Data for the yield parameters of both crops were subjected to the Analysis of Variance (ANOVA) and means were separated using Least Significant Difference (LSD) at 5 % level of probability. The productivity from the mean yield data of both sole and intercropping system were determined by the land equivalent ratio (LER), (Willey, 1985).

the nutrient demand of the component crops were always higher than for sole crops.

### Effect of Fertilizer Rates on the Growth Parameters and of Soybean

The soybean yield and growth parameters increased with increase in NPK fertilizer application (Table 3). Similar positive responses of soybean to NPK fertilizer application have been observed by some researchers (Osunde *et al.*, 2004; Mbah *et al.*, 2007). In addition, Kang (1975) reported a significant linear increase in yield of soybean to nitrogen (N) applied at 0, 30, 60 and 120 kg N/ha but noted that N at 30 kg/ha with inoculation gave higher yields. Okpara *et al.*, (2002) in their study with straight nitrogen within the range (0-100 kgN/ha) and potassium (0-80 kg K<sub>2</sub>O/ha) fertilizers in the humid rainforest zone reported high response of soybean to fertilizer application and concluded that nitrogen alone was very effective in increasing soybean yield with application of up to 100 Kg N/ha.

Similar work by Chiezey (2001) in the guinea savanna showed increased soybean grain yield with increased nitrogen fertilizer application from 0 to 80 kgN/ha. The results of the present investigation showed that soybean benefited more from the highest fertilizer rate (300 kg/ha) in the two cropping seasons, hence corroborate these reports. The zero NPK treatment gave the least yield components assessed. Averaged over the two cropping seasons, the lowest numbers of pods per plant were obtained from intercropping at zero level of NPK fertilizer application while the highest values were obtained under sole cropping at 300 kg/ha NPK fertilizer in 2013. A similar trend was obtained in 2014 cropping season.

The productivity from the mean yield data of both sole and intercropping system was determined by the land equivalent ratio (LER) according to Willey (1985). In 2013 and 2014, intercropping resulted in yield advantage; the total land

equivalent ratio (LER) was (1.53) in 2013 and (1.35) in 2014 showing 35 % and 26 % land saved in 2013 and 2014 cropping seasons respectively (Table 4) due to intercropping compared to sole crop of both maize and soybean.

#### IV. CONCLUSION AND RECOMMENDATIONS

The results of the experiments showed that intercropping reduced the yields and growth parameters of maize and soybean compared with their sole crops. Fertilizer significantly ( $p < 0.05$ ) increased the yield and growth parameters of both crops in both seasons than when no fertilizer was applied. Increasing the quantity of NPK fertilizer resulted in significant increase in the yield and growth parameters of maize and soybean crops in both years.

The productivity of maize-soybean mixture showed yield advantage of 1.53 at 35 % land saved (2013) and 1.35 at 26% land saved (2014). The highest crops yields and growth parameters were obtained at the highest fertilizer rate used in the study. Based on yield and productivity advantage obtained from the intercropping, the effect of different rates of NPK fertilizer on the growth and yield of maize and soybean intercrop deserve further investigation using higher fertilizer rates.

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**Table 1: Soil physical and chemical properties of the experimental site before planting**

<b>Property</b>	<b>2013</b>	<b>2014</b>
<b>Chemical Property</b>		
pH H <sub>2</sub> O (1:1)	6.43	6.30
pH KCl (1:1)	5.70	5.50
Organic Carbon (%)	0.90	0.95
Organic Matter (%)	1.56	1.64
Total Nitrogen (%)	0.06	0.08
Available p (ppm)	3.00	3.80
<b>Exchangeable Cation (Cmol Kg<sup>-1</sup>)</b>		
Ca	3.28	3.06
Mg	1.40	1.37
K	0.26	0.25
Na	0.61	0.60
CEC	6.26	6.21
Base Saturation (%)	89.5	87.5
<b>Particle size Distribution</b>		
Sand (%)	78.4	76.0
Silt (%)	10.3	10.9
Clay (%)	11.3	13.1
Textural Class	Sandy loam	Sandy loam

**Table 2: Main effect of cropping systems and fertilizer rates on yield and growth parameters of maize**

Cropping Systems	NOL (4WAP)		NOL (8WAP)		LA (12WAP)		PLT HT (12WAP cm)		Grain Yield (kg/ha)	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Sole maize	3.68	4.13	11.85	12.06	571.00	898.00	109.40	120.90	1025.00	1275.00
Intercropped maize	2.00	4.00	10.77	11.94	480.00	877.00	100.80	111.70	775.00	575.00
LSD (0.05)	1.79	NS	1.91	NS	82.3	18.00	7.13	8.15	231.0	682.5
<b>Fertilizer Rates (Kg/ha)</b>										
0	2.22	3.43	10.64	11.25	391.00	879.00	85.60	89.00	800.00	375.00
150	2.37	7.58	10.71	12.17	570.00	962.00	109.70	100.00	900.00	1125.00
300	2.43	7.97	11.08	14.11	615.00	112.00	120.00	130.00	975.00	1250.00
LSD (0.05)	NS	3.99	NS	2.09	87.70	77.4	12.21	27.8	139.0	121.0

NS = Not Significant

**Table 3: Main effect of cropping systems and fertilizer rates on yield and growth parameters of soybean**

Cropping Systems	NOL (4WAP)		NOL (8WAP)		LA (12WAP)		PLT HT (12WAP cm)		Grain Yield (kg/ha)	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Sole Soybean	16.22	36.50	68.90	14.02	38.00	50.70	40.00	2.18	1300.00	1300.00
Intercropped Soybean	15.33	36.40	63.10	13.50	35.90	49.80	39.00	2.14	1000.00	1175.00
LSD (0.05)	1.99	NS	4.49	1.09	2.99	1.95	NS	NS	281.80	239.0
<b>Fertilizer Rates (Kg/ha)</b>										
0	15.25	16.33	57.70	68.00	26.00	39.00	37.61	38.00	800.00	500.00
150	15.42	16.99	61.10	69.65	38.00	59.60	39.03	39.00	1200.00	1250.00
300	16.67	17.76	79.20	80.00	44.00	66.20	42.74	45.00	1425.00	2000.00
LSD (0.05)	1.09	1.51	15.76	18.66	5.83	19.58	3.39	6.91	221.50	351.10

NS = Not Significant

**Table 4: Productivity from mean yield data of sole and intercropping system**

<b>Cropping System</b>	<b>Maize 2013</b>	<b>Soybean 2013</b>	<b>Maize 2014</b>	<b>Soybean 2014</b>
Sole crop yield (Kg)	1025.00	1300.00	1275.00	1300.00
Intercrop yield (Kg)	775.00	1000.00	575.00	1175.00
LER	1.53		1.35	
Land saved (%)	35		26	

# Neuroprotective effects of ginkgo biloba extract on brain damage induced by $\gamma$ -radiation and lead acetate

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**Abstract-** Exposure to  $\gamma$ -radiation and/or lead causes numerous malfunctions in the brain. The present study was performed to investigate the possible protective effect of ginkgo biloba extract in ameliorating the biochemical changes induced in brain of rats by single exposure to 6Gy whole body  $\gamma$ -radiation and/or i.p. administration of lead acetate (25 mg/kg) daily for seven days. Ginkgo was orally administered in two dose levels 50 and 100 mg/kg for 7 successive days. Animals were classified into 10 groups: control, 6Gy irradiated, lead-treated, irradiated lead-treated, irradiated treated by ginkgo extract in both dose levels, lead-treated receiving ginkgo in both dose levels and irradiated lead-treated receiving ginkgo in both dose levels. Radiation and/or lead acetate increased brain oxidative stress biomarkers manifested by increased brain contents of lipid peroxides and nitric oxide parallel to depletion of reduced glutathione. In addition, brain dopamine (DA) content and lactate dehydrogenase (LDH) activity increased; whereas cholinesterase (ChE) activity decreased. Furthermore, both toxicants increased brain contents of calcium and zinc; meanwhile iron content was decreased. Administration of ginkgo biloba, in both dose levels effectively alleviated radiation- and lead-induced brain oxidative stress and restored the activities of LDH and ChE enzymes. In addition, ginkgo corrected the metabolic disturbances induced in brain by radiation and lead as reflected by lowering of DA, calcium and zinc contents parallel to increased iron content. In conclusion, ginkgo biloba extract can protect the brain against the hazards of exposure to  $\gamma$ -radiation and/or lead.

**Index Terms-** Ginkgo biloba extract,  $\gamma$ -radiation, lead, oxidative stress, cholinesterase, dopamine.

## I. INTRODUCTION

Lead toxicity remains a major health problem that can result in life-long adverse health effects. Toxicity from lead may occur through environmental and/or occupational exposure (Baranowska-Bosiacka et al., 2012). Special attention is given to the neurotoxic effect of lead as it results in intellectual and behavioral deficits in children, including hyperactivity, deficits in fine motor function, and lower performance in intelligence tests (Winneke, 2011; Baranowska-Bosiacka et al., 2012).

The CNS is exposed to ionizing radiation in a number of clinical situations; radiotherapy remains a major treatment modality for primary and metastatic neoplasms located in the CNS (Caruso et al., 2013), and exposure of the brain and the spinal cord is often unavoidable in the radiotherapeutic management of tumors located close to the CNS such as head

and neck cancers. In addition, there is an increasing application of radiation in management of other disorders of the brain as epilepsy (Régis et al., 1999). The most serious complication of brain irradiation is the damage to normal tissues, which may be encountered in 40% of the cases receiving radiotherapy in brain tumors, resulting in edema and necrosis (Kamiryo et al., 1996).

A number of studies confirmed the involvement of reactive oxygen species (ROS) in radiation and lead induced toxicities (Flora et al., 2008; Pradeep et al., 2012; Zhang et al., 2013). Hence, using antioxidants to minimize lead and radiotherapy associated toxicities to the brain might prove useful.

Extracts of *ginkgo biloba* leaves have been widely used to treat cerebrovascular insufficiency, symptoms associated with dementia as well as cognitive decline and neurosensory impairments associated with aging and senility (Tian et al., 2012; Wang et al., 2013). Several studies have reported the potential of ginkgo biloba and its constituents as antioxidants and free radical scavengers (Sener et al., 2006; Martin et al. 2011; [Tulsulkar and Shah](#), 2013). The present study was thus performed to investigate the possible protective effect of ginkgo biloba extract in ameliorating the biochemical changes in brain of rats subjected to gamma irradiation and/or lead toxicity.

## II. MATERIAL AND METHODS

### Animals

Adult male Wistar rats weighing 150-200 g were used in this study. They were purchased from the National Research Centre (Giza, Egypt). Animals were housed under appropriate conditions of controlled humidity and temperature. They were fed with standard pellet chow and allowed free access to water. The study was carried out according to the guidelines of the Ethics Committee of Faculty of Pharmacy, Cairo University.

### Chemicals

Ginkgo biloba extract was received as a gift from Al-Amriya Pharmaceutical Industries (Alexandria, Egypt). It contains 24% flavone glycosides (primarily composed of quercetin, kaempferol, and isorhamnetin) and 6% terpene lactones (2.8-3.4% ginkgolides A, B, and C as well as 2.6-3.2% bilobalide). Other constituents include proanthocyanidins, glucose, rhamnose, organic acids, D-glucaric acid and ginkgolic acid.

Lead acetate was purchased from Sigma-Aldrich Chemical Co., St Louis, MO, USA. All other chemicals used were of the highest analytical grade. Kits for lactate dehydrogenase (LDH) and cholinesterase (CHE) were purchased from Stanbio Main St, Boerne (USA) and Quimica Clinica Aplicada Amposta/Tarragona (Spain), respectively.

### Experimental Design

Animals were classified into 10 groups. Group 1: received 1% tween 80 p.o. for seven successive days (control). Group 2: rats were subjected to 6Gy irradiation on day 7 (Sief El-Nasr et al., 1996). Group 3: rats received lead acetate (25 mg/kg/day; Daniel et al., 2004) i.p. for 7 successive days. Group 4: received lead acetate for 7 successive days and subjected to 6Gy irradiation on day 7. Groups 5 & 6: received ginkgo biloba extract (50 or 100 mg/kg; p.o.; Dias et al., 2013) and exposed to 6Gy irradiation on day 7. Groups 7 & 8: received lead acetate with ginkgo biloba extract 50 or 100 mg/kg for 7 successive days. Groups 9 & 10 received lead acetate with ginkgo biloba extract 50 or 100 mg/kg for 7 successive days and subjected to 6 Gy irradiation on day 7.

At day 8 (24 h following exposure to irradiation), all rats were sacrificed by decapitation. Brains were rapidly isolated, homogenized in ice cold saline to prepare 20% w/v homogenate using Glass-Col1 homogeniser, Terre Haute Indiana, USA. The prepared homogenates were used for determination of brain contents of nitric oxide (NO), lipid peroxides, reduced glutathione (GSH), dopamine (DA), iron, calcium and zinc as well as brain activities of CHE and LDH.

### Exposure to gamma-irradiation

Whole body  $\gamma$ -irradiation of rats was performed at the National Centre for Radiation Research and Technology (Cairo, Egypt) using Gamma cell-40, Caesium-137 irradiation unit manufactured by the Atomic Energy of Canada Limited (AECL). Radiation dose levels were delivered at a rate of 0.46 Gy/min.

### Determination of the chosen biochemical parameters

Brain NO content was measured as total nitrate/nitrite ( $\text{NO}_x$ ) using Griess reagent according to the method described by Miranda et al. (2001) and expressed as  $\mu\text{M/g}$  wet tissue. Brain GSH content was determined using Ellman's reagent according to the method described by Beutler et al. (1963) and expressed as mg/g wet tissue. Brain lipid peroxides were determined as

thiobarbituric acid reactive substances (TBARS) using malondialdehyde (MDA) as a standard according to the method described by Mihara and Uchiyama (1978) and expressed as nmol/g wet tissue. Brain DA content was determined according to the method of Guo *et al.* (2009) and expressed as  $\mu\text{g/g}$  wet tissue.

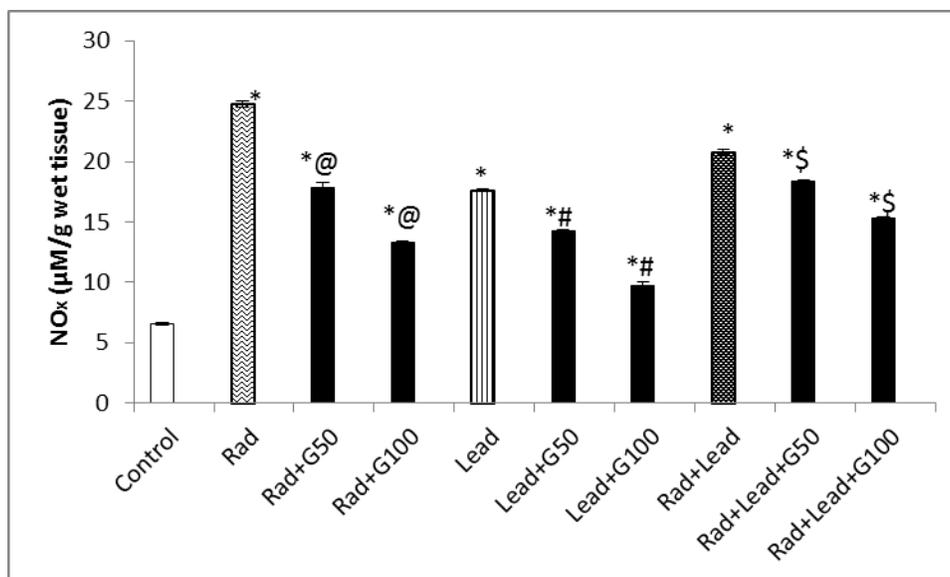
Brain CHE and LDH activities were determined using commercial reagent kits and expressed as U/g wet tissue. Brain calcium, iron and zinc contents were determined using the atomic absorption technique (Subramania 1995), using SOLAR System, Unicam 939 atomic absorption spectrophotometer (UK) equipped with deuterium background corrections and expressed as  $\mu\text{g/g}$  wet tissue.

### Statistical analysis

Data were expressed as means  $\pm$  S.E. Comparisons between means of different groups were carried out using one way analysis of variance (ANOVA) followed by Tukey Kramer multiple comparisons test. A probability level of less than 0.05 was accepted as being significant in all types of statistical tests. GraphPad Software InStat (version 2) was used to carry out these statistical tests.

### III. RESULTS

Exposure to radiation, lead as well as their combination increased brain NO to 375.68%, 267.78% and 315.80%, respectively as compared with that of control rats (Fig. 1). Treatment with ginkgo biloba extract in a dose of 50 mg/kg decreased brain content of  $\text{NO}_x$  to 72.16%, 81.04% and 88.30% as compared with that of the corresponding irradiated, lead-treated and irradiated lead-treated rats, respectively (Fig. 1). Similarly treatment with ginkgo biloba extract (100 mg/kg) decreased brain content of  $\text{NO}_x$  to 53.64 %, 55.38 % and 73.86% as compared with that of the corresponding irradiated, lead-treated and irradiated lead- treated rats, respectively (Fig. 1).



**Figure (1):** Effect of 7 days treatment with ginkgo biloba extract (50,100 mg/kg/day; G50, G100; p.o.) on brain content of total nitrate/nitrite ( $\text{NO}_x$ ) in irradiated (Rad), lead-treated and irradiated lead-treated rats. Lead (25 mg/kg) was i.p. administered daily for seven successive days. Exposure to irradiation was done on day 7.

Results are represented as mean  $\pm$  SE (n=8).

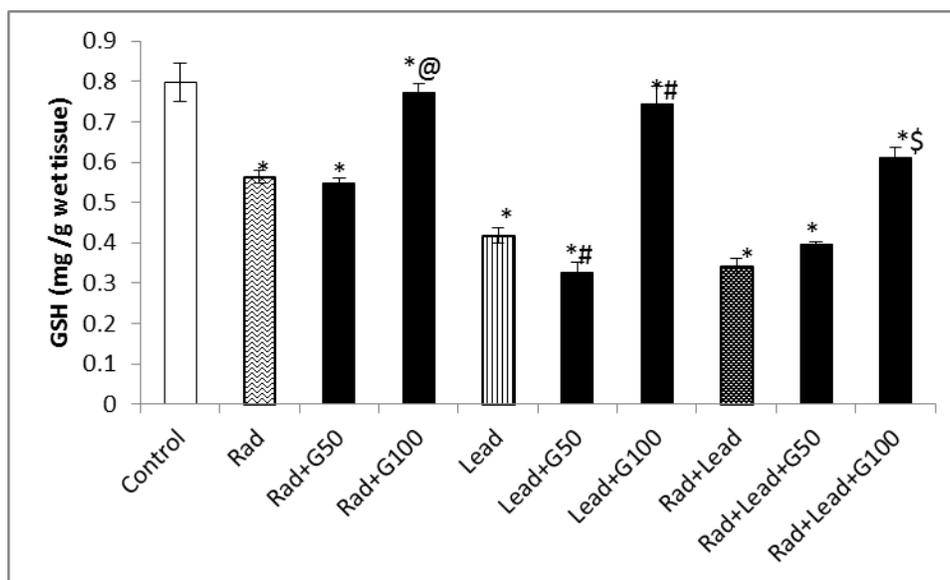
\*Significantly different from control group at  $p < 0.05$ .

@Significantly different from irradiated group at  $p < 0.05$ .

#Significantly different from lead- treated group at  $p < 0.05$ .

§Significantly different from irradiated lead- treated group at  $p < 0.05$ .

Exposure to radiation, lead or their combination decreased brain GSH content to 70.57%, 52.45% and 42.82%, respectively as compared with control rats (Fig. 2). Treatment with ginkgo biloba extract (100 mg/kg) resulted in a significant increase in brain GSH content to 97.24 (137.5)%, 178.22% and 178.88% as compared with irradiated, lead-treated and irradiated lead-treated rats, respectively (Fig. 2).



**Figure (2):** Effect of 7 days treatment with ginkgo biloba extract (50,100 mg/kg/day; G50, G100; p.o.) on brain content of reduced glutathione (GSH) in irradiated (Rad), lead-treated and irradiated lead-treated rats. Lead (25 mg/kg) was i.p. administered daily for 7 successive days. Exposure to irradiation was done on day 7.

Results are represented as mean  $\pm$  SE (n=8).

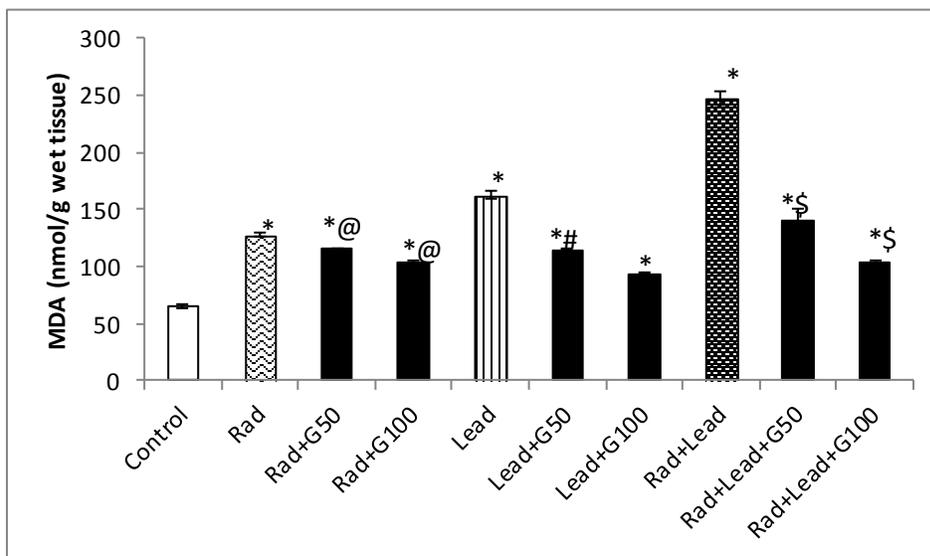
\*Significantly different from control group at  $p < 0.05$ .

@Significantly different from irradiated group at  $p < 0.05$ .

#Significantly different from lead- treated group at  $p < 0.05$ .

§Significantly different from irradiated lead- treated group at  $p < 0.05$ .

Brain lipid peroxides increased by exposure to radiation, lead or their combination to 195.47%, 248.85 % and 378.10%, respectively of the control value (Fig. 3). Treatment with ginkgo biloba extract (50 mg/kg) decreased brain content of MDA to 89.98%, 70.43% and 38.31% as compared with the corresponding irradiated, lead-treated and irradiated lead-treated values, respectively (Fig. 3). Similarly treatment with ginkgo biloba extract (100 mg/kg) decreased brain MDA content to 80.75%, 57.79% and 41.87% as compared with the corresponding irradiated, lead-treated and irradiated lead-treated values, respectively (Fig. 3).



**Figure (3):** Effect of 7 days treatment with ginkgo biloba extract (50,100 mg/kg/day; G50, G100; p.o.) on brain content of malondialdehyde (MDA) in irradiated (Rad), lead-treated and irradiated lead-treated rats. Lead (25 mg/kg) was i.p. administered daily for 7 successive days. Exposure to irradiation was done on day 7.

Results are represented as mean  $\pm$  SE (n=8).

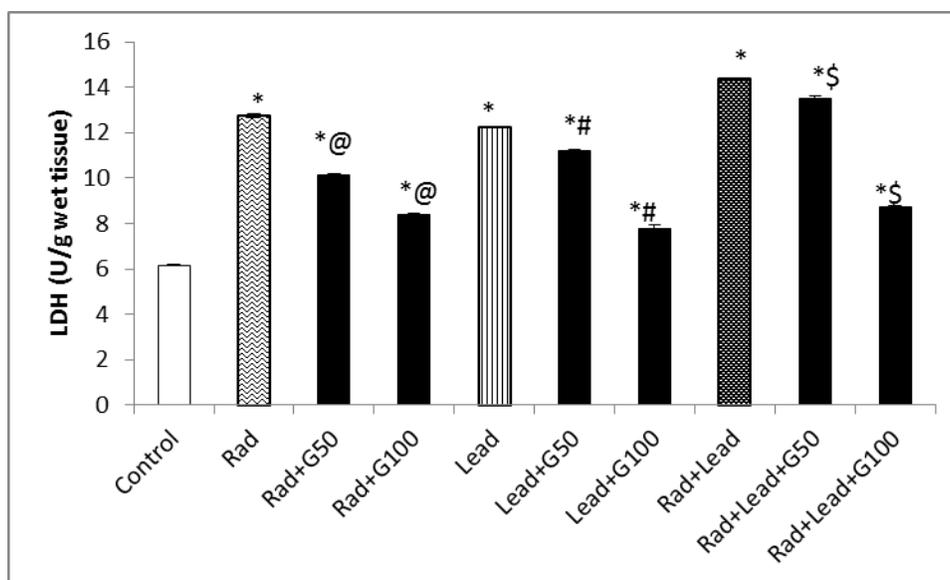
\*Significantly different from control group at  $p < 0.05$ .

@Significantly different from irradiated group at  $p < 0.05$ .

#Significantly different from lead- treated group at  $p < 0.05$ .

\$Significantly different from irradiated lead- treated group at  $p < 0.05$ .

Brain LDH activity increased by exposure to radiation, lead or their combination to 206.64%, 198.54% and 233.06% as compared with the control value, respectively (Fig. 4). Treatment with ginkgo biloba extract (50 mg/kg) decreased brain LDH activity to 65.66 (79.68)%, 91.59% and 93.88% as compared with that of irradiated, lead-treated and irradiated lead-treated rats, respectively (Fig. 4). Similarly ginkgo biloba extract (100 mg/kg) decreased brain LDH activity to 79.68% (65.66), 63.42% and 60.70% as compared with that of irradiated, lead-treated and irradiated lead-treated rats, respectively (Fig. 4).



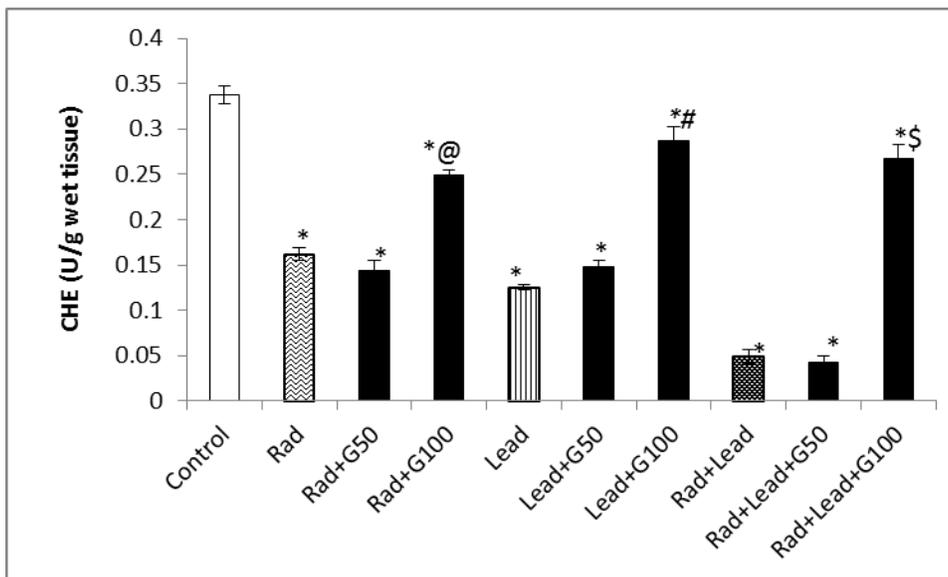
**Figure (4):** Effect of 7 days treatment with ginkgo biloba extract (50,100 mg/kg/day; G50, G100; p.o.) on brain activity of lactate dehydrogenase (LDH) in irradiated (Rad), lead-treated and irradiated lead-treated rats. Lead (25 mg/kg) was i.p. administered daily for 7 successive days. Exposure to irradiation was done on day 7.

Results are represented as mean  $\pm$  SE (n=8).

\*Significantly different from control group at  $p < 0.05$ .

@Significantly different from irradiated group at  $p < 0.05$ .  
#Significantly different from lead- treated group at  $p < 0.05$ .  
§Significantly different from irradiated lead- treated group at  $p < 0.05$ .

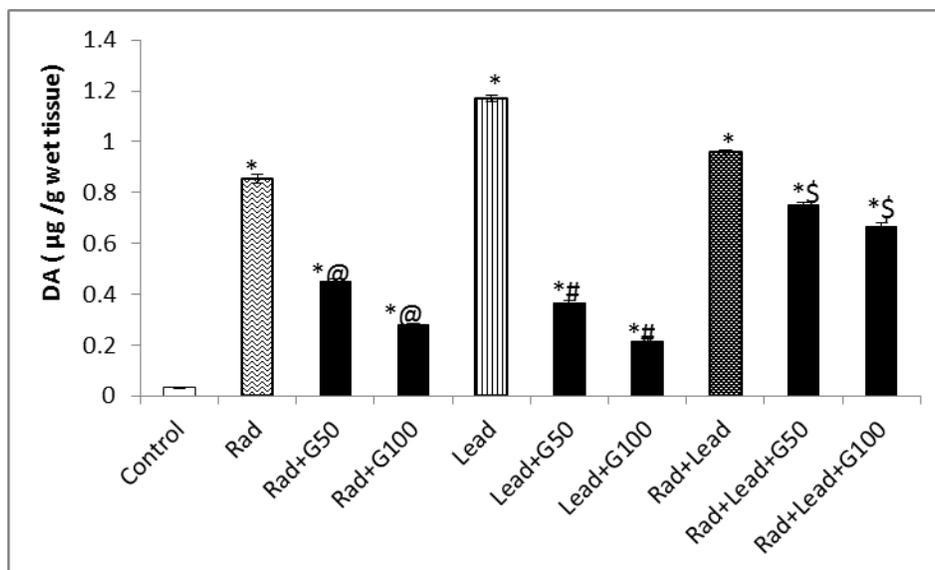
Exposure to radiation, lead or their combination resulted in a significant decrease in brain CHE activity of to 47.95%, 37.11% and 14.42%, respectively as compared with that of control rats (Fig. 5). Treatment with ginkgo biloba extract (100 mg/kg) increased brain CHE activity to 154.65%, 227.45% and 548.45% as compared with that of irradiated, lead-treated and irradiated lead-treated rats, respectively (Fig. 5).



**Figure (5):** Effect of 7 days treatment with ginkgo biloba extract (50,100 mg/kg/day; G50, G100; p.o.) on brain activity of cholinesterase (CHE) in irradiated (Rad), lead-treated and irradiated lead-treated rats. Lead (25 mg/kg) was i.p. administered daily for 7 successive days. Exposure to irradiation was done on day 7. Results are represented as mean  $\pm$  SE (n=8).

\*Significantly different from control group at  $p < 0.05$ .  
@Significantly different from irradiated group at  $p < 0.05$ .  
#Significantly different from lead- treated group at  $p < 0.05$ .  
§Significantly different from irradiated lead- treated group at  $p < 0.05$ .

Exposure to radiation, lead or their combination resulted in significant increase brain DA content to 2656.25%, 3625.00% and 2968.75%, respectively as compared with that of control value (Fig. 6). Ginkgo biloba extract (50 mg/kg) decreased brain content of DA to 52.46%, 31.04% and 78.21% as compared with that of irradiated, lead-intoxicated and irradiated lead-intoxicated rats, respectively (Fig. 6). Similarly treatment with ginkgo biloba extract (100 mg/kg) decreased brain content of dopamine to 32.77%, 18.13% and 69.47% as compared with that of irradiated, lead-treated and irradiated lead-treated rats, respectively (Fig. 6).



**Figure (6):** Effect of 7 days treatment with ginkgo biloba extract (50,100 mg/kg/day; G50, G100; p.o.) on brain content of dopamine in irradiated (Rad), lead-treated and irradiated lead-treated rats. Lead (25 mg/kg) was i.p. administered daily for 7 successive days. Exposure to irradiation was done on day 7.

Results are represented as mean ± SE (n=8).

\*Significantly different from control group at  $p < 0.05$ .

@Significantly different from irradiated group at  $p < 0.05$ .

#Significantly different from lead- treated group at  $p < 0.05$ .

\$Significantly different from irradiated lead- treated group at  $p < 0.05$ .

Exposure to radiation, lead or both of them increased brain calcium content to 128.80%, 210.60% and 227.30%, respectively as compared with that of control rats (Table-1). Treatment with ginkgo biloba extract (50 mg/kg) decreased brain calcium content to 89.90 %, 66.34 % and 87.00 % as compared with that of irradiated, lead-treated and irradiated lead-treated rats, respectively (Table-1). Likewise ginkgo biloba extract (100 mg/kg) decreased brain content of calcium to 84.11%, 61.20% and 51.90% as compared with that of irradiated, lead-treated and irradiated lead-treated rats (Table-1).

**Table (1):** Effect of 7 days treatment with ginkgo biloba extract (G50, G100; 50, 100 mg/kg/day; p.o.) on brain content of calcium, iron and zinc in irradiated (Rad), lead- treated and irradiated lead-treated rats.

Groups	Calcium (µg/g wet tissue)	Iron (µg/g wet tissue )	Zinc (µg/g wet tissue)
Control	92.79±0.04	31.13±0.03	16.81±0.04
Rad	119.60±0.14*	20.86±0.15*	18.12±0.04*
Rad+G50	107.60±0.10*@	22.50±0.08*@	18.03±0.03*
Rad+G100	100.60±0.03*@	29.69±0.04*@	16.70±0.14*@
Lead	195.50±0.16*	22.30±0.12*	21.50±0.10*
Lead+G50	129.70±0.01*#	23.79±0.03*#	20.36±0.04*#
Lead+G100	119.80±0.03*#	27.65±0.04*#	19.43±0.01*#

<b>Rad+ Lead</b>	211.00±0.03*	20.73±0.11*	19.79±0.03*
<b>Rad+ Lead+ G50</b>	183.60±0.02* <sup>§</sup>	24.44±0.09* <sup>§</sup>	18.94±0.01* <sup>§</sup>
<b>Rad+ Lead+ G100</b>	109.70±0.10* <sup>§</sup>	30.40±0.01* <sup>§</sup>	18.11±0.03* <sup>§</sup>

Lead (25 mg/kg) was i.p. administered daily for seven successive days. Exposure to irradiation was done on day 7.

Results are represented as mean ± SE (n=8).

\*Significantly different from control group at  $p<0.05$ .

@Significantly different from irradiated group at  $p<0.05$ .

#Significantly different from lead- treated group at  $p<0.05$ .

§Significantly different from irradiated lead- treated group at  $p<0.05$ .

Exposure to radiation, lead or their combination decreased brain iron content to 67.00%, 71.50% and 66.59%, respectively as compared with that of control rats (Table-1). Ginkgo biloba extract (50 mg/kg) increased brain content of iron to 107.86%, 106.68% and 117.89% as compared with that of irradiated, lead-treated and irradiated lead-treated rats, respectively (Table-1). Using ginkgo biloba extract (100 mg/kg) increased brain content of iron to 142.32%, 123.99% and 146.60% as compared with that of irradiated, lead-treated and irradiated lead-treated rats, respectively (Table-1).

Exposure to radiation, lead or both of them increased brain content of zinc to 107.79%, 127.9% and 117.72%, respectively as compared with that of control rats (Table-1). Ginkgo biloba extract (50 mg/kg) decreased brain content of zinc to 94.69 % and 95.70% as compared with that of lead-treated and irradiated lead-treated rats, respectively (Table-1). In a similar fashion, ginkgo biloba extract (100 mg/kg) decreased brain content of zinc to 92.16%, 90.37% and 91.50% as compared with that of irradiated, lead-treated and irradiated lead-treated rats, respectively (Table-1).

#### IV. DISCUSSION

In the present study, single exposure to  $\gamma$ -radiation and/or i.p. injection of lead acetate for 7 successive days increased brain NO content that was prevented by treatment with ginkgo biloba extract in both dose levels.

Increased NO in brain of rats by lead acetate administration was previously reported (Abdel Moneim et al., 2011; Abdel Moneim, 2012; Ebuehi et al., 2012). The enhancement of NO<sub>x</sub> content in the rat brains may be attributed to induction of inducible nitric oxide synthase (iNOS) by lead (Liu et al., 2012). In the same context, Ilhan et al. (2004) reported that exposure to electromagnetic radiation of mobile phones (900MHz for 7 days) increased brain NO content that was prevented by treatment with ginkgo biloba extract (100 mg/kg).

Single exposure to  $\gamma$ -radiation and/or i.p. injection of lead acetate for 7 successive days increased brain oxidative stress that was evident by increased brain lipid peroxides and reduced GSH contents. Increased oxidative stress and production of ROS following exposure to radiation (Freitinger Skalická et al., 2012; Bilgici et al., 2013) or lead intoxication (Ebuehi et al., 2012; Zhang et al., 2013) were previously reported. Indeed depletion of

brain GSH stores following exposure to 5Gy and 6Gy whole body irradiation was reported (Manda and Bhatia, 2003). Moreover, Saxena and Flora (2006) reported that 10 weeks exposure to 0.2% lead acetate reduced brain GSH stores parallel to increased lipid peroxides formation. Increased oxidative stress indicated via depletion of glutathione (El-Ghazaly et al., 2013). The brain is especially vulnerable to ROS attack owing to its high content of polyunsaturated fatty acids (PUFAs), initial targets for lipid peroxidation, and low capacity of antioxidant enzymes (Halliwell, 1992). This might explain brain affection by irradiation and/or lead insults and the observed protective effects of ginkgo biloba extract. The antioxidant potential of ginkgo biloba extract was previously reported in irradiated rats (Ilhan et al., 2004; Sener et al., 2006) as well as in models of hypoxia (Martin et al. 2011) and ischemia-reperfusion injury (Hu et al. 2002; Tulsulkar and Shah, 2013).

In the present study LDH activity was significantly increased in brain of rats following exposure to  $\gamma$ -irradiation and/or lead administration which is comparable to the results of Ivanova et al. (1984) and Lyshov et al. (1992) where enhanced LDH activity was observed in brains of rats receiving lead acetate in their drinking water. Similarly, Treshchenkova and Burlakova (1997) indicated that exposure of mice to chronic low doses of gamma radiation increased one or more of the kinetic parameters (mainly V<sub>max</sub>) of LDH in the brain of mice.

The present increase in LDH activity could be explained by the findings of Popov et al. (1986) who observed an increase in the rate of glycolysis in mouse brain following exposure to whole body gamma irradiation. Furthermore, ionizing radiation was reported to cause inhibition of cellular respiration in rats (Nosov et al., 1999), this inhibition of aerobic energy production might cause the activation of anaerobic energy production and results in enhanced activity of LDH.

In the present study, ginkgo biloba extract significantly decreased brain LDH of irradiated, lead-treated and irradiated lead-treated rats. In the same context, Sener et al. (2006) showed that ginkgo (50 mg/kg) decreased brain LDH in rats exposed to whole body gamma irradiation. Brain DA content increased following whole body irradiation and/or administration of lead acetate. An increase in DA contents in cerebral cortex, hippocampus and cerebellum of rats following lead acetate administration was reported (Devi et al., 2005; Basha et al., 2012). Administration of ginkgo biloba extract reduced the

increase in brain DA content induced by irradiation or administration of lead acetate. In accordance with the present findings, Shah et al. (2003) reported that ginkgo biloba extract restored restraint stress-induced elevation in brain DA content.

In the current study, CHE activity decreased in irradiated and/ or lead-treated rats. Several other authors reported a decline in CHE activity in lead intoxicated rats (Saxena and Flora, 2006; Antonio-García and Massó-Gonzalez, 2008). In addition, Abou-Seif et al. (2003) reported a decline in brain CHE following exposure to  $\gamma$ -irradiation. Pretreatment of rats with ginkgo biloba extract increased brain CHE activity of irradiated or lead-treated rats. The ability of ginkgo biloba to enhance brain CHE activity, in the present study, could be the reason behinds its usefulness in dementia and Alzheimer's disease (Tian et al., 2012; Wang et al., 2013).

In the present study exposure to  $\gamma$ -irradiation and/or administration of lead acetate increased calcium and zinc brain contents parallel to a decrease in iron content. The present results find support in the work of Nada *et al.* (2008 & 2012) who reported an increase in zinc and calcium brain contents in rats subjected to whole body gamma irradiation (6.5 Gy). In addition, Sidhu and Nehru (2003), reported that oral administration of lead in doses of 10, 50 and 200 mg/kg for 12 weeks resulted in a significant increase in brain calcium content.

Zinc is an essential component of many metalloenzymes and is known to have several biological actions. During cell damage and inflammation, liver cells take up more Zn to synthesize nucleic acids, proteins and enzymes related to zinc (Morcillo et al., 2000; Nada et al., 2008), which could account for the observed increase in brain zinc content following irradiation or administration of lead acetate.

The increase of brain calcium content may be attributed to irradiation-induced hypoxia; irradiation causes ischemic cell injury associated with rushed influx of calcium from extracellular into intracellular compartment (Alden and Frith, 1991). Increased intracellular calcium level in rat hippocampus by lead administration was previously reported (She et al., 2009). Similarly, cerebral ischemia/reperfusion (I/R) in whole body  $\gamma$ -irradiated rats raised brain calcium (Ca<sup>2+</sup>) level (Abd-El-Fattah *et al.*, 2010). In addition, during oxidative stress, the inadequate generation of ATP can cause malfunctioning of calcium ATPase pumps and an increase in intracellular calcium (Heunks *et al.*, 1999). The latter mechanism could explain the observed effects of irradiation and lead administration on brain calcium content.

Ginkgo biloba extract attenuated changes in brain zinc, calcium and iron contents induced by irradiation and lead administration in the present study. Hu et al. (2002) reported that ginkgo biloba extract inhibited the stimulatory effect of glutamate on calcium in rats during cerebral ischemia/reperfusion. The effects of ginkgo extract on brain iron content could be mediated by induction of heme oxygenase I, which acts as an antioxidant enzyme by degrading heme into iron (Zhuang et al., 2002), hence increasing brain iron content

## V. CONCLUSION

The present study revealed the hazards of exposure to  $\gamma$ -radiation or lead on brain of rats. Prophylactic treatment with

ginkgo biloba extract in both dose levels effectively attenuated many of the biochemical changes induced by irradiation and lead by decreasing oxidative stress, enhancing brain antioxidant status, increasing brain CHE activity and modulation of brain composition of calcium, zinc and iron.

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# A Prototype Intranet-Based Instant Messenger at Capiz State University, Mambusao Campus, Mambusao, Capiz, Philippines

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**Abstract-** The study was conducted to design and develop a prototype intranet-based instant messenger at Capiz State University, Poblacion Mambusao Campus, Mambusao, Capiz, Philippines and to determine its acceptability in terms of necessity, practicability and reliability. The software was designed as client-server application for the use of the students and employees to send, receive and check messages and to do chat. The users are allowed only to use the application that performs chatting, sending and checking of messages.

The server application was designed for chatting, sending and checking of messages, to access students, personnel, departments and programs' data entry, and to check the report. The system administrator is allowed to access all transactions in the server, the school administrator and the dean can perform only sending/receiving of messages, chatting and viewing of the reports, the faculty and staff can send/receive messages and chat only, the clerk who is the in charge in encoding is allowed only to access send/receive messages. To test its security, the software authenticates first the user if he or she was registered in the database before the user can access. The user cannot easily have access to the software without registering first to the data encoder of the department. The developed software can secure intranet-based instant messenger by authenticating the user's membership from the database. The researcher tested the acceptability of the software by allowing the target clients to use the program. A survey of the necessity, reliability and practicability of the software was filled among the client.

Based from the results, the researcher concluded that the prototype software for secure intranet-based instant messenger can be designed and developed. The developed prototype intranet-based instant messenger for CapSU Mambusao Campus was moderately acceptable in terms of necessity and practicability while acceptable in terms of reliability.

**Index Terms-** Prototype Intranet-Based Instant Messenger, Capiz State University, Acceptability

## I. INTRODUCTION

An intranet is essentially an Internet contained within an organization. Intranets have been rapidly growing in the business world in the last few years but are still in their infancy in educational institutions( Webb, 2015). Through the use of intranet within the organization, instant messaging could be possible in order to provide faster communication within the institution.

There are many search engines providing services for instant messaging, which has revolutionized in the recent years. Formerly, the use of instant messaging was personal but later it has been utilized widely in business. The problem that rose were the risks involved in using instant messengers among organization where privacy has to be maintained in order to keep up with competition. (Grey, 2008).

Instant messenger (IM) is small-sized communication software that provides real-time dialogue and file transfers for individuals via the internet. Without any IT supported IM systems, workers in enterprises try to develop IM's business value for an effective information processing facility. Users are trying to get free IM services at amazing rate. Everyone connected with the internet can easily use IM by downloading from the internet or using OS-embedded IM software. Aberrations resulting from IM overuse and misuse are its primary bad influence. Within most enterprises, IM users can manage IM because their circle of IM contacts is small. However, IM's basic foundation is its freewheeling nature and, as enterprise IM deployment grows, individual management techniques will fail without direction. IM is considered as a new manner for workers in enterprises to communicate and to collaborate each other. Regardless of whether IM use is sanctioned within the enterprise, it exists and is increasing in use. Enterprises should recognize the degree of IM prevalence within their environment and develop guidelines for use that are specific to the organization. (Grey & Batchelder, 2008).

The internet connection of CapSU is not stable because it is only dial up. The students and employees cannot access easily to the internet connection. It is very hard to the personnel to communicate because some of the offices do not have intercom. It is in this premise that this study was conducted with the purpose of designing and developing a secure intranet-based instant messenger and determining the acceptability of the developed intranet-based instant messenger.

## II. RESEARCH ELABORATIONS

As an initial activity, searching in the web was performed in order to look for topics or theories related to instant messenger. Likewise, the web was explored to broaden the researcher's knowledge by getting pertinent ideas and to make clear those uncertainties about the study.

Discussion with some experts on how the system could be developed was also done by the researcher. Several questions were asked to each of the experts primarily to gather their views

and ideas on how to come up with a good study. However, much of the time was spent in exploring the web until such time that the expected output or program was made a reality.

When the system was developed, the researcher tried to use it in her personal computer so that she would know if it is functional. She then tested it using two computers and after a few weeks of testing, the researcher installed it to the server of CapSU Computer Laboratory and with the LAN connections, students and CapSU personnel have access to the program and they use it as their medium of communication.

During the actual testing, the system administrator and the data encoder managed the server, while the other users utilized the computer intended for them or the so called client.

The computer used by the students was composed of virus scanner and screen saver. This can help the security of the system. Database Authentication was applied in retrieval of records in order to ensure security of data in the server. Otherwise, if the server is not activated, its user cannot have access to the system.

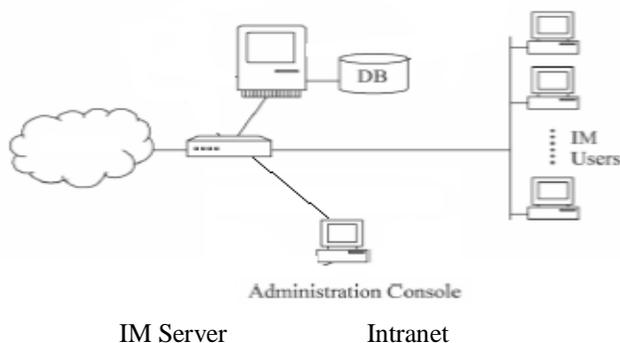
Each user's IM was configured to allow only the members of their buddy lists to track their presence. The IM management system performs monitoring of real-time connections, searching, and reporting. IM management system consists of the monitoring agent, database and administration manager.

On the operation process, the researcher developed a simple procedure. The IM procedure was delivered to the entire organization, which included the access and usage of the software for those who will use the IM. Before going to the operational phase of the software, the user is required to read first the procedure on how to operate the software and how to change the default password.

The researcher provided close-ended type of questionnaire to 80 students, 14 faculty members and 4 administrators to assess the acceptability of the system. Acceptability of the system was determined in terms of necessity of the development of the prototype CapSU instant messenger, reliability of the use of the prototype CapSU instant messenger and practicability of the use of the prototype CapSU instant messenger. They chosen respondents were the immediate users of the system. After gathering the answered questionnaires, the responses was then tallied and was subjected to statistical analysis in the form of mean.

### III. RESULTS OR FINDINGS

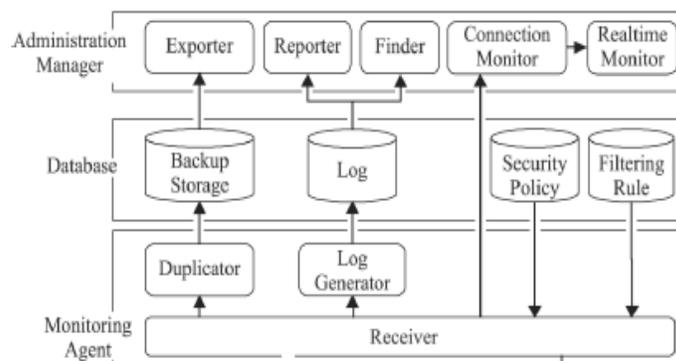
Figure 1. Architecture of the logical controls



Architecture of the logical controls shows that it consists of IM management system on the server side and security solutions on the client side. The security solution on the client side consisted of a data authentication on the database. Each software was installed on each user's desktop computer. The user can not access the file of each member. The user can perform both ways by sending messages and chatting alone. He/She can access the said data by enrolling first to the encoder. A default password was given and the user can change it once. Each user's IM was configured to allow only the members of their buddy lists.

The security on the server side consisted of a data authentication and IM management system. The IM management system performed the transaction by way of opening the chatting transaction. The client side cannot operate if the server side of chatting is closed. It also operates by sending messages. Other services include: encoding of data entries of employees and students, monitoring of real-time connections, searching, and reporting.

Figure 2. The logical diagram of the IM management system on Server



The logical diagram of the IM management system on the server side consisted of the monitoring agent, database and administration manager. The researcher developed a simple and consistent procedure on how to operate the system so that employees and the students can understand and that they can support the project. The IM procedure was delivered to the entire employees and students. The procedure on monitoring the IM communications clearly defined that the system administrator has the right to access the data. Before going to the operation phase of IM, the encoder give default password to each user to have privacy and security.

Table 1. The Acceptability of a Prototype Intranet-Based Instant Messenger at Capiz State University

	N	Mean	Interpretation
• Necessity of the development of the Prototype CapSU Instant Messenger	98	3.54	Moderately Acceptable
• Reliability of the use of the Prototype	98	3.76	Acceptable

CapSU Instant Messenger			
• Practicability of the use of the Prototype CapSU Instant Messenger	98	2.91	Moderately Acceptable

As to the necessity of the development of the prototype intranet-based instant messenger, the mean that was obtained was 3.54 which was interpreted as moderately acceptable. Regarding the reliability of the use of the prototype CapSU instant messenger, the mean was 3.76 which falls under the interpretation of acceptable. While when it comes to the practicability of the use of the prototype CapSU instant messenger to its users, a mean of 2.91 was obtained which has the interpretation of moderately acceptable.

#### IV. CONCLUSIONS

1. The prototype software for secure intranet-based instant messenger can be designed and developed.

2. The developed prototype intranet-based instant messenger for CapSU Mambusao Campus was moderately acceptable in terms of necessity and practicability while acceptable in terms of reliability

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# pH of Street- Vended Pork Barbeque in Mambusao, Capiz, Philippines

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**Abstract-** This study was conducted to determine the pH value of cooked pork barbeque samples from selected cooked pork barbeque stands in Mambusao, Capiz, Philippines.

Cooked pork barbeque samples from Site A, Site B and Site C in selected pork barbeque stands of Mambusao, Capiz were bought, frozen overnight and were then subjected to pH analysis at Department of Science and Technology (DOST)- Iloilo City, Philippines. Gathering of samples was done four times on the three identified sites.

Cooked pork barbeque samples have pH that are favorable for the growth of salmonella spp, staphylococcus aureus and Escherichia coli except vibrio cholera at two sites during the second sampling period.

**Index Terms-** pH, street-vended pork barbeque, Philippines

## I. INTRODUCTION

Street foods often reflect traditional local cultures and exist in an endless variety. There is much diversity in the raw materials as well as in the preparation of street food beverages, snacks and meals. Vendors' stalls are usually located outdoors or under a roof which is easily accessible from the street. They have low-cost seating facilities which are sometimes rudimentary. Their marketing success depends exclusively on location and word-of-mouth promotion. Street food businesses are usually owned and operated by individuals or families but benefits from their trade extend throughout the local economy. For instance, vendors buy their fresh food locally, thus linking their enterprises directly with small-scale farms and market gardens (Winarno and Allain, n.d). Street foods can be sources of enteropathogens (Mensah, et. al., 2002). pH is one of the intrinsic factors that determine the microbial growth in foods. pH impacts make up of microbial community and therefore types of chemical reactions occur when microbes grow in food. When the pH of the food is favorable for bacteria, food-borne infections and food intoxications possible occur. (U.S .FDA, 2013).

Mambusao, as one of the municipality in Capiz, Philippines is a place where travelers from the national and international destinations passes almost every day. People also in this place are busy due to the presence of numerous business and educational institutions and other government establishments. Street-food is indeed a part of people's routine in this area to cope with the busy schedules. Hence, it is timely to evaluate or assess the pH of the street-vended pork barbeque to determine the safety of the food to the consumers.

## II. RESEARCH ELABORATIONS

The materials used in the study were the cooked pork barbeque samples, thermochase, ice, aluminum foil, face mask, triple beam balance, laboratory gown for the researchers, thermometer, sterile plastic bags and 70% isopropyl alcohol.

To collect and transport samples, 15 to 20 pieces cooked pork barbeque samples were bought from Site A, Site B and Site C and were wrapped with clean aluminum foil. All samples were then immediately placed in the freezer in order to be ready for transportation on the next day. Every samples were labeled and sealed to prevent cross contamination. On the next day, the samples were then placed in a thermochase, full of ice, and was transported to DOST-Iloilo for analysis. Analysis of pH value of every cooked pork barbeque samples was done using Electrometric method conducted by DOST-Iloilo.

Mean was used to determine the pH of cooked pork barbeque samples in the identified cooked pork barbeque stands.

## III. RESULT OR FINDING

**Table 1. pH of cooked pork barbeque samples from selected cooked pork barbeque stands in Mambusao, Capiz**

Period of Sampling	Sources		
	A	B	C
Sept.7,2011	5.95	5.87	5.76
Sept.14,2011	6.14	5.92	5.78
Sept.21,2011	5.91	5.81	5.76
Sept.28,2011	5.67	5.77	5.67
Mean	5.92	5.84	5.74
**pH Growth Range of Some Pathogenic Bacteria (Jay, 1986 as cited by Ticar, 2015).			
		Pathogens	pH Range
		Salmonella spp	4.5 to 9.0
		Staphylococcus Aureus	2.6 to 10.0
		Vibrio cholera	6.0 to 9.6
		Vibrio parahaemolyticus	5.0 to 9.6
		Escherichia coli	4.6 to 9.5

The highest ph of cooked pork barbeque sample was obtained at site A during the second sampling period while the lowest pH was obtained also from site A but during the last sampling period. It further showed that the pH is within the favorable growth for salmonella spp, staphylococcus aureus, vibrio parahaemolyticus, escherichia coli from all sources at

different sampling periods except vibrio cholera which was only favorable for growth during the first sampling period of Site B and Site C.

#### IV. CONCLUSION

The pH of cooked pork barbeque samples are within the microbial growth range for Salmonella spp, Staphylococcus aureus and Escherichia coli, Vibrio parahaemolyticus but only 17% of the pH of cooked pork barbeque samples was favorable for growth of vibrio cholera.

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# Problem Solving Approaches and Mathematical Ability of College Freshmen

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**Abstract-** This study was conducted to determine the type of problem solving approaches used and the mathematical ability of the college freshmen of CapSU Mambusao in solving word problems. Specifically, it sought to determine the mathematical ability of the respondents and the difference in their mathematical ability when they are grouped according to gender, type of school graduated from, parent's educational attainment and course pursued. It further sought to determine the problem solving approach used by the respondents in solving mathematical problems and the effectiveness of the approach used. Likewise, it sought to find out if type of problem solving approach is related to students' mathematical ability.

The respondents consisted of 175 college freshmen of CapSU Mambusao enrolled during the first semester of school year 2011-2012. The study made use of a self-administered questionnaire and a problem solving test as the main research instruments. Frequency count, percentage, mean, t-test, F-test and chi square were used to analyze and interpret the data. Majority of the respondents was females. Most of them were graduates of National High School. A greater number of the respondents were pursuing the Bachelor of Science in Computer Science. Their parents had attained only elementary education. The mathematical ability of the respondents was "fair". When grouped according to gender, type of high school graduated from, parent's educational attainment and course pursued, t-test and F-test revealed no significant difference in their mathematical ability even though there was variation in scores. Majority of the respondents used an approach in solving mathematical problems. Of the respondents who used an approach, most of them used the "guess and check" approach, while the least used was the drawing a diagram approach. However, there were a considerable number of respondents whose approach could not be determined. On the effectiveness of the type of problem solving approach used by the respondents, the setting-up equation approach was more effective than the guess and check and the drawing a diagram approaches. Unfortunately, respondents who did not use any particular approach in solving problem had a rating equivalent to "needs improvement". On the relationship between type of problem solving approach and mathematical ability of the respondents, chi-square test revealed that these two variables were significantly related.

**Index Terms-** Problem Solving Approaches, Mathematical Ability, College Freshmen

## I. INTRODUCTION

As science and technology advances, mathematics must be so, for it is believed to be the language of science and technology. In fact science teachers realize that the subject cannot be presented without a satisfactory mathematics program. It is adjudged as a part of the environment expected to improve the lives of the learner considering the growing emphasis on technology. Scientist and psychologist, likewise consider it as an effective key to manpower development. Because of this, schools have made it a responsibility to be consistent with manpower development needs through the science of numeric.

There are many strategies and approaches to teaching mathematics. Problem solving involves different strategies to suit a given problem like guess and check, setting up equation, using formulas, drawing a diagram, making a table or looking for a pattern. It is for this reason that teachers should give more practice on the development of these skills or abilities needed for problem solving.

Problem solving is a systematic research by the individual through the given data and a synthesis of the findings into a neatly executed solution. Being systematic involves a step-by-step process. A step-by-step process to be applied in word problem is described by Maffel (1983) as reading activity that involves six steps. The reading skills utilized in the process are (1) reading to obtain a general idea of what the problem is all about; (2) reading to find what the problem is specifically asking for; (3) knowledge of synonymous phrases; (4) perceiving relationship of words and phrases to the whole problems; (5) ability to sequence ideas in a logical order, and (6) noting important details. Moreover, Eargs, M.W. (1980) listed down the steps in problem solving, which she found effective to her classroom, to wit: (1) Comprehension; (2) analysis and organization; (3) Recognition of the process; (4) solution; and (5) checking. The testimony of scientists and others however, indicates that the process of problem solving is not entirely open to consciousness. One may begin by reasoning consciously and deliberately but the solution often comes in its own time, suddenly and "out of nowhere".

Teachers need to provide students with good problem solving strategies and practice in using such strategies. Studies conducted on the relationship between sex and mathematical had varied results. Toledo for instance as mentioned by Gimoto (1996) compared the mathematical concepts of male and female from selected school of Iloilo found out that there were significant difference in their mathematical concept. This finding was supported by Santos as mentioned by Gimoto, who said that intelligence and mathematical ability of boys and girls had a high

degree of variability. Girls on the other hand were superior than boys in achievement and mental ability as mentioned by Alajar (1994). She further concluded that type of high school where students graduated from has relationship to college performance. Moreover, Montano (1990) and Caparino (1984) concluded that students whose parents that were college graduate and undergraduate scored better in mathematics achievement test than students whose parents were in the elementary level. Montano also agreed that educational attainment of parents influence mathematical achievement. Furthermore, student's ability in solving mathematical problems may likewise be influenced by the course he/she is taking according to Montano but it was opposed by Alajar who said that degree pursued by the students had no significant relationship with students' college performance.

However, it has been observed that many students had negative attitude towards mathematics especially on problem solving topics. Students find the subject very hard to learn especially on problems solving topics (Panganiban, 1985). No study had been conducted on the approaches used by students and their ability in solving mathematics problems among freshmen of CapSU Mambusao. It is because of this observation that this investigation on the approaches used by the students in solving word problem in mathematics was conducted. This study also focused on the determination of significant differences on the mathematical ability of the students when they are grouped according to gender, type of high school graduated from, parents' educational attainment and course pursued, on the determination of approaches used by the college freshmen of CapSU Mambusao in solving mathematical problems, on the determination of the most effective approach in solving mathematical problems used by college students, and on the determination of the type of problem solving approach that is related to students' mathematical ability.

## II. RESEARCH ELABORATIONS

The study was descriptive method of research. It was conducted at two campuses of CapSU, the Mambusao Poblacion Campus and the Burias campus. The respondents of the study were 132 females and 43 males. Most of these respondents were pursuing BSCS. As to the type of high school they graduated from, majority of the respondents (67.43%) were graduates from national high school; 27.71 percent were graduates of SUC and only 10.86 percent were graduates of private school. Most of their parents had only attained elementary education.

The instrument of the study was a self-administered questionnaire composed of two parts. Part I was used to determine the profile of the respondents and Part II was a 10-item test where the respondents were made to answer the mathematical problems indicating the approached they used in order to come up with their answers. The test was based on the standardized mathematical Olympiad test arranged from level I to IV and was subjects to content analysis by the subject specialist and school administrators for their comments and suggestions. It was then pretested and the difficulty index and discriminatory power of each item were then computed to determine its strength. Of the 20-item tests tested, 25% were revised and 25% were included without revision, thus completing the final 10-item problem solving test.

The researcher personally administered the questionnaire to the respondents with the help of the subject teachers from each campus to ensure a 100% retrieval. Statistical tools utilized in the analysis of the data were frequency count, percentage, mean, chi-square, t-test, and ANOVA.

## III. RESULTS OR FINDINGS

**Table 1. Distribution of respondents in terms of ability in problem solving.**

Percentage Score	Ability	Frequency	Percent
86 and above	Excellent	3	1.71
81 – 85	Very good	11	6.29
76 – 80	Good	35	20.00
71 – 75	Fair	62	35.43
70 and below	Needs improvement	64	36.57
Total		175	100.00
Mean		73.00	Fair

The result showed that the average mathematical ability of the respondents was 73.00 with a descriptive rating of "fair"

ability. As shown in the table, most of the respondents "need improvements" only 1.71% had "excellent" ability.

**Table 2. Mean score obtained by respondents grouped according to different variable.**

Variable	Frequency	Mean Score	Ability	Statistical Test
Sex				
Male	43	73.00	Fair	T = 0.298 <sup>ns</sup>
Female	132	73.20	Fair	

Type of High School Graduated from SUC				
National High School	38	78.00	Good	F = 0.022 <sup>ns</sup>
Private	119	72.00	Fair	
	18	73.00	Fair	
Parent's educational attainment				
Elementary level				F = 0.18 <sup>ns</sup>
Elementary graduate	47	72.15	Fair	
High school level	43	72.95	Fair	
High school graduate	31	73.32	Fair	
College level	26	72.38	Fair	
College graduate	10	74.60	Fair	
	18	74.76	Fair	
Course Pursued				
BSED	18	77.60	Good	F = 0.58ns
DVM	4	74.00	Fair	
BSFTE	11	73.50	Fair	
BSCS	50	73.33	Fair	
BSAE	14	73.10	Fair	
BSA	29	72.10	Fair	
BEED	40	72.00	Fair	
BSF	9	68.90	NI	

When grouped according to gender, the respondents had the same performance which was “fair”. T-test further concludes that variation in the mean score was statistically insignificant. This finding contradicts popular opinion that males are better in numbers than females. The results also negates the findings of Santos as cited by Gimoto (1996) and Caparino (1984) that mathematical abilities of boys had high degree of variability. However, the result agrees with the findings of Mac Coby and Jacklen (1987) who said that sexes did not differ in the test of total composite abilities.

When grouped as type of high school they graduated from, only the respondents from SUC had “good” ability while respondents from private school and national high school had “fair” ability. ANOVA further revealed that type of school where the students their secondary education has no relationship to student’s mathematical ability. The result disagrees with the findings of Ticao (1986) as cited by Montano (1990) who said that type of school was a significant factor in the varying performances of the students.

According to parents’ educational attainment, the higher the educational level attained by the respondents’ parents, the higher was their mathematical ability. However, the statistical test using ANOVA revealed that there was no significant difference in the mathematical ability when grouped according to parents’ educational attainment. This means that regardless of educational attainment of their parents, their ability is not far from each other. The result negates the findings of Montano and Caparino who concluded that parent’s educational attainment shows a significant relationship to school achievement of their children.

As to course pursued, only BSED students had “good” ability, BSCS, BSFTE, BSA, BEED and BSAE, “fair”; while BSF students had mathematical ability of “needs improvement”. Statistical analysis using ANOVA revealed that there is no difference in the mathematical ability of students regardless of the course they take. It implies that the course taken by the students had nothing to do with their mathematical ability.

**Table 3. Distribution of respondents as to the type of problem solving approach and their ability using this approach.**

Approach	Frequency	Percent	Mean score	Ability
Guess and check	54	30.86	75.30	Fair
Setting up an equation	33	18.86	80.00	Good
Draw a diagram	15	8.57	75.00	Fair
No particular approach used	73	42.71	69.00	Needs improvement
Total	175	100.00		

The study further revealed that majority of the respondents used an approach in solving mathematical problems. Of the respondents who used an approach, 30.86 percent used guess and check approach, 18.86 percent used setting up equation approach and only 8.57 percent used drawing a diagram approach. However, there were 42.71 percent whose approach cannot be determined.

On the effectiveness of the type of approach used by the respondents, setting up equations approach (mean rating 80.00) was more effective than the guess and check (mean rating = 75.30) and drawing a diagram (mean rating = 75.00) approaches. Unfortunately, respondents who did not use any particular approach in solving problem had the lowest rating of 69.00 or “needs improvement”.

**Table 4. Relationship between type of problem solving approach and mathematical ability.**

Type of approach	Mathematical ability			Total
	NI	Fair	Good	
No particular approach	55	17	1	73
Guess and check	5	25	24	54
Setting up an equation	2	11	20	33
Draw a diagram	2	8	5	15
Total	64	62	49	175

Chi- square value = 93.60 \*

\* significant

On the relationship of problem solving approach to the mathematical ability of the respondents, the chi-square test revealed that these two variables are significantly related. The findings agrees with those of Ancheta (1991) and leal (1984) that type of problem solving approach utilized by the teacher develops students’ problem solving ability. A student becomes a good problem solver when he understands the important features of a problem. Appropriate strategies in problem solving will make the teaching-learning process more enjoyable and the student is sure of correct answer. Since the result revealed that type of problem solving approach is related to their mathematical ability, the recommendation made by Palisao (1987) that there should be a mathematics clinic in every division for teachers to seek help needed and to avail of newer teaching strategies and an updated information on the new mathematics education program is necessary.

**IV. CONCLUSIONS**

1. Majority of the respondents was females. Most of them were graduates of National High School. A greater number of the respondents were pursuing the Bachelor of Science in Computer Science. Their parents had attained only elementary education.
2. The mathematical ability of the respondents was “fair”. When grouped according to gender, type of high school graduated from, parent’s educational attainment and course pursued, t-test and F-test revealed no significant difference in their mathematical ability even though there was variation in scores.
3. Majority of the respondents used an approach in solving mathematical problems. Of the respondents who used an approach, most of them used the “guess and check” approach, while the least used was the drawing a diagram approach. However, there were a considerable number of respondents whose approach could not be determined

4. On the effectiveness of the type of problem solving approach used by the respondents, the setting-up equation approach was more effective than the guess and check and the drawing a diagram approaches. Unfortunately, respondents who did not use any particular approach in solving problem had a rating equivalent to “needs improvement”.
5. On the relationship between type of problem solving approach and mathematical ability of the respondents, chi-square test revealed that these two variables were significantly related.

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# Institutional Assessment of Instruction at Capiz State University

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**Abstract-** This study was conducted in order to make an assessment of the instructions at the different campuses of Capiz State University (CapSU), Capiz, Philippines. Specifically, it aimed to determine the background characteristics of respondents in terms of CapSU campus and classification and to assess the Instruction at CapSU in terms of (a) Curriculum and Program Studies; (b) Instructional Process, Methodologies and Learning Opportunities; and (c) Classroom Management and overall. Respondents of the study included the five-hundred nineteen respondents from the ten CapSU campuses. They included the administrators, faculty members, students, alumni and community members where the campuses were situated. Data gathering instrument used was a questionnaire and analysis of data employed the use of both descriptive and inferential statistical tools with the help of the SPSS Program for Windows version 15.0. Level of significance was set at 0.05.

Overall instructions at Capiz State University was excellent. Instructions in terms of curriculum and program studies, instructional process, methodologies and learning opportunities and classroom management were all excellent.

The different campuses of Capiz State University have excellent instruction in such a way that curriculum reflects national and regional goals and institutional vision and mission and that teaching strategies stimulate the development of the students' critical and analytical thinking and independent learning while strict adherence to attendance policies are enforced.

**Index Terms-** institutional assessment, instruction, Capiz State University

**sustainable development ( World Data on Education,6<sup>th</sup> Edition, 2006).**

The most reputable programs are described in terms of their vision, purposes, and goals, and the degree to which they are internally and externally coherent (Jackson and Kelley, 2002 as cited by Davis et.al., 2005). A well-defined and coherent program is one that links goals, learning activities, and candidate assessments around a set of shared values, beliefs, and knowledge about effective administrative practice (Knapp et al., 2003 as cited by Davis et.al., 2005). ). Highly coherent programs offer a logical, often sequential array of coursework, learning activities, and program structures that links theory and practice and are framed around the principles of adult learning theory. The learning activities provide a scaffold on which new self-directed knowledge is constructed, foster deep self-reflection, link past experiences with newly acquired knowledge, are problem- rather than subject-centered, and offer multiple venues for applying new knowledge in practical settings (Granott, 2008; Lave, 2001 as cited by Davis et.al., 2005). In addition, the knowledge base upon which the program is grounded, as well as instructional strategies, are closely aligned with professional standards (Davis et.al. 2005).

In a university such as Capiz State University, instruction is one its major functions. With this, this study might be timely to determine the background characteristics of respondents in terms of CapSU campus and classification and to assess the instruction at CapSU in terms of (a) Curriculum and Program Studies; (b) Instructional Process, Methodologies and Learning Opportunities; and (c) Classroom Management.

## I. INTRODUCTION

The purpose of institutional assessment is to set out a process for the assessment of overall institutional effectiveness in key areas including teaching, research, student support services, aspects of institutional mission, and particular institutional goals. A more specific purpose of the assessment of institutional effectiveness is to foster the integration of strategic planning and assessment at the institutional and unit levels. The plan outlines efforts at the institutional level and provides guidelines for operational units of the institution to develop assessment plans as part of their respective strategic plans.

**The higher education system in the Philippines is a key player in the educational and integral formation of professionally competent, service-oriented, principled and productive citizens. It has a tri-fold function of teaching, research and extension services. Through these, it becomes a prime mover to the nation's socio-economic growth and**

## II. RESEARCH ELABORATIONS

This study was conducted in all 10 campuses of Capiz State University during the first semester of Academic Year 2010 – 2011 to all campus administrators of the 10 CapSU campuses, faculty members, students, alumni and community members where the campuses were situated. Data gathering instrument was a questionnaire divided into two parts. The first part gathered data about the campus and the classification of the respondent. The second part assessed the instruction at Capiz State University. Part A assessed Curriculum and Program Studies. Part B assessed Instructional Processes, Methodologies and Learning Opportunities. Part C assessed Classroom Management. The questionnaire was answerable by a five point Likert Scale depending on the degree with which the respondents agreed or disagreed with the statements. The questionnaires were distributed to the identified respondents who were given ample time to answer it completely. The questionnaires were

then retrieved, scored, tabulated and processed for analysis. Data and statistical tools used were frequency counts and percentage. was encoded on the SPSS Program for Windows, version 15.0

### III. RESULTS OR FINDINGS

**Table 1. Distribution of respondents according to CapSU campus**

Campus	f	%
Tapaz	32	6.17
Mambusao Poblacion	43	8.29
Mambusao Burias	52	10.02
Roxas City	99	19.08
Dayao	47	9.06
Sigma	51	9.83
Pontevedra	85	16.38
Dumarao	37	7.13
Sapian	34	6.55
Pilar	39	7.51
Total	519	100.00

This study included 519 respondents. The most number of respondents (19.08%) come from CapSU Roxas City Campus while the lowest number of respondents are from Tapaz Campus (6.17%).

**Table 2. Distribution of respondents according to classification**

Classification	f	%
Administrator	10	1.93
Faculty	136	26.20
Student	179	34.49
Alumni	100	19.27
Community Member	94	18.11
Total	519	100.00

When grouped according to classification, more than one third (34.49%) were students while more than one fourth (26.20%) were faculty members of the different campuses of Capiz State University. Moreover, the alumni made up almost one fifth (19.27%) of the sample while community members of municipalities where the campuses were located made up 18.11% of the sample. Furthermore, all the administrators of the 10 campuses were respondents of the study, making up 1.93% of the sample.

**Table 3. Assessment of instruction in terms of curriculum and program studies**

Items	Mean	Interpretation
1. The curriculum/program of study meets the requirements and standards of CHED, PRC, TESDA, Professional Organizations or Societies and other related agencies.	4.42	Excellent
2. The curriculum reflects national and regional goals and institutional vision and mission.	4.46	Excellent
3. The curriculum provinces for the development of the following professional competencies:		
a) Acquisition of knowledge of theories based on the field of specialization.	4.31	Excellent
b) Learning the conceptual application of the theories to real problems in the field.	4.22	Excellent
c) Demonstrating the skills to carry out the application or strategy in actual work setting.	4.27	Excellent
4. The courses are logically sequenced and prerequisite courses are identified.	4.42	Excellent
5. The curricular content responds to the needs of the country and recent developments in the profession.	4.27	Excellent

6. The curricular content reflects the depth and breadth of the professional and technical preparation required of its graduates.	4.26	Excellent
7. The curium integrates values, reflective of national customs, culture and tradition in cases where applicable.	4.37	Excellent
8. The curriculum provides for opportunities for participation in activities, such as immersion/practical training.	4.42	Excellent
9. The following activities are undertaken to ensure quality in the planning, design, monitory and review of the curriculum.		
a) periodic review, assessment and updating of the curriculum	4.27	Excellent
b) Participation in the development and revision of the curriculum of at least the faculty and/or students and alumni.	4.22	Excellent
c) participation in the review and approval of curricular programs of the academic council and/or administrative board, BOR/BOT	4.41	Excellent
Mean	4.33	Excellent

Assessment of instruction in terms of curriculum and program studies were all excellent.

**Table 4. Assessment of instruction in terms of instructional process, methodologies and learning opportunities**

Items	Mean	Interpretation
1. There is an updated syllabus for each subject duly approved by the Dean or official concerned.	4.39	Excellent
2. The syllabus is comprehensive and appropriate contents for the course are included.	4.40	Excellent
3. The syllabus allows flexibility to accommodate revisions and adjustments while the course progresses.	4.31	Excellent
4. The syllabus includes a list of suggested readings and references of recent edition.	4.31	Excellent
5. The faculty provides a copy of the syllabus to each student and discusses this at the beginning of the course.	4.19	Very Good
6. Classroom instruction is enriched through the following strategies:		
a) symposia, seminars, workshops, professional lectures	4.25	Excellent
b) field trips/learning visits/ other co-curricular activities	4.28	Excellent
c) peer teaching/cooperative learning	4.23	Excellent
d) computer-assisted instructions and computer-assisted learning	4.15	Very Good
7. Course requirements contribute to quality and independent study.	4.22	Excellent
8. Teaching strategies stimulate the development of the students' critical and analytical thinking and independent learning.	4.32	Excellent
9. Instructional strategies provide for student's individual needs and multiple intelligence.	4.27	Excellent
10. Varied, multi-sensory materials and computer programs are utilized for instruction	4.15	Very Good
11. Instructional materials are reviewed and recommended by an instructional materials committee.	4.21	Excellent
12. Faculty members are encouraged to produce their own instructional materials such as modules, software, visual aids, manuals and textbooks.	4.26	Excellent
13. The academic unit maintains consortia and linkages with other learning institutions for academic exchange of instructional materials.	4.24	Excellent
14. The prescribed textbook and other reference materials are of recent edition and reflect recent trends, issues and content related to the subject/course	4.20	Very Good
Mean	4.26	Excellent

Assessment of instruction in terms of instructional process, methodologies and learning opportunities were all excellent except on providing a copy of the syllabus by the faculty to each student and discussing the syllabus content at the beginning of the course, enriching of classroom instruction through the computer-assisted instructions and computer-assisted learning, utilization of varied or

multi-sensory materials and computer programs for instruction and prescribing of textbook and other reference materials that are of recent edition which reflect recent trends, issues and content related to the subject/course which were rated as very good, respectively.

**Table 5. Assessment of instruction in terms of classroom management**

Items	Mean	Interpretation
1. Records of students daily attendance are filed and used for monitoring and guidance/counseling purposes	4.29	Excellent
2. The policy on student's attendance in classroom and on other instructional activities is enforced	4.33	Excellent
3. Classroom discipline is maintained in consonance with democratic practices.	4.29	Excellent
4. Class officers and assigned students assist in maintaining cleanliness of classroom, laboratories and corridors.	4.21	Excellent
5. Administrative Support for Effective Instruction	4.24	Excellent
6. The institution implements rules on the attendance of the faculty in their respective classes.	4.34	Excellent
7. The institution has provisions for substitution or special arrangements whenever a teacher is on leave or absent.	4.22	Excellent
8. There is a periodic faculty performance evaluation in accordance with existing institutional policies.	4.25	Excellent
9. Dialogues involving the administration, faculty and students are encouraged.	4.23	Excellent
10. There is a system of awards and recognition for outstanding achievement of the faculty.	4.13	Very Good
11. Supervision/monitoring system is designed to ensure sufficient class preparation by the faculty.	4.23	Excellent
Mean	4.25	Excellent

Assessment of instruction in terms of classroom management was all excellent except in providing a system of awards and recognition for outstanding achievement of the faculty which was rated as very good.

**Table 6. Comparison of assessment of instruction in terms of curriculum and program studies of CapSU among respondents from different CapSU campuses**

CapSU Campus	Mean	Interpretation
Tapaz	4.30	Excellent
Mambusao Poblacion	4.38	Excellent
Mambusao Burias	4.38	Excellent
Roxas City	4.39	Excellent
Dayao	4.35	Excellent
Sigma	4.25	Excellent
Pontevedra	4.37	Excellent
Dumarao	4.22	Excellent
Sapian	4.38	Excellent
Pilar	4.16	Very Good
Total	4.33	Excellent

In terms of curriculum and program studies, all CapSU campuses were excellent except Pilar campus which was rated as very good.

**Table 7. Comparison of assessment of instruction in terms of instructional processes, methodologies and learning opportunities of CapSU among respondents from different CapSU campuses**

CapSU Campus	Mean	Interpretation
Tapaz	3.95	Very Good
Mambusao Poblacion	4.34	Excellent
Mambusao Burias	4.37	Excellent
Roxas City	4.35	Excellent
Dayao	4.30	Excellent
Sigma	4.17	Very Good
Pontevedra	4.30	Excellent
Dumarao	4.20	Very Good
Sapian	4.25	Excellent
Pilar	4.05	Very Good
Total	4.26	Excellent

Instructional processes, methodologies and learning opportunities of CapSU were rated excellent in all campuses except Tapaz, Dumarao and Pilar campuses which were rated as very good, respectively.

**Table 8. Comparison of assessment of instruction in terms of classroom management of CapSU among respondents from different CapSU campuses**

CapSU Campus	Mean	Interpretation
Tapaz	4.19	Very Good
Mambusao Poblacion	4.30	Excellent
Mambusao Burias	4.32	Excellent
Roxas City	4.34	Excellent
Dayao	4.30	Excellent
Sigma	4.16	Very Good
Pontevedra	4.28	Excellent
Dumarao	4.21	Excellent
Sapian	4.19	Very Good
Pilar	4.04	Very Good
Total	4.25	Excellent

Assessment of instruction in terms of classroom management of CapSU were all rated as excellent except Tapaz, Sigma, Sapian and Pilar Campuses which were all rated as very good, respectively.

**Table 9. Comparison of Assessment of Instruction of CapSU among Respondents from Different CapSU Campuses**

CapSU Campus	Mean	Interpretation
Tapaz	4.13	Very Good
Mambusao Poblacion	4.31	Excellent
Mambusao Burias	4.38	Excellent
Roxas City	4.37	Excellent
Dayao	4.32	Excellent
Sigma	4.21	Excellent
Pontevedra	4.34	Excellent
Dumarao	4.21	Excellent
Sapian	4.32	Excellent

Pilar	4.1	Very Good
Total	4.29	Excellent

Instructions were excellent in Mambusao Buriyas Campus, Roxas City, Pontevedra, Dayao, Sapián, Mambusao Poblacion, Dumarao and Sigma. However, instructions in the Tapaz and Pilar Campuses was only found to be very good.

#### IV. CONCLUSIONS

1. Overall instructions at Capiz State University was excellent. Instructions in terms of curriculum and program studies, instructional process, methodologies and learning opportunities and classroom management were all excellent.
2. The different campuses of Capiz State University have excellent instruction in such a way that curriculum reflects national and regional goals and institutional vision and mission and that teaching strategies stimulate the development of the students' critical and analytical thinking

and independent learning while strict adherence to attendance policies are enforced.

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# Miracle of Allicin, a Case Report

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**Abstract-** Hypertension is a chronic and end stage disease . The biomolecular mechanism involved in the pathogenesis can be interrupted for improving therapeutic approach and prognosis. Identifying the risk factors and causes of hypertension is essential to categorize into idiopathic and secondary hypertension. Garlic used since ancient time has drawn attention for deeper research towards its contribution to various health benefits. Its vital component allicin has played key role in beneficial effects of garlic.

**Index Terms-** hypertension, atherosclerosis, angiotensin converting enzyme, allicin , alliin.

## I. INTRODUCTION

5 years old male presented with history of indigestion since 3 months. More troublesome after having oily food stuff, fried items. Patient is a known case of type 2 diabetes mellitus since 8 years and hypertensive since 5 years. On treatment with T. Glimy 1 mg OD and T. Metformin SR 500 mg BD. T. Telmisartan 40mg OD and T. Amlodipine 2.5mg OD , T. Atorvastatin 20 mg HS , T. Aspirin 75mgHS .

Patient was examined thoroughly, basal BP measuring 158/92 mmHg and Per abdomen examination revealed tenderness in right hypochondriac region and epigastric region. Advised to undergo following biochemical investigations with respective test result as follows

FBS: 132 mg%

PPBS: 186 mg%

LIPID PROFILE: Total cholesterol – 248 mg%

Triglycerides – 228mg%

LDL Cholesterol – 112mg%

HDL cholesterol- 40mg%

S. Creatinine 1.0 mg%

Blood urea level: 32 mg%

Urine routine: NAD

Liver function tests:

Serum bilirubin total: 0.9 mg%

Direct: 0.3 mg%

Indirect 0.4 mg%

Total protein 7.0g%

Serum albumin 3.5g%

Serum globulin 1.8g%

SGOT levels: 48 IU/mL (normal range 12-38U/Lt)

SGPT levels: 55 IU/mL (normal range 7-41 U/Lt)

After the evaluation of biochemical investigations, the patient was advised to undergo ultrasound examination of

abdomen and pelvis, which revealed Grade 2 fatty liver, other solid organs didn't depict any abnormality.

Patient was advised to consume garlic, to get the essentials of allicin from it. The concentration of allicin to be consumed would be mg, and dandelion along with milk thistle post dinner for 6 weeks. Intermittent basal blood pressure reading after 15 days of prophylactic remedy showed 148/90 mmHg. This is bound to take serial reading on three different days at 8 am on empty stomach without tea/ coffee intake, thus avoiding effects of caffeine, phytates and tannates on blood pressure. Basal reading on all three days showed systolic BP 146-150 mmHg and diastolic reading 86-90 mmHg. Hence his antihypertensive medications were changed to Telmisartan 40 mg once daily skipping T. amlodipine with regular follow up. At the end of one month blood pressure reading with similar consecutive reading on three different days revealed systolic BP ranging between 138-144 mmHg and diastolic BP ranging between 82mmHg to 88mmHg, once again the dosage of antihypertensive medication was reduced to 20mg of telmisartan. At the end of 6 weeks, the biochemical investigations were repeated with more focused review on lipid profile. Astonishing results were received with following values

LIPID PROFILE: Total cholesterol – 202 mg%

Triglycerides – 153mg%

LDL Cholesterol – 92mg%

HDL cholesterol- 42mg%

The patient was made to discontinue T. Aspirin, T. Telmisartan and T. Atorvastatin and continued to consume garlic essentials.

## II. GARLIC ESSENTIALS: A BOON TO HEALTHY HEART

Being one of the most important organs in the body the heart is one of those organs that works non-stop. It circulates oxygen in the body and takes away the toxins produced, without which all other organs would shut down leading to death.

Atherosclerosis (in common term called as thickening and blocking of arteries) remains the major cause of death and premature disability in developed & developing countries. Current predictions estimate that year 2020 cardiovascular diseases, notably atherosclerosis, will become the leading global cause of total disease burden. Atherosclerosis of the coronary arteries commonly causes myocardial infarction and angina pectoris. Atherosclerosis of arteries supplying the central nervous system frequently provokes strokes and transient cerebral ischemia. In the peripheral circulation, atherosclerosis causes

intermittent claudication and gangrene, and jeopardizes limb viability.

It is the narrowing or occlusion of the arteries by plaque, which consists of cholesterol, platelets, monocyte/macrophages, calcium, aggregating proteins, and other substances. Morbidity of atherosclerosis-induced coronary heart disease (CHD) gradually elevates annually due to the improvement of life standard and the change of lifestyle in recent years. However, the mechanism of the onset and development of atherosclerotic lesions are not completely understood until now. Many complicated factors, its interaction and interrelated biological processes contribute to atherosclerosis. Among these, high plasma levels of low-density lipoprotein (LDL), especially its oxidized form (ox-LDL), and activation of the renin-angiotensin system (RAS) are considered to be the key influencing factor of the generation and development of atherosclerosis.

Growth of atherosclerotic plaques probably doesn't occur in a smooth, linear fashion, but rather discontinuously, with periods of quiescence punctuated by periods of rapid evolution. After generally prolonged 'silent' period, atherosclerosis can manifest clinically. The clinical expressions of atherosclerosis may be chronic, as in effort induced *angina pectoris* or of predictable and reproducible intermittent *claudication*. Alternatively, a dramatic acute clinical event, such as myocardial infarction, a *stroke*, or *sudden cardiac death* may first herald the presence of atherosclerosis.

MAJOR RISK FACTORS : <sup>1</sup>

1	Cigarette smoking
2	Hypertension (BP >140/90mmHg)
3	Low HDL cholesterol (<40mmHg)
4	Diabetes mellitus
5	Family history of premature coronary heart disease (CHD) CHD IN MALE FIRST –DEGREE RELATIVE < 55years CHD IN FEMALE FIRST –DEGREE RELATIVE < 65years
6	Lifestyle risk factors Obesity ( BMI > 30Kg/m <sup>2</sup> ) Physical inactivity Atherogenic diet
7	Age ( men > 45years, women >55years)

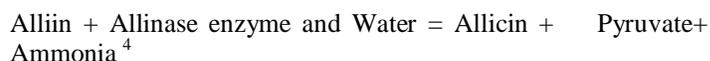
SCIENTIFIC ROLE OF GARLIC IN MAINTAINING HEALTHY HEART:

Garlic (*Allium sativum*) is originated from central Asia and belongs to Alliaceae family. It is used as a flavoring agent. In Egyptian codex 3500 years old document notifies that garlic was used in the treatment of heart disorders, tumors, worm and snake

bites etc. Majority of the garlic is composed by water around 65% followed by fructose, sulphur, zinc, selenium and moderate amounts of Vitamin A, low levels of calcium, magnesium, iron, manganese.

Alliin is an organosulphur compound, obtained from garlic. The aroma of garlic when freshly crushed is because of the content alliin released by the action of the enzyme alliinase on the substrate alliin. Alliin is an oily based yellowish liquid, which gives garlic its unique colour. Its biological activity can be attributed to both its antioxidant activity and its reaction with thiol containing proteins. The content of garlic by whole weight to its concentration of bioactive compound is 1:0.001 . Alliinase has a very short half life. Alliinase is irreversibly deactivated below pH 3; as such, alliin is generally not produced in the body from the consumption of fresh or powdered garlic. Alliin is unstable , breaking down into inactive components at 23<sup>0</sup> C, thus cooking destroys the bioactive component of garlic. Alliin exhibits lipid lowering, blood thinner, increases local circulation and platelet inhibitor action thus preventing aggregation and clot formation.<sup>3</sup>

III. MODE OF ACTION ALLICIN:



The biological activity of alliin extracted from fresh garlic is thought to be related to a combination of factors:

1. Antioxidant activity

*Potent antioxidant with relevance to LDL oxidation and reduces peroxides accumulation in endothelial cells. As oxidized LDL cholesterol is known to bind to specific receptors and stimulate the activation of numerous pro-inflammatory changes in the vascular wall.* <sup>5</sup>

2. Enzymes are also protein , and contain SH (sulphydryl) group for their biochemical interaction. Alliin attacks the SH groups of protein interfering with their function. Cholesterol is synthesized in the liver with the help of rate limiting enzyme HMG(beta-hydroxy-beta-methylglutaryl) Co A reductase. Organosulphur content of alliin reduces the enzyme forming internal disulphide bond and inactivation of thiol (-SH) group of enzymes like multienzyme complex of fatty acid synthesis. Thus contributing to lipid lowering action . <sup>6</sup>

Garlic, in an amount approximating one-half to one clove per day (600-900 mg), has been shown to decrease total serum cholesterol levels by about 9%

3. Because of its organic nature, alliin rapidly penetrates into the cell. <sup>6</sup>

HYPERTENSION AND ITS STAGES : <sup>1</sup>

CATEGORY	SYSTOLIC BP (mmHg)	DIASTOLIC BP (mmHg)
Normal	< 120 and	< 80
Pre hypertension	120-139 or	80-89
Hypertension stage I	140-159 or	90-99

Hypertension stage II	≥160 or	≥100
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#### IV. ROLE OF GARLIC IN PREVENTION AND TREATMENT OF HYPERTENSION

- a) Improvements in vasodilatation due to maintenance of healthy endothelium secondary to prevention of accumulation of peroxides and other free radicals in endothelium and LDL oxidation. Protects and restores the elasticity of the arteries.<sup>7</sup>
- b) Inhibition of angiotensin converting enzyme, thus reducing production of angiotensin II which is responsible for salt and water retention and vasoconstriction
- c) Decreasing platelet aggregation
- d) Lipid lowering effects by reducing hepatic cholesterol synthesis and fatty acid synthesis
- e) Prevents lipid peroxidation of oxidized erythrocytes.<sup>7</sup>

#### V. ROLE OF LIPID DISORDERS IN HEART DISEASE

Abnormalities in plasma lipoproteins and derangement in lipid metabolism rank the most firmly established and best understood risk factors for atherosclerosis. Elevated LDL levels promote atherogenesis likely involves oxidative modification. Cholesterol is necessary for the normal body process. It is the vital component of the cell membrane and transports nutrients into the cell and waste products out of the cell. Cholesterol being the component blood lipids: LDL, HDL, VLDL etc. Thus hypercholesterolemia causes metabolic derangement leading to oxidative stress causing LDL oxidation and subsequent subendothelial accumulation forming foam cells. The consistent benefit of LDL lowering by HMG CoA reductase inhibitors (eg. Atorvastatin) observed in risk groups causes salutary effects on lipid profile and direct modulation of plaque biology apart from lipid lowering.<sup>8,9,11</sup>

#### VI. OTHER USES OF GARLIC

It is beneficial in patients with chronic sinusitis, allergic rhinitis, hypertension in late pregnancy (pre-eclampsia), travelers diarrhoea, flu, enlarged prostate (BPH-benign prostatic hyperplasia), building up immunity, prevention and treatment of Colon CA, gastric CA, CA breast, CA prostate, CA lung.<sup>12,13</sup>

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# Effect of potassium and its time of application on yield and quality of tomato

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**Abstract-** A field experiment was conducted to investigate the effect of potassium and its time of application on yield and quality of tomato variety, Nagina. Treatments included three potassium levels i.e. 60, 90 and 120 kg ha<sup>-1</sup> and two application timings: at transplanting as single dose, and half at transplanting + half at 40 days after transplanting in two splits, were applied along with a control (0 kg ha<sup>-1</sup> K). Potassium application @ 60 kg ha<sup>-1</sup> either applied in single or in two splits, significantly increased the yield and improved the quality parameters of tomato over control while higher levels of K (90 and 120 kg ha<sup>-1</sup>) did not show further significant increase in the yield and quality subsequently. Ascorbic acid remained unaffected. Results revealed that time of application/splitting of K did not affect the yield and quality. The highest yield (23.3 t ha<sup>-1</sup>), firmness (8.32 kg), fruit weight (83.24 g fruit<sup>-1</sup>), total invert sugars (4.11 %), dry matter (6.33 %) and mineral matter (1.95 %) were recorded with the application of 120 kg ha<sup>-1</sup> potassium at transplanting while the highest values of acidity (0.81%), TSS (7.03 %) and ascorbic acid (30.33 mg 100 g<sup>-1</sup>) were observed in treatment where potassium was applied @ 60 kg ha<sup>-1</sup> in two splits. Minimum yield (17.2 t ha<sup>-1</sup>), firmness (6.35 kg), fruit weight (68.11 g/fruit), mineral matter (1.80 %), dry matter (5.26 %), acidity (0.61 %), ascorbic acid (21.79 mg 100g<sup>-1</sup>), TSS (6.60 %) and total invert sugars (3.85 %) were found in control.

**Index Terms-** Potassium, Tomato, Quality, Ascorbic acid, Acidity

## I. INTRODUCTION

Tomato (*Lycopersicon esculentum*) is a nutritious and popular product all over the world. Tomatoes are grown over about 53.1 thousand hectares in Pakistan with an average yield of about 10.1 t ha<sup>-1</sup> (Anonymous, 2008). Potassium is one of the essential mineral nutrients in the plant food and taken up by roots from the soil solution in its ionic form. It is involved in numerous physiological processes that control plant growth, yield and quality parameters such as sugars, titratable acidity, total soluble solids, taste, color and firmness (Lester *et al.*, 2005). High levels of available K improve the physical quality, disease resistance, and shelf life of fruits and vegetables (Better Crops, 1999). It is not a part of plant or plant product; however it is very important for the life process of plant (Haji *et al.*, 2011) and it is often referred as the quality element for crop production (Usherwood, 1985). Production of quality fruits is controlled by the interaction of genetic, environmental and cultural factors

including plant nutrients (Dorais *et al.*, 2001). Among essential plant nutrients, potassium is the one that is absorbed by the tomato plant in the largest amounts and it is considered to be the key to production of quality fruits (Mengel and Kirkby, 1987). According to several authors, it plays a key role in the improvement of several post harvest quality traits in tomato fruits and in almost all vegetables (Cakmak, 2005), Chapagain and Wiesman, 2004). Keeping in view the importance of potassium for tomato this study was carried out to see the effect of potassium on the yield and quality of tomato.

## 2. MATERIALS AND METHODS

This research was conducted in a field at Biochemistry Section, Post Harvest Research Centre, Faisalabad, Pakistan during 2012, 2013 and 2014 on tomato variety, Nagina. Randomized Complete Block Design was used as the experiment layout with three replications. Thirty days old seedlings were transplanted in the field during the last week of November of each year. The treatments detail of the experiment is shown below

Treatments	K-applied (kg ha <sup>-1</sup> )	Time of K-application
T <sub>1</sub>	00 (Control)	No K- applied
T <sub>2</sub>	60 (Single dose)	At transplanting
T <sub>3</sub>	60 (Two splits)	½ at transplanting + ½ at 40 days after transplanting
T <sub>4</sub>	90 (Single dose)	At transplanting
T <sub>5</sub>	90 (Two splits)	½ at transplanting + ½ at 40 days after transplanting
T <sub>6</sub>	120 (Single dose)	At transplanting
T <sub>7</sub>	120 (Two splits)	½ at transplanting + ½ at 40 days after transplanting

Recommended doses of N and P (100 and 90 kg ha<sup>-1</sup>) in the form of urea and single super phosphate were applied to all the treatments. Phosphorus was applied at transplanting while nitrogen in three splits: at transplanting, 40 days after transplanting and 60 days after transplanting. Potassium sulphate fertilizer was used for K and applied according to the treatment plan. Harvesting of mature fruits started during March and continued till June of every year. Yield was recorded and representative fresh fruit samples were collected for assessing the firmness, fruit weight, acidity, total soluble solid (TSS), ascorbic acid, total invert sugars, dry matter and mineral matter. Sugars, acidity and ascorbic acid were determined by methods given in AOAC, (2000). Dry matter was determined by drying the samples at 64°C till constant weight. TSS was

measured with a digital refractometer. The data collected were subjected to analysis of variance to test the significance at  $P \leq 0.05$  with Statistix 8.0 software and presented as means of 3 years and treatment means were compared using least significant difference (Steel *et al.*, 1997).

### 3. RESULTS AND DISCUSSIONS

#### Yield

Potassium application increased the yield significantly over control but increasing levels of potassium did not increase the yield subsequently (table 1). The highest yield ( $23.3 \text{ t ha}^{-1}$ ) was found with the application of  $120 \text{ kg ha}^{-1}$  potassium at transplanting in single dose. The lowest yield ( $17.2 \text{ t ha}^{-1}$ ) was found in control. The yield produced with the application of K @  $60 \text{ kg ha}^{-1}$  was  $20.0 \text{ t ha}^{-1}$  which was statistically at par with the yield  $20.6$  and  $23.3 \text{ t ha}^{-1}$  recorded in the treatments receiving  $90$  and  $120 \text{ kg ha}^{-1}$  potassium applied at transplanting. Results also revealed that time of application/splitting of K did not affect the yield significantly. Results were in agreement to the findings of Afzal *et al.*, (2015) who reported that foliar application of  $0.6\%$  K improved the fruit yield of tomato, however, higher doses of K ( $0.7, 0.8, 0.9,$  and  $1.0\%$ ) did not improve fruit yield subsequently. Similar results quoted by Kazemi (2014). Results are in contrary to Akhter *et al.*, (2010), Khan *et al.*, (2005), Gupta and Senger (2000) who found increased tomato yield by increasing levels of potassium. Javaria *et al.*, (2012) found an incremental increase in yield from  $12.34$  to  $30.56 \text{ t ha}^{-1}$  by increasing levels of K from  $0$  to  $450 \text{ kg ha}^{-1}$  while Iqbal *et al.*, (2011) found maximum yield ( $19 \text{ t ha}^{-1}$ ) with the application of  $130 \text{ kg ha}^{-1}$  potassium as compared to control ( $0 \text{ kg ha}^{-1}$ ). El-Nemr *et al.*, (2012) reported that by increasing potassium levels in the nutrient solution, total yields were increased significantly.

#### Firmness

Potassium application increased the firmness of fruit from  $6.35 \text{ kg}$  in control to  $8.32 \text{ kg}$  with the application of K @  $120 \text{ kg ha}^{-1}$  in single dose (table-1). The results revealed that firmness of fruits increased significantly with the application of potassium @  $60$  and  $90 \text{ kg ha}^{-1}$  at the time of transplanting as compared to control. After that, the effect of the application of increased levels of potassium leveled off and no significant difference was observed between the K- levels  $90$  and  $120 \text{ kg ha}^{-1}$ . The effect of potassium application in two splits was also found non-significant. The best dose of K for the good firmness was found as  $120 \text{ kg ha}^{-1}$  either applied at transplanting or in two splits. Asri and Sonmez (2010) found maximum firmness with increasing dose of potassium. The significant effects of enhanced potassium fertilization were observed on firmness, sweetness, crispness and flavor ( $P \leq 0.001$ ) by Javaria *et al.*, (2012).

#### Fruit weight

Average fruit weight was calculated by selecting ten fruits randomly and then weighing. Average fruit weight indicated that potassium application increased the fruit weight from  $68.11$  to  $83.24 \text{ g fruit}^{-1}$ , minimum in control and maximum in treatment where  $120 \text{ kg ha}^{-1}$  potassium was applied at transplanting as single dose. Results also revealed that time of application/splitting of K did not affect the fruit weight significantly (table 1). Iqbal, *et al.*, (2011) found that maximum fruit diameter ( $5.08 \text{ cm}$ ) was noted when plants received  $120 \text{ kg N}$  and  $90 \text{ kg ha}^{-1}$  K. Similar results were reported by Padem and Ocal (1999) who found that average fruit weight of tomato was increased significantly in all the potassium treated pots in comparison to K untreated pots. It was  $52.62 \text{ g}$  in the control while maximum fruit weight ( $106.4 \text{ g}$ ) was recorded in the treatment receiving  $450 \text{ Kg K}_2\text{O ha}^{-1}$ . Results was also in line with the results of Afzal *et al.*, (2015) who found that the fruit weight of variety Roma increased from  $57.30 \text{ g}$  (control) to  $72.0 \text{ g}$  with the foliar application of  $0.6\%$  potassium solution.

d		$\text{t ha}^{-1}$	kg	$\text{g fruit}^{-1}$
0	Control	17.2 c	6.35 b	68.11 e
60	at transplanting	20.0 b	7.01 b	69.49 e
60	½ at transplanting + ½ at 40 days after transplanting	21.2 ab	7.33 b	75.26 bc
90	at transplanting	20.6 b	7.40 ab	78.80 b
90	½ at transplanting + ½ at 40 days after transplanting	21.2 ab	7.57 ab	73.11 cd
120	at transplanting	23.3 a	8.32 a	83.24 a
120	½ at transplanting + ½ at 40 days after transplanting	20.8 b	8.03 a	79.40 ab
LSD		2.3	0.93	4.32

Acidity increased with the application of potassium @  $60 \text{ kg ha}^{-1}$  applied in two splits but the increasing levels of potassium caused no effect on the acidity of tomato (table 2). Results also revealed that the time of application/splitting of K dose did not affect the acidity significantly. Acidity ranged from  $0.61$  to  $0.81\%$ , minimum in control and maximum in treatment where potassium was applied in two splits @  $60 \text{ kg ha}^{-1}$ . At higher levels of potassium ( $90$  and  $120 \text{ kg ha}^{-1}$ ), acidity did not increase further. The results of this study showed correspondence with the results of Kazemi (2014), Asri and sonmez, (2010), EL Nemr *et al.*, (2012) and Wuzhong (2002). Present results are in contrast to the results of Akhter *et al.*, (2010) who found no significant effect of potassium application and its increasing levels on the acidity of the tomato.

#### Acidity

Table 2 Effect of potassium application on Acidity, TSS and Ascorbic acid of tomato

K-applied	Time of K-application	Acidity	TSS	Ascorbic acid
$\text{kg ha}^{-1}$		%	%	$\text{mg } 100\text{g}^{-1}$
0	Control	0.61 c	6.60 c	21.79 b
60	at transplanting	0.70 bc	6.88 abc	26.06 ab

Table 1 Effect of potassium application on Yield, Firmness and Fruit weight of tomato

K-applied	Time of K-application	Yield	Firmness	Fruit weight
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60	½ at transplanting + ½ at 40 days after transplanting	0.81 a	7.03 a	30.33 a
90	at transplanting	0.71 b	6.98 a	25.64 ab
90	½ at transplanting + ½ at 40 days after transplanting	0.71 b	7.00 a	22.65 b
120	at transplanting	0.67 bc	6.96 a	21.83 b
120	½ at transplanting + ½ at 40 days after transplanting	0.73 ab	6.95 ab	25.63 ab
LSD		0.10	0.31	6.57

**Total soluble solids**

Potassium application had a significant effect on the total soluble solids (TSS) of tomato. However, splitting of K into two doses had no effect on TSS. The highest TSS content (7.03%) was observed in treatment where K was applied @ 60 kg ha<sup>-1</sup> in two splits while the lowest TSS (6.60 %) was found in control (table 2). However, increasing levels of K did not make a further increase in TSS. Potassium application rates above 60 kg ha<sup>-1</sup> i.e. 90 and 120 Kg ha<sup>-1</sup> were found statistically at par. Contrary results obtained by Cakmak (2005) and Asri and Sonmez (2010) who found the highest TSS with ascending doses of potassium. El-Nemr *et al.*, (2012) reported that by increasing the potassium levels in the nutrient solution, TSS were increased significantly.

**Ascorbic acid:-**

Potassium either applied in one or in two splits had no significant effect on the ascorbic acid contents of tomato (table 2). Ascorbic acid content in tomato varied from 21.79 to 30.33 mg 100g<sup>-1</sup>. It is indicated that potassium application @ 60 kg ha<sup>-1</sup> in two splits yielded the highest ascorbic acid content (30.33 mg100g<sup>-1</sup>) while minimum ascorbic acid (21.79 mg 100g<sup>-1</sup>) was recorded in control as well as in the treatment (21.83 mg 100g<sup>-1</sup>) where 120 kg ha<sup>-1</sup> potassium was applied at transplanting in single dose. The study of Asri and Sonmez (2010) supported the results of present study who found no significant difference in ascorbic acid concentration of fruit for K and Fe application. Results obtained are contradictory to the findings of Wuzhong (2002) and Bose *et al.*, (2006) who reported a positive correlation between enhanced potassium doses and ascorbic acid contents. Afzal *et al.*, (2015) found that among foliar treatments (0.5, 0.6 and 0.7 %), 0.7 % K spray improved ascorbic acid contents in tomato.

**Total invert sugars**

Total invert sugars were significantly increased in tomato fruit by the application of potassium over control, but splitting of K had no significant effect on total invert sugars. Potassium application increased the total invert sugars from 3.85 % in control to 4.11 % in treatment where 120 kg ha<sup>-1</sup> potassium was applied at transplanting in single dose (table-3). Increasing levels of potassium i.e. 90 and 120 kg ha<sup>-1</sup> were found at par. The reason of enhanced sugar content could be the role of potassium in biosynthesis and transfer of sugars (Karam *et al.*, 2009). Present results were in agreement with results reported by Javaria *et al.*, (2012). These results are in contrast with the result

quoted by Akhter *et al.*, (2010) who found no significant effect of potassium on total sugars in tomato.

**Dry matter**

Dry matter increased significantly with the application of potassium. But the increasing levels of potassium and time of application did not affect the dry matter significantly (table 3). Dry matter increased from 5.26 % in control to a maximum of 6.33 % at 120 kg ha<sup>-1</sup> potassium application in single dose at transplanting.. Splitting of K did not differ statistically from the application of K in a single dose. These results were in agreement with those of Wuzhong, (2002) who found that increasing potassium levels from 0 to 112.5 kg ha<sup>-1</sup> resulted in a higher level of dry matter in tomato fruit i.e. 5.82 to 7.15 %. Amjad *et al.*, (2014) reported that application of potassium both in soil (3.3 and 6.6 mmol kg<sup>-1</sup>) and foliar form (4.5 and 9 mM), significantly increased the TSS and fruit dry matter in all genotypes of tomato compared to the control (0 mM K). Similar results were quoted by Payvast, *et al.*, (2009).

Table 3 Effect of potassium application on Total invert sugars, dry matter and mineral matter of tomato

K-applied	Time of K-application	Total invert sugars	Dry matter	Mineral matter
Kgha <sup>-1</sup>		%	%	%
0	Control	3.85 c	5.26 c	1.80 c
60	at transplanting	3.94 b	5.78 b	1.86 bc
60	½ at transplanting + ½ at 40 days after transplanting	3.95 b	6.02 ab	1.81 c
90	at transplanting	4.00 ab	5.83 b	1.82 c
90	½ at transplanting + ½ at 40 days after transplanting	4.05 ab	5.63 bc	1.91 ab
120	at transplanting	4.11 a	6.33 a	1.95 a
120	½ at transplanting + ½ at 40 days after transplanting	3.98 ab	6.00 ab	1.83 c
LSD		0.091	0.428	1.069

**Mineral matter**

Result showed that the potassium application significantly increased the mineral matter in tomato (table 3). The highest mineral matter 1.91 and 1.95% were noted in treatments where potassium was applied at the rate of 90 and 120 kg ha<sup>-1</sup> respectively applied in one or two splits. The lowest mineral matter (1.80 and 1.81%) was observed in control and in treatment where potassium was applied at the rate of 60 kg ha<sup>-1</sup> in two splits respectively. The results also showed that time of application /splitting of potassium had no significant effect on mineral matter. Khan *et al.*, (2006) reported a synergistic effect of foliar application of potassium on ash content.

4. CONCLUSIONS

It is concluded that potassium application @ 60 kg ha<sup>-1</sup> significantly increased the yield, fruit weight, firmness, acidity,

dry matter, mineral matter, TSS and total invert sugars of tomato fruit over control while statistically, higher levels of K (90 and 120 kg ha<sup>-1</sup>) did not further increase the yield and quality parameters subsequently. Ascorbic acid remained unaffected. Results also revealed that time of application/splitting of K did not affect the yield and quality parameters.

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# Maternal and fetal outcome in liver diseases of pregnancy - A tertiary hospital experience

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**Abstract- Objective:** To determine the frequency, causes and outcome of liver disease in pregnant women

**STUDY DESIGN:** This retrospective cohort study was conducted in the Department of Obstetrics and Gynecology, in a tertiary hospital in Punjab between January 2014 and December 2014. Medical records of all pregnant patients who were admitted to our department with pre-existing liver disease or those suspected to have liver dysfunction on the basis of clinical and /or laboratory data were reviewed and analyzed statistically.

**RESULT:** During the study period, there were 1528 deliveries in the hospital and 51 pregnant women were diagnosed to have liver disorders giving an overall incidence of 3.3%. Cholestasis of pregnancy was the commonest cause accounting for 54.9% of cases, followed by hypertensive disorders/HELLP (21.6%) and viral hepatitis (19.6%). Hepatitis E infection was most common cause for viral hepatitis (11.8%). DIC (33.3%) was most common maternal complication. There was one maternal death. Preterm delivery occurred in 13.7%, while intrauterine fetal death (IUFD) occurred in 5.7% of patients. There was no neonatal death.

**CONCLUSION:** Signs and symptoms of liver disease in pregnancy are not specific, but the underlying disorder can have significant morbidity and mortality effects on the mother and fetus. Early recognition can be lifesaving

**Index Terms-** Liver disease, pregnancy, cholestasis of pregnancy, maternal and fetal outcome

## I. BACKGROUND AND OBJECTIVE

Liver disease in pregnancy encompasses a spectrum of diseases encountered during gestation and the postpartum period that result in abnormal liver function tests, hepatobiliary dysfunction, or both. It occurs in 3% to 10% of all pregnancies<sup>[1]</sup>. The cause of liver disease in pregnancy can be difficult to diagnose. Making the correct diagnosis is of paramount importance, as failure to do so can result in morbidity or mortality for not only the mother, but also for her fetus. Pregnancy causes very few alterations in the results of standard liver tests. The aminotransferases (AST and ALT), -glutamyl transpeptidase (GGTP), total bilirubin, and serum bile acid level remain within the normal range. Alkaline phosphatase rises modestly in the third trimester. The albumin level is lower than in nonpregnant women, and the cholesterol level higher<sup>[2]</sup>. Thus, elevations in aminotransferases or GGTP signify pathology, and should prompt a search for disease.

The objective of our study was to bring forward the incidence and maternal and fetal outcome in Indian scenario.

## II. MATERIAL AND METHODS

This is a retrospective cohort study conducted in the Department of Obstetrics and Gynecology, in a tertiary hospital in Punjab. We reviewed the medical records of all pregnant patients who were admitted to our department with pre-existing liver disease or those suspected to have liver dysfunction on the basis of clinical and /or laboratory data from January 2014 through December 2014. The results were tabulated and data was analyzed as frequencies, percentages and descriptive statistics.

## III. RESULTS

During the study period, there were 1528 deliveries in the hospital and 51 pregnant women were diagnosed to have liver disorders giving an overall incidence of 3.3%. The demographic characteristics of women with liver disorder are elaborated in Table 1.

Liver disease was more commonly seen in younger age group (52.9%). The maximum number of women in the entire study group were primigravida (51%) followed by second gravida (21.6%). Most of these patients were of low income group (62.7%) but residing in urban area (84.3%) and thus aware of the possible complications during pregnancy, thereby leading to less maternal mortality.

**Table 1: Frequency distribution of socio-demographic variables**

Characteristics	Cases (n = 51)	Percentage (%)
AGE( YRS)		
21-25	27	52.9
26-30	17	33.3
31-35	5	9.8
36-40	2	3.9
EDUCATIONAL STATUS		
No formal education	5	9.8
Primary	4	7.8
Secondary	27	52.9
Higher education	16	31.4
RELIGION		
Hindu	28	54.9
Christian	4	7.8
Muslim	19	37.2
OCCUPATION		

Housewife	35	68.6
Employed	16	31.4
ANC Status		
Booked	37	72.5
Unbooked	14	27.5
GRAVIDA		
1	26	51.0
2	11	21.6
3	7	13.7
4	5	9.8
≥5	2	3.9
GESTATIONAL AGE		
Term	37	72.5
Preterm	14	27.5
SOCIECONOMIC STATUS		
Low income group	32	62.7
Medium income group	20	39.2
High income group	2	3.9
RESIDENCE		
Urban	43	84.3
Rural	8	15.7

The commonest chief complaints associated with liver disease found in this study was pruritus (76.5%) followed by jaundice (17.6%) and gastrointestinal symptoms (13.7 %) as elaborated in Table 2. Intrahepatic cholestasis of pregnancy was most common cause of liver disease (54.9 %) followed by hypertensive disorders / HELLP syndrome (21.6%) and viral hepatitis (19.6%). Hepatitis E infection was most common cause of viral hepatitis (11.8%) in this study as elaborated in Table 3.

**Table 2: Distribution of cases according to symptoms**

	Cases (n=51)	Percentage (%)
Pruritus	39	76.5
Jaundice	09	17.6
Gastrointestinal symptoms	07	13.7
Altered sensorium	01	02

**Table 3: Etiological factors**

Causes	Cases (n=51)	Percentage (%)
Cholestasis of pregnancy	28	54.9
Preeclampsia/Eclampsia/ HELLP	11	21.6
Acute fatty liver of pregnancy ( AFLP)	01	2.0
Viral hepatitis (n=10; 19.6%)		
Hepatitis E	06	11.8
Hepatitis B	02	3.9
Hepatitis C	02	3.9
Cirrhosis	01	02

Most common abnormality in laboratory parameters were abnormal liver enzymes (49%) followed by increased serum bilirubin (35.3%) and abnormal coagulation profile in 33.3% of patients. Out of 51 patients 21 (41.2%) had normal vaginal

delivery, 7 patients (13.7%) had preterm vaginal delivery, 4 patients (7.8%) had forceps delivery, 1 patient (2%) had assisted breech delivery while 18 patients (35.3%) underwent LSCS. The most common maternal complication seen was DIC (33.3%) followed by preterm labour (27.4%). Meconium staining of liquor (15.7%) and fetal heart abnormalities were seen in 13.7% as elaborated in Table 4.

**Table 4: Obstetric complication**

	Cases (n=51)	Percentage (%)
Preterm labor	14	27.4
Premature rupture of membranes	01	02
Fetal growth restriction	02	3.9
Fetal distress	07	13.7
Meconium stained liquor	08	15.7
Postpartum hemorrhage	01	02
Disseminated intravascular coagulation	17	33.3
Acute renal failure	01	02
Hepatic encephalopathy	01	02
Maternal death	01	02
Blood/ blood product transfusion	06	11.8
ICU admission	02	3.9

Regarding the neonatal outcome, out of 52 babies born, there were 49 (94.2%) live births and 3 (5.7%) fresh still births. Majority (67.3%) of the neonates born to mother with hepatic disorder were appropriate for their gestational age as elaborated in Table 5. NICU admission (57.6%), hypoglycemia (7.6%) and neonatal hepatitis (1.9%) were few of the complications seen in the live births. There were no neonatal deaths as elaborated in Table 6

**Table 5: Birth weight characteristics**

Weight (kg)	Cases (n=52)	Percentage (%)
≤1	2	3.8
1.1-2	5	9.6
2.1-3	35	67.3
>3	10	19.2

**Table 6: Neonatal outcome**

	Cases (n=52)	Percentage (%)
Singleton	50	96.1
Twin	1+1	3.8
Live birth	49	94.2
Still birth	3	5.7
Complications		
Hypoglycemia	4	7.6
Neonatal hepatitis	1	1.9
NICU Admission	30	57.6

#### IV. DISCUSSION

Liver disease in pregnancy can manifest as a benign disease with abnormal elevation of liver enzyme levels and a good outcome, or it can manifest as a serious entity affecting hepatobiliary function and resulting in liver failure and death to the mother and her fetus. There are no clinical markers that predict the course of a pregnancy and the pathophysiologic mechanisms are not always understood. The overall mortality attributed to liver disorders in pregnancy has dramatically decreased in the past few years because of clinicians' understanding of the physiologic changes that occur during pregnancy, their vigilance in recognizing clinical and laboratory abnormalities, identifying the etiology and its effective management in a timely manner. A coordinated team approach that involves the primary care physician, obstetrician, hepatologist, is often required to promote good maternal and fetal outcomes.

The incidence of liver disorders in pregnancy varies in different parts of the world. Liver disease in pregnancy can present with subtle changes in liver biochemical profile or with fulminant hepatic failure (FHF). The overall incidence of liver disorder in pregnancy in our institution (3.3%) was comparable to previously reported studies.<sup>[1]</sup>

The peak age of incidence in our study was 21-25 years (52.9%) and majority were primigravida ( 51 %): it is consistent with study by Acharya N et al.<sup>[3]</sup> Cholestatic jaundice was found to be the most common cause (54.9%) of liver dysfunction associated with pregnancy in our study. It presents with non specific symptoms like pruritis (76.5%) which may be ignored by the clinicians. Hence, a high index of suspicion is required for diagnosis. Pruritis is the hallmark feature of this disease. In the study done by Reily et al<sup>[4]</sup>, 80% of the patients presented with pruritus. Maternal prognosis was excellent with symptoms and lab parameters improving rapidly postpartum, as has been reported.<sup>[5]</sup> Hepatitis E was the most common cause of acute hepatitis in our study. It was commonly associated with FHF and high maternal and perinatal morbidity and mortality with 2% patients developing FHF. This is in accordance with previous reports from India.<sup>[6,7]</sup> AFLP was found to be responsible for the worst maternal and perinatal outcomes in our study with 2% maternal deaths which is similar to study conducted by Fisk et al.<sup>[8]</sup> The rate of occurrence of complications like DIC was high being 33.3%. Similar results have been reported in literature.<sup>[9]</sup>

Nearly 2% of the patients required ICU admission in our study. Intensive care is a necessity in these cases and various studies had ICU admissions raging from 4.3% to 62.6%.<sup>[10]</sup> Hypertensive disorders, AFLP, Hepatitis E were the leading cause in obstetric patients requiring ICU admissions.

Liver disorders during pregnancy have a devastating effect not only on the mother but also on the neonate. In our study, 94.2% were live births and 5.7% fresh still birth. A study done by [Oladokun A](#) et al<sup>[11]</sup> showed similar results. The incidence of prematurity found in this study is 13.7 % which matches with 15-44%, that reported by Fisk et al.<sup>[8]</sup>

#### V. CONCLUSION

- Signs and symptoms of liver disease in pregnancy are not specific, but the underlying disorder can have significant morbidity and mortality effects on the mother and fetus. Early recognition can be lifesaving.
- Vigilance in recognizing liver disorders in pregnancy and early coordinated multidisciplinary team approach is key for the successful management of pregnancies complicated by conditions such as those described here, to optimize the maternal and fetal outcome.

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# Adsorption Efficiency of Coffee Husk for Removal of Lead (II) from Industrial Effluents: Equilibrium and Kinetic Study

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**Abstract-** This study was carried out to investigate the efficiency of Ethiopian coffee husk (husk of coffee Arabica) to adsorb Pb(II) from industrial effluents using batch experiment. During the batch experiment effects of some parameters such as pH, dose of coffee husk, contact time, initial concentration(Pb(II)), and agitation speed were evaluated and the results indicate that optimum condition for Pb (II) adsorption were pH, 5; contact time, 90 minutes; dose of coffee husk, 2 g; initial concentration, 50 mg/L and agitation speed, 200 rpm. The coffee husk yielded a maximum adsorption efficiency of 95.14%. The residual metallic ion concentrations were determined using Atomic Absorption Spectrometer (AAS). Surface properties of the adsorbent were studied using Fourier Transform Infra-red (FTIR) spectrometer. The linear form of Langmuire and Freudlich models were applied to represent adsorption data. The calculated equilibrium data of Pb(II) were well fitted to both Langmuir and Freudlich isotherm models with maximum adsorption capacity ( $q_{max}$ ) of 50 mg/g. Two kinetic models were used to determine the adsorption mechanism and the kinetic data were correlated ( $R^2 = 0.99$ ) well with the pseudo second order kinetic model for the adsorption study of Pb(II) which implies that adsorption follows second order kinetics. To evaluate the practical applicability of the coffee husk, adsorption study was also carried out using real samples collected from waste water generated auto-garage and battery charging workshop.

**Index Terms-** coffee husk, adsorption capacity, removal efficiency, adsorption isotherm.

## I. INTRODUCTION

The release of huge amounts of industrial effluents containing heavy metal ions such as Pb(II), Cd(II), Cu(II) etc are becoming a serious environmental problem due to its toxicity to aquatic and terrestrial life including human beings. Heavy metals present in these effluents are more stable and persistent environmental contaminants; since they cannot be degraded or destroyed. Thus they tend to accumulate in ground water, the soil, seawater and sediments, which cause deleterious effects on the health of many biological species and on the environment. Lead, is one of the typical heavy metals even at very low concentration, may bring substantial threat to human health through the food chains. It is released into the environment in

different ways, including lead acid batteries, pulp and paper, petrochemicals, refineries, printing, pigments, photographic materials, explosive manufacturing, ceramic, glass, paint, oil, metal, phosphate fertilizer, electronic goods, wood production and also combustion of fossil fuel, forest fires, mining activity, automobile emissions, sewage wastewater and sea spray (Conrad and Hansen, 2007).

The presence of high levels of lead in the environment may cause long-term health risks to humans and ecosystems. It is a poisonous metal that can damage nervous connections (especially in young children) and cause blood and brain disorders. When present above 0.05 mg / L in drinking water, Pb(II) is a potent neurotoxic metal (Sag *et al.*, 1995). Acute lead poisoning in humans affects the central nervous system, the gastrointestinal system, the liver, and the kidneys, and it can directly or indirectly cause serious health issues, such as anemia, hepatitis, nephritic syndrome, and encephalopathy. It is therefore mandatory that their levels in drinking water, waste water and water used for agricultural and recreational purposes must be reduced to within the allowable concentrations recommended by national and international health authorities such as the World Health Organization. Lead removal from the wastewater prior to discharge into environment is, therefore, necessary (Groffman *et al.*, 1992).

Therefore, the removal of Pb(II) from wastewater has received much attention in recent years. As the result, the development of reliable and economical feasible methods for the removal of lead from waste water is particularly significant from aquatic environment. Some of heavy metal polluted effluent treatment technologies are chemical precipitation (Sampaio *et al.*, 2009), reverse osmosis (Cadotte *et al.*, 1981), ion exchange (Alyuz, 2009), solvent extraction, flocculation, membrane separation, electrolysis (Bessbousse *et al.*, 2008), photochemical reactions (Fox and Dulay, 1993), activated sludge (Bromley-Challenor *et al.*, 200), magnetic separation (Karapinar, 2003). However, these technologies are becoming uneconomical and unfavorable (some of them produce large toxic sludge like precipitation) to remove heavy metals from industrial wastewaters (Ahalya *et al.*, 2005).

Searching for a low cost and easily available adsorbent has led to the selection of materials from agricultural and biological origin, along with industrial by-products, as adsorbents. Biological treatment using either living or dead microorganisms or plants, offers unique capabilities to concentrate and reduce the

levels of heavy metals to environmentally acceptable limits in economically and environmentally friendly manner (Volesky, 2001).

The adsorption of metals on different microbial and agricultural wastes like treated and untreated rice husk, Parthenium carbon, walnut hull, wood-rotting mushrooms, mango seed husks, barley straws, bituminous coal, sphagnum peat moss, coconut husks and palm pressed fibers, sawdust, sugarcane bagasse, sugar beet pulp and maize cob etc in different countries have been reported (kumer, 2006).

Coffee husk used as an adsorbent in this study is one of the agricultural by products or wastes obtained from coffee processing units. Coffee husk is an abundant and a low-cost adsorbent material on a large scale in many African countries especially in Ethiopia. Ethiopia is home land of coffee & the prominent producer of coffee in Africa, and has many Coffee processing units. The huge amount of coffee production and the increasing number of coffee husk residue from processing units in the country indicates the likely increase in quantities of coffee husk residue from processing units. In this study, coffee husk which was an agricultural waste were used as an adsorbent to remove Pb (II) from aqueous solutions and industrial effluent (effluents from battery charging workshop) under different experimental condition (contact time, pH, amount of adsorbent and initial concentration). The adsorption isotherm and kinetic studies were carried out to explain nature and rate of adsorption process respectively.

## II. MATERIALS AND METHODS

### 2.1. Preparation of Adsorbent

Coffee husk collected from coffee Hirna coffee processing unit was used in this study as adsorbent. Then the collected coffee husk sample was powdered by using electrical mill and allowed to pass through different mm sieves (8, 6, 4, 2, 1 mm) and the powdered coffee husk was washed with distilled water to remove dirt and boiled to remove color. Finally, it was dried at 105 °C for 5 h in a convection oven and treated with 2% formaldehyde solution in order to reduce biodegradation of organic compounds and avoid mould formation during batch sorption (Chen, 2005).

### 2.2. Adsorbate Solutions

Stock standard solutions of Pb(II) having concentrations of 1000 mg/L were prepared from analytical reagent grade lead nitrate (Pb(NO<sub>3</sub>)<sub>2</sub>) dissolving 1.6g (Pb(NO<sub>3</sub>)<sub>2</sub>) in deionized water. Finally, 5.00 ml of concentrated nitric acid solution was added to stock solution and these solutions were used to prepare working solutions of various concentrations by appropriate dilution.

### 2.3. Batch Adsorption Experiment

Batch adsorption studies were carried out using 250 ml Erlenmeyer flask. The effects of different parameters such as adsorbate (Pb(II)) concentration, adsorbent(coffee husk) dose, agitation time and pH were studied. Standard solutions of the Pb(II) were mixed with the coffee husk and agitated at different agitation rate on a mechanical shaker.

This was carried out by varying Pb(II) concentrations, pH and mass of coffee husk used for adsorption. Finally, the resulting suspension of the metal ion was filtered using a Whatman No. 42(125mm) filter paper and the filtrates were analyzed by AAS (GBC 932 plus ). All experiments were performed in triplicate, and mean values were considered in data analysis. The percentage of Pb(II) removal (%adsorption) and q<sub>e</sub> (mg/g) amount of Pb(II) adsorbed per unit mass of the coffee husk were determined using the following equations or relationships.

$$\text{Adsorption (\%)} = ((C_0 - C_e)/C_0) \times 100 \quad (1)$$

Where C<sub>0</sub> = initial concentration Pb(II) (mg/L) and C<sub>f</sub> = final concentration (mg/L) of Pb(II)

$$q_e = (C_0 - C_e) V/M \quad (2)$$

Where q<sub>e</sub> = adsorption capacity at equilibrium (mg/g), C<sub>0</sub> = initial concentration of Pb(II) (mg/L), C<sub>e</sub> = equilibrium concentration of Pb(II) (mg/L), M = mass of coffee husk (g), V = volume of the solution

### 2.4 Desorption Studies

In order to regenerate or elute Pb(II) from the coffee husk, desorption experiment was carried out using the desorbing media – distilled water at pH ranges 1 to 7 using dilute solutions of 0.1 M NaOH and 0.1 M HCl. Then they were agitated for the equilibrium time of adsorbate. The desorbed adsorbate in the solution was separated and analyzed for the residual Pb(II). The recovery percentage was obtained according to Arica *et al.*(2003) using the following equation.

$$\text{Desorption efficiency (\%)} = (\text{Desorbed} / \text{Adsorbed}) \times 100 \quad (3)$$

Desorbed = concentration of metal ion in desorbing solution after desorption process.

Adsorbed = (C<sub>0</sub> - C<sub>e</sub>) where C<sub>0</sub> and C<sub>e</sub> are initial and equilibrium concentration of the heavy metal ion respectively.

### 2.5. Infrared Spectroscopic Analysis

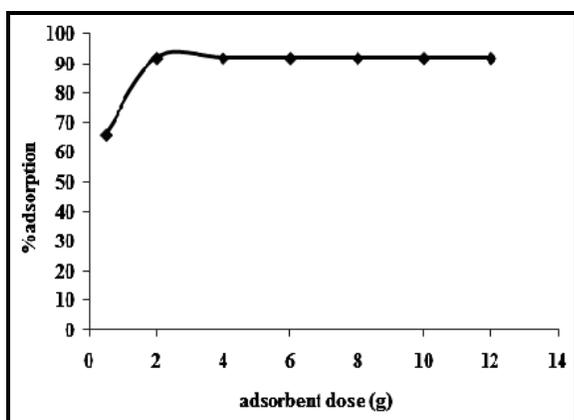
The Fourier Transform Infrared Spectrometer (FTIR Presige 21, Gemen) was used to identify the functional groups present in the coffee husk involved in Pb(II) adsorption process. For this purpose 2 mg of ground coffee husk was placed on KBr disk and dissolved with 10 drops of paraffin. Then the KBr disk with the sample was immediately put into sample holder. Then FTIR spectra were recorded.

## III. RESULTS AND DISCUSSION

### 3.1. Effect of Adsorbent Dose

The effect of the adsorbent dose was studied at room temperature by varying the adsorbent amounts from 0.5 to 12 g. For all these runs, initial concentration of Pb (II), pH, agitation speed and contact time was kept constant. Figure-1 shows that adsorption efficiency of different doses of coffee husk as adsorbent. The result revealed that adsorption efficiency for removal of Pb(II) increased with adsorbent dose in the range from 0.5- 2 g and showed little variation with further increment.

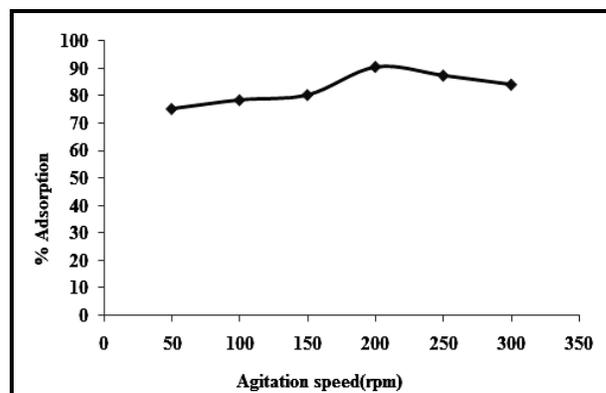
This is due to limited availability of adsorbate species for a relatively larger number of surface sites on the adsorbent at higher dosage of adsorbent. It is reasonable that with higher dosage of adsorbent, there would be greater number of exchangeable sites for metal ions (Selvaraj *et al.*, 1997, Babel and Kurniawan, 2004). Therefore, the maximum removal efficiency of Pb (II) was obtained at an coffee husk dose of 2 g. In all subsequent studies, the amount of coffee husk was taken as 2 g of coffee husk. In the case of adsorption capacity the reverse trend was observed as the dose of the adsorbent increased i.e., the adsorption capacity decreased as the dose of the sorbent was increased. Since adsorption capacity is expressed as the mass of metal ion adsorbed per unit mass of the adsorbent, its value decreases when the mass of the metal ion adsorbed gets smaller for the same increase in the mass of the adsorbent. This is then the reason for the observed decrease in adsorption capacity with an increase in adsorbent dose.



**Fig.1. Pb (II) removal efficiency (%): (Co =50 mg/L, contact time = 90 min, solution pH = 4, agitation speed = 150 rpm)**

### 3.2 Effect of Agitation Speed

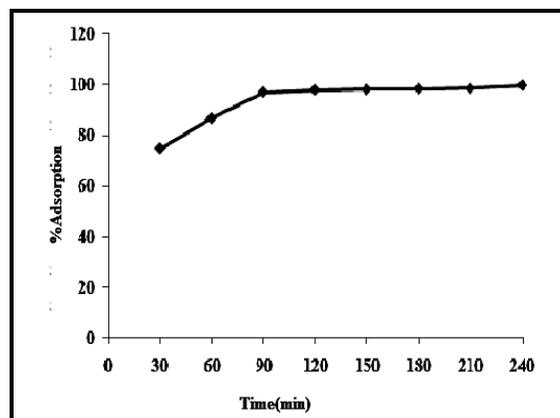
Results of agitation speed effect on adsorption of Pb(II) which is illustrated in Figure 2 shows that adsorption efficiency of a coffee husk increased from 75.22% to 90.46% when the agitation rate increased from 50 to 200 rpm. According to the research carried out by Nomanbhay and Palanismay (2005), the increase in agitation rate improves the diffusion of metal ions towards the adsorbent surface and the same thing was observed in this study. Therefore, decreased value of the Pb(II) adsorbed by coffee husk after 200 rpm is the result of too vigorous agitation rate which causes more metal ions to be desorbed from the adsorption sites.



**Fig.2 Effect of agitation speed on Pb (II) removal efficiency (pH = 5, dose = 2 g, time = 90 min, Co = 50 mg/L)**

### 3.3. Effect of Contact Time

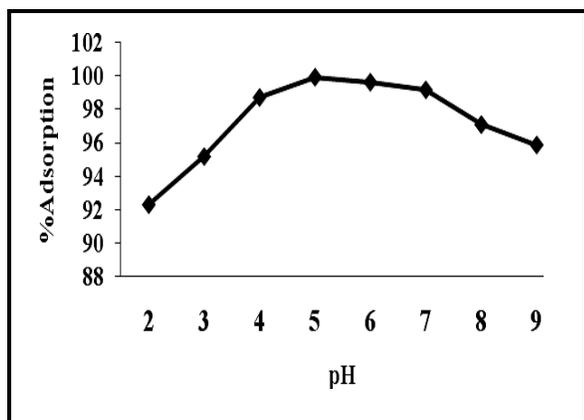
The effect of contact time on Pb (II) adsorption efficiency of coffee husk as adsorbent illustrated in figure 3 and the result shows that the adsorption process took place in two stages. The first stage was rapid, where about 97.1%, of adsorption was completed and second stage represented a slow progress of adsorption. The rapid initial adsorption may be attributed to the accumulation of metals on to the surface of adsorbent, due to the large number of free binding sites. With the progressive occupation of these sites, the process in the second stage became slower. This is in accordance with the observations of other similar studies (Sangi *et al.*, 2008; Qaiser *et al.*, 2009). The removal efficiency turned sharply at contact time of 90 minute and this optimum time was selected as contact times for all experiments.



**Fig. 3 Pb(II) removal efficiency (%) at various contact time (Co = 50 mg/L, dose = 2g, solution pH = 4, agitation speed = 200 rpm)**

### 3.4. Effect of pH

The effect of pH on the extent of adsorption of the Pb (II) on to the coffee husk was studied by varying the pH in the range 2 to 9 with metal concentration 50 mg/L and at an agitation speed of 200 rpm. The contact time was set at 90 min. The obtained results are illustrated in Figure-4.

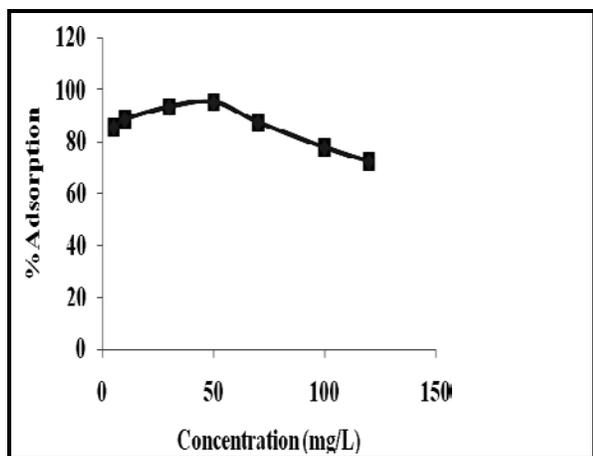


**Fig.4. Effect of pH on Pb(II) removal efficiency (%) (Co = 50 mg/L, dose = 2 g, time = 90 min, agitation speed = 200 rpm)**

The results in Figure 4 depicted clearly that lead adsorption increases with an increase in pH in the range between pH 2 and 5, whereas it decreases with further increase above pH 5. Maximum adsorption of Pb<sup>+2</sup> was attained at pH 5 in which 99.9% of the lead in the solution were removed. At low pH (below 3), there was excessive protonation of the active sites at coffee husk surface which prohibited the formation of links between Pb (II) ions and the active sites. At moderate pH values (3 to 5), linked H<sup>+</sup> was released from the active sites and this resulted in an increase in the amount of metal ions adsorbed. At higher pH values (above 5), the precipitation was dominant or both ion exchange and aqueous metal hydroxide formation could become significant processes. Similar results were obtained by Senthilkumar (2009) studying the adsorption efficiency bael tree leaf powder for removal of Pb(II) from aqueous solution.

**3.5. Effect of Initial Concentration**

Results of the study on the influence of initial Pb (II) concentration on the removal efficiency of the coffee husk are depicted in Figure 5 and the obtained result indicated that the adsorption efficiency coffee husk increase initially and then decrease from 95.1% at 50 mg/L to 72.5% at 120 mg/L Pb (II).



**Fig.5 Effect of initial concentration on Pb (II) removal efficiency (%) (pH = 5, dose = 2 g, time = 90 min, agitation speed = 200 rpm)**

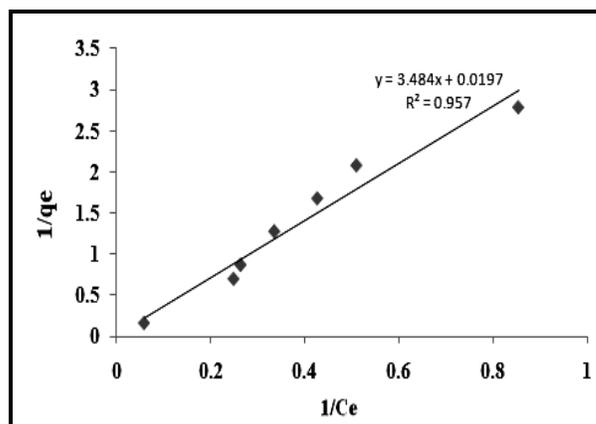
At lower concentrations, the number of moles of lead ion is small relative to the available adsorption sites on the adsorbent. Subsequently, adsorption becomes independent of initial concentration and as a result adsorption was found to increase. However, at higher concentrations, most of the adsorption sites will be occupied by lead ions and the available sites of adsorption become fewer, hence the percentage removal of lead ions which depends up on the initial concentration decreases.

**3.6. Adsorption Equilibrium**

Adsorption isotherm is needed to explain the adsorption process and to determine the adsorption efficiency of an adsorbent. Out of the different adsorption isotherm models, Langmuir’s and Freundlich’s models have been preferred by most of the studies concerning about adsorption. The present experiment also used Langmuir’s and Freundlich’s equations to explain the adsorption mechanism of the adsorbent considered.

**3.6.1 Adsorption isotherms**

The study was carried out by using 0.5 g, 2 g, 4 g, 6 g, 8 g, 10 g and 12 g dose of coffee husk. Figure 6 shows the relationship between the quantity of Pb (II) adsorbed per gram of adsorbent and the equilibrium liquid phase concentration at room temperature. Adsorption equilibrium isotherm models were used describe the adsorption process and the results obtained were analyzed using different isothermal equations. The graph obtained by Langmuir equation shows that the relation between 1/Ce in the x axis and 1/qe in the y axis. On the other hand, the graph of Fruendlich’s equation shows the relationship between log Ce in the X axis and log qe in the y axis.



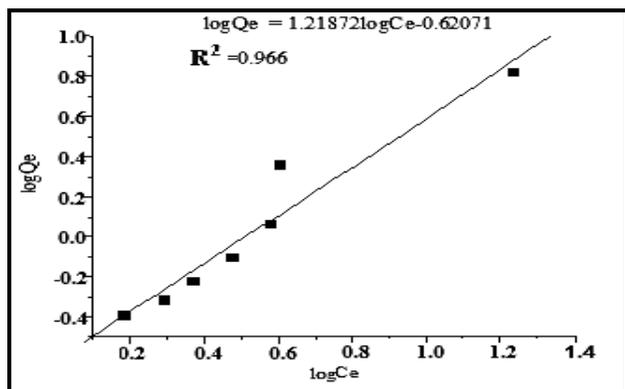
**Fig.6 Langmuir adsorption isotherm of Pb (II)**

According to figure.6:

Intercept Y (1/q<sub>m</sub>) = 0.0197, q<sub>m</sub> = 50.8  
 Slope (1/bq<sub>m</sub>) = 3.484, bq<sub>m</sub> = 0.2870,  
 Langmuir’s equation, qe = 0.2870Ce / (1+0.00574Ce)

Using Langmuir’s equation, the maximum adsorption capacity by coffee husk was obtained as 50.8 mg/g. That is one gram of the coffee husk can absorb 50.8 mg lead. The value of R<sub>L</sub> obtained is 1/1.287 = 0.78. The shape of isotherm by Langmuir’s equation was therefore, favorable isotherm. This

means that at equilibrium high concentration of lead was adsorbed on coffee husk surface compared to its amount remained in aqueous solution.



**Fig.7. Freundlich adsorption isotherm for Pb(II)**

For linearization of the data, the Freundlich equation is written in logarithmic form.

$$\text{Log } x/m = \text{logK} + 1/n \text{ log } C_e$$

According to Fig 7,

$$\begin{aligned} \text{Slope } 1/n &= 1.2187 \\ \text{Intercept Y (logk)} \text{ logK}_f &= -0.6207 \\ \text{Constant } K_f &= 0.2395 \end{aligned}$$

$$\text{Freundlich's equation } q_e = K_f C_e^{1/n} = 0.2395 C_e^{1.2187}$$

The values of 1/n and n obtained from Freundlich's equation were 1.22 and 0.82 respectively. It means that the surface of coffee husk becomes less heterogeneous which leads to less adsorption intensity. The lead adsorption on coffee husk also fitted to both models since the correlation coefficients ( $R^2$ ) are 0.957 and 0.966.

**Table 1 Langmuir and Freundlich constants for the adsorption of Pb (II)**

Langmuir		Freundlich				
$q_{max}$	b	$R^2$	$R_L$	$K_f$	1/n	$R^2$
50.8	0.006	0.957	0.777	0.240	1.22	0.966

$q_{max}$  = maximum adsorption capacity (mg/g), b = constant related to binding energy,  $R^2$  = correlation coefficient,  $R_L$  = separation factor,  $K_f$  = Freundlich adsorption capacity, n = Freundlich constant related to intensity of adsorption.

**3.6.2. Comparison of adsorption capacity of coffee husk with other adsorbents**

**Table 2 Comparison of adsorption capacity of coffee husk for Pb (II) with other adsorbents**

Adsorbent	$q_{max}$ (mg/ g)	References
Palm kernel fibre	40.2	Ho <i>et al.</i> , 2005

Tree tern	40.0	Ho <i>et al.</i> , 2004
Na-montmorillonite	9.6	Abollino,2003
Sawdust	21.05	Li <i>et al.</i> , 2007
Modified peanut husk	29.14	Li <i>et al.</i> , 2007
Fly ash	17.2	Alinoor., 2007
Coffee husk	50.8	Present study

The comparison of adsorbent capacity of coffee husk with other materials reported in literature is given in Table 2. Accordingly; the adsorption capacity of coffee husk obtained is higher than adsorbents from various industrial and low cost adsorbent.

**3.7. Adsorption Kinetics**

Adsorption kinetics, which describes the solute adsorption rate, is an important characteristic in evaluating the efficiency of adsorption. The adsorption data (at pH 4) for initial Pb (II) concentration of 50 mg/L is shown from Figure 8. The 2 g of coffee husk were taken for this study. The plot shows that the adsorption of Pb (II) with different contact time consists of two phases; an initial rapid phase where adsorption was fast and a second slower phase where adsorption equilibrium uptake was achieved. In adsorption process identification of the slowest step or rate determining step is very crucial. Previously several researchers used different kinetic models, such as Lagergren's pseudo first order, pseudo second order, Elovich kinetic equation, and parabolic diffusion model, in order to predict the mechanism involved in the adsorption process. Currently, the Lagergren pseudo first order and pseudo second order models have been widely used for adsorption systems due to their good representation of the experimental data for most of the adsorbent-adsorbate systems (Inbaraj *et al.*, 2002; Mall and Upadhyay, 1998). Therefore, the two kinetic models were applied. The pseudo- first order model can be represented in the following form

$$dq_t / dt = k_1 (q_e - q_t) \tag{4}$$

Where  $k_1$  is the rate constant,  $q_e$  and  $q_t$  are the amounts of the metals adsorbed (mg/g) at equilibrium and at any time t, respectively. This equation can be integrated to yield a linearized form at initial conditions where  $q_t = 0$ ,  $t = 0$  and at any time t, where  $q_t = t$  and  $t = t$ .

$$\log (q_e - q_t) = \log q_e - k_1 t / 2.303 \tag{5}$$

In this equation, the rate of adsorption is assumed to be proportional to the difference between the adsorption capacity at equilibrium ( $q_e$ ) and the adsorption capacity at time t ( $q_t$ ). The pseudo- first order kinetics is applicable if the plot of  $\log (q_e - q_t)$  against t shows linear relationship. A straight line plot of  $\log (q_e - q_t)$  versus t was used to determine the rate constant,  $k_1$  and correlation coefficient,  $R^2$  (0.915) as shown in Figures 8. The values of  $k_1$  ( $L/min^{-1}$ ) and  $q_e$  (cal) in mg/g of Pb (II) predicted from those plot are  $2.12 \times 10^{-2}$  and, 1.10. The result shows that the pseudo-first order rate equation did not adequately describe the adsorption result of Pb(II). The pseudo second order rate equation is expressed as shown in equation 6 (HO and McKay, 1999):

$$dq_t / dt = k_2 (q_e - q_t)^2 \tag{6}$$

Where,  $k_2$  is equilibrium rate constant of second order kinetics model ( $\text{g mg}^{-1} \text{min}^{-1}$ ). After integrating equation (6) for a condition  $q_t = 0$  at  $t = 0$  and  $q_t = q_t$  at  $t = t$ , it can be obtained:

$$t/q_t = 1/k_2 q_e^2 + t/q_e \quad (7)$$

Equation (7) can be rearranged to obtain a linear form:

$$t/q_t = 1/h + t/q_e \quad (8)$$

Where initial adsorption rate ( $\text{mg g}^{-1} \text{min}^{-1}$ ),  $h = k_2 q_e^2$

The pseudo-second order rate constant ( $k_2$ ),  $h$  and the equilibrium adsorption capacity ( $q_e$ ) can be determined experimentally from the slope and intercept of the plot  $t/q_t$  versus  $t$ . The plot  $t/q_t$  versus  $t$  should give a straight line if pseudo-second order kinetics is applicable. The plot of the linearized form of the pseudo second order reaction of Pb (II) on adsorbent surface is shown in Figures 9. The plot of  $t/q_t$  versus  $t$  for pseudo second order rate equation yields a good straight line ( $R^2 > 0.99$ ) as compared to the plot of pseudo first order. The pseudo second order rate constant and initial adsorption rate for Pb (II) was obtained as  $3.25 \times 10^{-2} \text{ g mg}^{-1} \text{min}^{-1}$  and  $0.44 \text{ mg g}^{-1} \text{min}^{-1}$ . The theoretical values of  $q_e$  ( $2.49 \text{ mg g}^{-1}$ ) predicted from pseudo-second order plot also agrees well with the experimental one ( $2.43 \text{ mg g}^{-1}$ ) (Table 3). This suggests that the adsorption of Pb (II) by coffee husk follows pseudo-second order model, which relies on the assumption that chemisorptions is rate limiting step.

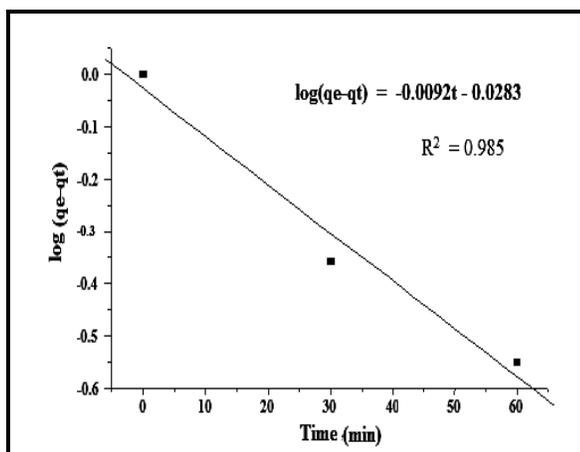


Fig. 8 Pseudo first order plot for Pb (II) at fixed solution pH and adsorbent dosage

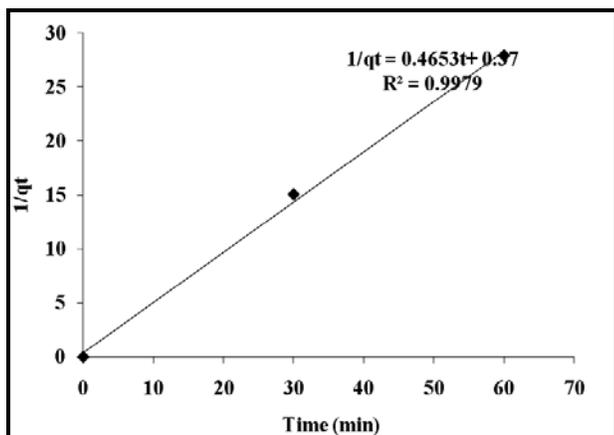


Fig. 9 Pseudo second order plot for Pb (II) adsorption at fixed solution pH and adsorbent dosage

Table 3 Adsorption kinetic rate constants for Pb(II)

Pseudo-First order		Pseudo-Second order					
Parameters							
$q_e$ (exp)	$q_e$ (cal)	$K_1$	$R^2$	$q_e$ (cal)	$k_2$	$h$	$R^2$
2.43	1.10	$2.12 \times 10^{-2}$	0.985	2.49	$4.35 \times 10^{-1}$	2.70	0.998

$q_e$  (exp) = experimental equilibrium adsorption capacity( $\text{mg/g}$ ),  $q_e$ (cal) = calculated equilibrium adsorption capacity(  $\text{mg/g}$ ),  $K_1$  = pseudo first order rate constant( $\text{L/min}^{-1}$ ),  $R^2$  = correlation coefficient  $k_2$  = pseudo second order rate constant( $\text{g mg}^{-1} \text{min}^{-1}$ ),  $h$  = initial adsorption rate  $\text{mg/g min}$ ).

### 3.8 Desorption studies

Desorption of Pb (II) from lead loaded adsorbents increased with decrease in the initial pH. At pH 1, 75.98% of Pb (II) was desorbed from coffee husk. Lead (II) was removed maximally at an initial pH of 1.0. At acidic conditions,  $\text{H}^+$  ions protonate the adsorbent surface by replacing the adsorbed metal ions on the adsorbent surface leading to desorption of the positively charged metal ion species. As the pH increases, desorption of Pb (II) from lead loaded adsorbents gradually decreases. This is due to the less availability of  $\text{H}^+$  that can displace the lead ion. The above figure shows the effect of pH on desorption of Pb(II) from coffee husk. For this desorption process a distilled water (pH 1-7) was used.

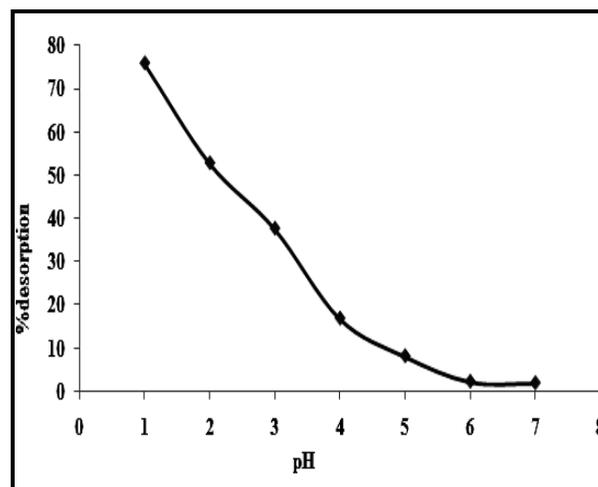


Fig. 10 Effect of pH on desorption of Pb (II)

### 3.9. Adsorption of Pb (II) from industrial effluents (battery charging workshop)

The feasibility and efficiency of adsorption process depends not only on the properties of the adsorbents, but also on successful application of adsorbent in industrial effluents. Therefore, perusal of data obtained from the effluent collected from auto-garage and battery charging workshop of Haramaya

University was used to conduct experiment to determine the adsorption efficiency of coffee husk. The Pb(II) removal efficiency of coffee husk from industrial effluent was obtained as 88.04% (Table 4). Moderate reduction was recorded in adsorption efficiency of the coffee husk for removal of Pb(II) from industrial effluents than from synthetic solutions. This could be due to various impurities present in industrial effluents in the form of anions i.e.,  $\text{SO}_4^{2-}$ ,  $\text{NO}_3^-$  and  $\text{Cl}^-$  etc that may compete for binding sites on coffee husk.

**Table 4 Pb(II) removal efficiency of coffee husk from real solution**

Initial Concentration (mg/L)	Concentration after adsorption	removal efficiency (%)	adsorption capacity (mg/g)
10.51±0.002	1.26±0.033	88.04	0.46

### 3.9 Infrared Spectroscopic Studies

Samples of the adsorbent used in the present study; namely coffee husk, were subjected to Fourier Transform Infrared Spectrometer, FTIR (Presige 21, Gemen). The FTIR Spectroscopic analysis indicated broad bands at  $3441\text{ cm}^{-1}$ , may be representing bonded -OH groups rather than -NH groups. This is because of the peak of O-H stretching is broad with rounded tip but the peak for bonded-NH group is a broad peak with two sharp spikes (primary amines), a broad peak with one sharp spike (secondary amines) or no signal (tertiary amines). The bands observed at about  $2955\text{--}2852\text{ cm}^{-1}$  may shows the presence of C-H stretching but not aldehydic C-H because the aldehydic C-H stretching vibration occurs in the region of  $2830\text{--}2700\text{ cm}^{-1}$  with the appearance of two intense bands. The peaks around  $1722\text{ cm}^{-1}$  correspond to the C=O group and at  $1652\text{--}1616\text{ cm}^{-1}$  C=C. The C-O band absorption peak is also observed at  $1035\text{ cm}^{-1}$ . These types of functional groups are important sorption sites of coffee husk to participate in Pb(II) binding from aqueous solution or industrial effluents.

## IV. CONCLUSIONS

In this study, batch adsorption experiments for the removal of Pb (II) from aqueous solutions and industrial effluents have been carried out using coffee husk as a low cost, readily available adsorbent. The adsorption characteristics have been examined at different pH values, initial metal ion concentrations, contact time and adsorbent dosages. The effect of adsorbent dosage on the adsorption of Pb(II) by coffee husk showed that the percentage of Pb(II) removed increased with increase in adsorbent dosage due to increased adsorption surface area. Then 2g of coffee husk was selected as an optimum dosage through the experiment. The optimum pH for the removal of Pb(II) was 5. The amount of the Pb(II) removed at optimum pH increased with increase in initial Pb(II) concentration but the percentage adsorbed decreased with increase in initial metal concentration. Adsorption data for wide ranges of adsorbent doses were treated by Langmuir and Freundlich isotherms and then calculated equilibrium data of Pb (II) were well fitted to both Langmuir and Freundlich isotherm models. Comparison of the adsorption capacity of the coffee husk with that cited in literature reveals that coffee husk has also higher adsorption capacity. The kinetic data correlated ( $R^2 = 0.99$ )

well with the pseudo second order kinetic model for the sorption studies of Pb(II) which implies that adsorption follows second order kinetics.

Desorption studies of the adsorbates showed that regeneration of the Pb(II) is possible. Ion exchange might be the main mechanism by which the Pb(II) was attached to the adsorbents. Physical adsorption played a minimal role in the process.

The absorption spectra revealed that -C-O, -O-H and C=O bonds were predominant in the surface of the adsorbents and played a major role in the adsorption of Pb(II) from aqueous solution and industrial effluents. Coffee Husk as agro-industrial waste has negligible cost and has also proved to be an efficient adsorbent for the removal of Pb(II) from aqueous solution and industrial effluents. Furthermore, these adsorbed metal can be easily desorbed and the biomass be incinerated for final disposal. This adsorbent is of low cost; its utility will be economical and can be viewed as a part of a feasible waste management strategy.

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# A step towards a maternal health: retrospective study

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**Abstract-** Pregnancy and motherhood is the most joyful and happiest moment of women's life. Culturally, Nepalese women are habituated to perform daily chores more in a squatting position which they continue even during pregnancy and immediately after giving birth. In Nepal, unlike other developed countries, antenatal and postnatal exercises are not practiced commonly due to lack of awareness among general population and medical professionals. Regular exercise performed during antenatal and postnatal periods reduces the risk of incontinence, pelvic organ prolapse (POP) and other complications which ultimately results in improving quality of life of women. The aim of this study was to investigate the physiotherapy services provided to postnatal women admitted at the obstetric and gynecology ward of Dhulikhel Hospital (DH) to prevent POP. A retrospective study was conducted at the Department of Physiotherapy at Dhulikhel hospital which documented all the cases treated by physiotherapists in the obstetric & gynecology ward. Out of the 2072 deliveries conducted in DH in year 2013 only 1078 women were provided physiotherapy services (only 52%). The requirements and need of physiotherapy management for postnatal care among the health professionals and the general population still need to be considered. This leading to less number of physiotherapist working in this field causing the low manpower for the management of all the cases.

**Index Terms-** Postpartum complication, Postnatal exercise, Pregnancy.

## I. INTRODUCTION

Uterine prolapsed (UP) or pelvic organ prolapsed (POP) or fallen womb is a widespread major problem amongst Nepalese women.<sup>1,2</sup> It is an abnormal descent of the pelvic organs from their normal position in the pelvis into the vagina, accompanied by urinary, bowel, sexual, or local symptoms.<sup>3</sup> Globally, 30% of all women who have delivered a child are affected. For every maternal death, an estimated of 6 to 15 women face debilitating morbidity.<sup>4</sup>

Culturally, Nepalese women are habituated to perform daily chores more in a squatting position which is one of the risk factors for pelvic organ prolapse in future.<sup>5</sup> Women are bound to continue working in squatting position even during pregnancy and immediately after delivery. Various studies show that more than 600,000 women in Nepal are suffering from prolapsed uterus and that 200,000 of those needed immediate surgery.<sup>5</sup> Another study showed 30-40% of women suffer from pelvic organ prolapse just after the birth of their first child.<sup>6</sup> one of the study reported 11%, 60% and 25 % had first, second and third stage uterine prolapse respectively in a hill district of Nepal.<sup>7</sup>

There is huge number of research providing evidence that first and second stage prolapse can be treated with conservative management involving exercises.<sup>8,9,10</sup> In Nepal, unlike other developed countries, antenatal and postnatal exercises are not practiced commonly due to several factors including lack of awareness among general population as well as medical professionals. Regular exercise performed during antenatal and postnatal periods reduces the risk of postnatal complications like urinary incontinence, fecal incontinence and POP which ultimately results in improving quality of life of women. Various studies have been conducted in Nepal for POP, and reported the need for the pelvic floor exercise to prevent POP.<sup>3, 11, 12</sup> However, there is no data to support that this recommendation has been exercised. Therefore, this study aimed to investigate the number of the patient who underwent physiotherapy exercise to prevent the postnatal complications like incontinence, POP at obstetrics and gynecology ward of the Dhulikhel hospital.

## II. RESEARCH METHODOLOGY

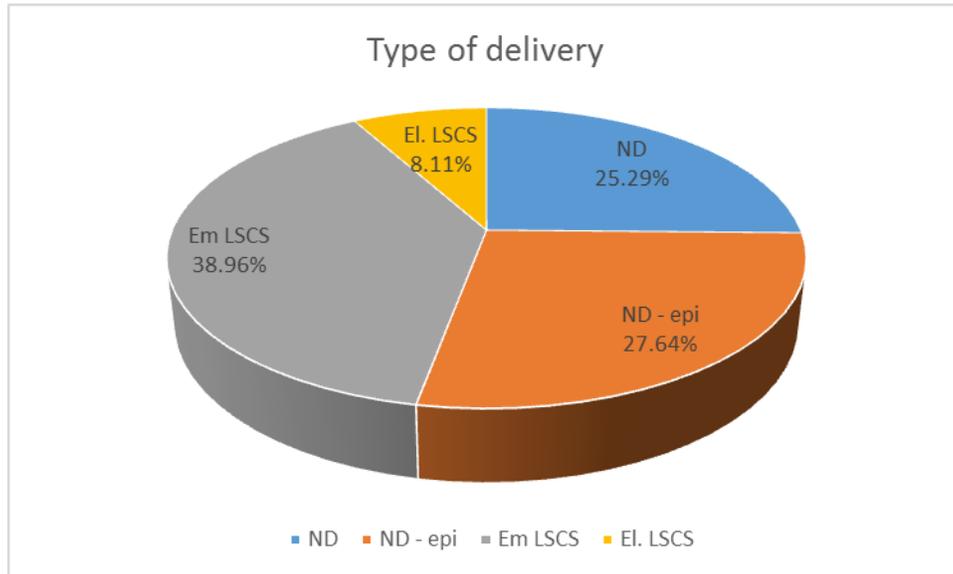
For the availability of the data the permission was taken from the hospital administration and through department of physiotherapy, Dhulikhel hospital. The files of all the women admitted in the Obstetrics and Gynecology Department in Dhulikhel Hospital, Kathmandu University over one year (January to December 2013) were reviewed retrospectively by the hospital's Physiotherapy Department. The Physiotherapy Department documented all the cases treated by physiotherapists including information about the number of previous pregnancies and deliveries and the mode of current delivery. The total number of registered deliveries occurred in same time at Dhulikhel hospital was also recorded. For the data collection data was filtered to select the patients based on patients who were treated by the Physiotherapists. The documentation of all the cases seen by physiotherapist was filtered according to inclusion and exclusion criteria. In inclusion criteria all the mothers who delivered in hospital and treated by physiotherapist are taken whereas all the gynecological and the other surgeries apart from delivery cases seen by the physiotherapist are excluded. Data were entered in SPSS version 16 and from this set of eligible cases, coding was done for the different variables like mode of delivery and age of the women. Descriptive analysis was done for those different variables like mode of delivery, parity and age of the patient that were compared and analyzed accordingly to prevent from the postnatal complication like incontinence & POP in Dhulikhel hospital among the women who got physiotherapy services were identified. The incomplete data were not included for the further analysis. A total of 2072 cases were treated in the Obstetrics and Gynecology Department of Dhulikhel Hospital in the year 2013. Of the 1078 women provided with physiotherapy

services, 54 patients were provided with surgeries that were not related to pregnancy, hence eliminated from the sample size for the purpose of this research.

physiotherapy services and were included as the sample size for the further analysis of this retrospective study. Of the remaining 1024 cases, 38.96% women underwent emergency lower caesarian section (Em LSCS), 27.64% had normal delivery with episiotomy (ND-epi), 24.10% had normal delivery (ND) and 8.81% had elective lower caesarian section (El LSCS).

**III. WRITE DOWN YOUR STUDIES AND FINDINGS**

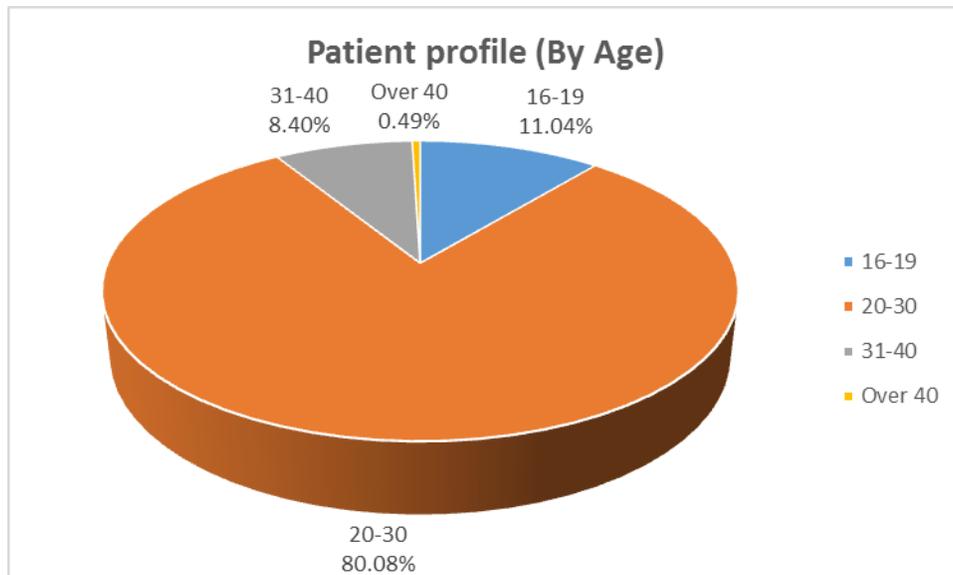
Among these only 1024 women got a chance to experience physiotherapy services i.e. only 52% of cases were provided a



**Fig 1. Pie chart showing the type of the delivery of the women who received physiotherapy management**

The age of the women varied from 16-52 years. A majority of the patients, 80.08%, fell under the age group of 20-30 years with the mean age being 24 years while teenagers (16-19 years)

formed 11.04% of the patients. 8.40% belonged to the age group 31-40 years and only 0.5% patients were above 40 years old.



**Fig.3. Piechart showing age category of the postnatal mother who received Physiotherapy management.**

**Table: 1 showing the age and type of delivery.**

Age Group	Total	ND		ND – epi		Em LSCS		El. LSCS	
		No.	%	No.	%	No.	%	No.	%
16-19	113	22	19.47%	48	42.48%	37	32.74%	6	5.31%
20-30	820	209	25.49%	227	27.68%	318	38.78%	66	8.05%
31-40	86	26	30.23%	7	8.14%	42	48.84%	11	12.79%
Over 40	5	2	40.00%	1	20.00%	2	40.00%	0	0.00%
Total	1024	259	25.29%	283	27.64%	399	38.96%	83	8.11%

**I. DISCUSSION**

The result of this study showed only 52 % of women treated at the Obstetrics and Gynecology ward in Dhulikhel Hospital got chance to get physiotherapy service. Acharaya et. al. reported that there is good awareness about the physiotherapy services among clinicians but only 3% gynecologists were aware about the utility of physiotherapy services in treatment or prevention of pregnancy related health issues.<sup>15</sup> In the same study it is mentioned Health professionals rarely referred to physiotherapists and sought PT services only for limited cases. This lack of awareness lead to diminished the need of physiotherapy in the hospitals. One of the reasons for treating only 52% is due to lack of manpower in the field of women’s health. These cases were treated by the Physiotherapy Department on a voluntary basis with the intention to prevent from the postnatal complications such as urinary and fecal incontinence and POP. This could be probably due to either lack of awareness about the effectiveness of PT treatment approaches or low confidence in referring cases to other health professionals. The findings of this study shows the consistency with Acharya’s study. Pelvic floor muscles strengthening exercise performed after delivery can prevent the possible complication in later life. The health professional always neglected PT services in spite of being essential in preventing the postnatal complications like urinary incontinence, prolapsed etc.

In our study we found the most deliveries happen at age of 20-25. But there were also the deliveries which occurred in <20 years. In one of study done in Nepal reported 65.16% women who experienced prolapsed had their 1<sup>st</sup> pregnancy in their teens and 34.86% had their 1<sup>st</sup> pregnancy in 22-32 years. 46.97% women experienced prolapsed with 3 children recorded in the same study.<sup>7</sup> In our study we could not relate parity as there was lots of missing data But we noted 11.04% of women had teenage pregnancy which is not only risk for prolapse but also for other different complication.

Women aged over 30 years when having their first baby and parity were significantly associated with prolapse. In the same study they reported elective caesarean section were the least likely to have prolapsed while Compared with women whose births were all spontaneous vaginal deliveries .<sup>16</sup> But in this study we could not find the proper relation between the parity as the data was not sufficient. Though women’s health is one of the upcoming and highlighted subject in world scenario but when it comes to developing countries it still need to be studied as well as considered. Five years after childbirth the stage of prolapse

worsened after vaginal delivery but not after caesarean. However, there was no impact on prolapse symptoms or quality of life. After vaginal delivery women were more likely to experience a worsening in general sex score, but no other difference in quality of life.<sup>17</sup>

According to Lieschen H.Quiroz et.al. (2010) pelvic organ prolapse were almost 10 times higher after a single vaginal birth indicating that 52.93 % of the sampled population (25.29% with Normal Delivery and 27.64% with normal delivery with episiotomy) was at a risk of POP.<sup>18</sup> During the study period, 38.96% women delivered through Em LSCS indicate is 66.60 % of the sample population. During vaginal delivery, the pelvic floor can be irreversibly traumatized, resulting in pubovisceral muscle avulsions. Pubovisceral muscle avulsions are known risk factors for pelvic organ prolapsed.<sup>19</sup> J cooper 2014 also reported Symptoms of POP were increased in those women who had experienced a vaginal delivery, whilst the sensation of having a tight vagina was decreased in those who had had a previous vaginal birth.<sup>20</sup> A growing number of literature supports the idea that PT can reduce POP. Study done in Norway reported pelvic floor muscle exercise improved pelvic organ prolapse quantification system as well as it elevated the bladder, rectum and also reduced the frequency and bother of symptoms without the adverse effect.<sup>8</sup> According to the Cochrane review for conservative prevention and management of pelvic organ prolapse the pelvic floor muscle training have positive effects for the prolapse symptoms and severity<sup>9</sup>. It suggested six months of supervised PFMT has benefits in terms of anatomical and symptom improvement immediately post intervention. Altogether, 91.89% of the sample population was at a risk of POP that could be prevented with PT. Lots of risk factor studies done for POP in Nepal but still exercise related studies are not documented though Pelvic floor muscle training remains the first-line treatment for pelvic floor disorders with high levels of evidence and grades of recommendation. Various studies done in Nepal always recommended for the proper antenatal care, postnatal care and the early preventive measures, they also warranted clearly for the pelvic floor exercise.<sup>3,4,5</sup> However, the implementation of these research is still a questionable since the only maternity hospital in Nepal lack the physiotherapy service. The present study emphasize the further requirements for the need of PT services in the sector of women’s health. Since it physiotherapy treatment is the cost effective treatment for the poorest country like Nepal, it should not be neglected. This study also feel the necessity for the further studies with respect to exercise and adherence among the community people as well as health professionals.

In this study the data obtained cannot be used to see the correlation of the associated factors and the women were seen only one time, so the effectiveness of the treatment couldn't be identified.

## II. CONCLUSION

Dhulikhel Hospital which have the major motto of offering health services for the rural poor could provide physiotherapy services to only 52% with one-visit PT services as preventive measure for postnatal complications like urinary incontinence, POP, which was highly insufficient. This showed lack of awareness among medical professionals and general populations about importance of PT for preventing POP is putting a lot of new mothers at risk. This study indicates for long term practice of exercise with follow up case studies and documentation about need of physiotherapy and also determine effectiveness of PT in preventing postnatal complications.

## ACKNOWLEDGMENT

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# Delayed and Fatal Presentation of Femoral Pseudoaneurysm after Percutaneous Coronary Intervention

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**Abstract-** We report a case of a 42 year old female patient who presented with a large femoral pseudoaneurysm 18 days after femoral catheterization, for percutaneous coronary intervention, with life threatening bleeding. Diagnosis of the condition was made by ultra sound examination and CT angiogram of femoral vessels. The method of management for pseudoaneurysm is local ultrasound guided compression if the neck is amenable to compression, minimally invasive percutaneous treatment and surgical repair if the other methods fail.

**Index Terms-** Pseudoaneurysm, Common Femoral Artery (CFA), Percutaneous Coronary Intervention (PCI), Right Coronary Artery (RCA), Ultrasound Compression

## I. INTRODUCTION

Cannulation of the femoral artery, done with only anterior wall puncture, i.e, by Seldinger technique is a safe procedure<sup>1</sup>. Complications occur in less than 1% patients. They include hematoma, pseudoaneurysm, ischemic damage, AV fistula<sup>2</sup>.

Pseudoaneurysm is a collection of blood, formed as a result of a vascular wound and retained in the tissues surrounding the vessel breached. It consists of a perfused sac, the false lumen, connected to the femoral artery by a neck<sup>1</sup>. Its incidence varies from less than 1% for diagnostic procedures to upto 10% for therapeutic procedures<sup>3</sup>. The risk factors are catheterization of both femoral artery and vein, low puncture, i.e. of superficial femoral artery instead of common femoral artery, female sex, age more than 60years, obesity, calcified arteries, anticoagulation, thrombolytic state and inadequate post procedure compression<sup>4</sup>. The average time of onset is 5 to 6 days after catheter removal<sup>6</sup>.

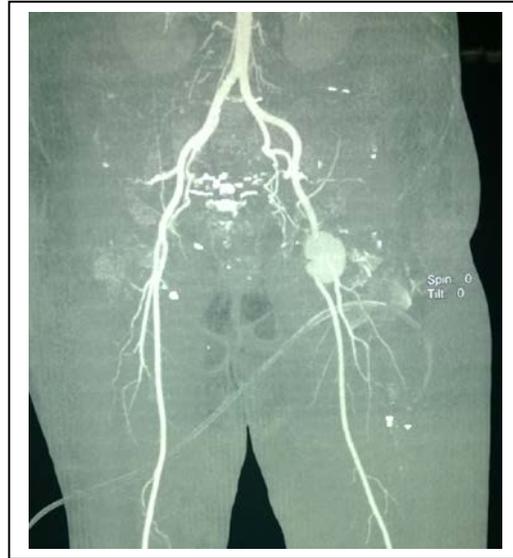
## II. CASE REPORT

A forty two year old female patient was admitted to that ICCU with history of rest angina of three days duration. She was a known diabetic and hypertensive since six years, on regular treatment with Tab. Telmisartan 40 mg daily and Tab Glimipride 1 mg twice daily. On examination the patient was obese. (Wt: 82 kg; ht 1.5 sq.cm: BMI: 36.4. Her vitals were stable. The resting ECG revealed evolved inferior wall MI. 2D Echo revealed RWMA in RCA territory and fair LV function. RV function was normal. She was initially stabilized with IV heparin, oral antiplatelet agents, anti anginal agents and statins. As she continued to have intermittent rest angina, the next day she was

taken up for CAG, via Rt. radial route, which revealed subtotal occlusion of proximal RCA. She was taken up for PCI the next morning once the financial clearance was obtained. Rt. Radial puncture and Rt. femoral puncture was attempted but access could not be obtained. Arterial access was obtained through the left femoral route, with a single puncture, using Seldinger's Technique. PCI with deployment of a drug eluting stent was done to proximal RCA and the patient was shifted to ICCU. The immediate post procedure period was uneventful. On the third day after the procedure, patient developed rest angina. ECG revealed ST elevations in inferior leads. Check angiogram, done again through left femoral route revealed 100% occlusion of the stent in proximal RCA. A diagnosis of sub acute stent thrombosis was made and repeat PCI of proximal RCA was done. The patient developed a small hematoma over the puncture site post procedurally. Clinically there was no bruit over the puncture site, .Arterial Doppler study of left femoral vessels revealed no pseudoaneurysm. It was treated with sand bag, painkillers and oral serratiopeptidase. She was discharged on the fifth day after the second procedure and was asked to come for review after one week.

Pt came to OPD after ten days. She complained of pain and swelling at the puncture site and bleeding from the puncture site. Clinical examination revealed pulsatile swelling in the left groin, with necrosis of the overlying skin and a bleeding point. The blood pressure was under control. There was a systolic bruit over the swelling. She was admitted in ICCU. On investigation, her hemoglobin dropped from 11gm% to 8gm%. Her blood sugars were out of control and her renal function was normal. Doppler examination of left lower limb arteries revealed a large pseudoaneurysm in left common femoral artery (CFA) with a relatively broad neck. CT angiogram of left femoral artery revealed a large pseudoaneurysm measuring 5.1 x 5.9 x 4.2 cm with extravasation of dye into the adjacent soft tissue. The neck of the pseudoaneurysm was not amenable to ultrasound guided compression. The patient had another episode of moderate bleeding from the site on the next day. She was stabilized with immobilization, compressive dressing and three fresh blood transfusions.

She was taken up for surgical repair of the pseudoaneurysm the next day, under general anesthesia. The antiplatelet agents were continued. During surgery, after induction of anesthesia, once the wound was opened and clamping of the common femoral artery was done, patient had massive haemorrhage from the site of pseudoaneurysm, followed by cardiac arrest, from which she could not be resuscitated.



**CT angiogram of left lower limb vessels showing a large pseudoaneurysm of left common femoral artery**



**Femoral puncture site with pseudoaneurysm and pressure necrosis of the overlying skin**

### III. DISCUSSION

Pseudoneurysms after femoral puncture for diagnostic or therapeutic procedures generally present 5 to 6 days after the puncture. However, we report the presentation of pseudoneurysm 18 days after sheath removal, presenting with pain at the puncture site, pulsatile swelling, a new bruit, a classic presentation.

Ultrasound is the usual mode of diagnosis, with 94 to 97% sensitivity. The findings will be swirling color flow seen in a mass separate from the affected artery, color flow within a tract leading from the artery to the mass, consistent with the neck of pseudoneurysm, and a typical to and fro Doppler wave form in the neck<sup>6</sup>.

CT angiogram of the affected limb helps in the measurement of the pseudoaneurysm, in the visualisation of the anatomy of the distal vessel<sup>6</sup>

Complications of pseudoaneurysm are distal embolization, overlying skin necrosis due to pressure effect, rupture with catastrophic bleeding<sup>6</sup>

Treatment options are ultrasound guided compression, minimally invasive percutaneous treatment with thrombin injection, coil embolization, covered stent, and surgical repair<sup>7</sup>. In our patient, surgery had to be attempted as ultrasound guided compression caused moderate bleeding from the site and the pseudoaneurysm was rapidly expanding.

#### IV. CONCLUSION

Based on this unusual and catastrophic experience, we could make the following recommendations for prevention and management of iatrogenic pseudoaneurysms: nontraumatic fluoro guided puncture of common femoral artery, using Seldinger technique.(puncture of only the anterior wall of the artery.),use of smaller introducer sheaths, manual or mechanical compression of puncture site for 15 to 20 minutes, followed by bed rest and compressive bandage, close follow up of the patient who develops even a small hematoma following catheterization ,for extended periods, including serial ultrasound and Doppler exams.

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# Some Aspects of the Biology of *Vernonia cinerea* (Linn.) Less. in Awka Town, Anambra State, Nigeria.

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**Abstract-** Studies were carried out in a screen house, in a compound off Arthur Eze Avenue, Awka, Anambra State, using germinated seeds in five polythene bags to determine the life cycle characteristics, and the seeding potential of *Vernonia cinerea* (Linn.) Less. Results of the vegetative growth studies showed that *V. cinerea* had a mean height of  $103.8 \pm 34.4$  cm, the mean number of leaves per plant was  $301 \pm 133$ , the mean number of branches of stem was  $19 \pm 3$  and the mean life cycle duration was  $28 \pm 2$  weeks. Results of the studies on the reproductive potential of *V. cinerea* showed that the mean number of buds per plant was  $1,050 \pm 883$ , the mean number of seeds per capitulum was approximately  $21 \pm 0.6$ , and the mean number of seeds per plant was  $21,774 \pm 18,740$ . The phenological observations of *V. cinerea* showed that the vegetative phase lasted for 8 weeks before the appearance of the flower buds which marked the beginning of the reproductive phase, while the reproductive phase of *V. cinerea* lasted for 20 weeks, from the appearance of flower buds to the time the plant withered. It is concluded from the result that *V. cinerea* has the ability to flower and fruit within a period of 5 months, with life cycle duration of approximately 7 months. And that the high seed production potential of *V. cinerea* will help it survive competition in areas where it occurs.

**Index Terms-** Life cycle, phenology, seeding potential, *Vernonia cinerea*.

## I. INTRODUCTION

*Vernonia cinerea* (Linn.) Less. is a member of the Asteraceae family, belonging to the class: Dicotyledonae; order: Asterales and tribe: Vernonieae. It is an erect, slender, rarely branching annual herb that grows up to 1.3 m tall. The stems are finely pilose and glandular. The leaves are alternate, lower ones being petiolated while the upper ones are reduced and sessile. They measure between 2-6 cm long; more or less, densely and finely hairy (Harborne and Williams, 1977). The heads are small, about 7 mm long and 2.5 mm in diameter. The flowers are all tubular, rather bright purple, pink, or white about 20 in each head, twice as long as the involucre bracts. The pappus bristles, measure 3-5 mm long. The achenes are rounded, nearly ribless and measure about 1.5 mm long (Harborne and Williams, 1977). *Vernonia cinerea* is an annual plant widely distributed in Africa, India, Bangladesh and Srilanka. It is commonly known as little iron weed. Its other names include; blue fleabane, inflammation bush, strongman bush, tropical fleabane, goat weed and ash-coloured fleabane (Herrera *et al.*, 1980). *V. cinerea* is native to Africa (e.g Benin, Cameroon, Nigeria, Gabon, Ghana, Kenya,

Liberia, Madagascar etc.), tropical and temperate Asia (e.g China, Fujian, Bangladesh, Jiangxi, India, Japan, Indonesia, Malaysia etc.) and Australia (Harborne and Williams, 1977). *V. cinerea* occurs mostly in sunny or slightly shaded habitats, in general corresponding with young secondary vegetation, wasteland, roadsides, disturbed areas, cultivated land and other anthropogenic habitats (Harborne and Williams, 1977). *V. cinerea* reproduces and spreads by seeds which are adapted to wind dispersal. In addition, seeds may be secondarily dispersed as a contaminant in crop seeds, pasture seeds, and in agricultural machinery (Holm *et al.*, 1997). *V. cinerea* is a herbaceous plant of high medicinal value. Ground leaves or a poultice of leaves of *V. cinerea* are a remedy for headache and when mixed with a little lime they are also applied to dress wounds (Herrera *et al.*, 1980). The leaves either ground or as a decoction, are also used against skin diseases (Oliver, 1986).

Phenology is the study of periodic plant life cycle events and how these are influenced by seasonal and inter-annual variations in weather (George and Bell, 2001). Zhang *et al.* (2006) stated that the study of plant phenology provides knowledge about the pattern of plant growth and development as well as the effects of environment and selective pressures on flowering and fruiting behavior. In the study of plant phenology, Wittwer and Robb (1964) stated that a green screen house is a building or complex in which plants are grown. With emergence of the radicle during germination, seedling establishment begins and may not be considered successful until an adequate root system and leaf area have developed to sustain a high rate of growth (McKell, 1972). Fenner (1987) stated that in a strict physiological sense, a plant developed from a seed is a seedling as long as it depends on seed reserves. Roberts (1939) stated that vegetative growth is triggered by photoperiod and temperature and reproductive initiation is triggered primarily by photoperiod. Dahl (1995) stated that the reproductive phase of a plant is triggered primarily by photoperiod but can be slightly modified by temperature and precipitation. Akobundu and Agyakwa (1998) stated that *Vernonia cinerea* is propagated by seeds, flowering and fruiting throughout the year.

The objectives of this study are to establish the life cycle characteristics as well as the seeding potential of *Vernonia cinerea*, so as to acquire some knowledge on the plant's growth cycle.

## II. MATERIALS AND METHODS

This study was carried out in a screen house, off Arthur Eze Avenue, Awka, using the germinated seeds in polythene bags. Awka town lies between latitudes  $7^{\circ}00'$  and  $7^{\circ}10'$  N and

longitudes  $6^{\circ}05'$  and  $6^{\circ}15'$  E (Richards, 2005). A total of five perforated polythene bags were filled with top soil (loam) and five seeds were sown in each perforated polythene bag. They were moistened adequately and observed daily for germination.

As soon as the seedlings emerged from the soil, growth and phenological observations followed immediately on a weekly basis, and at the end of the first week after germination, the seedlings were reduced to one seedling per bag.

At each sampling date (once every seven days), the shoot systems were observed. The branching system of the shoot was followed up to determine the plant's habit of growth. When the reproductive phase started, that is from the appearance of flower buds, observation was no longer on a weekly basis, but on a daily basis.

The time taken for the different reproductive phases, including flowering period (onset & end of flowering dates), fruit set and fruit maturity, was recorded.

In addition, the following attributes were recorded on a weekly basis:

1. plant height (cm);
2. number of leaves per plant and
3. number of primary branches developed on the main stem.

Reproductive characters that were quantified included:

1. mean number of buds per plant;
2. mean number of seeds per capitulum and
3. mean number of seeds per plant.

These investigations were complemented with observations of the plant in the field.

### Computation and Statistical Analysis of Data

Data obtained were analysed statistically using mean and confidence limit at 95 % level of probability.

## III. RESULTS

### Vegetative and Reproductive Growth of *V. cinerea*

The seeds planted on the 3<sup>rd</sup> of July, 2013, in a screen house, germinated after four days of sowing. All the seeds that were sown in the five polythene bags germinated. The emergence of the plumule (seedling establishment) marked the beginning of the vegetative phase. On week 3, the mean plant height was  $6.4 \pm 1.4$  cm and, the mean number of leaves was approximately  $8 \pm 1.4$  (Figure 1). The plant started producing primary branches on

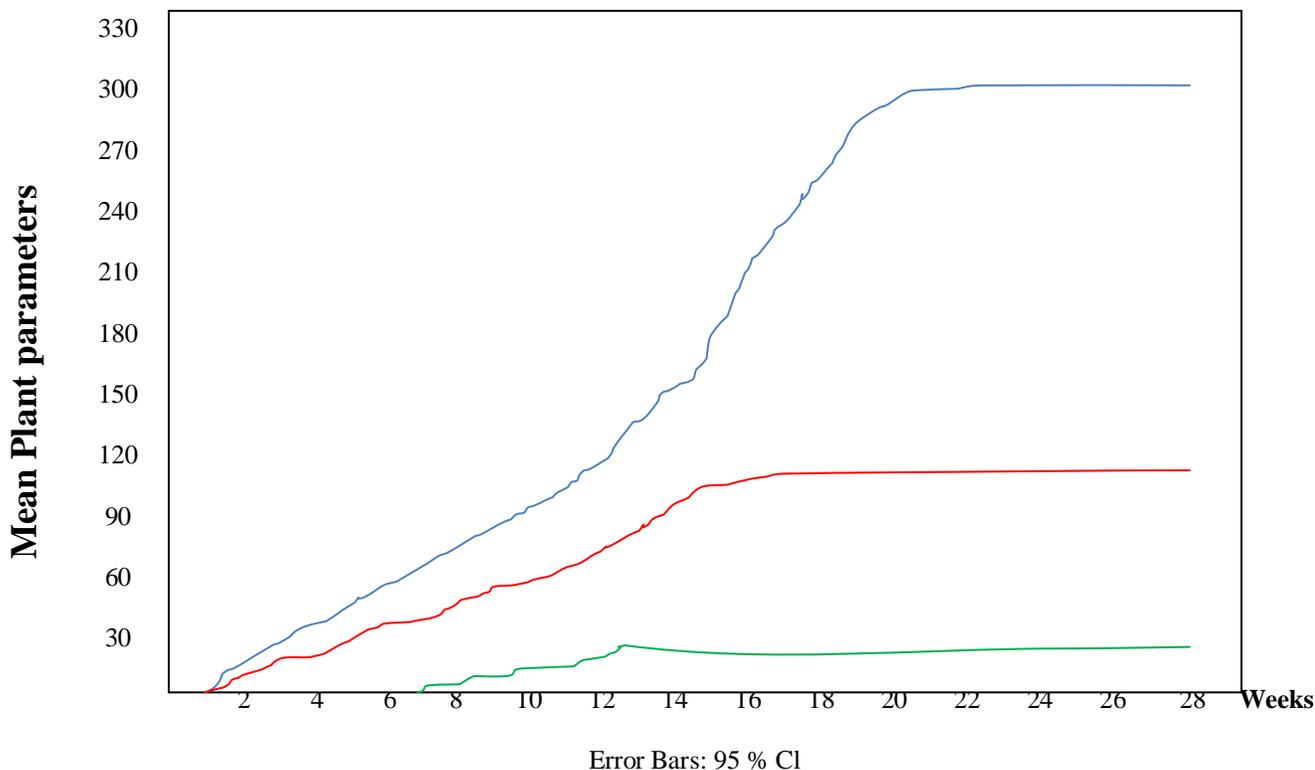
week 7 and it stopped on week 13 (Figure 1). The vegetative phase lasted for 8 weeks (Table 3) before the appearance of flower buds (week 8), which marked the beginning of the reproductive phase. The mean height of the plant at this date was  $31 \pm 10.5$  cm, while the mean number of leaves of the plant was approximately  $41 \pm 17.8$  (Figure 1). The appearance of flower buds lasted for a mean of  $20.2 \pm 1.1$  days (Table 3) before the opening of the flower buds on week 11. The mean height of the plant at this date was  $78.2 \pm 10.7$  cm, the mean number of leaves was approximately  $95 \pm 32.7$  and the mean number of branches of stem was  $17 \pm 3.6$  (Figure 1). The opening of the flower buds lasted for a mean of  $13.2 \pm 0.6$  days (Table 3), before the appearance of parachute of hairs containing seeds on week 13. The mean height of the plant at this date was  $92.8 \pm 20.7$  cm, the mean number of leaves was approximately  $113 \pm 27$  and the mean number of branches of stem was  $19 \pm 3$  (Figure 1). The production of new branches of stem stopped at the start of the fruiting stage (week 13). The appearance of parachute of hairs lasted for a mean of  $7.2 \pm 0.6$  days (Table 3), before the plant shed its fruit (fruit maturity). The minimum number of seeds per plant (a mean of  $477 \pm 162$  seeds) was produced on week 15, while the maximum number of seeds per plant (a mean of  $2519 \pm 2216$  seeds) was produced on week 19. Flowering and fruiting period (reproductive phase) lasted for a mean of  $139 \pm 14$  days before the plant withered (Table 3). Observations showed that *V. cinerea* flowers and fruits at any given time of the year. Observations of the vegetative growth characteristics of *V. cinerea* (Table 1) showed that the plant attained a mean height of  $103.8 \pm 34.4$  cm, a mean number of leaves of  $301 \pm 130$ , a mean number of branches of stem of  $19 \pm 3$  and a mean life cycle duration of  $28 \pm 2$  weeks.

### Reproductive Potential of *V. cinerea*

The mean number of buds produced per plant was  $1,050 \pm 883$ , the mean number of seeds produced per capitulum was  $21 \pm 1$  and the mean number of seeds produced per plant was  $21,774 \pm 18,740$  (Table 2).

### Vegetative growth Parameters

- Plant Height (cm)
- No. of leaves per plant
- No. of primary branches



**Figure 1: Graph illustrating the weekly vegetative growth parameters of *V. cinerea***

The graph (Fig 1) above showed that the plant height increased gradually from week 1 to week 22, where it attained a mean height of  $103.4 \pm 34.0$  cm, and the plant height stopped to increase on week 23, at a mean height of  $103.8 \pm 34.3$  cm. The number of leaves per plant increased exponentially from week 3 to week 25, where it produced a mean number of leaves of  $298 \pm$

130, and the plant stopped producing leaves on week 26, at a mean number of leaves of  $301 \pm 130$ . It also showed that the primary branching started on week 7 and stopped on week 13 when the plant attained a mean of  $19.0 \pm 3$  branches on the main stem.

**Table 1: Duration of the vegetative growth parameters of *V. cinerea***

Plants	Height (cm)	No. of Leaves	No. of Branches of Stem	Life Cycle Duration (in weeks)
1	148	479	20	30
2	90	300	20	28
3	92	214	21	28
4	112	275	19	29
5	77	238	15	26
Mean±CL	$103.8 \pm 34.4$	$301 \pm 130$	$19 \pm 3$	$28 \pm 2$ weeks

Data were statistically analysed using mean and confidence limit at 95 % level of probability.

**Table 2: Reproductive growth of *V. cinerea***

Plants	No. of Buds Per Plant	No. of Seeds Per Capitulum	No. of Seeds Per Plant
1	2,275	21	47,775
2	834	21	17,514
3	518	20	10,360
4	902	20	18,040
5	723	21	15,183
Mean ± CL	$1,050 \pm 883$	$20.6 \pm 0.6$	$21,774 \pm 18,740$

Data were statistically analysed using mean and confidence limit at 95 % level of probability.

**Table 3: Durations of the vegetative and reproductive phases of *V. cinerea***

Plants	Vegetative phase (in days)	Appearance, to opening of flower buds (in days)	Opening of flower buds to appearance of parachute of hairs (in days)	Appearance of parachute of hairs to start of wilting of flowers (in days)	Reproductive phase (in days)
1	61	19	13	7	149
2	53	21	14	7	143
3	62	20	12	7	134
4	55	21	14	8	148
5	50	20	13	7	120
Mean±CL	56 ± 5.6	20.2 ± 1.1	13.2 ± 0.6	7.2 ± 0.6	139 ± 14

Data were statistically analysed using mean and confidence limit at 95 % level of probability.

#### IV. DISCUSSION

Observation from the growth studies of *V. cinerea* showed that the seed of the plant germinated in 4 days, and this is in line with that of Akinola and Jennifer (1993) who reported that the emergence of the radicle of *V. cinerea* from the soil surface took 3 days after imbibitions and the establishment of its seedlings in a natural environment took 5-6 days. The observed difference may be as a result of difference in soil and environmental conditions (though not investigated). Observation from the growth studies which also showed that the vegetative phase of the plant lasted for 8 weeks before the appearance of the flower buds (mature plant), is not in line with that of Akinola and Jennifer (1993) who reported that the seedlings of *V. cinerea* grew into mature plants within four weeks after germination. This observed difference could be as a result of difference in the climatic and edaphic factors of the two areas of study (though not investigated). Observation from phenological studies which showed that the plant could flower and fruit at any given time of the year, and that, this flowering and fruiting period (reproductive phase) lasted for a period of a mean of between 4 months and 3 days and 5 months and 1 days, is in agreement with that of Jordano (1992) who noted that in the tropical community, there are usually some species that are in fruit at any given time of the year, and individual species tend to have longer fruiting periods, with a mean of more than 4 months. In addition, Murali and Sukumar (1994) noted that the timing of flowering is one of the most widely investigated aspects of the phenology of plant life-cycles. Observation from the growth characteristics of *V. cinerea* showed that the plant attained a mean height of between 69.4 cm (0.694 m) and 138.2 cm (1.382 m), and this can be related to that of Dogra *et al.* (2009) who noted in his study that *Ageratum conyzoides* (like *V. cinerea*, which belongs to the family: Asteraceae) can gain height of up to 2 m in the Shivalik hills. The difference in these observations may be due to differences in plants and study areas. In addition, Akinola and Jennifer (1993) stated that the size of a mature plant depends on the environment in which the plant is growing. Observations from the growth parameters also showed that the mean number of leaves of *V. cinerea* was between 171 and 431, the mean number of branches of stem was between 16 and 22 and the

mean life cycle duration was between 26 weeks and 1 day and 30 weeks and 1 day. These phenological observations provided information about the pattern of growth and development of *V. cinerea*. This is in agreement with what Zhang *et al.* (2006) stated that the study of plant phenology provides knowledge about the pattern of plant growth and development as well as the effects of environment and selective pressures on flowering and fruiting behaviour.

Observation from the records of the reproductive potential of *V. cinerea* which showed that the mean number of buds per plant was between 167 and 1,933, the mean number of seeds per capitulum was between 20 and 21.2 and the mean number of seeds per plant was between 3,034 and 40,514 contradicts that of Akinola and Jennifer (1993) who reported that *V. cinerea* produces 100-800 capitula per plant which bear 2,500-20,000 seeds (achene). The difference in these observations could be as a result of difference in the environmental conditions, even though these were not investigated.

#### V. CONCLUSION

The ability of *Vernonia cinerea* to flower and fruit at any given time of the year and within a period of 5 months, and its high seeding potential will help it survive competition in places where it occurs.

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# Some Aspects of the Ecology of *Vernonia cinerea* (Linn.) Less. in Awka Town, Anambra State, Nigeria.

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**Abstract-** This study was carried out to assess how the presence of *Vernonia cinerea* (Linn.) Less. impacts on plant biodiversity wherever it occurs, and to determine the species diversity in the plots where *V. cinerea* was present and those in which the plant was absent. Abundance measures of *V. cinerea* and other associated species in its natural environment and species diversity (using Shannon-Wiener Index) were determined using the quadrat method. Four different plots were chosen for the study: two plots were chosen from sites where *V. cinerea* was present and the other two plots were chosen from sites where *V. cinerea* was absent. Results from the species abundance of *V. cinerea* and other associated species in plots where *V. cinerea* was present showed that *V. cinerea* had low density, frequency and importance value; implying that, *V. cinerea* had very low species abundance. While the observations from the diversity of species showed that although, the plots where *V. cinerea* was present and absent had high species diversity, plots where *V. cinerea* was present had a higher number of species and these species were more evenly distributed. It is concluded from the results that the presence of *V. cinerea* did not have any observable impact on the plant biodiversity in areas where it occurred and *V. cinerea* is, therefore, not an invasive species.

**Index Terms-** Abundance measures, quadrat, species diversity, *Vernonia cinerea*.

## I. INTRODUCTION

*Vernonia cinerea* (Linn.) Less. is a member of the Asteraceae family, belonging to the class: Dicotyledonae; order: Asterales and tribe: Vernoniaeae. *Vernonia cinerea* is an annual plant widely distributed in Africa, India, Bangladesh and Sri Lanka. It is commonly known as little iron weed. Its other names include; blue fleabane, inflammation bush, strongman bush, tropical fleabane, goat weed and ash-coloured fleabane (Herrera *et al.*, 1980). *V. cinerea* is native to Africa (e.g Benin, Cameroon, Nigeria, Gabon, Ghana, Kenya, Liberia, Madagascar etc.), tropical and temperate Asia (e.g China, Fujian, Bangladesh, Jiangxi, India, Japan, Indonesia, Malaysia etc.) and Australia (Harborne and Williams, 1977). It occurs mostly in sunny or slightly shaded habitats, in general, corresponding with young secondary vegetation, wasteland, roadsides, disturbed areas, cultivated land and other anthropogenic habitats (Harborne and Williams, 1977). *V. cinerea* reproduces and spreads by seeds which are adapted to wind dispersal. In addition, seeds may be secondarily dispersed as a contaminant in crop seeds, pasture seeds, and in agricultural machinery (Holm *et al.*, 1997). *V. cinerea* is a plant of high medicinal importance. In India, the

flowers are administered to treat conjunctivitis and the root is given in cases of dropsy, whereas the seeds are also employed as an anthelmintic and alexipharmic (Tadesse *et al.*, 1993). The leaves either ground or as a decoction, are also used to treat skin diseases (Oliver, 1986).

Hopkins (1974) noted that one qualitative method of analysis of a community is to list all the species present. The number of species in a community is important ecologically since the species diversity seems to increase as the community becomes stable (Michael, 1984). In ecological methods, Jackson and Forrester (1974) stated that a typical modern technique is to select a proportion of the total population from which the characteristics of the whole can be inferred. Smith (1991) noted that in a simple random sample at a given size, all such subsets of the frame are given an equal probability. Sutherland (1997) stated that a quadrat is a frame of any shape that can be placed over vegetation so that cover can be estimated, plants counted and species listed. Curtis and McIntosh (1950) noted some important quantitative analysis such as density, frequency, and abundance of plant species. Communities are often described by the species or genera that are determined to be the most important in the community. This is quantified by calculating the statistics known as Importance Value (Schmidt, 2005). Clarke and Warwick (2001) stated that Shannon diversity is a very widely used index for comparing diversity between various habitats.

The objectives of this study are to determine the abundance of *Vernonia cinerea* and other associated species in areas where *V. cinerea* is present, and also, to determine the species diversity in areas where *V. cinerea* is present and absent, so as to determine the impact of the presence of *V. cinerea* on plant biodiversity.

## II. MATERIALS AND METHODS

### Description of the study areas

Ecological field studies were carried out in Awka town, Anambra State. Awka town lies between latitudes 7°00' and 7°10' N and longitudes 6°05' and 6°15' E (Richards, 2005). The study area is in the tropical rain forest zone of Nigeria. The temperature in Awka is generally 27-30°C between June and December but rises to 32-34°C between January and March, with the last few months of the dry season marked by intense heat. The rainfall is intensive with an annual range of between 1200 mm and 1500 mm and it occurs in a single season from April to November (Akamigbo, 1992). The pedology of the area shows that the soil is of sedimentary origin with sandstone and shale as the two

dominant parent materials (Akamigbo, 1992). The study areas were of uniform elevation, very well exposed and homogeneous.

**METHODOLOGY**

A total of four plots were chosen for the study: two plots were chosen from sites where *V. cinerea* was present and the other two plots, adjacent to the first, were chosen from sites where *V. cinerea* was absent.

**Mapping Out of Four Sampling Areas**

An area of 225 m<sup>2</sup> (15 m by 15 m) was mapped out in the four different plots with a 30 metre tape. Pegs were inserted at the four corners of the study areas. Rope was used to demarcate the measured areas.

**Sampling Technique Used**

The sampling unit used for counting species in the study areas was the quadrat.

The sampling percentage intensity used in the study areas was 6.67 %.

**Quadrat Method**

A 1 m<sup>2</sup> quadrat was placed fifteen times in each of the mapped out areas. This, therefore, gave a sample area of 15 m<sup>2</sup> for each site.

**Sampling Method**

Random sampling method was used in sampling the study areas. At each random point, the quadrat was placed in such a way that the random point was in the centre of the quadrat. The species present were counted and identified. Only plants that were actually rooted inside the quadrat were counted. The number and type of species present in each quadrat were recorded. This procedure continued until the fifteen random points were sampled for each of the infested and the un-infested plots. Code numbers were given to all plants that could not be identified in the field. They were collected, preserved, properly labeled and taken to the Botany Department Herbarium of the university, for identification.

**Computation of Data**

From the results obtained, the following were determined for both the infested and the un-infested plots.

$$(1) \text{ Sampling intensity} = \frac{\text{Sampled Area}}{\text{Total Area}} \times \frac{100}{1}$$

$$\text{That is, } \frac{15}{225} \times \frac{100}{1} = 6.67 \%$$

$$(2) \text{ Density} = \frac{\text{No. of Individuals of a species}}{\text{Total area sampled}}$$

$$(3) \text{ Relative density} = \frac{\text{Density of one species}}{\text{Total density for all species}}$$

$$(4) \text{ Frequency} = \frac{\text{No. of occurrences of a species}}{\text{No. of quadrats sampled}}$$

$$(5) \text{ Relative frequency} = \frac{\text{Frequency of one species}}{\text{Total frequency for all species}}$$

$$(6) \text{ Importance value} = \frac{\text{Relative density of one species} + \text{Relative frequency of same species}}{1}$$

$$(7) \text{ Extrapolation} = e.g \text{ if in } 15 \text{ m}^2, \text{ the density of } V. \text{ cinerea}$$

for infested plot was 0.67/m<sup>2</sup>. Therefore, in 225 m<sup>2</sup>, the density would be 225 m<sup>2</sup> x 0.67 m<sup>-2</sup> = 150.75 per 225 m<sup>2</sup>, and in one hectare, the density would be

$$10,000 \text{ m}^2/\text{ha} \times 0.67 \text{ m}^{-2} = 6,700 /\text{ha}$$

(Note that one can extrapolate density in either per square metres (/m<sup>2</sup>) or per hectare (/ha))

(8) Species Diversity: using Shannon-Wiener Index

$$\text{Step 1 } H = - \sum_{i=1}^S (P_i) \times (\ln P_i)$$

(Where P<sub>i</sub> is the sum of each species divided by sum of all species)

$$\text{Step 2: } H_{\text{Max}} = \ln S$$

(Where S is the total number of species)

$$\text{Step 3: } E = \frac{H}{H_{\text{Max}}}$$

Where, P<sub>i</sub> = Sum of individual species divided by sum of all species.

H = Shannon Wiener's Index of diversity

H<sub>Max</sub> = Maximum diversity possible

S = Number of species

E = Equitability

i-1 = individual species to one

(Note that equitability value ranges from 0.1 to 0.99 and the higher the value, the higher the species diversity)

**III. RESULTS**

**Density and Importance Value of species in the plots where *V. cinerea* was present and in those ones where the plant was absent**

*Oldenlandia herbaceae* had the highest density, followed by *Scoparia dulcis* and *Eleusine indica*, while *Emilia praetermissa* had the lowest density, followed by *Cyperus rotundus* in plot 1 where *V. cinerea* was present (Table 1). *Oldenlandia herbaceae* had the highest frequency, followed by *Eleusine indica*, *Scoparia dulcis*, *Calapogon mucunoides*, *Pennisetum purpureum* and *Cocculus pendulus* th the same frequency, while *Euphorbia heterophylla* had the lowest frequency, followed by *Emilia praetermissa* and *Spigelia anthelmia*, with the same frequency (Table 1). *Oldenlandia herbaceae* had the highest importance value, followed by *Scoparia dulcis* and *Eleusine indica*, while *Emilia praetermissa* had the lowest importance value, followed by *Euphorbia heterophylla* in plot 1 where *V. cinerea* was present (Table 1). *Vernonia cinerea* in this plot had low density, frequency and importance value (Table 1).

*Oldenlandia herbaceae* had the highest density, followed by *Scoparia dulcis* and *Eleusine indica*, while *Crotalaria retusa* had the lowest density, followed by *Mimosa invisa* and *Andropogon tectorum* in plot 1 where *V. cinerea* was absent (Table 2). *Oldenlandia herbaceae* had the highest frequency, followed by *Eleusine indica* and *Scoparia dulcis*, while *Andropogon tectorum* and *Crotalaria retusa* had the lowest and the same frequency, followed by *Mimosa invisa* (Table 2). *Oldenlandia herbaceae*

had the highest importance value, followed by *Eleusine indica* and *Scoparia dulcis*, while *Crotalaria retusa* had the lowest importance value, followed by *Andropogon tectorum* and *Mimosa invisa* in plot 1 where *V. cinerea* was absent (Table 2).

*Eleusine indica* had the highest density, followed by *Gomphrena celosioides* and *Oldenlandia herbaceae*, while *Spigelia anthelmia* had the lowest density, followed by *Euphorbia heterophylla* in plot 2 where *V. cinerea* was present (Table 3). *Ageratum conyzoides* had the highest frequency, followed by *Eleusine indica*, *Gomphrena celosioides* and *Oldenlandia herbaceae* which had the same frequency, while *Tridax procumbens* and *Euphorbia hirta* had the lowest and the same frequency (Table 3). *Eleusine indica* had the highest importance value, followed by *Gomphrena celosioides* and *Ageratum conyzoides*, while *Tridax procumbens* had the lowest importance value, followed by *Spigelia anthelmia* and *Euphorbia hirta* in plot 2 where *V. cinerea* was present (Table 3). *Vernonia cinerea* in this plot had low density, frequency and importance value (Table 3).

*Ageratum conyzoides* had the highest density, followed by *Tridax procumbens*, while *Emilia praetermissa* had the lowest density, followed by *Spigelia anthelmia* in plot 2 where *V. cinerea* was absent (Table 4). *Tridax procumbens* had the highest frequency, followed by *Ageratum conyzoides* and *Sida acuta* which had the same frequency, while *Crotalaria retusa*, *Spigelia anthelmia*, *Emilia praetermissa*, *Panicum repens* and *Calapogonium mucunoides* had the lowest and the same frequency in plot 2 where *V. cinerea* was absent (Table 4). *Ageratum conyzoides* had the highest importance value, followed by *Tridax procumbens*, while *Emilia praetermissa* had the lowest importance value, followed by *Spigelia anthelmia* and *Crotalaria retusa* in plot 2 where *V. cinerea* was absent (Table 4).

**Species Diversity**

Although the plots where *V. cinerea* was present and absent had high species diversity, plots where *V. cinerea* was present had a higher number of species and these species were more evenly distributed (Table 5).

**Table 1: Abundance of species in the first plot where *V. cinerea* was present**

Quadrat Size: 1 m <sup>2</sup>		Sampling intensity: 6.67 %						
S/N	Species	No. of each species	Density (m <sup>-2</sup> )	R.D. (%)	Freq. (%)	R. F. (%)	I.V.I. (%)	Extrapolation (ha)
1	<i>Ageratum conyzoides</i>	21	1.40	7.28	40.00	6.38	13.66	14,000
2	<i>Calapogonium mucunoides</i>	13	0.83	4.52	46.67	7.45	11.97	8,700
3	<i>Cocculus pendulus</i>	16	1.07	5.56	46.67	7.45	13.01	10,700
4	<i>Cyperus rotundus</i>	5	0.33	1.72	26.67	4.26	5.98	3,300
5	<i>Eleusine indica</i>	34	2.27	11.80	46.67	7.45	19.25	22,700
6	<i>Emilia praetermissa</i>	3	0.20	1.04	20.00	3.19	4.23	2,000
7	<i>Euphorbia heterophylla</i>	7	0.47	2.44	13.33	2.13	4.57	4,700
8	<i>Euphorbia hirta</i>	13	0.87	4.52	40.00	6.38	10.90	8,700
9	<i>Gomphrena celosioides</i>	7	0.47	2.44	26.67	4.26	6.70	4,700
10	<i>Oldenlandia herbaceae</i>	43	2.87	14.92	66.67	10.64	25.56	28,700
11	<i>Panicum maximum</i>	22	1.47	7.64	40.00	6.38	14.02	14,700
12	<i>Pennisetum purpureum</i>	21	1.40	7.28	46.67	7.45	14.73	14,000
13	<i>Scoparia dulcis</i>	40	2.67	13.88	46.67	7.45	21.33	26,700
14	<i>Senna mimosoides</i>	11	0.73	3.80	40.00	6.38	10.18	7,300
15	<i>Sida acuta</i>	13	0.87	4.52	26.67	4.26	8.78	8,700
16	<i>Spigelia anthelmia</i>	9	0.60	3.12	20.00	3.19	6.31	6,000
17	<i>Vernonia cinerea</i>	10	0.67	3.48	33.33	5.32	8.80	6,700
		Σ288	Σ19.20		Σ626.69			

Where R. D. =Relative Density, Freq. =Frequency, R. F. = Relative Frequency and I. V. I. = Importance Value Index.

**Table 2: Abundance of species in the first plot where *V. cinerea* was absent**

Quadrat Size: 1 m<sup>2</sup>      Sampling intensity: 6.67 %

S/N	Species	No. of each species	Density (m <sup>-2</sup> )	R.D. (%)	Freq. (%)	R. F. (%)	I.V.I. (%)	Extrapolation (/ha)
1	<i>Ageratum conyzoides</i>	21	1.40	7.28	40.00	6.38	13.66	14,000
2	<i>Andropogon tectorum</i>	11	0.73	4.10	20.00	4.17	8.27	7,300
3	<i>Cocculus pendulus</i>	17	1.13	6.35	40.00	8.33	14.68	11,300
4	<i>Crotalaria retusa</i>	4	0.27	1.52	20.00	4.17	5.69	2,700
5	<i>Eleusine indica</i>	37	2.47	13.88	53.33	11.11	24.99	24,700
6	<i>Mimosa invisa</i>	8	0.53	2.98	26.67	5.56	8.54	5,300
7	<i>Oldenlandia herbaceae</i>	42	2.80	15.73	60.00	12.50	28.23	28,000
8	<i>Panicum maximum</i>	19	1.27	7.13	40.00	8.33	15.46	12,700
9	<i>Panicum repens</i>	18	1.20	6.74	33.33	6.94	13.68	12,000
10	<i>Pennisetum purpureum</i>	21	1.40	7.87	33.33	6.94	14.81	14,000
11	<i>Phyllanthus amarus</i>	16	1.07	6.01	33.33	6.94	12.95	10,700
12	<i>Scoparia dulcis</i>	39	2.60	14.61	46.67	9.72	24.33	26,000
13	<i>Sida acuta</i>	14	0.93	5.22	33.33	6.94	12.16	9,300
		Σ267	Σ17.80		Σ479.99			

Where R. D. =Relative Density, Freq. =Frequency, R. F. = Relative Frequency and I. V. I. = Importance Value Index.

**Table 3: Abundance of species in the second plot where *V. cinerea* was present**

Quadrat Size: 1 m<sup>2</sup>      Sampling intensity: 6.67 %

S/N	Species	No. of each species	Density (m <sup>-2</sup> )	R.D. (%)	Freq. (%)	R. F. (%)	I.V.I. (%)	Extrapolation (/ha)
1	<i>Ageratum conyzoides</i>	33	2.20	11.04	60.00	11.11	22.15	22,000
2	<i>Chromolaena odorata</i>	21	1.40	7.02	33.33	6.17	13.19	14,000
3	<i>Crotalaria retusa</i>	14	0.93	4.67	40.00	7.41	12.08	9,300
4	<i>Cyperus rotundus</i>	13	0.87	4.37	33.33	6.17	10.54	8,700
5	<i>Eleusine indica</i>	45	3.00	15.05	46.67	8.64	23.69	30,000
6	<i>Euphorbia heterophylla</i>	11	0.73	3.66	33.33	6.17	9.83	7,300
7	<i>Euphorbia hirta</i>	14	0.93	4.67	26.67	4.94	9.61	9,300
8	<i>Gomphrena celosioides</i>	41	2.73	13.70	46.67	8.64	22.34	27,300
9	<i>Oldenlandia herbaceae</i>	34	2.27	11.39	46.67	8.64	20.03	22,700
10	<i>Panicum maximum</i>	21	1.40	7.87	33.33	6.94	14.81	11,300
11	<i>Scoparia dulcis</i>	22	1.47	7.38	40.00	7.41	14.79	14,700
12	<i>Spigelia anthelmia</i>	39	2.60	14.61	46.67	9.72	24.33	6,700
13	<i>Tridax procumbens</i>	12	0.80	5.22	33.33	6.94	12.16	8,000
14	<i>Vernonia cinerea</i>	12	0.80	4.01	33.33	6.17	10.18	8,000
		Σ299	Σ19.93		Σ540.00			

Where R. D. =Relative Density, Freq. =Frequency, R. F. = Relative Frequency and I. V. I. = Importance Value Index.

**Table 4: Abundance of species in the second plot where *V. cinerea* was absent**

Quadrat Size: 1 m <sup>2</sup>		Sampling intensity: 6.67 %						
S/N	Species	No. of each species	Density (m <sup>-2</sup> )	R.D. (%)	Freq. (%)	R. F. (%)	I.V.I. (%)	Extrapolation (/ha)
1	<i>Ageratum conyzoides</i>	62	4.13	23.65	46.67	10.94	34.59	41,300
2	<i>Calapogonium mucunoides</i>	20	1.33	7.62	26.67	6.25	13.87	13,300
3	<i>Cocculus pendulus</i>	13	0.81	4.98	33.33	7.81	12.79	8,100
4	<i>Crotalaria retusa</i>	12	0.80	4.58	26.67	6.25	10.83	8,000
5	<i>Emilia praetermissa</i>	6	0.40	2.29	26.67	6.25	8.54	4,000
6	<i>Mimosa invisa</i>	14	0.93	5.33	33.33	7.81	13.14	9,000
7	<i>Oldenlandia herbaceae</i>	19	1.27	7.27	40.00	9.37	16.64	12,700
8	<i>Panicum repens</i>	16	1.07	6.13	26.67	6.25	12.38	10,700
9	<i>Pennisetum purpureum</i>	14	0.93	5.33	40.00	9.37	14.70	9,300
10	<i>Sida acuta</i>	22	1.47	8.42	46.67	10.94	19.36	14,700
11	<i>Spigelia anthelmia</i>	11	0.73	4.81	26.67	6.25	10.43	7,300
12	<i>Tridax procumbens</i>	53	3.53	20.22	53.33	12.50	32.72	35,300
		Σ262	Σ17.46	Σ426.68				

Where R. D. =Relative Density, Freq. =Frequency, R. F. = Relative Frequency and I. V. I. = Importance Value Index.

**Table 5: Species diversity for the plots where *V. cinerea* was present and absent**

Plots	Equitability
Where <i>V. cinerea</i> was present	0.95
Where <i>V. cinerea</i> was absent	0.92

Where  $H^l$  = Shannon Wiener Index of Diversity.

#### IV. DISCUSSION

Observations from the abundance of *V. cinerea* and other associated species in the infested plots showed that *V. cinerea* had very low density, frequency and importance value index; implying that, *V. cinerea* had very low species abundance. This also implies that the presence of *V. cinerea* had no influence on the abundance of other associated species in areas where it was present. This observation could be as a result of the presence of some plant species with high competitive ability, capable of suppressing *V. cinerea* and some other species around them. Okereke and Mbaekwe (2011) noted that *Mimosa invisa* has the ability to dominate and suppress all other species around it due to its high competitive ability in any environment it was found. Competition for nutrient, water and light will cause the plants that are more fit, to suppress the plants that are less fit. Speaking on fitness in plant, it describes individual reproductive success. Vandermeer (1989) stated that differences in the way plant species respond to the environment in which they are grown are thought to lead to a more efficient use of available growth resources (nutrients, water, light) with the potential of increasing yields and the competitive suppression of weeds.

Observations from the diversity of species showed that although the plots where *V. cinerea* was present and those in which the plant was absent had high species diversity, plots where *V. cinerea* was present had a higher number of species and these species were more evenly distributed. The high diversity of the species in the plots where *V. cinerea* was present and absent

could be as a result of the presence of less invader species in the plots (though not investigated). This agrees with what Kercher and Zedler (2004) stated that an increase in abundance of the invaders can decrease the diversity of species.

#### V. CONCLUSION

It was concluded that the presence of *V. cinerea* did not have any observable impact on the plant biodiversity in areas where it occurs and *V. cinerea* is, therefore, not an invasive species. Because of its low competitive ability as established in this study and its high medicinal value as found in the literature, effort should be made to conserve this plant and prevent it from going into extinction.

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# Assessment of the Effect of Kerosene Spill on Microbial Population of Soil Ten Years after the Spill at Maikunkele, Niger State Nigeria.

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**Abstract-** Assessment of the effect of kerosene spill on microbial properties of soil ten years after the spill at Maikunkele, Niger State was carried out. The counts of total aerobic heterotrophic bacteria (AHB) ranged from  $1.1 \times 10^6$  cfu/g to  $1.9 \times 10^6$  cfu/g of soil in the kerosene polluted soil (KPS) as compared to  $1.3 \times 10^6$  cfu/g -  $2.1 \times 10^6$  cfu/g of soil in the kerosene free soil (KFS). However, the spill promoted the growth of kerosene utilizing bacteria (KUB) in the soil. The population of KUB in the KPS ranged from  $1.1 \times 10^5$  cfu/g to  $1.7 \times 10^5$  cfu/g as compared to  $1.0 \times 10^5$  cfu/g -  $1.6 \times 10^5$  cfu/g in the KFS. The results obtained also revealed that the counts of fungi were higher in KFS ( $1.3 \times 10^3$  cfu/g -  $2.1 \times 10^3$  cfu/g) than in KPS ( $1.1 \times 10^3$  cfu/g -  $1.6 \times 10^3$  cfu/g). The kerosene utilizing microorganisms were identified as species of *Bacillus*, *Micrococcus*, *Acinetobacter*, *Alcaligenes*, *Pseudomonas*, *Aspergillus*, *Fusarium*, *Mucor* and *Penicillium*. The amount of carbon dioxide evolved by *Bacillus subtilis* strains (KUB07 and KUB04) was relatively higher compared to the amount of carbon dioxide evolved by other strains and mixed culture after 16 days, meaning that there may be no special benefit in using mixed culture in the bioremediation of kerosene pollute environment. Thus *Bacillus* strains KUB04 and KUB07 can be used in reclaiming the kerosene polluted soil.

**Index Terms-** Kerosene spill, Soil, Micro-organism, Bioremediation, Carbon dioxide evolution

## I. INTRODUCTION

Oil spills on land affect plants, animals, soil microbes and physicochemical properties of soil. Oil spills kill or inhibit the continuous growth of an already established vegetation. It deprives plants of oxygen availability and decreases moisture and air availability in soil for plant use. Such anaerobic conditions may give rise to microbial generation of compounds that are toxic to plants, such as hydrogen sulphide. The exhaustion of oxygen could be due to use of the oxygen by petroleum degrading microorganisms (Ijah *et al.*, 2000; Okoh, 2006). Terrestrial animals suffer much from oil spills due to toxicity of some petroleum components, particularly the low boiling compounds. Oil blocks the respiratory channels of arthropods and interferes with their respiration (Okoh, 2006). When petroleum spill in soil the physicochemical properties of the soil undergo major alterations which affect the growth of plants and microbial activities. A typical microbial growth curve is observed when oil is introduced to soil. A short lag period is followed by a rise in numbers of microorganisms until maximum

number of growth is reached. The decrease in microbial number in soil immediately after oil addition is due to the unfavourable condition the oil creates. However, the high microbial numbers, particularly the oil utilizers could be due to nutrients provided by the oil contaminant (Ojo, 2005). Thus, the level of hydrocarbon-utilizing microorganisms may reflect the degree of pollution of the ecosystem (Ijah *et al.*, 2000; Bragg *et al.*, 2010). In Nigeria, most of the terrestrial ecosystem in oil producing and non oil producing communities are important agricultural land under cultivation. Any contact with petroleum hydrocarbon results in damage to soil condition of this agricultural lands, microorganisms and plants (Onuoha *et al.*, 2003). Petroleum hydrocarbon polluted soils are of environmental concern because they are unsuitable for agriculture and recreational uses, and are potential sources for surface and ground water contamination. Generally speaking, high concentration of petroleum hydrocarbon in an environment is harmful to soil biota and crop growth. When natural ecosystems are contaminated with petroleum hydrocarbons, the indigenous microbial communities are likely to contain microbial populations of different taxonomic characteristics, which are capable of degrading the contaminating hydrocarbons (Antai, 1990; Ijah and Ukpe, 1992; Ijah *et al.*, 2000; Ijah and Antai, 2003). Microbial degradation process aids the elimination of oil spill from the environment after initial removal of large amounts of the oil by various physical and chemical methods. This is possible because microorganisms have enzymatic systems to degrade and utilize petroleum as a source of carbon and energy (Ijah and Antai, 2003). This advantage has been used in the current area of bioremediation of oil spills. Petroleum degrading microorganisms isolated from the Nigerian environment include species of *Bacillus*, *Pseudomonas*, *Candida*, *Streptomyces*, *Penicillium*, *Aspergillus* and *Torulopsis* (Akpoy, 2007). The main aim of the study was to assess the microbiological properties of the soil impacted by kerosene at Maikunkele, Niger State ten years after the spill, to ascertain if the impacted area has recovered completely. The specific objectives of the study were to assess the effect of the kerosene on the microbial population of the soil, to isolate and identify microorganisms in the kerosene polluted soil, and to assess the rates and the total extent at which residual kerosene in the soil was degraded.

## II. MATERIALS AND METHODS

**Description of Study Site:** The study site was kerosene spilled soil at Maikunkele, Bosso Local Government Area of

Niger State, Nigeria. The kerosene spill covered an area of 1800m<sup>2</sup>. The spill occurred in August 1998, when a tanker carrying several thousands litres of kerosene spilled its content on a field near Airport Junction at Maikunkele, Bosso Local Government Area of Niger State (Ijah *et al.*, 2000). The spillage withered grasses and shrubs for a period of over one year (Ijah *et al.*, 2000). At the time of first sampling in April 2008, the affected site was covered with grasses such as *Ajaratum coinzoides*, *Cylindrica indica*, *Sida acuta*, *Bohavia diffusa* and *Aspilla africana*, similar to the unpolluted control site. The soil particle analysis revealed that the study site is made up of coarse sand, fine sand, and clay. Thus, the soil is a sandy loam soil with a good drainage system.

**Collection of Samples:** The kerosene polluted site divided into two plots of 900m<sup>2</sup> each. Four soil samples were collected from each plot at random, making a total of eight bulk samples. The kerosene free soil was also divided into two plots of 900m<sup>2</sup> each and the samples were similarly collected. The samples were collected in polythene bags each month, for a period of six months (April-September) and transported to the laboratory for analysis.

**Enumeration of Microorganisms:** Ten grammes (10g) of the soil samples were serially diluted and plated on Nutrient agar (NA), Sabouraud dextrose agar (SDA) and kerosene agar (KA), for the enumeration of total aerobic heterotrophic bacteria, fungi and kerosene utilizing bacteria respectively. The NA and KA plates were incubated at 30°C for 48 h while SDA plates were incubated at room temperature (28 ± 2°C) for 5 days. Colonies which developed on the plates were counted and recorded as colony forming units per gramme (cfu/g) of soil. The isolates were subcultured repeatedly to obtain pure cultures. The pure cultures were stored on slants in the refrigerator for further characterization and identification. The isolates were characterized using the following biochemical tests: Gram staining, Methyl red-Voges proskauer (MR-VP) tests, indole test, sugar fermentation, coagulase test, catalase test, motility test and spore staining test. The bacteria isolate were identified by comparing their characteristics with those of known taxa using the scheme of Cowan (1970).

The fungi isolates were characterized based on the colour of aerial and substrate hyphae. Furthermore, the nature of hyphae and shape as well as the presence of special structures such as rhizoid were noted. Other structures were examined using the method described below: The characteristics of the fungi isolates were compared with those of known taxa using the scheme of Domsch and Gams (1970) to identify the fungi.

**Utilization of Kerosene by Microbial Isolates:** Mineral salt medium of Zajic and Supplisson (1972) containing kerosene as the only source of carbon was inoculated with 0.1ml (10<sup>3</sup>cells) nutrient broth grown culture of kerosene utilizing bacteria isolates and incubated at 30°C for 4 days. Similarly, Bushnel and Haas (1941) medium was inoculated with fungi spores and incubated for 7 days. Turbidity produced as a result of microbial growth on kerosene was monitored visually at the end of the incubation period and assigned (+) to (+++) depending on the intensity of the growth.

**Determination of Rates of Kerosene Degradation by Bacteria Isolates:** Carbon dioxide (CO<sub>2</sub>) evolution method of

Stolky (1965) was used to measure the rates of kerosene degradation by the bacterial isolates

Two hundred and fifty milliliters (250ml) of Zajic and Supplisson (1972) medium plus 1.25ml of kerosene in twenty four samples of screw capped bottles were sterilized by autoclaving at 121°C for 15minutes. 0.1ml of nutrient broth culture of kerosene utilizing bacteria such as species of *Bacillus* (KUB03, KUB04, KUB07, KUB08) were aseptically inoculated into the kerosene medium. One gramme of Barium peroxide was mixed with 5ml of distilled water in a plastic vial and the mixture was lowered into each of the screw capped bottle and incubated to absorb the carbon dioxide liberated during kerosene degradation. A control (with no organism was equally set up). At the end of each incubation period of four days interval for a period of sixteen days at 30°C, the vials containing barium carbonate and barium hydroxide (BaCO<sub>3</sub> and BaOH) were washed with 40ml distilled water into 250ml conical flask and the residual barium hydroxide (BaOH) was titrated 2N HCL using phenolphthalein (1 or 2 drops) as indicator. The amount of carbon dioxide produced by the bacteria that utilized the hydrocarbon was estimated by Stolky's (1965) formula given below:

(B-V)NE

Where;

B = Volume (ml) of acid used to titrate the alkaline in carbon dioxide collectors from control to end point.

V = Volume (ml) of acid used to titrate the alkaline in the carbon dioxide collectors from treatment to end point.

N=Normality of acid.

E=Equivalent weight, if data are expressed as CO<sub>2</sub>, E = 22 but if expressed as C, E=6.

### III. STATISTICAL ANALYSIS

The microbial counts and physicochemical properties in this study were analyzed statistically using parametric tests involving the Analysis of Variance (ANOVA).

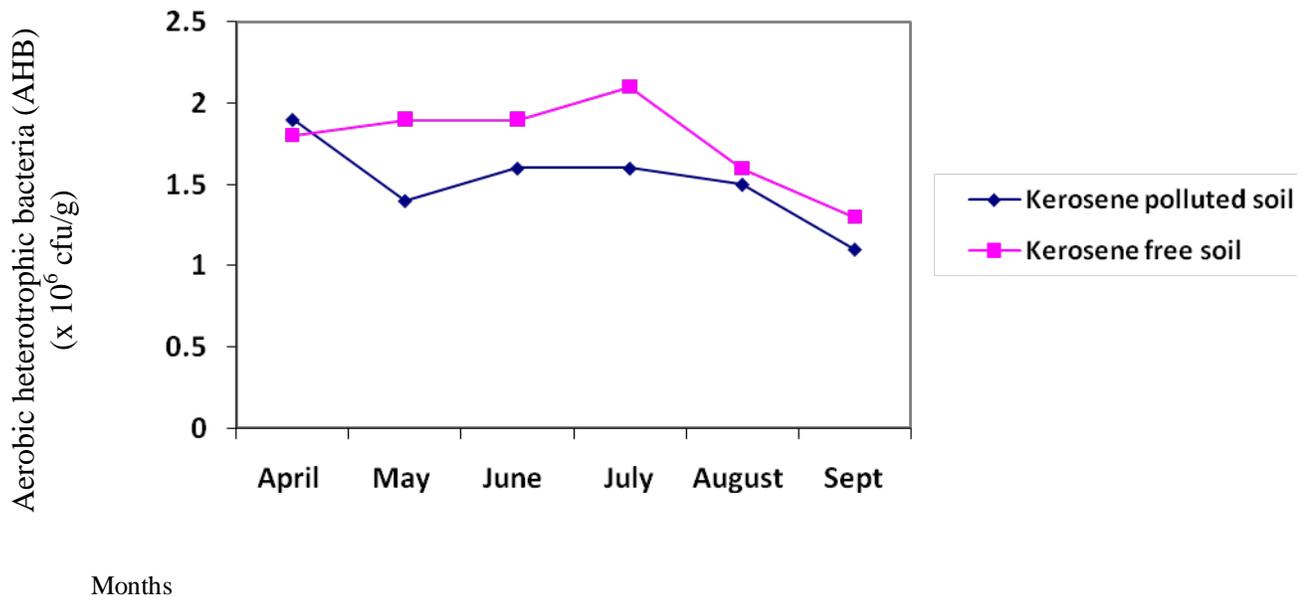
### IV. RESULTS

The results showed that the counts of total aerobic heterotrophic bacteria (AHB) in kerosene polluted soil ranged from 1.1 × 10<sup>6</sup> cfu/g to 1.9 × 10<sup>6</sup> cfu/g of soil while in kerosene free soil the counts ranged from 1.3 × 10<sup>6</sup> cfu/g to 2.1 × 10<sup>6</sup> cfu/g of soil. The counts of AHB in kerosene polluted soil decreased rapidly from April to May, and remained unchanged until August when the counts decreased slightly (Fig.1).

Conversely, the counts of AHB in kerosene free soil increased gradually from April till July, when the highest counts (2.1 × 10<sup>6</sup> cfu/g) were recorded. Thereafter the counts decreased gradually (Fig.1). Generally, the counts of AHB were higher in kerosene free soil than kerosene polluted soil (Fig.1). Statistical Analysis using Analysis of Variance ANOVA, revealed that the difference in counts between the two sites was not significant (P>0.05).

The counts of kerosene utilizing bacteria (KUB) in kerosene polluted soil (KPS) ranged from 1.1 × 10<sup>5</sup> cfu/g to 1.7 × 10<sup>5</sup> cfu/g

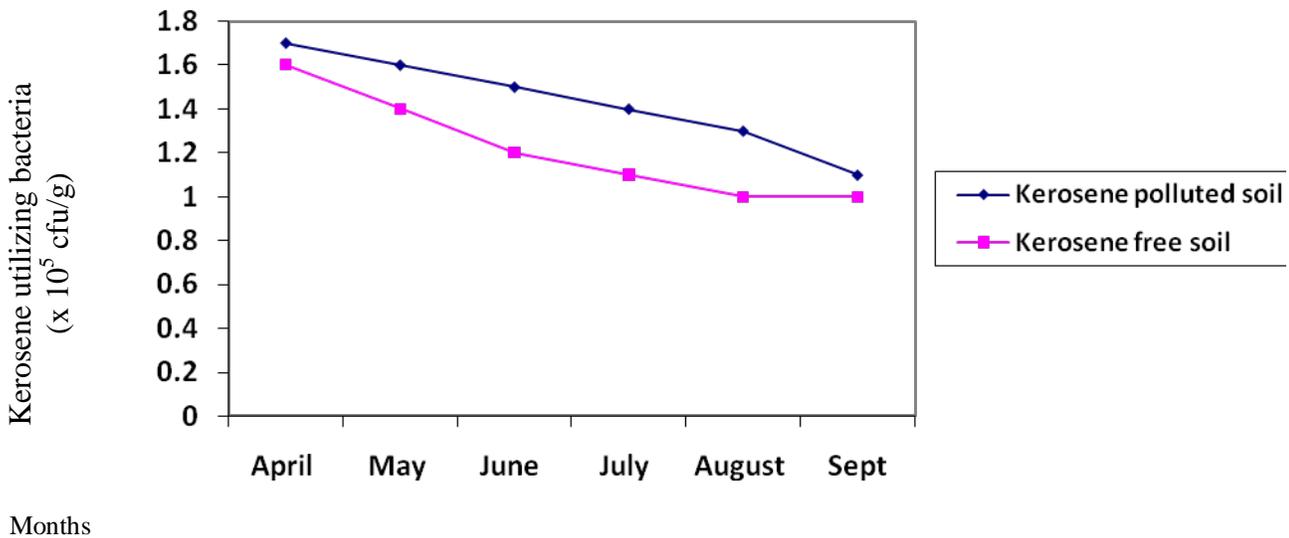
of soil while in kerosene free soil the counts ranged from  $1.0 \times 10^5$  cfu/g to  $1.6 \times 10^5$  cfu/g of soil.



**Figure 1. Counts of total aerobic heterotrophic bacteria in kerosene polluted soil.**

The counts of KUB in both kerosene polluted soil and kerosene free soil decreased gradually from April to September (Fig.2). It was however, observed that there were higher counts of KUB in kerosene polluted soil than in kerosene free soil (KFS). There was no significant difference ( $p > 0.05$ ) in counts between KPS and KFS. The counts of fungi in kerosene polluted soil (KPS) ranged from  $1.1 \times 10^3$  cfu/g to  $1.6 \times 10^3$  cfu/g of soil while in kerosene free soil (KFS), the counts ranged from  $1.3$

$\times 10^3$  cfu/g to  $2.1 \times 10^3$  cfu/g of soil. The result (Fig.3) indicated that counts of fungi in KPS soil increased gradually from April to July, after which the counts decreased till the end of the study in September. Similar trend was observed in the kerosene free soil (KFS). Generally, the counts of fungi in KFS were relatively higher than those of KPS. However, statistical analysis of the data revealed that there was no significant difference ( $P > 0.05$ ) in counts between KPS and KFS.



**Figure 2. Counts of kerosene utilizing bacteria in kerosene polluted soil.**

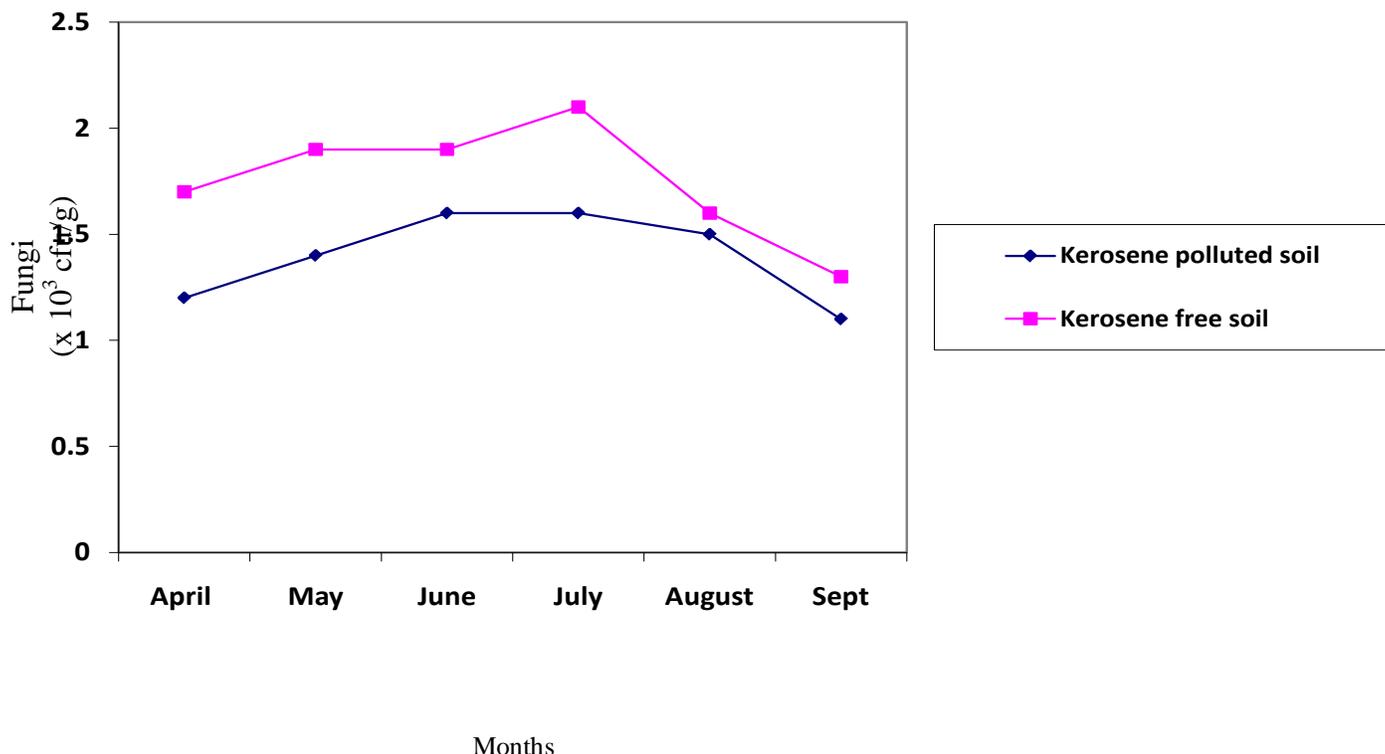


Figure 3. Counts of fungi in kerosene polluted soil.

The bacterial isolates were identified as species of *Acinetobacter*, *Alcaligenes*, *Bacillus*, *Micrococcus*, and *Pseudomonas*. The fungi were identified as species of *Aspergillus*, *Mucor*, *Penicillium* and *Fusarium*.

Table 1. revealed the ability of the microbial isolates to utilize kerosene as a source of carbon and energy. *Bacillus* species exhibited higher capacity of utilization than other isolates tested. The fungi utilized the hydrocarbon at moderate rates like some bacteria. However, one fungus isolate (*Penicillium notatum* KUF05) utilized the incorporated hydrocarbon at a minimal rate. The results (Table 2) revealed that the amount of carbon dioxide evolution by the *Bacillus* isolates increased gradually from the 4<sup>th</sup> to the 16<sup>th</sup> day. It was observed that the amount of carbon dioxide evolved by *Bacillus* isolates (KUB 03) was relatively lower

compared to the amount evolved by other isolates and the mixed culture after 16 days. However, statistical analysis (ANOVA) revealed that the difference in carbon dioxide production between KUB03 and KUBMC was significant (P< 0.05). Conversely, *Bacillus* strains KUB04 and KUB07 produced more carbon dioxide than the mixed culture, but the difference was not significant (P> 0.05). The carbon dioxide that was produced by *Bacillus* strains KUB07 was higher compared to the carbon dioxide evolved by the mixed culture. Statistical analysis (ANOVA) also revealed that the difference in carbon dioxide production between the two organisms was not significant (P> 0.05). It was also observed that the mixed *Bacillus* culture produced more carbon dioxide than *Bacillus* strain KUB08 but the difference was no significant (P>0.05).

Table 1. Utilization of kerosene by microbial isolates

Coded microorganisms	Growth in kerosene medium after 7 days
<i>Micrococcus</i> sp KUB 01	++
<i>Pseudomonas aeruginosa</i> KUB 02	++
<i>Bacillus subtilis</i> KUB 03	+++
<i>Bacillus subtilis</i> KUB 04	+++
<i>Micrococcus</i> sp KUB 05	++
<i>Pseudomonas aeruginosa</i> KUB 06	++
<i>Bacillus subtilis</i> KUB 07	+++
<i>Bacillus subtilis</i> KUB 08	+++
<i>Acinetobacter</i> sp KUB 09	++
<i>Acinetobacter</i> sp KUB 10	++

<i>Alcaligenes</i> sp KUB 11	++
<i>Alcaligenes</i> sp KUB 12	++
<i>Aspergillus niger</i> KUF 01	++
<i>Mucor</i> sp KUF 02	++
<i>Fusarium</i> sp KUF 03	++
<i>Aspergillus niger</i> KUF 04	++
<i>Penicillium notatum</i> KUF 05	+

+++ : maximum growth, ++ : moderate growth, + : minimal growth.

**Table 2 Carbon dioxide evolved as a result of kerosene degradation by *Bacillus* strains**

Time (Days)	Carbon dioxide evolved (cm <sup>3</sup> )				
	<i>Bacillus</i> strains				
	KUB03	KUB04	KUB07	KUB08	kUB MC
4	13.20	167.20	122.00	136.40	114.40
8	15.00	184.80	171.60	142.00	161.60
12	18.50	193.60	198.00	185.00	184.80
16	22.00	210.00	228.00	193.60	198.60

MC: Mixed culture of *Bacillus* strains (KUB03, 04, 07, 08)

#### V. DISCUSSION

In the present study, the counts of aerobic heterotrophic bacteria (AHB) in kerosene free soil were higher than the counts in kerosene polluted soil probably because of the inhibitory effects on some hydrocarbon components (Okoh, 2006). The results of the study indicated that counts of AHB were less than those obtained by Ijah and Abioye (2003) who studied the same site 30 months after the spill. The difference in counts may be due to changes in the physicochemical properties of the soil. However, in the present study, no significant difference in counts of AHB between kerosene polluted soil (KPS) and kerosene free soil (KFS) was observed probably due to rapid biodegradation of the kerosene in the same soil. The counts of kerosene utilizing bacteria (KUB) in KPS were higher than those of KFS, although the difference was not significant. The reason for higher counts in KPS may be the presence of residual kerosene in KPS which boosts the carbon supply in the soil, hence favour the growth of the bacteria as compared to KFS. However, the counts of KUB decreased gradually in KPS and KFS from April to September. This may be as a result of moderate rainfall during the months of July to September which might have washed away some residual kerosene and nutrients in the soil or hinder oxygen in the soil thus affecting bacteria growth adversely (Ijah and Antai, 2003). The counts of fungi in KPS increased gradually from April to July, after which the counts decreased till the end of the study in September. Similar trend was observed in the KPS. These changes may be attributed to seasonal variation (Ijah and Antai, 2003). Generally, the counts of fungi in KFS were relatively higher than those of KPS, which is a sharp contrast to the results of Ijah and Abioye (2003). This may be as a result of changes in nutrient status of the soil. It is also possible that the residual kerosene in the soil has some toxic components which do not favour fungal growth.

The rate of Kerosene biodegradation in the soil seems to be rapid. This may be due to the fact that the microorganisms in the soil have efficient ability in utilizing the residual kerosene as a source of carbon and energy. Kerosene utilizing microorganisms isolated from the soil were species of *Bacillus*, *Acinetobacter*, *Alcaligenes*, *Micrococcus*, *Pseudomonas*, *Aspergillus*, *Penicillium*, *Fusarium* and *Mucor*. *Bacillus subtilis* predominated especially in the kerosene polluted soil. This may be due to the ability of the bacteria to produce spores which may shield them from the toxic effect of the hydrocarbons (Ijah and Abioye, 2003). *Aspergillus niger* also produce spores which may help the fungi to be widely distributed in the soil (Okoh, 2006).

The rates of utilization of kerosene in mineral salt medium by the microorganisms varied. *Bacillus subtilis* manifested higher capacity of utilization than other isolates tested. The greater ability of *Bacillus subtilis* in utilizing the kerosene in mineral salts medium than the other isolates may be due to production of efficient enzymes for the breakdown of the hydrocarbon (Ojo, 2005).

The amount of carbon dioxide evolved by *Bacillus* strains KUB04 and KUB07 was relatively higher compared to the amount of carbon dioxide evolved by other strains and mixed culture after 16 days, meaning that there may be no special benefit in using mixed culture in the bioremediation of the kerosene polluted environment as they are prone to competition for hydrocarbon as carbon and energy sources thereby limiting the competence of the organisms for effective biodegradation. Thus *Bacillus* strains KUB04 and KUB07 can be used in reclaiming the kerosene polluted soil.

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# A study on Production Behaviour of Bongaigaon Refinery of Assam

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**Abstract-** Petroleum industry has important role in the process of industrialisation of Assam. There are four oil refineries in the state-Digboi Refinery, Guwahati Refinery, Bongaigaon Refinery and Numaligarh Refinery Limited. Bongaigaon Refinery, the third refinery in Assam was set up as public sector limited company in January 1972 and was commissioned in 1974 with headquarter at Dhaligaon in the old Bongaigaon district of Assam. The objective of the study is to analyse the production behaviour of Bongaigaon refinery using two production functions- Cobb-Douglas (C-D) production function and Constant Elasticity of Substitution (CES) production function.

**Index Terms:** Production Behaviour, Production Functions, Petroleum Industry, Assam.

## I. INTRODUCTION

Assam has a unique historical distinction with regard to the process of industrial development like some other states of the country like Maharastra and West Bengal. In fact, the base for industrial development of the State was started with the establishment of tea plantation and oil industry in the upper Assam area as were the cases of Maharastra and West Bengal in regard to cotton textile and jute textile industries respectively. Although the rate of process of industrial development in Assam is slow compared to many emerging States like Gujarat, Haryana, etc. in spite of that the petroleum industry has made significant contribution to the process of industrial development in the State.

The petroleum crude oil in the country was first discovered in 1866 in and around Digboi and Naharkatia in upper Assam and consequent upon it, a refinery was established in Digboi under Assam Oil Company in 1901, a then British Company responsible for exploration and production of petroleum product in Assam.

The percentage contribution of Petroleum Industry towards Gross State Domestic Product ranges between 8 to 10 percent. (Report, Indian Bureau of Mines, Nagpur, 2005). Petroleum Sector in Assam provides direct and indirect employment to about 10,000 people. It may be noted that the direct employment of Bongaigaon Refinery was 1723 in 2005-06.

But indirect employment generation in the State as well as in the rest of the country in several times more than the direct employment due to linkage effects. Moreover, backward and forward linkages of the petroleum refining sector as a whole on the aggregate economy of Assam is quite significant. (Govt of Assam, Report, 1990).

At present, there are four Refineries in the State – Digboi Refinery, Guwahati Refinery, Bongaigaon Refinery and Numaligarh Refinery.

The first commercial activity of the Digboi refinery started with the despatch of the first batch of Kerosene to the market in January 1902. Digboi Refinery was entirely rebuilt in 1923. Simultaneously, the oil field production and refinery capacity increased. Ultimately Digboi emerged into a cost efficient commercially viable unit.

Establishment of another new refinery became necessary after discovery of new crude oil fields in the District of Sibsagar in upper Assam. The second refinery was commissioned at Noonmati area of Guwahati in 1961 and managed by Indian Oil Corporation (IOC) with the refining capacity of 1 MMTPA (million metric tonnes per annum).

Bongaigaon Refinery, the third refinery in Assam was set up as Public Sector Limited Company in January 1972 and was commissioned in 1974 with headquarter at Dhaligaon in the old Bongaigaon District of Assam, with the refining capacity of 2.35 MMTPA.

Again the Government of India set up the 4th Refinery in Assam at Numaligarh under Golaghat district of Assam. This new company, Numaligarh Refinery Limited (NRL) was set up in 1993 with the refining capacity of 3 MMTPA.

The factor which tempted to choose Bongaigaon refinery among the refineries of Assam for our study is that it is one of the high profit making refinery.

In 2005-06, profits before tax and profits after tax of Bongaigaon Refinery are Rs. 267.27 crores and Rs. 174.26 crores respectively.

The refinery consists of Crude Distillation Unit (CDU), Kerosene Treating Unit (KTU), Delayed Coker Unit (DCU) and Coke Calcination Unit (CCU).

## II. OBJECTIVE

The object of the study is to analyse the production behaviour of Bongaigaon Refinery in terms of productivity, rate of return, economic efficiency etc. using two standard production functions like Cobb – Douglas (C-D) production function and Constant Elasticity of Substitution (CES) production function.

## III. HYPOTHESIS

The hypothesis of the study is that the refinery is running under increasing returns to scale with high economic efficiency.

## IV. METHODOLOGY

The production behaviour of Bongaigaon refinery is investigated with the help of production function. In this study production functions, namely, Cobb-Douglas (C-D) production function and Constant Elasticity of Substitution (CES) production function are applied in our empirical investigation.

The usual Cobb-Douglas production function in the form

$$Q = AK^\alpha L^\beta e^u$$

Where Q, K and L denote output, capital and labour and A,  $\alpha$  and  $\beta$  are the parameters and u is random variable, is used in the estimation of the production behaviour of Bongaigaon refinery. Parameters are estimated using the Least Square Method after logarithmic transformation of the variables. (Cobb C.W. & Douglas P.H., 1928)

The generalized form of Constant Elasticity of Substitution production function developed by Arrow, Chenery, Minhas and Solow,

$$Q = A[\sigma K^\sigma + (1-\sigma)L^\sigma]^{-\frac{1}{\sigma}} e^u$$

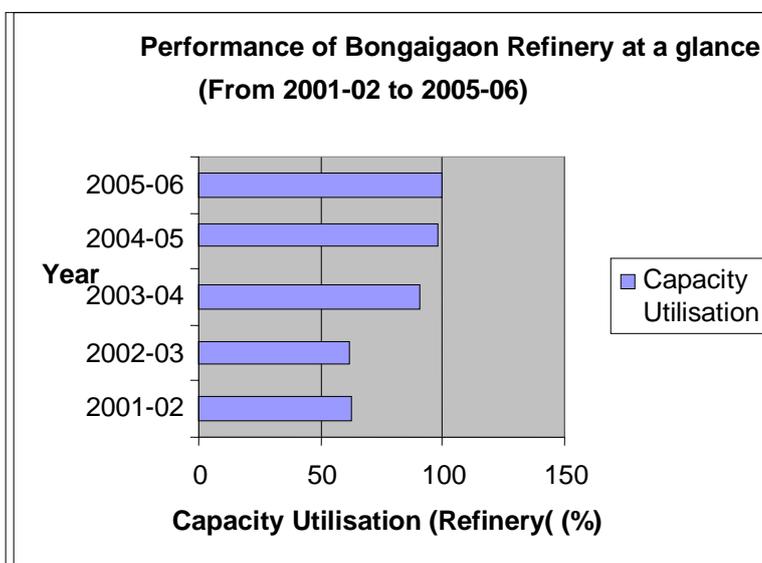
Where Q, K and L have the same meaning as in the case of C-D production function, has been used in our empirical investigation. The CES production function has been estimated adopting Kmenta's method. (Kmenta, 1986)

The status of production of Bongaigaon refinery in recent years has been furnished in the Table (1)

**Table 1. Performance of BRPL at a glance (From 2001-02 to 2005-06)**

<b>Year ended</b> <b>31 March</b>	<b>2001-02</b> <b>Rs. Lakh</b>	<b>2002-03</b> <b>Rs. Lakh</b>	<b>2003-04</b> <b>Rs. Lakh</b>	<b>2004-05</b> <b>Rs. Lakh</b>	<b>2005-06</b> <b>Rs. Lakh</b>
Crude throughput (Refinery) (MMT)	1.475	1.463	2.127	2.311	2.356
Capacity Utilisation (Refinery) (%)	63	62	91	98	100
Distillate yields (Refinery) (%)	81.2	82.8	85.8	84.1	89.5
Fuel Loss (Refinery) (%)	6.5	6.5	5.6	5.5	5.4

Source : 32nd Annual Report 2005-06, BRPL



Highlights of Physical Performance:

- The percentage of capacity utilization in BRPL is satisfactory in recent years. In 2005-06, 100% capacity utilization creates a record in the history of BRPL.
- The refinery processed 2.35million tonnes of crude oil in 2005-06 which is also remarkable.
- In 2005-06, there is lowest fuel & loss of 5.4% on crude throughput. Previous year fuel & loss was 5.5%.

In 2001-02 distillate yields of the refinery was 81.2%, which again shows satisfactory yield i.e. 89.5% in 2005-06.

From above analysis it is found that the physical performance of refinery is most satisfactory in the year 2005-06.

### **Review of Literature on Empirical Production Function:**

A good deal of analytical literature exists at broad levels like comprehensive analysis of various industries. But few empirical studies have been carried out relating to the production behaviour of specific industries.

Some studies relating to the production behaviour of industries are :-

Recently a number of authors like Buck and Atkins (1976), Dixon and Thirlwall (1975), Tooze (1976) have fitted Constant Elasticity of Substitution (CES) production function to regionally differentiated census of production data for U.K. manufacturing industries. The estimated values of parameters of these production functions especially the value of the elasticity of substitution have been used both in the analysis of regional problems and as a basis for regional policy recommendations. Pokorney (1993) used Cobb-Douglas (C-D) production function for the estimation of behaviour of U.K. coal- mining industry. He used a time series data over the period 1964 to 1980.

There have been many applications of C-D production function to individual industries. An interesting contribution based almost completely upon engineering data in the metal machine industry is a study by Kurz (1963).

A study on cross-section production functions and the elasticity of substitution in American manufacturing industry was done by C.E. Ferguson (1963). The author used international data from 19 countries and 24 industries to fit this regression. The author used Arrow, Chenery, Minhas, Solow (ACMS) model. He found that the elasticity of substitution between capital and labour in manufacturing industry was less than unity.

A study on production functions for Australian manufacturing industries was done by W.T. Burley (1973). This paper takes as its point departure the Arrow, Chenery, Minhas, Solow (ACMS) (1958) time series estimation of the side relationship of the CES production function and proposes an energy measures of capital namely, horsepower.

Another well known cross section study is by Hilderbrand and liu (1965). Though they took a C-D production function but allowed an important modification. The parameters  $\alpha$  and  $\beta$  are taken to vary over the cross section and depends on the quality of capital and labour. Their model is –

$$Q = AK^{\alpha (\ln R_i)} L^{\beta (\ln S_i)} \epsilon$$

Where  $R_i$  and  $S_i$  are the measures of quality of capital and labour respectively.

Nerlove (1963) also used cross section data to study the behaviour of US electric supply industry. He studied the returns to scale of the industry.

Dhrymes (1965) did some extensions and facts for the CES class of production functions.

An alternative estimates of the elasticity of substitution – an inter-metropolitan CES production function analysis of U.S. manufacturing industries, 1958-1972 was prepared by Christos C. Paraskevopoulos (1979).

Clague (1967) did an international comparison of industrial efficiency between Peru and U.S. by fitting CES production function. The study is important in the sense that the careful studies on inter-country differences in productivity are few in number. The study measured the efficiency parameters of eleven manufacturing industries in Peru and the U.S.

Another related work on the efficiency of cotton textile industry in various countries was carried out by the Economic Commission for Latin America (1950). Similarly, attempt was made by Health (1957) to measure the efficiency of a group of industries taken together in Canada and Britain, by fitting C.D. production function.

Ashraf (1986) in one of his studies fitted CD production function for different Indian industries. The importance of the study is that the selections of variables were done on the ground that the model should not emphasize only on the demand side or supply side factors, e.g. in one of the models, output is taken to depend not only on industrial power but also on the per-capita income.

Mohanty (1986) exploited C-D type production function to see the behaviour of the small scale industries of Orissa. Mohanty took time series data for five years only from 1976-77 to 1980-81 to estimate the C-D production function, but the study has a limitation of very smaller degrees of freedom.

Edward J. Mitchell (1968) presented a production model with two labour inputs explaining the international pattern of labour productivity and wages.

Thus, keeping in view different production functions used to study the production behaviour of industries, we have adopted the appropriate production functions to suit our data for empirical study of Bongaigaon refinery.

**Regression Analysis:**

The Cobb- Douglas production function of the following form has been estimated

$$Q = AK^\alpha L^\beta e^u$$

Q = Output produced by the industry, K = Capital, L = Labour,

$\alpha$ ,  $\beta$  and A are parameters and u is disturbance term.

Data of Output., Labour and Capital have been collected for 16 years. i.e. from 1990-91 to 2005-06.

**Table. 2**

**Estimated Results of Cobb-Douglas (C-D) Production Function of Bongaigaon Refinery**

Regressor	Co-efficient	t- ratio
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Constant	93.901	-
Capital	1.009	2.806*
Labour	2.384	3.042*

$R^2 = .71$       Degrees of freedom = 13

\* significant at 5% level

F = 15.535, significant at 5% level

The estimated results for Bongaigaon refinery shown in the table 2. Elasticity of output with respect to capital ( $\alpha$ ) and elasticity of output with respect to labour ( $\beta$ ) are 1.009 and 2.384 respectively. Since  $\alpha + \beta > 1$ , the industry is operating under increasing returns to scale. It implies that proportionate rise in output is larger than proportionate rise in capital and labour inputs. The hypothesis of increasing returns to scale is accepted.

The efficiency parameter A is equal to 93.901 implying high economic efficiency of the industry. One of the hypotheses is of our study is that the industry is operating under high level of economic efficiency. Hence, the hypothesis is accepted. From the statistical point of view the estimated regression line fit the data well because  $R^2$  is .71. That is 71% variation of output is explained by the regressors.

It is found that Variance of Inflation Factor (VIF) is 2. Since VIF is less than 10, there is no severe multicollinearity problem.

The Durbin – watson d statistic is found to be 1.78 implying no autocorrelation.

**Estimated Constant Elasticity of Substitution (CES) Production Function**

The CES production function of the following form has been estimated for the Bongaigaon refinery –

$$Q = A[\delta K^\rho + (1-\delta)L^\rho]^{-\frac{1}{\rho}} e^u$$

Where Q is the output produced by the industry, K is capital, L is total labour employed,  $\delta$ ,  $\rho$ ,  $\rho$  and A are parameters and u is the disturbance term. To estimate the above regression equation for Bongaigaon refinery time-series data (period) has been taken into consideration.

The estimated CES production function for Bongaigaon refinery is –

$$\ln Q = (11.711) \ln K + 8.085 \ln L + 2.027 (\ln K - \ln L)^2$$

$R^2 = .84$

F = 21.688, significant at 5% level

**Table 3: Estimated Results of CES Production Function of Bongaigaon refinery**

A	55.334
$\delta$	3.23
$\sigma$	.155
$\rho$	3.626

For Bongaigaon refinery, the distribution parameter  $\delta$  is estimated 3.23 and substitution parameter  $\sigma = .155$ . Hence substitution between capital and labour is

$(1 + \sigma) = .865$ , which is smaller than unity implying relatively inelastic. Again  $\rho = 3.626$  indicating returns to scale is estimated at 3.626 implies that the refinery is operating under increasing return to scale. The proportionate rise in output is larger than the proportionate rise in capital and labour inputs. Hence the hypothesis of increasing returns to scale is accepted.  $R^2$  is .84. and .81 implying good fit. F statistic is also found to be significant. For Bongaigaon refinery, the efficiency parameter (55.33) is found to be very high implying high level of economic efficiency i.e. the industry is operating with good management and satisfactory technical efficiency. Thus the hypothesis of high economic efficiency is accepted.

The hypothesis of the study is tested by using two production functions i.e. Cobb-Douglas (C-D) production function and Constant Elasticity of Substitution (CES) production function. In the estimation of these two production functions, we get that the Industry is running under increasing returns to scale with high economic efficiency. The high economic efficiency is seen implying efficient management as well as high technical efficiency. That is, hypothesis is found to be true.

In view of the shortfall in crude oil production in the North East Region vis-à-vis the available refining capacity, the allocation of Ravva crude oil to Bongaigaon refinery is vital for the economic operations of the oil refineries in the North East. This is helping the north east refineries including Bongaigaon refinery to achieve better capacity utilization.

Implementation of improved quality specification Bharat Stage-II for HSD (High Speed Diesel) and MS (Motor Spirit) has commenced from 1st January 2005. Bharat Stage-III (Euro III equivalent) specifications for HSD and MS have come into force from April 2010.

Besides, Bongaigaon refinery has established a Diesel Hydro treatment facility to meet Euro – III/IV quality specification. Motor Spirit (MS) produced at the refinery conforms to Bharat Stage-II specifications. However for meeting BS-III specification of MS, which is effective from April, 2010 and to lower the production of demand limited Naptha, the refinery has initiated action to implement MS Maximisation & Quality Upgradation Project.

The company is engaging a consultant to study its petrochemicals business to determine the future course of action.

Conclusion : The Board of Directors of Bongaigaon refinery in their meeting held on 7th July, 2005 had approved in principle the merger of the company with holding company Indian Oil Corporation Limited. Further steps are being taken in this direction. It is expected that merger will lead to synergic benefits resulting in improvement in group’s profitability.

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# Effect of Yoga on Metabolic Syndrome

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**Abstract-** Metabolic syndrome is now considered as a serious public health problem, rising at an alarming rate in developed and developing countries of the world. It is estimated that 20-25% of the world adult population is suffering from this disorder. People with metabolic syndrome have five times greater risk of developing Type II diabetes. Diabetes is considered as fourth or fifth leading causes of death in the developed world and Cardiovascular Diseases represents the first leading cause of death in the world in men and women. Modern urban diet and physical inactivity are underlying key factor to develop metabolic dysfunction of our body. Yoga, the ancient Vedic science was developed in India for improving spiritual health and wellbeing. In recent times yoga is widely used to improve health and to prevent and cure disorders. Yoga asana or specific posture, pranayama or controlled breathing and dhyana or meditation practice has its own specific and overall benefits. Yoga asana uses various postures to improve physical strength, flexibility, balance, co-ordination and endurance. Hence the present study was undertaken to find out the effect of yoga therapy in metabolic syndrome.

Diagnosis of Metabolic Syndrome was based on according to the modified South Asian guidelines of the United States National Cholesterol Education Program (NCEP) Expert Panel Adult Treatment Panel (ATP). Total 135 subjects within the age group 15-65yrs those are fulfilled the criteria for research was recruited in this study. After recruitment participants grouped as i) yoga with diet group ii) only yoga group and iii) control group advised to follow the yoga training scheduled for 6 months and every 3 months interval for anthropometric and biochemical measurements. Subjects who assigned to the yoga with diet group, and only yoga group, yoga intervention comprised of Asanas (physical posture), Pranayama (breathing techniques), Meditation, for about 1 hour a day and 5 days in a week. Control group did nothing only to maintain as usual daily living during the study.

After 6 months study result shows statistically and clinically significant. The analysis of data obtained from base line, after 3 months and after 6 months has been done using STATA11.1, statistical software it was observed that body weight ( $p < 0.01$ ), BMI ( $p < 0.1$ ), Waist circumference ( $p < 0.01$ ), systolic blood pressure ( $p < 0.01$ ), fasting blood sugar ( $p < 0.05$ ) significantly decreased in Yoga with diet group in comparison to control as well as only yoga group. Only yoga group also shows improvement in comparison to control group. No significant changes were observed between or within all groups for triglycerides and HDL.

Yoga is beneficial in maintaining good health and wellbeing by regulating body weight, improving Biochemical parameters and helpful to overcome the obesity related complications as well

as metabolic risk factor. Yoga could be beneficial to prevent or delayed onset of Type-2 diabetes and cardio vascular diseases.

**Index Terms-** Body Mass Index, Insulin Resistance, Metabolic Syndrome, Obesity, Yoga Therapy.

## I. INTRODUCTION

Metabolic syndrome is now considered as a serious public health problem, rising at an alarming rate in developed and developing countries of the world. It is estimated that 20-25% of the world adult population is suffering from this disorder<sup>1</sup>. Metabolic syndrome is a deranged condition of energy utilization and storage of the body, which promotes to develop some co-related medical conditions like, elevated fasting plasma glucose, central obesity, high serum cholesterol (Triglyceride) and low high density cholesterol level (HDL), elevated blood pressure<sup>2-5</sup> and over time (estimated 3 to 10 years) strikes fatally as Cardiovascular Diseases and Type II Diabetes which are considered as twin global epidemic<sup>1</sup>. Modern urban diet and physical inactivity are underlying key factor to develop metabolic dysfunction of our body. People with metabolic syndrome have five times greater risk of developing Type II diabetes<sup>6</sup>. Diabetes is considered as fourth or fifth leading causes of death in the developed world and Cardiovascular Diseases represents the first leading cause of death in the world in men and women<sup>10</sup>. Recent studies show that the worldwide prevalence of Diabetes Mellitus appears to be increasing alarmingly. It is estimated that 5.4% of the total population would be affected with the disease by the year 2025. It is estimated that by the year 2030 maximum number of diabetic patient will be in India in comparison to the other countries of the Globe and in 2015 Cardiovascular disease (CVD) will be the single most leading cause of death in India<sup>7</sup>. Yoga, the ancient Vedic science was developed in India for improving spiritual health and wellbeing<sup>11</sup>. In recent times yoga is widely used to improve health and to prevent and cure disorders. Yoga asana or specific posture, pranayama or controlled breathing and dhyana or meditation practice has its own specific and overall benefits. Yoga asana uses various postures to improve physical strength, flexibility, balance, co-ordination and endurance<sup>13</sup> and can be used as a moderate- intensity exercise for patients with limited vital capacity or restricted ability to exercise<sup>14</sup>. Apart from these above-mentioned benefits, yoga has further proved its usefulness to decrease hypertension and cardiac inflammation, and improve cardiac function, stabilize the sympathetic nervous system and improve psychological health.<sup>15-17</sup>

American College of Sports Medicine (ACSM) and Centre for Disease Control (CDC) suggest moderately intense physical activity for obese subjects,<sup>18,19</sup> because exercise training has been

shown to improve metabolic risk factor in subjects with obesity.<sup>20- 23</sup> Practice of yoga increases muscle strength and cardio- respiratory fitness and has limited side effects. This is a cost effective training programme because it requires virtually no equipment.<sup>13, 25</sup>

Limited information is accessible regarding the effects of yoga training on metabolic syndrome or metabolic risk factor including hypertension, high blood sugar, dyslipidemia in obese subjects. Accordingly, I hypothesized that yoga exercise training may have beneficial effects on metabolic parameters in overweight and obese subjects. Therefore, I evaluated the effect of yoga exercise training on body composition, lipid profile, fasting blood sugar in overweight and obese subjects for a period of six months.

## II. METHODS

Study was conducted at Nirmala Arogya Kendra yoga clinic. Diagnosis of Metabolic Syndrome was based on according to the modified South Asian guidelines of the United States National Cholesterol Education Program (NCEP) Expert Panel Adult Treatment Panel (ATP)., in which an individual diagnosed with metabolic syndrome has three or more of the following characteristics<sup>3</sup>.

- 1) Central obesity (waist circumference exceeds 90cm or 80 cm for Asian male and female, respectively)
- 2) Hypertension (systolic pressure equals or exceeds 130 mmHg or diastolic pressure equals or exceeds 85 mmHg)
- 3) Elevated blood glucose (Fasting glucose level equals or exceeds 5.5 mmol /L [ 100 MG/DL])
- 4) Elevated plasma triglyceride level (equals or exceeds 1.70 mmol /L [150 mg/dl]) and
- 5) Low level of high density lipoprotein – cholesterol (HDL-C); level equals or is less than 40 mg/ dl for male and 50 mg/ dl for female

Subjects were explained about the potential risks and benefits of their participation, and written informed consent was taken as a voluntary basis before the study began.

Body weight (with light clothes and without footwear) measured using pedestal type scale having an accuracy of 10gm. Height(without footwear) measured using a vertical scale, BMI calculated from the formula:  $BMI = Wt(kg)/Ht(m)^2$ , BMR and % body fat measured using bio-impedance technology. For waist/hip circumference ratio (W/H), waist circumference (in cm) measured at the level of the umbilicus in the erect position. The hip circumference measured 4 cm below the anterior superior iliac spine (i.e., the bony prominence at the front of the hip with underclothing on). Heart rate and Blood pressure recorded after ten minutes of supine rest by a mercury sphygmomanometer .Blood sample was collected to measure the bio-chemical parameters (fasting blood sugar, fasting insulin, HbA1c, Lipid profile) blood sample preserved properly with standard mechanism and set for test within 4 hours after sample collection.

Total 135 subjects within the age group 15-65yrs those who fulfilled the criteria for research were recruited in this study. After recruitment participants grouped as i) yoga with diet group ii)only yoga group and iii)control group were advised to follow the yoga training schedule for 6 months and in every 3 months interval they were asked to report for anthropometric and biochemical measurements. Subjects who were assigned to the yoga with diet group, yoga intervention comprised of Asanas (physical posture), Pranayama (breathing techniques), Meditation, for about 1 hour a day and 5 days in a week. This group was advised to take yogic concept of diet i.e. more Sattvik food, comprising of complex carbohydrate, more fruits and vegetables, there should be restriction of extra oil, sugar and sweet product and high glycaemic food. There should be complete restriction of taking Tamasik food or alcohol, beverage etc. Yoga group followed the same yoga intervention as yoga with diet group but they were not asked to follow the dietary restriction. Control group were not advised to practice yoga or diet within 6 months, they maintained their daily activity . They came only for periodic check-ups at 3 months interval for 6 months duration.

## III. RESULTS

The present study involved the assessment of the effect of yoga therapy on metabolic syndrome risk factors in overweight individuals. The present study showed that the individual with metabolic risk factors significantly reduces their body weight, abdominal obesity, systolic blood pressure, fasting blood sugar level.

The analysis has been done using STATA 11.1, statistical software. I have approached to use the difference-in-differences estimation, a useful technique in the field of statistical analysis of baseline and follow-up surveys. First, this technique measures the mean (average) and standard deviations (SD) of all the variables. Secondly, this allows to measure the difference(s) in between mean and SD of variables, phase-wise. Not only that, but also it calculates the difference of phase-wise differences. Finally, it detects the effect of treatment how significant it is.

For example, at the baseline survey i.e. at phase I, I have taken ninety patient's data on few medical outcomes when no treatment is started. There were differences in mean and SD, which is summarised in table 1. Now after 6 months treating thirty patients with Yoga & Diet, thirty with Only Yoga; and thirty without any such prescription, I again surveyed the same and see the differences in mean and SD. To assess the sole effect of treatment on different medical outcomes, the difference-in-differences technique has been especially used.

I have analysed two things –

1. Significance of Yoga & Diet:
  - In comparison to Control group patients between Check-up Phase I & III.
2. Significance of only Yoga:
  - In comparison to Control group patients between Check-up Phase I & III.

**Results from analysis:**

**Table 1: Summary Statistics of information collected over different Check-up Phases**

Check-up Variables ↓	Phases →	Yoga & Diet prescribed Patients		Only Yoga prescribed Patients		Control Group Patients – prescribed <i>nothing</i>	
		Check up Phase I	Check up Phase III	Check up Phase I	Check up Phase III	Check up Phase I	Check up Phase III
		Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Weight		68.4±12.1	65.6±11.9	71.9±11.8	70.9±11.3	74.4±10.6	74.9±10.6
BMI		29.0±5.7	27.5±5.1	28.3±3.9	27.7±3.4	29.3±3.3	29.5±3.3
Systolic BP		131.4±12.5	122.2±8.6	133.5±11.5	127.2±8.8	134.7±6.9	134.2±5.9
Diastolic BP		83.9±7.5	80.0±6.5	84.6±6.5	81.4±6.4	85.2±4.6	83.9±4.3
WC		97.0±3.8	91.4±3.5	98.3±2.5	96.3±2.6	99.1±2.3	99.8±2.3
FBS		102.8±11.2	99.1±8.1	124.4±31.1	122.4±32.3	116.7±41.3	122.4±55.8
HDL		43.5±9.9	47.7±8.6	44.2±12.7	45.7±11.5	48.4±11.1	47.2±9.7
Triglycerides		124.0±58.0	121.9±52.8	147.8±64.0	138.9±71.7	140.0±46.6	141.5±45.6

**Table 2: Significance of Yoga with Diet in comparison to Control group patients between Check-up Phase I & III**

Variable specific significance (P-value)	Chek-up Phase I	Chek-up Phase III	Difference-in-Differences
	Difference between Control and Diet & Exercise Patients	Difference between Control and Diet & Exercise Patients	
Weight	0.043**	0.002***	0.412
BMI	0.827	0.079*	0.274
Systolic BP	0.147	0.000***	0.008***
Diastolic BP	0.394	0.012**	0.234
WC	0.304	0.000***	0.027**
FBS	0.133	0.012**	0.462
HDL	0.055*	0.834	0.131
Triglycerides	0.226	0.14	0.85

Note: \*\*\* P < 0.01: \*\*\* signifies at 1 per cent level of significance  
 \*\* P < 0.05: \*\* signifies at 5 per cent level of significance  
 \* P < 0.1: \* signifies at 10 per cent level of significance

Table 2 shows that the diet and exercise has significant effects on the difference between treated and non-treated patients. At the phase-III, the treatment is found out to be highly significant at 1 per cent level of significance in case of weight, systolic blood pressure and waist circumferences. Again, the treatment has moderate significance over diastolic blood pressure and FBS. Difference-in-differences technique also detects the significance levels of the treatment in pre- and post-treatment differences between patients. It is found that due to the treatment

of diet & exercise, the difference-in-differences of systolic BP and waist circumference has been affected significantly. In other terms, when our null hypothesis ( $H_0$ ) is that diet & exercise have *significant* effect on patients' medicinal outcomes compared to the control group patients; then there is a mere 0.8 per cent chance of being not true i.e. 99.2 per cent of studies will confirm that due to treatment, difference in systolic blood pressure significantly decreases compared to that of control group patients (as P-value=0.008).

**Table 3: Significance of Yoga in comparison to Control group patients between Check-up Phase I & III**

Variable specific significance (P-value)	Chek-up Phase I	Chek-up Phase III	Difference-in-Differences
	Difference between Control and Exercise Patients	Difference between Control and Exercise Patients	
Weight	0.394	0.164	0.702
BMI	0.291	0.048**	0.51
Systolic BP	0.587	0.002***	0.065*
Diastolic BP	0.694	0.089*	0.352
WC	0.624	0.029**	0.226
BS	0.467	0.993	0.603
HDL	0.153	0.616	0.509
Triglycerides	0.609	0.864	0.628

Note: \*\*\* P < 0.01: \*\*\* signifies at 1 per cent level of significance

\*\* P < 0.05: \*\* signifies at 5 per cent level of significance

\* P < 0.1: \* signifies at 10 per cent level of significance

Table 3 shows that the exercise has significant effects on the difference between treated and non-treated patients.

#### IV. DISCUSSION

The present study confirmed the positive effect of yoga therapy as a conventional modality of treatment on biochemical imbalances and effective in reducing the risk factors of metabolic syndrome in overweight subjects.

Body Mass Index provides a simple calculation to detect the persons “fatness” or “thinness”, allowing health professionals to discuss over and under weight problems more objectively with their patients. Excessive body weight or obesity is associated with chronic storage of excess calorie<sup>1</sup> and lack of physical activity is pivotal in its development<sup>2</sup>. From various studies it is confirmed that obesity is one of the main risk factor for insulin resistance or metabolic syndrome and over time which leads to several chronic and morbid diseases including heart diseases, diabetes II, hypertension, stroke, gall- bladder diseases, osteoarthritis, cancer and also associated with high blood cholesterol, in female complications of pregnancy, menstrual irregularity, hirsutism, stress incontinence etc. The epidemic of obesity in adolescents and adult population has been expanded in the past several years<sup>3</sup>, raising in body fat mass during adolescents may be related to the development and acceleration of metabolic risk factor including hyperlipidemia and insulin resistance along with cardiovascular diseases and diabetes type II.<sup>4,5</sup> Long term insulin resistance may cause type II diabetes and subsequent acceleration of morbidity and impaired glucose tolerance.<sup>7</sup> Thus controlling is crucial for the reduction of future health problem and morbidity.<sup>8,9</sup>

The significant reduction in the Body weight, BMI and Waist circumference as recorded in the present study are in line with the earlier studies, wherein, a 6-day yoga programme led to decreased Body Mass Index (BMI), Waist and hip circumference, Fasting blood sugar level<sup>32</sup>. Med Sci Monit 2010; 16:35-40.) According to yoga, the root causes of the

abnormalities are adhi or mental stress. Due to high stress the person habituates over eating leading to the deposition of fat in the body. Excess fat is undoubtedly related with metabolic dysfunction of our body and promotes to develop metabolic risk factors. To combat with overweight or metabolic risk factors one has to reduce stress, increase physical activity and regulate diet. The practice of yoga can regulate the body functions in a balanced manner and helpful in providing sustainable health. Analysis of the results of my study clearly indicate that the complications of overweight and metabolic risk factors can be reduced by yoga therapy. The reduction in the body weight might be due to reduction in the deposited fat on adipose tissue.

A reduction in the FBS after the practice of 6 months yoga indicated the improvement in the biochemical functions in overweight individuals. His findings are similar to the findings of Malhotra et al. who showed that yoga asanas significantly decreased FBG concentrations in type-2 Diabetic patients after forty days<sup>33</sup>

#### V. CONCLUSION

The prevalence of obesity is increasing among all ages, including the elderly. Research has proved that people with metabolic syndrome have five times greater risk of developing Type II diabetes<sup>6</sup>. Diabetes is considered as fourth or fifth leading causes of death in the developed world and Cardiovascular Diseases represents the first leading cause of death in the world in men and women<sup>10</sup>. Yoga therapy is beneficial in maintaining good health by regulating BMI, improving the biochemical functions of the body and helpful to overcome the complications of obesity and reduces the metabolic risk factors. This may have direct impact on the use of yoga therapy as a safe and cost-effective therapeutic modality in combating metabolic syndrome and obesity.

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# Retail Management-Performance Measurement Analysis and Revenues in Airports

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**Abstract-** The significance of non-aviation revenues, especially from retail outlets, has grown greatly. For many airports today non-aviation revenue has become as important as traditional aviation earnings. Then the natural question is "how to organize retail operations to satisfy the airport's targets?" This research specifies this question as follows: "If the retail revenue is taken as a measure of performance, which airport retail management structure performs better?" Thereby the aim of this study is to find out the character of a relationship between different structures of airport retail management organization and the level of retail revenues. The additional task is to distinguish these relationships between airports of different size and capacity.

**Index Terms-** Retail outlets, Non-aviation revenues, Factors Analysis, Retailing structure, Measure of performance analysis

## I. INTRODUCTION

The last decades saw significant transformations in the airport industry. Changes in the ownership structure, the understanding of an airport's mission and the influence of new market players (for instance, low cost carriers or shopping malls in the airport) have modified the priorities of airport management and led to an increased focus on non-aeronautical revenue. This has happened because of two simultaneously working factors: newly appeared barriers to aeronautical revenues' level increase and total change of airport's retail image.

Factors: I) Considering the first factor one needs to mention two main points.

- Firstly, the trend of increased passenger and cargo traffic creates the problem of congestion in airports, which by-turn sets upper limit on aeronautical revenues or demands to make considerable investments in airport's expansion.
- The development of low cost carriers and their grown popularity have decreased negotiation power of airports.

II) The second factor appeared as soon as development of airport retail had overcome a threshold when the very idea of airport retail business had been changed from supplemental for the aeronautical activity (coffee machines and newspapers kiosks to ease passengers' discomfort while waiting for a plane) to a separate one with great potential of revenue.

## II. PERFORMANCE OF DIFFERENT RETAIL MANAGEMENT STRUCTURES.

Thereby the aim of this study is to find out whether there is a relationship between different types of retail management organization and the level of retail revenues obtained and what form it has. The additional task is to distinguish these relationships for the following kinds of airports: large hubs (those which process at least 1.5% of revenue passenger boarding's annually), medium hubs (those which process between 0.25 percent and one percent of revenue passenger boarding's annually), small hubs (which process between 0.05 percent and 0.25 percent of 6 revenue passenger boardings annually) and non-hubs (those which process more than ten thousand (10000) but less than 0.05 percent of revenue passenger boardings annually).

## III. MANAGEMENT STRUCTURES OF RETAILING:

- ❖ **Multiple operators:** Commercial space is leased to retailer operators, or concessionaires (retailer with the right to sell goods in a particular airports), which are obliged to develop, finance, and manage concession facilities. The airport collects rental fees in term of fixed or stepped percentage rates from gross sales or square based rate.
- ❖ **Prime operator:** Some airports award contracts for particular categories of concessions, whereby the principal concessionaire develops and operates a substantial portion of the space. The main advantage is that the airport can take advantage of the know-how of the master concessionaires in their sales, merchandising, and marketing. A disadvantage is the resulting lack of individuality in the operations of the various concessions;
- ❖ **Wholly-owned subsidiary:** Under this structure the airport hires off a retail activity from the airport authority to a subsidiary and creates a separate corporate identity, thereby attracting more experienced staff and managers;
- ❖ **Direct operation:** Airports directly control all retail operations including running commercial outlets. It is used in cases, where commercial activities require limited commercial skills or they involve a level of investment, which retail operators (or concessionaires) are not ready to undertake. The main problem with this structure is most likely an insufficient commercial knowledge of airports' staff;

- ❖ **Joint venture:** To attract investments in commercial space development the airport and its partners can create a joint venture company. This allows airport to save part of operational control and not to bear all the risk on itself;
- ❖ **Fee management contract (or Management Company):** One or more management companies are hired to operate concessions, and the airport authority compensates the management company the monthly fees and a percentage of the net operation incomes derived from the concession operation. The airport authority is in charge of financing, providing space, capital improvement, facility design, development and updates, developing operation standards, keeping inventory, tenant relationship, and financial accounting of profitability;
- ❖ **Developer approach:** A commercial developer can be hired to design and develop the concession facilities. The developer provides the required financing and administration of all phases of concession operation as well as subleasing of spaces to qualified retailers. The developer can lease the commercial space from the airport or to privatize it.

#### IV. BACKGROUND THEORY: AIRPORT RETAIL VERTICAL (VALUE) CHAINS

To understand distinctive characteristics of different retail management structures, at first, we need to overview the underlying theory. The theory of vertical chains in this chapter is mainly taken from (D. Besanko, D. Dranove, M. Shanley, S. Schaefer, 2007 "Economics of strategy").

**Definition: Vertical (value) chain:** The process that begins with the acquisition of raw materials and ends with the distribution and sale of finished goods and services is known as the vertical chain. Early steps in the vertical chain are upstream in the production process and later steps are downstream. But sometimes small shops don't stock products for which they are unable to obtain favorable wholesale prices.

#### **Complementarities and Strategic Fit**

This very general idea can refer to many processes which overall can be described as a strategy. For example, higher outlets' concentration makes their maintenance and supply cheaper. Also some types of outlets can serve as magnets of customers for other types of outlets which should be taken into account when planning a retail mix.

#### **Make-or-buy decision**

Among the management structures of this study "Prime operator", "Multiple operator" and "Management company" represent outsourcing decisions (or "to buy") for only the second stage of the vertical chain, whereas "Developer" approach represents outsourcing for both stages. "Direct control" approach is a fully vertically integrated option (or "to make") and "Hybrids" structures can be involved in every stage.

#### **Asset ownership and vertical integration**

GHM (Grossman, Hart, Moore) model establishes that the form of integration affects the incentives of parties to invest in relationship-specific assets. By having control over other unit's assets, a unit has a better bargaining position when it negotiates with the other unit over the operating decisions that they could not contract on.

The direct control approach is found to be the lowest preferred method of managing airport concessions from every aspect of performance. The following managements structures were analyzed:

1. Airport directly;
2. Prime operator (or master concessionaire);
3. Developer;
4. Airport/Operator hybrid;
5. Other/developer hybrid.

The main results are the following:

- In general developer structure outperforms others;
- Distribution of outcomes for developers was much broader. (difference between 4<sup>th</sup> a 1<sup>st</sup> percentiles of "sales per EP" measure);
- Dynamics of efficiency growth is comparably high for developers;
- Hybrids perform better than alone (than just airport directly, prime operator or developer).

According to the research direct control of concession operations should remain limited for three main reasons:

- Direct operation requires a critical size (traffic, surface) to ensure return on investment.
- Direct operation represents an opportunistic move and cannot result in a long-term diversification strategy.
- The ability of direct operation to generate higher revenues and margins through more competitive prices has still to be proven. (V. Bamberger, A. Bettati, S. Hoeffinger, T. Kuruvilla, V. Wille (2009): "Mastering airport retail")

According to the authors' opinion operators' local know-how and the way they leverage it to propose the highest concession fees is no longer as important as it has been; airports are increasingly looking for operators who can demonstrate financial robustness, strong offer flexibility, international know-how and high-quality operational performance.

#### **Research**

The main part of this study tries to compare the performance of retail management structures through estimation of their effects on retail revenue. For the beginning we will explain why "retail revenue per enplaning passenger" can be a measure of performance and under which assumptions.

#### **Performance Measurement**

The primary target of such airports – perform their transportation function. Hence, deciding which management

structure to implement, the airport is guided by other performance measures than profit it can earn. For example, these could be – product mix which is offered to passengers and which increase their satisfaction of using a particular airport or investment's size a partner can spend for development of commercial space and so on. In these cases, anyway, the airport should be interested in values that particular management structures can create. Thereby estimation of their performance still makes sense, giving to airports secondary arguments.

To figure them out, let's look at general profit functions of airports using different structures:

**1. In cases of leasing commercial space to operators or a developer profit is a sum of different types of lease payments:**  
 $\pi_{\text{lease}} = (\text{Retail revenue})_{\text{sales}} + (\text{Leased space})_{\text{rspace}} + \text{MAG} - \text{Investments (1)}$

Investments here are related to the development of commercial space, which can be made fully or partially by airports.

**2. In case of Direct control structure, the profit looks like:**  
 $\pi_{\text{direct}} = (\text{Retail revenue})_{\text{direct}} - (\text{Variable Costs})_{\text{direct}} - \text{Fixed Costs (2)}$

where Fixed Costs contain investments in commercial space development.

**3. In case of management company structure:**  
 $\pi_{\text{management}} = (\text{Retail revenue})_{\text{management}} - (\text{Management Fee} + \text{Other variable costs}) - \text{Fixed Costs (3)}$

To represent the profit our proxy measure must be highly correlated with it. So for "retail revenues" to become a performance measure the following assumptions must hold:

1. Retail profitabilities of airports which belong to the same retail management structure must be equal;

2. Retail profitabilities of airports with different retail management structures must be equal.

The acceptance of the first assumption for the first case of leasing the space is comparatively easy and doesn't distort the reality much. The reason underlies in the lease payment structure which turns out to be pretty stable for airports. (According to Airport retail study 2006/2007 by Moodie)

To make the second assumption without a large distortion of reality, we must believe in some kind of an effective market of airport retail. This means that following the aim of maximizing retail profit the airport should choose the management structure which is most profitable for it. But as far as we observe different management structures in airports, all of them can maximize airport's profit only in one case – when their profitability for airport is the same.

After we have made assumptions 1 and 2, we can consider retail revenue as a good proxy of airport's profit (because of high correlation between them) and hence, we can use retail revenue as measure of retail management performance.

We use the modification of retail revenue, namely, "Retail revenue (or sales) per enplaning passenger" to clear the performance measure from positive effect of various levels of passenger capacities in airports. This gives us more qualitative characteristic, which allow to compare airports, completely different by size. These measures along with "Retail revenue per sq. foot" are common in the related research literature. Enplaning

passengers are taken into account instead of total passengers, because most of the retail revenue is generated by passengers while waiting for departure and only insignificant amount is generated by deplaning passengers. Transferring passengers who wait in the airport for the next flight are considered as half enplaning and half deplaning. Hence, such a measure, scaled by enplaning passenger, is more accurate and informative.

We use total revenue, because there is no point in considering retail management structures' effects on revenues of specific divisions, such that Food & Beverage, Specialty retail, News / Gifts, Duty free and General services, presented in the database, because we are not provided with information about cases, where airports assign most suitable management structure for every division. If such cases exist, they might belong to a Hybrid structure, according to the classification of ARN Factbook.

### Developer related

1. Large investments in retail space development (which are an example of indivisibilities or sunk costs) developer has an opportunity to exploit economies of scale and scope. To do that and to return those investments the quantity and range of products sold and services provided should be as high as possible, hence the revenue's level is also supposed to be higher in comparison with no-specific-investments cases.

2. Unified design & development of the whole commercial area (using know-how) developer can benefit from engineering principles associated with the "cube-square rule;

3. The large the scale of business of a developer the more benefits he can extract also from economies of learning;

4. Having vast experience in designing commercial space, developers can benefit from complementarities and strategic fit.

5. As a representative of an outsourcing option for an airport, developers are subject to the discipline of the market and must be efficient and innovative to survive.

6. According to GHM (Grossman, Hart, Moore) model developers which privatize (not lease) retail space in the airport has better bargaining position over operating decisions and as a result can capture more of the economic value created by the transaction.

7. Developed market of private developers in North America make us believe in their experience which should positively affect retail revenues;

### Prime operator structure in large hub group related

8. To obtain discounts from suppliers operators should by in bulk, this motivates them to expand their scale of business – to serve many airports and to sell as much as possible in every airport.

9. To exploit economies of learning (which is an example of increased productivity of variable inputs) and hence economies of scale, operators have to expand their business.

10. Selling more, cost of inventories (which is proportional to the ratio of inventory holdings to sales) decreases and profitability level grows;

11. Unified development of outlets prime operator can benefit from engineering principles associated with the "cube-square rule or complementarities and strategic fit of facilities (but less than developer who is in charge of the whole commercial area development);

12. As far as operators represent the market, they should be innovative and efficient to survive. This might positively reflex in retail revenues;

13. This structure is also involved in large investments in commercial area development and tend to target large revenues to cover them and to exploit economies of scale and scope, but airport has less incentives to do that, because it has other sources of income, mainly aeronautical revenues;

14. In contrast with large operators or developers airports can't expand their business beyond their own territory, so even for airports with critical mass direct structure limits economies of scale, scope;

15. Airport can benefit from unified design and development of commercial area using engineering principles associated with the "cube-square rule, but in most cases they don't have know-how, unless services of consultants are used;

#### Multiple operators structure related

16. Same effects as for prime operator but weaker;

#### Management company

17. Theory doesn't point on any significance positive effects, except those, general for outsourcing options. Firstly, this structure must lead to a decrease in agency and influence costs. And secondly, management companies are supposed to be efficient and innovative to survive in the market.

#### Hybrids

18. Successfully organized hybrid structure, which represents a mixture of different structures, is supposed to show many positive effects on retail revenues from those listed above. So they can appear in every place of performance ranking.

### V. CONCLUSION

To analyze the effect of airport retail management structures on retail revenue two approaches are applied, statistical analysis and econometric modeling. The main problem which this study faced is a lack of data. A lot of missing values made us to drop many airports out from the research. This is most likely the reason of discovering only three significant effects of airport retail management structures on retail revenue. They are:

- Positive effect of Hybrid structure in large hubs;
- Negative effect of Direct control in large hubs

- Negative effect of Prime operator in medium hubs

In spite of the fact that it's not enough to constitute the comprehensive answer on the research question of this study "If the retail revenue is taken as a measure of performance, which airport retail management structure performs better?", it's still can help airports' authorities to narrow the range of options to take into account when deciding how to organize their retail operations. For future research it would be useful to re-estimate the influence of management structures on retail revenues using larger sample of airports from North America and try to discover some new significant effects. Moreover, similar studies must be carried out with airports from other regions. The differences between aeronautical and retail industries in USA, Europe, Asia and etc. are very significant, and the composite resulting effect of these industries' differences is hard to predict at this stage.

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# Designing and Implementation of Neural Network Architecture Using Phonetic Identification Algorithms for Obtaining Performance Improvement of Recognizing English Homophone Words

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**Abstract-** Neural network architecture is widely used in computer science for solving complex problems arise in various research applications. One of the popular applications of neural network is pattern recognition. Neural network can be used to solve real world complex problems that can be solved by human being among which some require less effort while others require tremendous efforts. If neural network is incorporated with phonetic algorithms that recognize whether the given two words are phonetically similar or not yields improved outcome. The integrated approach discussed here results in performance improvement over any single algorithm implementation. Different phonetic algorithms are developed to identify phonetic similarity with different set of rules and different set of output after processing English words. Homophones are the English words having similar pronunciation but different spelling and meaning. The number of such phonetic algorithms are studied and discussed briefly here and then another algorithm with phonetic rules is built. Each algorithm has different level of performance. The performance word used here is in the context of identifying the homophones but not the processing performance of algorithm performed by a computer system. Each algorithm has advantages and limitations but by incorporating these algorithms in neural network results in improvement compared to any single algorithm implementation. Neural networks are commonly used for solving pattern recognition problems and so the efforts are being made here to recognize similar English words pattern found in pronunciation of the English words.

**Index Terms-** Neural Network, Phonetic algorithms, Matching, Soundex, Metaphone, Comparison, Pattern matching, Pronunciation, Match Rating, Pattern recognition

## I. INTRODUCTION

Identification of whether given English words are homophones meaning that whether they have similar pronunciation or not requires text processing through a computer. Many numbers of algorithms are developed for such purposes which are implemented in many applications development as well as database tools.

Each such algorithm has its own advantages and limitations. Here an effort is to build a neural network consisting of more

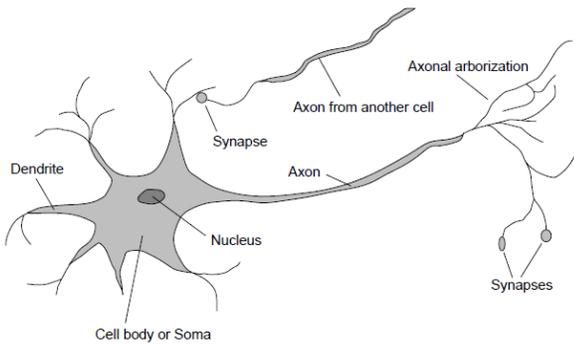
than one algorithm to identify homophone. The integrated approach applied here proved better performance compared to an individual implementation. Neural network consists of a network of neurons in which each neuron performs some unique functionality and passes the result to its nearer another neuron. Each neuron receives result consisting of data as well as weight associated with it from more than one neuron and processes them. Thus it forms a complex network of neurons and forwarding the processed data to the next layer in the network. Each neuron is considered as to perform an individual processing. Network binds all neurons in a single unit. Here the algorithms that we have used for phonetic identification represented as a neuron. Weights of the neuron can be initially decided and updated using experiments and performance criteria. Once the acceptable result is achieved neural network can be used for other set of data. The prime goal of the research paper is to achieve a better performance of phonetic algorithms which if implemented individually fails for certain kind of data. By using cumulative weight from different neuron's output it can be determined whether the given words have similar pronunciation or not. Here two levels processing of neurons are applied. At first level two existing algorithms and one derived algorithm is applied. The result is feed forward to next level of neuron representing match rating algorithm. Further if the accepted result is obtained from first level than it doesn't require processing of second level. At last set of data are experimented as analyzed by comparing individual algorithm performance and applied as whole neural network performance. The neural network applied here can be considered as AND feed forward neural network.

## II. NEURAL NETWORK INTRODUCTION

Artificial intelligence, a branch of computer science which is one of the popular research area in solving complex problems which can be solved by human being. Human can think and solve logical, reasonable and innovative ideas due to the powerful mind which is composed of plenty of neurons. Complex structure of neural network can find out solution of almost any kind of complex problem efficiently with compared to any powerful computer. Computer is powerful device for manipulating numerical and textual data as well as storing and retrieving operations but it is more difficult for a computer to identify

pattern from thousands of other patterns. But human mind can recognize the face seen many years ago within a fraction of a time. To solve such a problem using a computer requires massive data processing. The power of human brain lies in complex natural neural network which is a parallel processor and can solve such complex problems very quickly.

Following figure[7][9] describes the natural neural network of human brain. Each neuron has a nucleus with a cell body or soma and connected with other neurons through axon. Dendrite is the fiber which is an input to the neuron. Biochemical signal moves through axon from one neuron to another with weighted sum of all the input and must have value greater than or equal to some value called threshold value. Threshold value is determined by synapse. Here is decided whether the signal is to be exhibited or inhibited to the next neuron.



**Figure 1 : Biological neural network**

Key components of neural network are listed below[7].

*Soma / Cell Body*

Soma is the cell body of nucleus of an individual neuron.

*Dendrite*

Dendrite is connected with a neuron and is treated as the input to the neuron. A neuron may have multiple input dendrites.

*Axon*

Axon is treated as output from neuron as an electrical impulse. This axon is connected with synapses via boutons.

*Synapse*

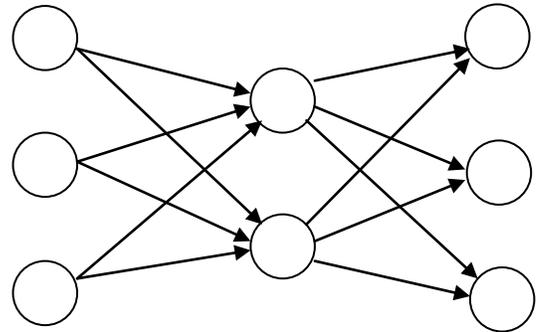
Synapses are connected with axons and responsible for processing of activation of the signal to the next neuron. Synapses connect all the neurons as network and responsible for passing signal for the next level of processing.

The processing power of neural network is due to the powerful interconnections among the thousands of neurons. If signal passing from one neuron to another is delayed than it slows down the processing of neural network.

**III. ARTIFICIAL NEURAL NETWORK**

Artificial neural network idea is directly derived from the human brain nervous system. Artificial neural network consisting of a layered architecture where input layer neurons receives input, perform processing at its own and then forwarding the result to its next layer which is a hidden layer[9]. Neural network may have more than one hidden layers which are responsible for core processing of neural network. The output of the hidden layer is forwarded to the next level which is represented by output neuron. Output layer results the possible outcome. Input data

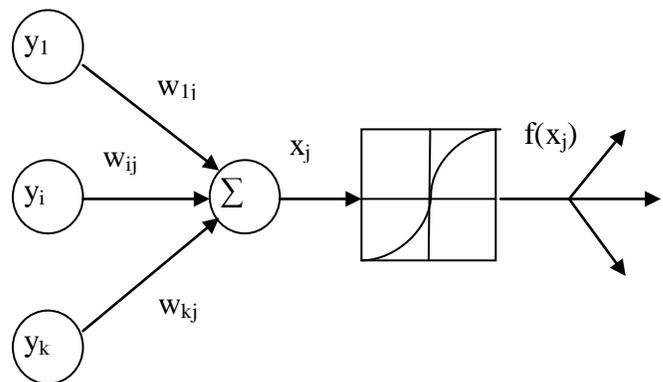
including weight given to neuron is processed by the neuron using weight sum of all inputs and output the result to next neuron. The simplest form of neural network is feed forward neural network which controls the processing in one direction[9]. The neural network represented here in figure 2 is a feed forward neural network.



**Figure 2 : Feed forward neural network**

Each layer has input and output connections. A cumulative effect of all the input signals will direct the network neuron. In human brain neural network signals are of biochemical electrical signal pulses whereas in our artificial neural network signals are described as weight sum of real value. Each connecting arc is given a specific weight value along with the actual data. If this sum qualifies the expected threshold value then the neuron is activated. Threshold value and weights of the arc may be changed during the processing. At some level of time the threshold value is set to certain value once the training period of neural network has been over.

Following figure 3 represents [12] the working mechanism of a single neuron.



**Figure 3 : Single neuron functionality**

A neuron takes the input from other neurons with different weights and summation function is performed to calculate cumulative effect of its input neurons using  $x_j = \sum w_{ij} y_i$ . A nonlinear function  $f(x_j)$  for example logarithmic or trigonometric is calculated and the result is forwarded to the next layer of neural network. The threshold value determines the activation of a neuron for acceptance or rejection. During neural network

processing the threshold value is subject to changes until network becomes saturated.

#### IV. EXISTING PHONETIC ALGORITHMS

There exist many phonetic identification algorithms to determine similar pronunciation of different words. Following are the brief introduction of popular algorithms.

##### *Soundex*

The soundex algorithm is one of the oldest algorithms which was originally developed by Robert C. Russell and Margaret K. Odell in 1918[2][9]. The soundex algorithm returns an encoded string for the given word. The first character in return string is the starting alphabet of the given input word and remaining three characters are digits as per the defined rules.

##### *Daitch-mokotoff soundex*

By taking base of original soundex algorithm, Gary mokotoff developed D-M soundex in 1985 and its improved variation was designed by Randy Daitch to match surnames of Slavic and German languages. The D-M soundex algorithm returns the six digit numeric code for the given word[1,5].

##### *Kolner phonetic*

This algorithm was designed for German words [1].

##### *Metaphone, Double metaphone and Metaphone 3*

Lawrence Phillips Initially developed metaphone algorithm in 1990. Metaphone algorithm returns three characters encoded string for English word. Again he developed improved variation called double metaphone for other languages. He then released the third version of metaphone in 2009 with accuracy up to 99% of English words. This metaphone algorithms family formed the basis for many English spell checkers and dictionaries.

##### *NYSIIS*

New York state Identification and Intelligence System also known as NYSIIS phonetic algorithms developed in 1970 and achieved better accuracy over soundex algorithm.

##### *Match Rating Approach*

The match rating Approach MRA is a phonetic algorithm based on the distance among words developed by Western Airlines in 1977 for indexing and comparing homophonous names[1].

##### *Caverphone*

David Hood at the University of Otago in New Zealand developed the Caverphone phonetic algorithm in 2002 and revised in 2004. Primary aim of algorithm was data matching between late 19<sup>th</sup> century and early 20<sup>th</sup> century electoral rolls to commonly recognize the names[1].

By studying such algorithms researcher has developed a new algorithm[3]. The algorithm takes an English word as input text and produces the output text based on the pronunciation of the word. The output pattern is followed similar to which of metaphone algorithm. The process is simplified by applying phonetic identification rules to determine the outcome.

All these variety of algorithms can be used for spell correction and spell generators that can identify the words phonetically nearer to the given misspelled English words. Also these algorithms are the basis for determining the homophones means similar pronunciation with different spelling and different meaning. But each algorithm has specific advantages and

limitations resulting in to unexpected outcome. For some set of words one algorithm is better while for other set another algorithm proves better. So, an effort of incorporating more than one algorithm has been made by constructing a neural network which require more processing of the given word but proves better performance for identifying homophones.

Three algorithms soundex, metaphone and user developed algorithms are used to form a neural network at one level and match rating at second level are implemented in Java to test the performance.

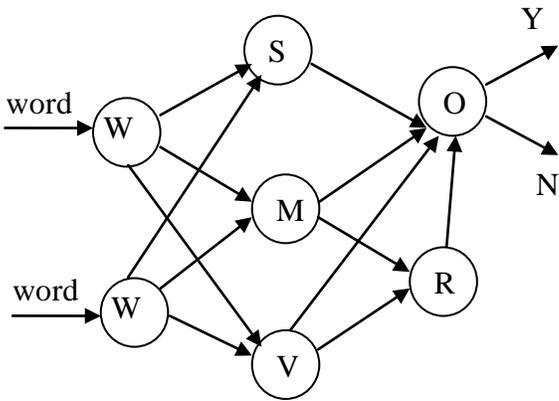
#### V. PHONETIC ALGORITHMS INCORPORATED WITH ARTIFICIAL NEURAL NETWORK

A neural network of phonetic algorithms can be formed to realize better performance. More than one algorithm in form of neural network is used to determine phonetic similarity. The resultant outcome is more accurate than any single such algorithm.. Neural network can be constructed in which input layer receives two English words. These input words are handed over to different neurons with some initial weight. Each neuron represents the separate processing of individual algorithm. We have used three different algorithms as three neurons. Each algorithm will try to determine whether the given words are homophone or not. If either of the algorithms identifies homophones then result is sent to the output neuron which will display the message. Weight can be calculated based on the recognition performance of each algorithm. If algorithms responses success then based on probability, weight can be increased otherwise decreased by calculating total experiments data and success cases. If all the algorithms are failed then only encoded strings from two algorithms are passed over to second level processing which identifies homophones liberally. So imposing constrains of both the outcome one from first encoded string to second level and second from second encoded string to second level identifies homophones then only the word are said as homophone.

The above described processing looks tricky and somehow complex but improves result far better. For calculating threshold value for individual neuron sine or other functions can be useful. Probability calculation is useful for determining the weight.

#### VI. NEURAL NETWORK ARCHITECTURE FOR DETERMINING HOMOPHONES

Neural network approach and phonetic algorithms can be integrated to determine homophones. Following diagram figure 4 depicts the neural network approach for homophone identification consisting of four layers. Here for simplify the calculation the weight is taken as 1 and 0 meaning homophone recognize or not. This value along with the encoded output string is forward to second layer when first layer failed to recognize homophone. If first layer successfully identifies homophones then the processing of second layer is skipped.



**Figure 4 : Neural network of phonetic algorithms**

The neural network represented consists four layers. Input layer takes two input English words this word is passed to first hidden layer consisting of three neurons namely S representing soundex, M representing metaphone and V representing user’s developed algorithm to determine phonetic similarity. Initially weights can be set equally or based on the experimented set of data. The outcome of these neurons are sent to output neuron represented by O which is responsible for displaying whether the given words are homophones or not based on cumulative effect of three algorithms. If all these three algorithms are failed then encoded strings from neurons M and V are sent to neuron R which represents the Match-rating algorithm. If this algorithm identifies homophones from both the neurons M and V then result is yes otherwise no displayed through output neuron.

**Homophone Identifier Neural Network Processing Mechanism**

Input layer takes two English words as input.

This words are passed to all the three neurons representing separate processing by different algorithms.

The result from each algorithm passed over to the output layer. For simplicity 1 is taken for identifying homophone and 0 for failure.

If either of the neuron identifies homophone, then the output neuron displays the success message of identifying homophone and process terminate.

But if neither of the neuron identifies homophone then the encoded output strings from neuron M and neuron V are passed to the another neuron in hidden layer R.

Now neuron R takes two sets of encoded strings from each neuron and performs processing by applying match rating algorithm to obtain further encoded string.

If neuron R can identify as homophone for both sets of the encoded input strings then only it will pass acceptance noation to output neuron other wise failure signal.

Output layer displays wether homophones are recognize or not either taking input from three nurons or from R neuron .

The output layer neuron O calculates summation of all three input layers. If it reaches at thresold value which is taken here as 1 for simplicity, outputs as homophone words otherwise not. The output of hidden layer neurons may be 0, 1, 2 or 3 for constant weight. If homophone match found then it is 1 otherwise it is 0. If real weights are taken in calculation then based on the

experimental data, for each algorithm separate weight is calculated and it should be multiplied with 1 or 0 depending on the matching and passed over to the output layer. Output layer may also take input in form of 1 or 0 from neuron R.

Thus the proposed neural network consisting of massive processing of textual comparison and encoding strings but proves better performance compared to performing the same task using any individual algorithm used in neural network.

**VII. TESTING APPROACH USING SAMPLE DATA**

Following table represents the test experiments performed on sample data set of homophones. Here the effort is to determine the performance of each individual algorithm with compared to one in which all are united through a neural network approach.

**Table 1**

Testing and Evaluation of neural network with sample data set						
Sr. No.	English Input Word	M	S	V	R	Result
1.	WEEK	1	1	1	-	✓
	WEAK					
2.	PIECE	1	1	1	-	✓
	PEACE					
3.	BED	1	1	1	-	✓
	BAD					
4.	WOULD	0	0	1	-	✓
	WOOD					
5.	SUN	1	1	1	-	✓
	SON					
6.	SHIP	1	1	1	-	✓
	SHEEP					
7.	LATER	1	1	1	-	✓
	LETTER					
8.	LOW	1	1	1	-	✓
	LAW					
9.	CASE	0	1	1	-	✓
	CASH					
10.	OF	1	1	1	-	✓
	OFF					
11.	LIVE	1	1	1	-	✓
	LEAVE					
12.	SIGN	1	0	1	-	✓
	SINE					
13.	SIN	1	1	1	-	✓
	SEEN					
14.	BY	0	1	1	-	✓
	BYE					
15.	REACH	1	1	1	-	✓
	RICH					
16.	SORT	0	1	1	-	✓
	SHORT					
17.	CENTER	1	1	1	-	✓
	CENTRE					

18.	FULL	1	1	1	-	✓
	FOOL					
19.	THEN	0	1	1	-	✓
	THAN					
20.	FILL	1	1	1	-	✓
	FEEL					
21.	FOUR	1	1	1	-	✓
	FOR					
22.	MAT	1	1	1	-	✓
	MET					
23.	MERRY	1	1	1	-	✓
	MARRY					
24.	WEATHER	0	1	1	-	✓
	WETHER					
25.	BALL	1	1	1	-	✓
	BAWL					
26.	CELL	1	0	1	-	✓
	SELL					
27.	CEIL	0	0	1	-	✓
	SEAL					
28.	WAIT	1	0	1	-	✓
	WEIGHT					
29.	HIGHER	0	0	0	1	✓
	HIRE					
30.	KNIGHT	1	0	1	-	✓
	NIGHT					
31.	DEAR	1	1	1	-	✓
	DEER					
32.	ROOT	1	1	1	-	✓
	ROUTE					
33.	DESCENT	1	1	1	-	✓
	DISSENT					
34.	KNOW	1	0	0	-	✓
	NO					
35.	POLE	1	1	1	-	✓
	POLL					
36.	TIDE	1	1	1	-	✓
	TIED					
37.	DIE	0	1	1	-	✓
	DYE					
38.	MAIL	1	1	1	-	✓
	MALE					
39.	SOME	1	1	1	-	✓
	SUM					
40.	BITE	1	1	1	-	✓
	BYTE					
41.	ROSE	1	1	1	-	✓
	RAWS					
42.	ROTE	1	0	1	-	✓
	WROTE					
43.	BRAKE	1	1	1	-	✓
	BREAK					
44.	VICE	1	1	1	-	✓
	WISE					
45.	I	0	0	0	-	✗
	EYE					

46.	FAIR	1	1	1	-	✓
	FARE					
47.	CUE	1	0	1	-	✓
	QUEUE					
48.	HOUR	0	0	0	1	✓
	OUR					
49.	CATTELE	1	0	1	-	✓
	KETTLE					
50.	CANVAS	1	1	1	-	✓
	CANVASS					
51.	LESSON	1	1	1	-	✓
	LESSEN					
52.	MEET	1	1	1	-	✓
	MEAT					
53.	HAIR	1	1	1	-	✓
	HARE					
54.	GATE	1	1	1	-	✓
	GAIT					
55.	HEAL	1	1	1	-	✓
	HEEL					
56.	ACCEPT	0	0	0	1	✓
	EXCEPT					
57.	CAST	1	1	1	-	✓
	CASTE					
58.	CHORD	0	1	1	-	✓
	CORD					
59.	CHEQUE	1	1	1	-	✓
	CHECK					
60.	CASH	0	1	1	-	✓
	CASE					
61.	BIRTH	1	1	1	-	✓
	BERTH					
62.	THERE	1	1	1	-	✓
	THEIR					
63.	CLOCK	1	1	1	-	✓
	CLOAK					
64.	SHE	0	1	1	-	✓
	SEE					
65.	SEE	0	1	1	-	✓
	SEA					
66.	TWO	0	1	0	-	✓
	TO					
67.	TOO	1	1	1	-	✓
	TO					
68.	MADE	1	1	1	-	✓
	MAID					
69.	ALoud	0	1	0	-	✓
	ALLOWED					
70.	PLANE	1	1	1	-	✓
	PLAIN					
71.	WHICH	0	0	0	0	✗
	WITCH					
72.	TAIL	1	1	1	-	✓
	TALE					
73.	SAIL	1	1	1	-	✓
	SALE					

74.	BLUE	1	1	0	-	✓
	BLEW					
75.	SENT	1	0	1	-	✓
	CENT					
76.	FAZE	1	0	0	-	✓
	PHASE					
77.	FEAT	1	1	1	-	✓
	FEET					
78.	HEAL	1	1	1	-	✓
	HEEL					
79.	HI	1	0	0	-	✓
	HIGH					
80.	HOLE	1	0	0	-	✓
	WHOLE					
81.	KNOT	1	0	1	-	✓
	NOT					
82.	PEEK	1	1	1	-	✓
	PEAK					
83.	ROLE	1	1	1	-	✓
	ROLL					
84.	RING	1	0	1	-	✓
	WRING					
85.	SCENE	1	1	1	-	✓
	SEEN					
86.	SOME	1	1	1	-	✓
	SUM					
87.	STEAL	0	1	1	-	✓
	STEEL					
88.	VARY	1	1	1	-	✓
	VERY					
89.	WEE	1	1	1	-	✓
	WE					
90.	ASSENT	1	1	1	-	✓
	ASCENT					
91.	BEACH	1	1	1	-	✓
	BEECH					
92.	BOARDER	1	1	1	-	✓
	BORDER					
93.	BEE	1	1	1	-	✓
	BE					
94.	CARRIER	1	1	1	-	✓
	CAREER					
95.	DUAL	1	1	1	-	✓
	DUEL					
96.	DISCRETE	1	1	1	-	✓
	DESCREET					
97.	GREAT	1	1	1	-	✓
	GRATE					
98.	HEAR	1	1	1	-	✓
	HERE					
99.	LESSEN	1	1	1	-	✓
	LESSON					
100.	PORE	1	1	1	-	✓
	POUR					
101.	RAISE	1	1	1	-	✓
	RAYS					

102.	SHEAR	1	1	1	-	✓
	SHEER					
103.	TIED	1	1	1	-	✓
	TIDE					
104.	WASTE	1	1	1	-	✓
	WAIST					
105.	WRING	1	0	1	-	✓
	RING					

Table – 1 (Sample Data Test)

Performance Analysis And Comparison Of Sample Test Data Result

Table 2

Analysis and success percentage of each algorithm						
Sr. No.	Result	M	S	V	R	Success
1.	Total	85	83	93	3	103
2.	Percentage	80.95	79.04	88.57	2.86	98.09

Table – 2 (Analysis of result)

From the table 1 sample data experiment, Table 2 is derived. Table 2 represents the performance of each algorithm and cumulative performance of neural network as a whole. First column is serial number. Second column is total number of success from 105 experimental data and percentage of success. Third, fourth, fifth, and sixth column headed with M, S, V and R represent the individual algorithm success with percentage applied here on 105 homophones. Last column is the total success and percentage entirely of approach. The match rating algorithm represented by R, applied here invoked only when all the preceding algorithms are failed. Further the input to neuron R is the encoded pair of input words from both M and V. If it success in both, then only the result is treated as successful otherwise fails. By incorporating more than algorithms the result is achieved here 98% which is greater than any individual implementation.

### VIII. CONCLUSION

From the testing result of Table – 1, the model gives acceptable performance to identify homophone compared to any individual algorithm. The approach can be further experimented on other data to see the effect. The neural network described here processes massive text data using multiple algorithms. The performance obtained here can be further improved by incorporating other phonetic algorithms based the application. The performance is obtained here due to the increased cost of processing. Further optimization on this text processing can be applied to achieve the desired performance in terms of processing and computer power[13]. The goal of neural network model represented here is to incorporate neural network with phonetic identification algorithms. To performance to identify homophone and processing are inverse proposals. But due to availability of powerful computer second issue can be resolved. The weights used here in calculation are just binary but actual real valued weight can be calculated by applying nonlinear

function and success ration of each algorithm. The neural network can be trained by experimenting on homophone words which will reflect the weight of joining arcs. Each time a neural network weight can be updated or taken fixed after training is over. The text processing is performed on word by word bases but it can be processed character by character which requires more processing.

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# Correlating Structure Property Relationship of Kevlars by Scattering and Birefringence

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**Abstract-** Brand of para-aramid fiber, patented by DuPont called Kevlar. According to Mulkern and Raftenberg, “This material has a high strength (several times stronger than steel)” (2002, 13). For the first time Kevlar was obtained in 1964 by the research team Stephanie Kwolek (Hancox, 1993, 312). A production technology has been finalized a year later. However, commercial production of Kevlar began only in 1970 (Chaos.org.uk, 2015). The high *strength* and good *thermal properties* are the two most important qualities that are characteristic for Kevlar fibres (Brody, 1994, 113). The study of synthetic fiber’s features such as Kevlar is a very important practice today. Therefore, this work has relevance to modern scientific base.

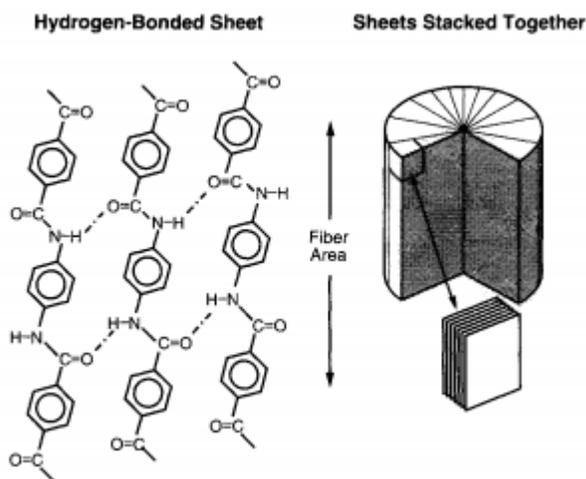
This paper focuses on research of structure and certain features of the Kevlar 29 and Kevlar 49. Especially, it is considered certain properties by *birefringence* and *scattering* (Toennies, 1973, 129). In the first part of paper, the author will consider the basic information about Kevlar 29 and Kevlar 49 for a better understanding of the research subject. Next, it will be introduced information about structure’s and other features of these materials. The next part of this paper will be considered two types of processes that can be applied to such types of materials as Kevlar 29 and Kevlar 49. This is especially considered mechanical, thermal and electrical-light properties of this type of fiber. The work uses a wide range of sources. First of all these are scientific works of various scholars from around the world which are more or less available to students. It also uses all available official information on the matter and objects that are considered in the work.

**Index Terms-** Birefringence, Property, Scattering, Structure

## I. INTRODUCTION

In the history of the wars most pressing question was the protection of life soldier. Steel armour, leather jackets - all at once it became archaism after the invention of firearms. The world began to look for weapons workshops materials that could have an impact, or at least reduce the deadly effect of bullets and shells. The problem was that traditional steel plates were too heavy and inefficient (Vriens, 1968, 49). The emergence of new plastic materials has become almost a panacea for seemingly stalled development of passive protection. But the developers had to search long before it was matched the perfect composition and technology of producing over impact-resistant plastic. The problem was solved due the para-aramid yarn (Kevlar para-aramid pulp, 1991,7). “Composite materials are defined as a

combination of two or more materials that have quite different properties, which offer more desirable and unique properties than the individual materials. As a result, it can also be noted that the combination of materials do not dissolve or blend into each other, and the theory behind the construction of composite materials comes from the need to create strong, stiff, and light materials. Materials such as glass, carbon and Kevlar have extremely high tensile and compressive strength, but in solid form, many random surface flaws are present in such materials, which cause them to crack and fail at a much lower stress than it theoretically should. Fiber-reinforced composite materials are continuing to replace the conventional metals in primary and secondary aerospace and aircraft structural elements owing to their superior mechanical properties such as high strength-to-weight stiffness-to-weight ratios.” (Abu Talib et al., 2011, 1) In 1965, DuPont scientists developed a new method (for the production of almost perfect polymer chain length) (DuPont ups US Kevlar production, 2001, 14). According to Lewis, “Polymer was obtained in the form of a liquid crystal solution, due to the simple repetition of molecular structures”(Lewis, 1999, 68). The key structural requirement for basis consisted in the fact that oriented in the position of the benzene ring in the rod was formed the molecular structure. This development is further embodied in the creation of fibre Kevlar (Technologystudent.com, 2015). Hodgson noticed, that “If it is considered stiff-molecules, there are rod-like molecules, they represent a well formed oriented chains in the diluted solution and at a high concentration their shape does not change” (Hodgson, 1963, 71). Then, when it is applied to the solution of shear stress, it is forms oriented molecular structure of which is shown in Fig. 1.



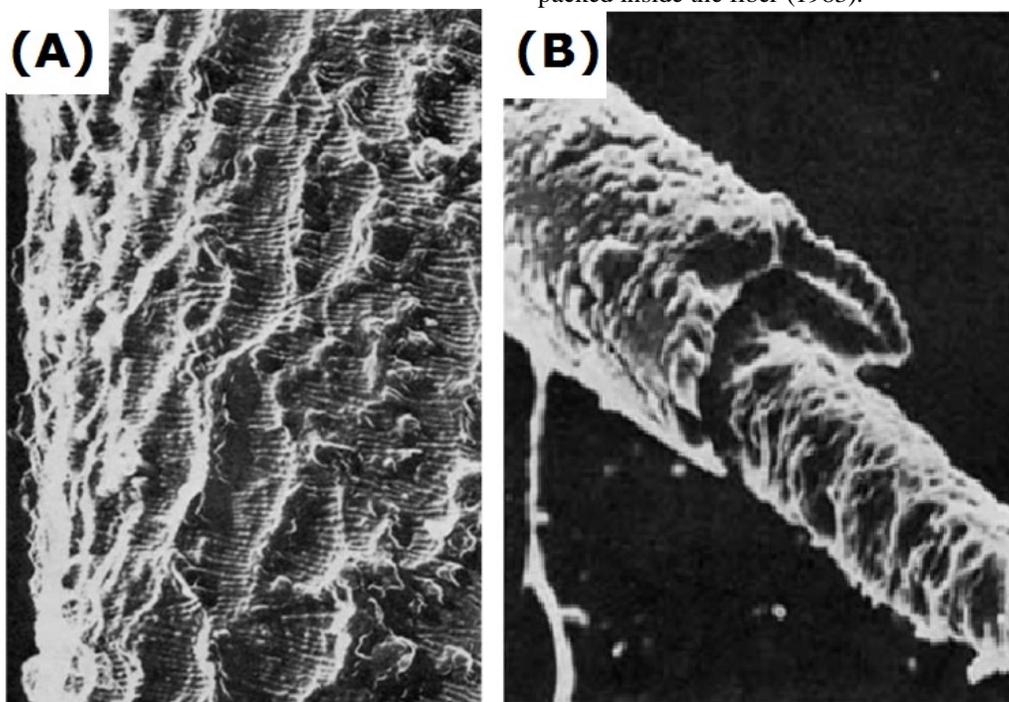
**Figure 1: Rod-like fiber structure by the radial stacking of hydrogen-bonded sheets. (Dupont.com, n.d., 4)**



**Figure 2: Bundles of PPTA fibrils**

The fibril structure of Kevlar has been suggested by Panar et al., as being shown on Figure 2, where ripped end of a PPTA fiber is visible (1983).

Surface of a PPTA fiber is shown of Figure 3 (A), the image has been obtained using transmission electron microscope (TEM). The fibrils are approximately 600 nm wide and several centimetres long (Panar et al., 1983). Skin-core structure of etched PPTA fibers can be seen on Figure 3 (B). The image has been created by scanning electron microscope (SEM), with ends of the fiber cut using plasma technique to study skin-core structure of the fibre. These images shown to Panar et al. that while skin fibres are perfectly oriented, core ones are imperfectly packed inside the fiber (1983).



**Figure 3: (A) The etched surface of PPTA fiber by TEM. (B) Skin-core structure of PPTA fibers by SEM (Panar et al., 1983).**

## II. METHODOLOGY

“There are several different grades of Kevlar, but the most common types of Kevlar are Kevlar 49 (composites grade) and Kevlar 29 (ballistics grade). Fibre Glast only carries Kevlar 49 fabrics. These fabrics are developed specifically for composite reinforcement. They can be used with Epoxy, Vinyl Ester or Polyester Resins to create a rigid laminate.” (Fibre Glast Blog, 2013)

For these work it can be used any Kevlar sample. Since this material is actively used for over 30 years, it is no problem to find or buy a pattern of a certain type of fibers of the finished product (helmet, body armour and so on). To begin, it is necessary to understand the basic principles of research. Since it is a popular method of structure research and materials’ properties, it is necessary to consider the case and noted some already known results. It uses a large set of resources that include books, scientific articles and so on.

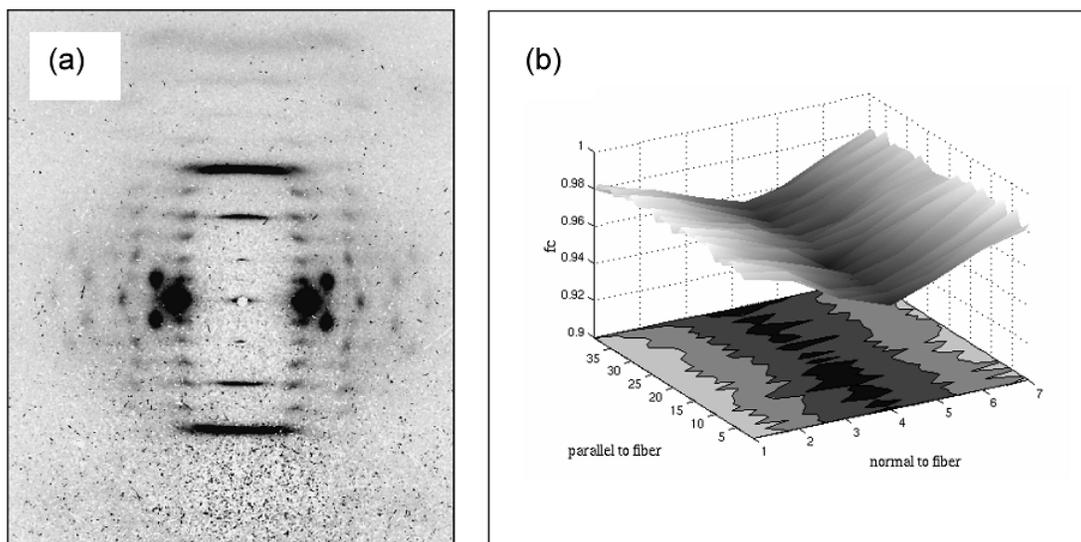
In general, the birefringence is the effect of splitting the light beam into two components in anisotropic media. It was first discovered by Danish scientist Rasmus Bartholin in the crystal of Iceland spar. If the light beam is incident perpendicularly to the crystal surface, this surface it splits into two beams (Fewster, 2003, 40). The first beam continues to spread directly and called ordinary (o), the second is deflected to the side, and is called extraordinary (e). "Birefringence (double refraction) of a fibre is the difference between the refractive index of the fibre along its axis and across the fibre axis." (Abu Talib et al., 2011, 3) The method of stress strain measurement for characterization of synthetic fibers is a well known technique. Fibers with a high tensile modulus can be classified as high performance fiber. In considering the stress-strain curve of Kevlar 49, it is clear that there is linear relationship indicates that the behavior of the material (in general elastic behavior) on not big extensions. As a result, it can be concluded that since Kevlar has sufficient specific strength (ratio of the strength to specific gravity) (Mechanical properties of hybrid, 1988, 80), this material is quite unfit for use as reinforcement for composite materials. This method is particularly useful in those cases where the robot is carried out with Kevlar par amid fiber. The main feature of these fibers is that they provide high modulus and high strength (Ericksen, 1979, 227). This is possible due to the highly oriented, highly crystalline structure of the solid chain. Despite the fact that it is fairly easy to measure the stress-strain behavior of Kevlar fibers, however birefringence of such materials is too high to be measured by ordinary methods (Lee, 1989, 201). "The value of optic birefringence for Kevlar 29 fiber is 0.625 and that for Kevlar 49 fiber, 0.662; the form birefringence correction was not reported in either case. Due to the presence of radial structure, Kevlar also exhibits lateral birefringence in the range of 0.022-0.065 (McIntyre, 2005, 31). Strain birefringence has also been reported in Kevlar and it has been concluded that birefringence increases with strain even at relatively constant fibre modulus" (Kumar, 1990, 53).

In generally, scattering of particles that change of the motion direction of the particles resulting from collisions with other

particles (Cohen et.al., 1992, 43). Quantitatively, the scattering is characterized by effective cross-section (Barakat and Hamza, 1990, 90). This is usually considered a common experimental situation, when the particle hits the other particle (target), which can be considered fixed. After the collision, the particle changes its direction of motion, and the target particle is experiencing the impact. The system of reference in which the target is fixed, called the lab. Theoretically, it is more convenient to consider the scattering in the frame center of inertia, limited relative motion of the particles (Udd, 1992, 331). For example, in the case of two-particle scattering in the centre of mass scattering problem is reduced to a single particle with the reduced mass on a stationary target. One of the parts of nuclear physics and particle physics is a specific theory which is based on elastic scattering. This process is characterized by the fact that the kinetic energy of the particles is always saved if the point belongs to the particle point of the center of mass frame (Toennies, 1973, 129). However there is one nuance, the direction of this propagation is changed. Also it should be noted that the processes of scattering processes usually are explained process for which the total kinetic energy of the system will remain.

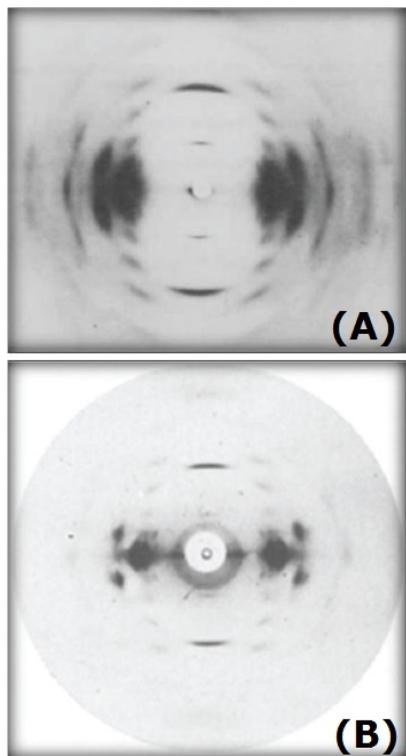
In the case of Kevlar there are many methods. Apparent crystallite size in Kevlar is 6.5, 5.3 > 10.9 nm measure from (110), (200) and (006) reflections respective using wide angle X-ray scattering (WAXS). Based primarily on electron microscopy observation and peeled sections of Kevlar, it was concluded that the super molecular structure has radically oriented crystallites. This fibre is also characterized by pleated structure being about 170 and it overall fibre structure being fibrillar" (Kumar, 1990, 52). These findings only reaffirm sufficient specificity of Kevlar as usefulness composite many goals material. That is why such research is very important.

Diffractiongram of the Figure 4 was obtained from Kevlar fiber with a 3 mm diameter X-ray beam at the ESRF (European Synchrotron Radiation Facility) synchrotron source.



**Figure 4: Wide-angle X-ray diffraction data from a Kevlar fiber using 3 mm diameter beam ( $\lambda$  0.08 nm). (b) Plot of the Herman's orientation function (Murthy, 2004).**

Hindeleh and Abdo (1989) reported that “the angular range of the diffraction angle  $2\theta$  of the peaks of the (110) and the (200) reflection-planes is  $12-35^\circ$ ”, and after  $35^\circ$  the scan gave flat intensity curves (Ahmed, 2014). Figure 5 illustrates the WAXD patterns of the equatorial and meridional scan of Kevlar 29 and Kevlar 49 fibres.



**Figure 5: WAXD patterns of Kevlar fibres for (A) Kevlar 29, and (B) Kevlar 49.**

### III. RESULTS

Depending on the process conditions the hood, it is possible to obtain two basic types of fiber Kevlar - a material with high modulus of elasticity and a smaller elongation, or a material with a large elongation and a lower modulus. These materials have received trademark Kevlar 29 and Kevlar 49. Table 1 shows the properties of all types of these two types of fibres. As already noted, the main difference is the modulus of elasticity and elongation at break. Kevlar 29 has an elongation at break of 3.6% vs. 2.4% for the Kevlar 49, and on the modulus of elasticity of Kevlar 49 almost 30% higher than Kevlar 29. Besides factor of depending on the strength of the fiber twist it can be considered in detail the effect of the number additions of the threads during the formation of Kevlar cord on his strength. High level Kevlar properties observed not only at high temperatures but also at low arctic temperatures. At a temperature of  $-46^\circ\text{C}$  the strength does not change, modulus increases slightly, lengthening also does not change, both along and across the fibers. Thus, the data show high performance Kevlar fibers not only at high but also at low temperatures, which has significant practical importance.

Properties	Unit	Kevlar 29	Kevlar 49
Type	denier (dtex)	1500 (1670)	1140 (1270)
Density		1.44	1.44
Breaking Strength	N	338	264
Breaking Tenacity	MPa	2920	3000
Tensile Modulus	MPa	70500	112400
Elongation at Break	%	3.6	2.4

**Table1: Some mechanical properties of Kevlar 29 and Kevlar 49. (Dupont.com, n.d. 9)**

The polymer chains orientation is much more perfect in Kevlar 49 than in Kevlar 29. The reason for this is the fact that Kevlar 49 is made by the heat treating process of dried Kevlar 29 under tension at high temperature, hence passage of the water molecules is much smaller in Kevlar 49 (Ahmed, 2014).

The most important characteristic of the strength properties of the Kevlar fibers is depending of the strength fiber on the exposure time at various temperatures. These data are shown in

Fig. 6. As can be seen from the figure, at temperatures up to  $155^\circ\text{C}$ , the strength of Kevlar fiber varies little (3-4%). When the temperature rises to  $175^\circ\text{C}$ , change in strength for 125 decreases almost 3 times. The temperature of  $245^\circ\text{C}$  is critical at this temperature Kevlar fiber can be exhibited only for 25 hours with a decrease in the strength of 2-2.5. Thus, it is seen that in the temperature range up to  $195^\circ\text{C}$  Kevlar fiber effectively preserves the strength properties for a long time.

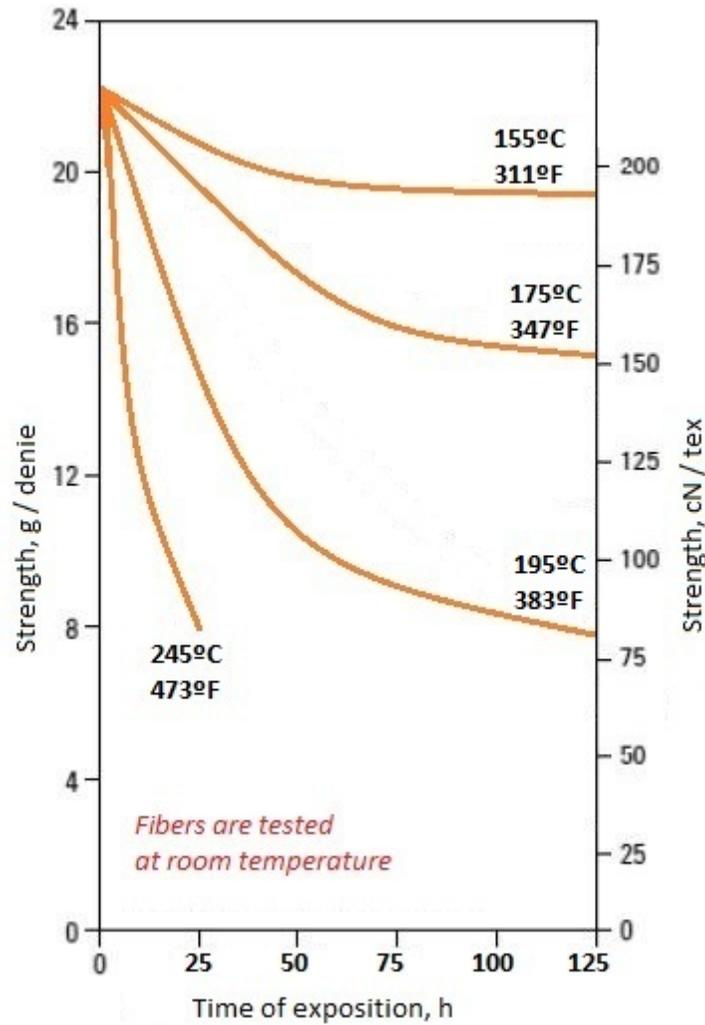


Figure 6: Kevlar fiber strength as a function of dwell time at different temperatures.

Figure 7 shows stress–strain curves and plot of relationship between strain and loss factor of Kevlar 49.

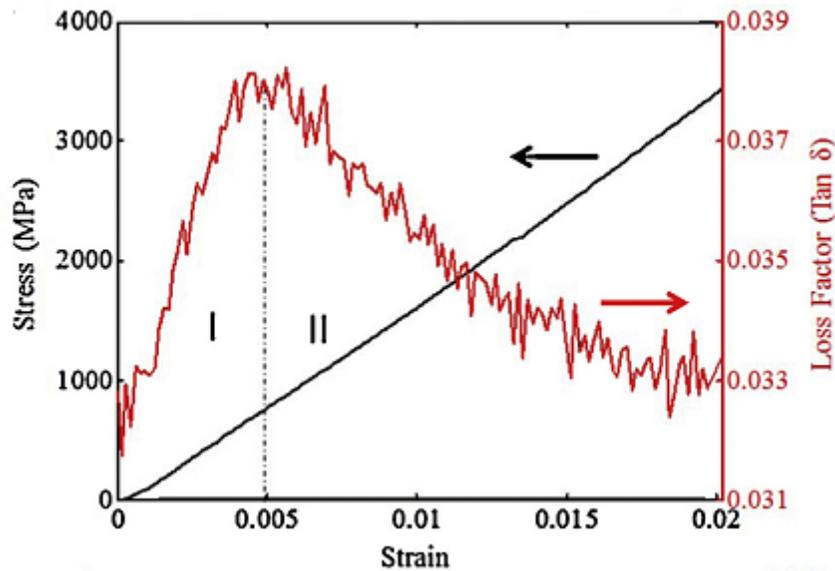


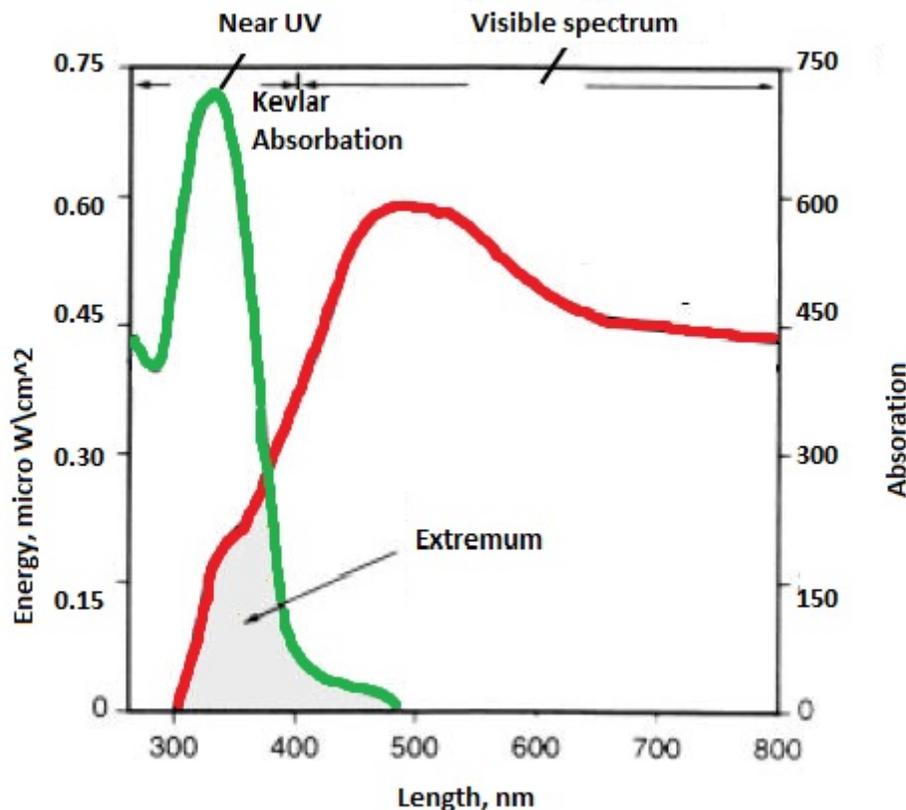
Figure 7: Plot of stress and loss factor versus strain in Kevlar 49, shown up to a failure strain of 0.02 (Raja et al., 2014).

**Table 2 summarizes the hydrolytic stability of fibers Kevlar for exposures up to 40 hours. It was shown that in these cases, the strength is retained more than 80%.**

Exposition, hours	Retention strength,%
0	100
20	96
40	91

Table 2: The hydrolytic stability of the fiber Kevlar

The most important issue of stability to external influences Kevlar is its interaction with ultraviolet radiation. Figure 8 shows the absorption spectra of Kevlar fiber of radiation from sunlight. It can be seen that there is an overlapping zone with a wavelength of 300 to 480 nm, wherein the active Kevlar absorbs ultraviolet radiation of the solar spectrum.



**Figure 8.: Aliasing of the Kevlar fiber absorption and sunlight**

#### IV. DISCUSSION AND CONCLUSIONS

From the preceding paragraphs it is clear that these two types of Kevlar – Kevlar 29 and Kevlar 49 have some similar properties and at the same time very different. The comparison shows that Kevlar fiber is less durable than glass fibers and there is at high of carbon fibers in this context. On the other hand, its modulus of elasticity even surpasses the glass fibers, and there is close to a high strength polyethylene. Certainly almost twice yield carbon fiber and steel wire. With regard to the elongation at break, Kevlar fibers are on one level with high strength polyethylene, steel wire, and significantly higher than the carbon fiber. Polyamide and polyester yarns are strongest than Kevlar. Data show that the Kevlar fibers are very high-tech and provide a high level of workability of the polymer fibers.

In conclusion it is worth say that materials such as Kevlar 29 and Kevlar 49 are quite complex composites. Despite the fact

that their active use began in the 70s of the last century, and now they still remain relevant materials for integrated research. Such techniques as scattering and birefringence are powerful mechanisms for research and not only mechanical properties of various kinds of materials, including for Kevlar. That is why, active using of such techniques is very important for understanding of nature.

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# User Session Based Test Case Generation for Website: A Review

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**Abstract-** The existing testing approaches for web application testing can takes long time to generate test suites. So that the User Session Based Testing has introduced which is depends on capturing and replaying user sessions of a website. It is an effective testing methodology for web applications. Previous studies have exposed that the testing suites generated by user session based testing frequently find the faults neglected by other testing approaches. This paper addresses the problem and discussing different techniques and methodologies have been proposed for taking care of their issues. Genetic Algorithm (GA) is one such form of evolutionary algorithms which is the area of research. In this paper we discuss the algorithms based on genetic algorithm and in future we will try to resolve its problem.

**Index Terms-** Web application testing, User session based testing, Web server, Session log

## I. INTRODUCTION

### Web Application

Today web application is the most significant and fastest growing field of software systems. Web applications may support a wide range of activities including education, research, e-commerce, business, sales, medical etc. It is important for Web applications to be dependable, but recent studies conclude that they are not dependable. [1]

Below Figure 1.1 shows how a simple web application operates by taking example of online shopping. In it customer can send a request through a web browser by sending website address to web server. It can responds by sending the front page for the given URL that is static page of the web application. All these contents are taken form the markup language which is further interpreted by the browser to render a web page at the user site.

Some requests requires additional infrastructure to execute their complex task. For example, in an online shopping site as shown in the below figure a request may be of different type client may request for the product details to the web server as per the request from the client web server response with respective pages or information. If customer place request to order a particular product then first stock has to be verify for getting the availability of product.

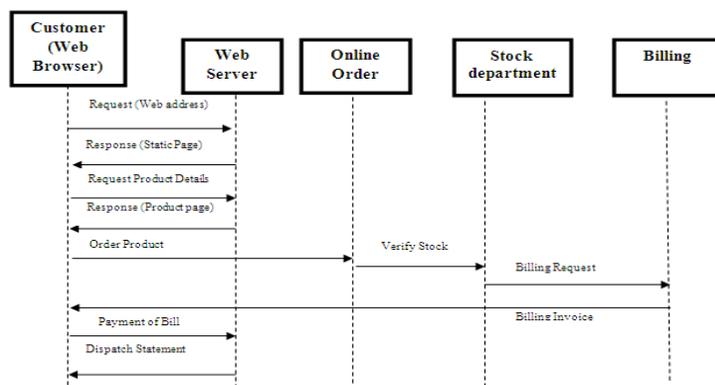


Figure 1.1: Sequence diagram of a web application

After checking availability bill is generated and then forwarded to the client in response to request from it. A set of name-value pairs (input fields' names and their values) is generated by translating information and it becomes part of the request.

Although the web server receives any request and it requires further elements to complete the process. According to the client requests and elements requires it generate pages by running its respective script. The newly generated page, generated at run time and depending on user's input, is called a dynamic web page [53].

### Web Application Testing

#### Definition:

“Web application testing, is a software testing technique, exclusively implemented to test the applications that are hosted on web in which the application interfaces and other functionalities are tested”. [16]

The aim of Web application testing is to execute application by trying different input values and state to determine failures. A failure is detected for finding the incapability of a system or for verifying the performance requirements of the application [16]. Generally, failure is nothing but the faults in the application itself .Fault may be in application or its running environment or in the interface between the environment and the application on which it runs.

Since a web applications execution is depends on it running environment it should be test differently to detect failure. To discover the various failures the different types of testing have to be executed [11]. Because of the functional requirement of the application the running environment affects the non-functional requirements of a Web application [1] [2].

**User Session Based Testing**

White box web application testing techniques has limitation such as Ricca and Tonella’s technique has cost of finding inputs that exercise the system as desired. For the selection of such inputs is slow and must be accomplished manually. This problem can be solved by transparently collecting user session log and generating test cases from it [1].

Web application is a combination of static and dynamic web pages. Web server generates dynamic pages according to the request from the client. Changing user summaries and frequent minor maintenance changes complicate automated testing. Cost of creating test cases using white box testing is higher. It is easy and cheaper to collect user sessions and generates test cases from it.

In the form of URLs and name-values pair this technique captures and stores the client’s requests, and then applies policies to create test cases. Generally, a user session starts when a request from a new IP address reaches the server and finished when the user leaves the web sites or when the session times out. Every logged request of the user session is changed into HTTP request that can be sent to a web server and it transforms into test case. A set of HTTP requests that are associated with each user session is contained within the test case. For collected user session several approaches are applied to generate test cases.

**Generalized Framework**

Below Figure1.2 shows the generalized framework for User Session Based Testing which is further described below.

**1. User Request**

User can use the services by sending request via various links provided on website. The various request types explained below:

**i. GET**

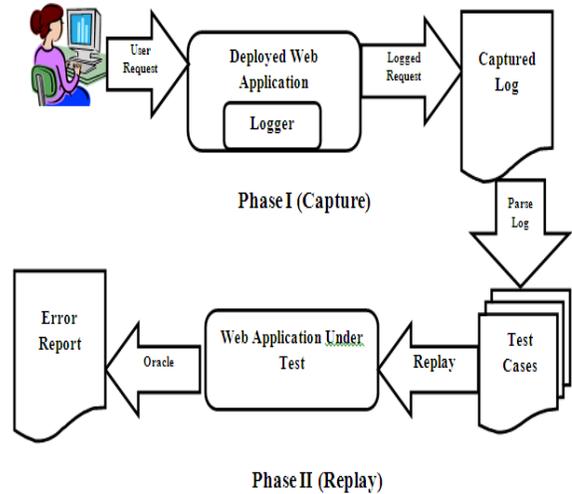
For the specified resource or service it will send request. By using GET request only data can be retrieve nothing else.

**ii. POST**

It requests to the server that it accept the entity enclosed in the request as a new subordinate of the web resource recognized by the URL. And the posted data might be, for example, an explanation for existing resources, a message for a newsgroup, mailing list and a block of data that is the result of submitting a web form to a data handling process or an item to add to a database.

**iii. CONNECT**

It converts the request connection to a transparent TCP/IP tunnel, usually to facilitate SSL-encrypted communication (HTTPS) through an unencrypted HTTP proxy.



**Figure1.2 shows the generalized framework for User Session Based Testing**

**II. DEPLOYED WEB APPLICATION**

To make all of the activities available for use the web application is deployed on the web server. Some correlated activities are involved in deployment process with possible transitions between them. These activities can occur at the producer side or at the consumer side or both sides.

**III. CAPTURED LOG**

A request for a file made by a user is called as Hit. Web browsers and search engine indexing programs are included by user. Every time a user view a webpage it requests the separate files that make up the page from the web server where the website is stored. In the web server the record of the hits received is automatically created and saved and it is called as web server log. Log can be treated and the resulting statistics interpreted to build a representation of how people might be using a website

Each time a person views a webpage a request is sent from their computer to the computer where the website is stored (server). These requests are for the individual files that make-up the webpage. The web server log is a record of these requests. Figure 1.3 shows the sample access.log file. Statistics included in Server log:

- The type of [browser](#) used to view the website
- The details of the service the person uses to connect to the internet, including an [IP address](#)
- Their country of origin
- If the person linked to the website from a search engine, the words they searched for (*query*)
- The webpages viewed
- The time spent on the website
- Sample path is the order in which webpages were viewed

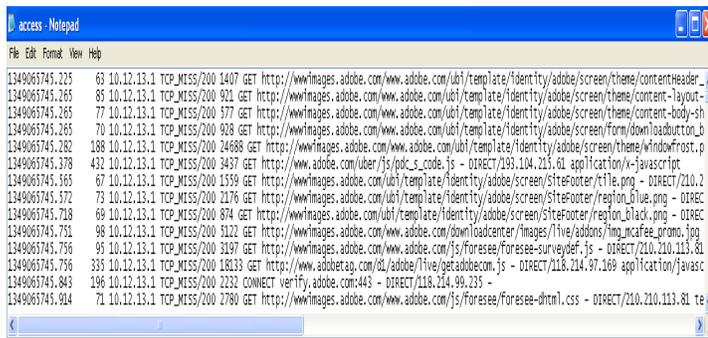


Figure 1.3 : Access.log

faults, even that techniques presented it was possible to find different kinds of faults these algorithms are comparable. This research also exposed that the effectiveness of user session techniques recovers as the number of collected user sessions increases.

Jessica Sant & et.al [3] has proposed methods that builds model of web application by means of user session log and on the web server it is stored. The captured user sessions log data shows the dynamic actions of an application that can be useful for addressing the web applications testing problems. Their systems are able to generate test cases that achieve high coverage and in which user behavior is mapped correctly. A preliminary estimation that demonstrates the coverage found using the randomly generated test suite along with the accuracy of the replayed test cases is also introduced by them.

Sara sprenkle & et.al [4] for the automated web application they make the replay and oracle modules, which pose problems beyond those in the corresponding testing steps for traditional web applications. It involves implement and assess the set of automated replay tool and oracle comparators for user session based testing of web applications. Giuseppe & et.al [6] have discussed about functional and non-functional testing of web application. They conclude their exploration as all the testing aspects that are directly dependent on the implementation technologies have to be deeply adapted to the heterogeneous and dynamic nature of the web applications and the other features may be used again with a reduced adaptation effort.

Sara Sprenkle & et.al [8] propose automatic test case generation on various levels of multi user interaction and also state the dependencies by leveraging web application data field. Izzat Alsmadi & et.al [6] discussed the utilization of user sessions for test case generation and execution of those test cases. Their method utilizes the user sessions which are expected to improve from being copied and reused in the framework, by this it will become difficult to edit and translate into a format that can be used and utilized in different platforms and applications. They have also discussed the utilization of user session test automation for GUI. They have developed a system to create user session information in a format that is independent of the tool that collects them.

T.Deenadayalan & et.al [7] explores the clusters user session based approach. This method has the clusters user sessions depends on the service profile and selects a set of demonstrative user sessions from each cluster and personalized by augmentation with further requests to cover the relationships of web page dependencies. Furthermore, through attaching the requests with dependence relationships with the requests contains in user sessions generated during user events, it permits the coverage of the structure of the implementation.

The approach proposed by Xuan Peng & et.al [10] is depends on grey box testing. The concept of named transition relation in the form of page-request-page to represent the transition relationship between pages and requests for the pages has been introduced by them. In proposed approach, first the structural analysis was made with the application and then RDG is constructed according to the request dependence relationship between pages of web application. The relations are extracted according to RDG and other examination of data dependence and link dependence was made to recognize the significance of each

#### IV. TEST CASES

Server maintains the log of all the users accessing the website. These sessions are parsed into test cases. There are several algorithms available to generate test case. That we will study in next chapter.

#### V. WEB APPLICATION UNDER TEST

In this phase the generated test cases are tested for its Functionality test, Coverage test, Block test.

#### VI. ERROR REPORT

According to the result of above block the report is generated in the form of tables and graphs.

#### Test case generation by User Session Based Testing

##### Generalized Algorithm

1. Access Record {User IP address, Request time, Request mode (GET, POST, CONNECT), URL, Data Transport Protocol (HTTP), Status code, No. of bytes transferred and the type of client}.
2. Firstly, purge irrelevant data including the records whose status codes are erroneous which contains error status code like (Status Codes =200 for success and 400 for error).
3. Create user sessions by scanning the log from web servers.
4. For every new IP address, a new user session is created.
5. Requests form same IP address is appended to r respective session.
6. Test Cases are generated for all the requests from all the users.
7. Test cases are reduced by applying reduction techniques.

#### VII. RELATED WORK

S. Elbaum & et.al [1][2] explores a user session based techniques to test a Web application and also comparative study the effectiveness of white box and user session techniques. They also introduce three test case generation methods that are US-1, US-2 and US-3. Along with the effectiveness of white box and user session techniques in terms of capability of recognizing the

transition relation. In the last phase Genetic Algorithm empirical user sessions so as to cover as many fault sensitive transition was proposed to generate test cases with combination of different relations as possible.

**Comparison of Algorithms**

**Table 1.2: Description and drawbacks of Test Case Generation Techniques**

Sr.NO	Technique	Description	Drawbacks
1	US-1	Direct Reuse of User Session	Privacy Problem caused by the more intensive instrumentation used by capture replay tool.
2	US-2	Combining different user session	Lowest coverage than others.
3	US-3	Reusing User Sessions with form modification.	No multi user session interaction.
4	Random Test Case Generation	Select User Sessions Randomly.(Using Random Traversal)	Lack of Accuracy and fault detection.
5	Fixed Time Blocks	Multi-user interaction, Variable sized test cases.	Requires smart timeout: likely to split user sessions across test cases.
6	Server Inactive	Multi-user interaction, Variable sized test cases.	Requires smart threshold: can split user sessions across test cases.
7	Augmented User Session	Represent logical user sessions, multi user interaction.	Larger test cases than user sessions, higher cost to generate test cases.
8	User Session Clustering	Uses Clusters of user sessions.	No identification for obsolete test cases and test case prioritization.
9	ReduceUSession	It combines test case creation and reduction.	It only consider Test coverage ratio. (Running time, time to save test state should be considered)
10	Test Case generation using genetic Algorithm(US-RDG)	User Session log is considered as Initial population of GA.	Only those sessions are covered which are covered in transition relation.

**Table 1.1: Comparison of algorithms**

From the above study we have map the comparison report of all user session based test case generation approaches shown in below table 1.2

Year	Technique	No. of Requests	Test Suite Size/no. of test cases	Block Coverage	Function Coverage	Faults Detected
2003	US-1	1975	85	263	65	23
	US-2	1919	84	255	64	23
2005	US-1	1975	85	263	65	23
	US-2	1919	84	255	64	23
	US-3	2742	407	288	65	26
	Random Test Case Generation	-	-	-	-	-

2006	Fixed Time Blocks	Min	16275	8447	-	12,270(45.2)	-
		Hour	16275	1769	-	15,713(57.9)	-
	Server Inactive		16275	1814	-	17,745(65.4)	-
	Augmented User Session		184656	1342	-	N/A	-
2010	User Session Clustering		-	-	-	-	-
	ReduceUSession		-	-	-	-	-
2011	TestCase Generation Using Genetic Algorithm(US-RDG)		1415	<ul style="list-style-type: none"> <li>• Unique Requests 10(100%)</li> <li>• Data dependence transition relations 15(100%)</li> <li>• Link dependence transition relations 26(76.47%)</li> <li>• Transition relations 41(83.67%)</li> </ul>			

**Table 1.2: Comparison report of test case generation approaches**

### VIII. CONCLUSION

In this paper we discussed about web application and its execution. Also explore the Web application testing strategies. Generating test cases of high quality is the premise of web application testing. The various approaches we have discussed in this paper. The US-RDG is the existing method used for test case generation by using Genetic Algorithm. The limitation of US-RDG is, only those sessions are covered which are covered in transition relation. We are trying to resolve this problem in future.

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# Influence of Service Delivery Strategies on Customer Satisfaction at the British High Commission in Kenya

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**Abstract-** Despite the public complaints on the services being delivered at the British High Commission (BHC) there has been reluctance in addressing the concerns raised from the public. This study investigated the influence of service delivery strategies on customer satisfaction at the British High Commission (BHC) in Kenya. The specific objectives that were studied are the effect of back office, front office services and virtual office services on customer satisfaction; and the influence of customer service expectations on customer satisfaction at the BHC. The researcher used assimilation, contrast and negativity theories as some of the theories for customer satisfaction. Exploratory design was used alongside descriptive research. Closed ended questionnaires were used in the study. A pilot study of 11 respondents was carried out at the British High Commission. The data was analysed by use of content analysis, both qualitative and quantitative analysis. Inferential statistics were used to make inferences about the population based on results obtained from samples. Researcher used Chi-Square tests which attempted to establish the relationship between independent variables and the dependent variables which are categorical in nature. The researcher presents the quantitative data using tables. Qualitative data was presented through content narration. Many respondents agreed on the accuracy of documents in visa processing by the back office at the British High Commission. In findings on front office operation, there were a total of 97 responses that indicated poor coordination, facilitation and communication, especially from the security at the entrance on the processes and requirements for visa application. Regarding the virtual services, the respondents noted that there were no consumer surveys that provide a clear perception on the services offered at the British High Commission. Some were of the view that the individual feedback is never taken into consideration. The study recommended for the need of annual open days within the BHC that creates opportunity for the mission staff to engage with the local public regarding the visa services offered and other related services that are available and that the security team should not have knowledge limited to the issues in their domain.

**Index Terms-** Customer satisfaction, Back office services, Front office services, Virtual

## I. INTRODUCTION

Customer satisfaction is the focus of organisations aimed at meeting the expectation of after the actual cumulative performance. Many people equate value with quality for

achieving customer satisfaction. Satisfied customers are an important goal and an important asset for successful organizations. When customers believe they have received a high service value from one service provider they are more likely to display loyalty behaviour, including relationship continuance, increased scale or scope of relationship, and recommendations for that service provider (Ostroff, 2010).

Meeting customers' needs is aimed at giving customers what they want, when they want it and how they want it. Behind the approach is a customer-focused philosophy aimed at delivering the services that customer seek, market share and profits are derived by keeping close remote customers (Mullings, 2002). The greater the levels of satisfaction, the more consumers are expected to reward the company with their long-term loyalty, which should result in healthy profits over a long period of time (Barbara, Bryant and Claes, 2005).

Customer satisfaction is responding to customer needs and expectations in a way that will make them have a memorable experience and motivate them to come back and to tell others. In this, competitive world, business as well as diplomatic organizations and embassies must understand the importance of customer as its future or growth is concerned. It must understand that its existence lies in the hands of the customer and therefore the service provider should make many efforts at all costs to attract, maintain and capture customer's loyalty. It should seek first the needs and wants of the target population and deliver them in an efficient and effective way that satisfies the target population (Lee and Yoo, 2000).

Other studies, such as Gummesson (2006) and Storbacka et al. (2004) discussed the link between satisfaction and loyalty. Serving experienced customers will result in higher productivity for the service providers because those customers have become familiar with an organization's service delivery system. As a result, loyal customers can contribute to the productivity gain of the service delivery system by making suggestions for improvement or just simply being more cooperative with aim of getting satisfaction fulfilment (Lau, 2000).

Sevottam (2012) observes that performance excellence the world over is assessed on two kinds of parameters: the results that the organization can show, and the manner in which the results are being achieved. The British High Commissions together comprise the UK's "diplomatic missions" overseas. The role of a UK diplomatic mission is to function as the channel of communication between the British government and that of the host country, to act as the official representative of the UK in general, and in respect of specific public agencies with local interests in that country, and to promote the interests of the UK

and its citizens in that country. Diplomatic missions are also sent to international organizations and conferences, with similar roles (GOUK, 2014)

Among the services provided by the British High Commission include: visas, travel advice, support for British nationals abroad, notarial and documentary services, passports and emergency travel documents, births, deaths and marriages, data protection and out-of-hours emergency assistance. There are over 1,350 people working in British embassies/high commissions worldwide who assist with processing entry clearance applications (UK Visa Bureau, 2014)

There is growing recognition that, despite significant increases in resourcing, public service delivery is still failing (Harris et al., 2012). Despite bold plans and massive injections of international and domestic resources, public customer satisfaction is still failing in many areas. This suggests that there is a need to revisit approaches to assisting service delivery sectors. Mcloughlin and Batley (2012) study on service delivery confirms there is fairly generic terms about political and governance constraints. For example, concepts like 'political will' or the existence of 'weak incentives' are often referred to but rarely further developed in terms of the specific institutional and governance arrangements that contribute to these factors, and in terms of which of these may offer strategies for overcoming common bottlenecks or gaps. According to Ostroff (2010) in his study on client satisfaction, he notes that there is a mismatch from the expectations and the actual outcome from the services received by clients.

The general perception in the public domain relating to service delivery at high commissions in Kenya is that there is a complete detachment between service providers at the commission and service recipients, the customers. This is evidenced by the numerous cases highlighted in the local media relating to complaints by customers of unfair treatment at the commissions (Harris et al., 2012).

Despite the public complaints on the services being delivered at the British High Commission (BHC), there has been reluctance in addressing the concerns raised from the public. There exist no direct feedback mechanism between the BHC and the consumers of the services-both public and government. The BHC has overtime turned out to be an island that does not consider the operating environment. No simple customer feedback mechanisms like the suggestion box; instead there is an enquiry email address that rarely responded to all the concerns raised. When the response is made in some of the enquiries, it normally dwells on defensive line instead of addressing the concerns raised (Stefan, 2014). The BHC has turned out to be more of a political department in the local politics than restricting to its mandate of diplomatic representation (Ibid). Under the circumstances, it is difficult to meet the customer expectations within the realm of the actual service provided. As a result, there is high level of distrust in the related services provided at the BHC and the public perception on level of satisfaction. The study, therefore, seeks to investigate the influence of service delivery strategies on customer satisfaction at the British High Commission.

The general objective of this study was to investigate the influence of service delivery strategies on customer satisfaction at the British High Commission in Kenya. The specific

objectives were examine the effect of back office services on customer satisfaction at the British High Commission in Kenya, to assess the effect of front office services on customer satisfaction at the British High Commission in Kenya, to examine the effect of virtual office services on customer satisfactions at the British High Commission in Kenya and to assess the influence of customer service expectations on customer satisfaction at the British High Commission

The findings of this study will be useful to the British High Commission office in Kenya, its employees and academicians. Firstly, the findings will be useful to the British High Commission office in Kenya in reviewing its standard operating procedures and customer satisfaction frameworks to improve on its quality of service delivery and ensure that procedures followed in serving customers ensure their satisfaction. To employees, the study findings will provide useful insights on how to serve customers better to ensure their satisfaction at all times. This will be critical to the overall image of the commission's office in Kenya. The findings of the study will also be useful to academicians interested in conducting further research in relation to the recommendation that will be given for further research areas.

The researcher was faced with the problem of identifying and locating the previous customers at the British High Commission. The researcher used the existing records to identify location of customers, for example the previous Visa applicants with complaints. As a remedy, the researcher enlisted the services of research assistant that is was experienced in data collection and setting aside adequate financial resources to ensure successful completion of the exercise. Some of the respondents were also unable to provide all the information due to the sensitive nature of this research. The researcher explained the purpose as being academic in nature without any ill intention of victimising individuals.

## II. LITERATURE REVIEW

### 2.1 Theoretical Framework

There are a number of theories that can be used to explain customer satisfaction in service delivery. According to Barbara, Bryant and Claes (2005), theoretical approaches are broadly classified in three categories; attribution, equity and expectancy disconfirmation. The level of satisfaction is linked to the comparison of the expected and the actual performance of the service to the required expectation by the client. This process is described as either confirmation or disconfirmation to the expectation of the clients regarding the particular service. As an example, the expectancy disconfirmation theory suggests that consumers form satisfaction judgments through individual and group evaluation of the actual satisfaction derived from the service. Four psychological theories were identified by Anderson that can be used to explain the impact of expectancy or satisfaction: Assimilation, Contrast, Generalized Negativity, and Assimilation-Contrast.

#### 2.1.1 Assimilation Theory

The theory of assimilation states that clients to a service make some kind of comparison regarding the expectation on the specific service and the actual performance that is viewed as a

post usage evaluation of the service received. According to Wirtz (2003), consumers of the service seek to avoid dissonance by making an adjustment of their perceptions regarding the specific service to ensure it is according to their expectations. The service clients can make a choice to adjust their expectation to match with the actual performance of the service provider in order to avoid any potential tension for failing to meet the expectation by the service provider. The theory assumes that there is a relationship that exists between satisfaction and expectation. It also assumes the clients to the specific service have motivation to make adjustments on both expectations and the actual performance of the service consumed.

### **2.1.2 Contrast Theory**

Contrast theory was first introduced by Hovland, Harvey and Sherif (1987). Gerpott et al., (2001) define contrast theory as the tendency to magnify the discrepancy between one's own attitudes and the attitudes represented by opinion statements. Contrast theory presents an alternative view of the consumer post-usage evaluation process than was presented in assimilation theory in that post-usage evaluations lead to results in opposite predictions for the effects of expectations on satisfaction. According to the contrast theory, any discrepancy of experience from expectations will be exaggerated in the direction of discrepancy. If the firm raises expectations in his advertising, and then a customer's experience is only slightly less than that promised, the product/service would be rejected as totally unsatisfactory.

### **2.1.3 Theory of Negativity**

This theory is originally traced to Carlsmith and Aronson (1963) as the proponents. It argues that any form discrepancy in relation to the actual performance from the intended expectations will affect the individual, producing some kind of negative energy. Gerpott et al. (2001) argues that the theory of Negativity has its genesis in disconfirmation process. According to this theory, when expectations are convincingly upheld, it creates room for consumers to respond negatively to any disconfirmation. Dissatisfaction will appear when the actual performance is less than the expectations.

### **2.1.4 Theory of Disconfirmation**

The theory of disconfirmation states that satisfaction is linked to extent size and direction of the experience of disconfirmation that takes place as an outcome of comparison between actual performance and the consumption expectation of the service. According to this theory, satisfaction is the consumers achieved fulfilment.

## **2.2 Conceptual Framework**

The conceptual framework of this study is based on the independent variables namely: back office services, front office service, virtual office services and customer perception and the dependent variable is the customer satisfaction at the British High Commission office in Kenya.

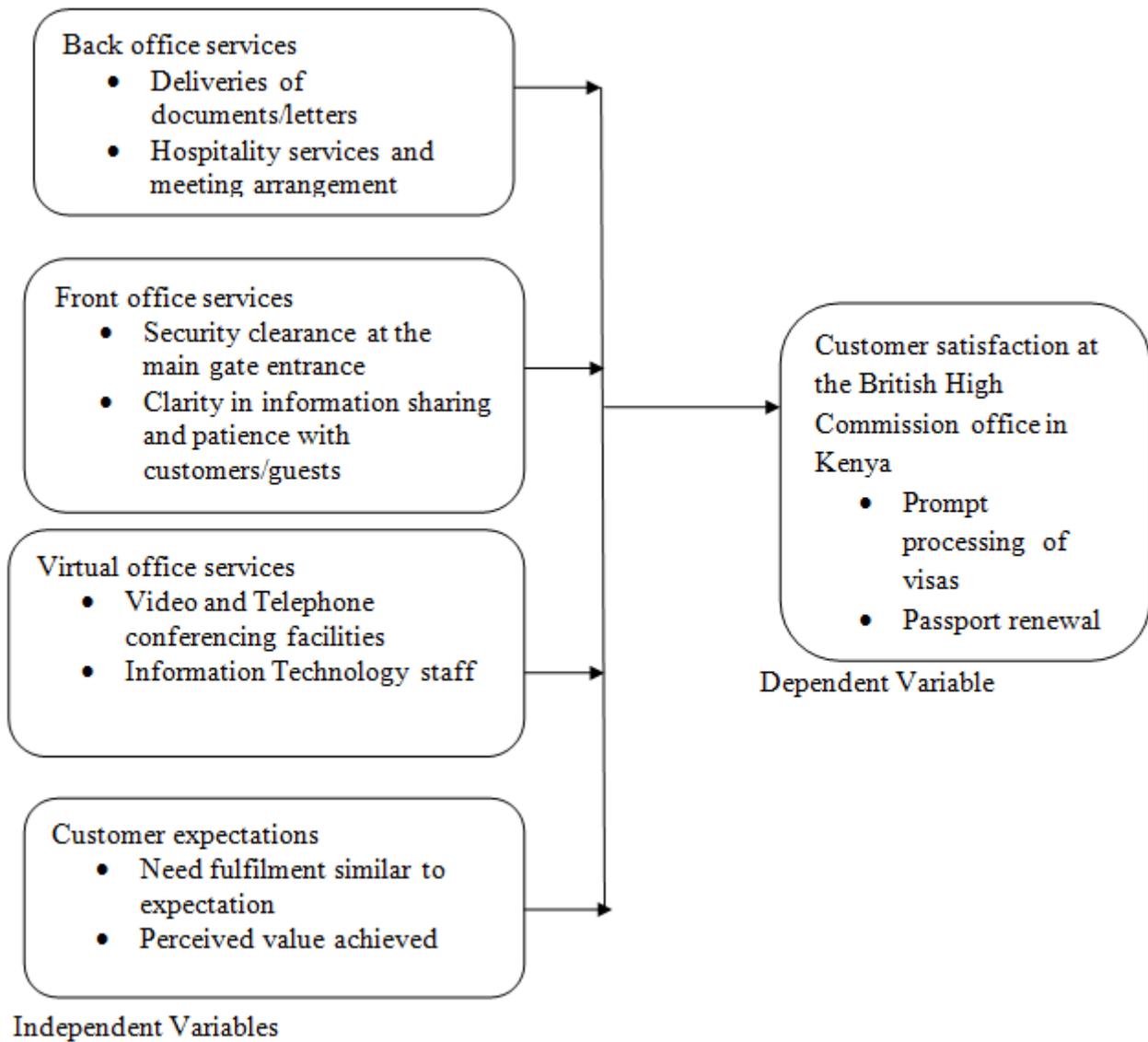


Figure 2.1 Conceptual Framework

### 2.3 Empirical Review

The concept of customer service has taken root in both public and private sectors in Kenya. The foreign High commissions and Embassies in Kenya have undergone management as well as service delivery reviews with the aim of leading as a showcase of expertise in service provision to the customer satisfaction level. According to survey conducted by the British High Commission (2013), the provision of quality service to the customers is crucial for meeting the service satisfaction to the customers. By understanding and ensuring the customers' needs are met, the British High Commission can effectively contribute to the improvement of the quality service being provided.

Caryforth et al. (2004) notes that Organisations that provide services in an excellent manner to their clients, achieve a lot of benefits to their customers as well as organizations. The High Commissions and Embassies that offer good standard services to

the customers can depend on the use of word of mouth to increase the overall number of new customers without doing advertisement. The dissatisfied customers are a threat to the reputation of the organization and may to greater extent keep away new potential customers.

Customer service includes various functions besides the proactive selling of both services and products; it involves one to one interactions with customers in person, through telecommunication which include the use of mail service. It is designed and performed with the agenda of achieving satisfaction of customers and the level of efficiency in operational functions. The behaviour of service provider during the interaction with the customers is a mirror of what takes place within the organization. The customer attitude of the service is linked to the overall behaviour and personal traits of the service provider, rooted in the doing business philosophy of the organization that is based

on commitment and customer satisfaction as the key priority for the organization.

It is vital to be aware of the demographic key characteristics of the customers and their individual beliefs, preferences, social habits, expectations and attitudes. The manner in which problems are resolved has a long term crucial ramifications to the top loyalty of customers and the overall success of the organization. Customer satisfaction from the services leads to contentment and builds trust and confidence in the existing services. Once the needs of the customers are met, there is a high chance of retaining the old clients and attracting new clients.

According to Awara (2010), everyone in the organization is responsible for the ensuring quality excellent quality services. To a great extent, it is the management responsibility to mould good atmosphere that fosters services that are customer driven by prioritizing their interests. The achievement of incredibly excellent customer service is a direct output of good managers that ensures it happens.

### 2.4 Research Gaps

The literature reviewed in this study points to the fact that a number of studies relating to the subject matter of this study have been done, while empirical evidence on most other areas are lacking. It is also evident that most of those studies already done, a majority of them are from around the globe and in and around Africa establishing a gap in terms of scope providing a rationale for further research attempts to zero in on this gap, especially in relation to the local context.

To start with regarding back office services, no analytical evidence has been found to indicate how back office services affect service delivery and customer satisfaction at the High Commissions' office in Kenya. This calls for an attempt to do the same to bridge this gap (Goluboff, 2009). In addition, as relates to front office services no evidence is available of a study that has attempted examining these services on service delivery at the High commissions' office in Kenya.

Finally, most of the studies done on virtual office services have been skewed towards online services but again not based service delivery at the British High commissions' office. Consequently, it is in this background the researcher contemplates the need to further explore and document the same for use in academia and in practice.

## III. RESEARCH METHODOLOGY

Exploratory research design was used in the study. This involved exploration of causes and effects of the independent and dependent variables associated with the problem. The research methodology also used descriptive approach combined with exploratory design. The study population consisted of all customers to the British High Commission office in Kenya. The UK Visa Bureau (2014) approximates that at least 10,000 customers sought the services of the High Commission office in Kenya each year. However, only about 10,000 customers interact physically with the High Commission employees per year. This represents the number of customers that have characteristic to be measured.

**Table 3.1: Population**

Category	Pop frequency
Locals	8,000
Foreigners from Africa	1,600
Foreigners from outside Africa	400
<b>Total</b>	<b>10,000</b>

(Source: UK Visa Bureau, 2014)

The sample size for the study was calculated using Mugenda and Mugenda (2003) formula for sample size determination for population more than 10,000. The sample size for British High Commission was estimated within 95% confidence interval. Table 3.1 indicates that there is an estimate of about 10, 1000 customers visiting the British High Commission, while table 3.2 shows the sample population. According to Mugenda and Mugenda (1999), when the population of the study is more than 10,000 individuals, 384 of them are recommended for as the desired sample size given that Z statistic is 1.96 at 95% confidence level as shown in the following formula.

$$N = (z^2 P_q) / d^2$$

Where:

N = the desired sample size (when the population is less than 10,000)

Z = the standard normal deviate at the required confidence level

P = the proportion in the target population estimated to have characteristic being measured

$$q = 1 - p$$

d = the level of statistical significance set

$$384 = 1.96^2(0.5)(0.5) / (0.05)^2$$

Therefore,

$$nf = 384 / (1 + 384 / 10000)$$

$$nf = 369.8 = 370 \text{ respondents}$$

Since resources and time are a major constraint the above procedure helped in guiding the researcher in determining the sample size. The study used 30% of the desired sample size of 370 respondents which was 111 persons of the desired target population.

**Table 3.2: Sample Size**

Category	Population frequency	Sample size
Locals (Kenyan)	8,000	89
Other African citizens	1,600	18
Other citizens from outside Africa	400	4
<b>Totals</b>	<b>10,000</b>	<b>111</b>

(Source: UK Visa Bureau, 2014)

The study used random sampling technique so as to achieve desired representation of the respondents from the study's target population. The two main types of random procedures include simple random sampling and stratified random sampling. Primary data was collected mainly by the use of structured questionnaires. The first part sought to obtain general information or bio data of the respondents. The second part was

devoted to the identification of determinants of service delivery strategies the British High Commission's office in Kenya. The questionnaire helped in collecting as much information as possible. The structured questionnaires were administered by dropping the questionnaire to the respondents and picking them after a period of one week. It also involved use of email to send the questionnaires for respondents' feedback. Closed ended questionnaires were also used because of their restriction to the specific responses. The questionnaire items were set based on the study objectives and research questions that were tested. It reduced capturing of other irrelevant issues to the study. Email use facilitated easy communication from customers outside Kenya. Secondary data was collected through the literature and empirical review of existing information on the study topic as reviewed from text books, journals, and newspaper articles, published and unpublished theses.

A pilot study of 10% (8 respondents) of the desired sample size of 111 respondents was used at the British High Commission. The pre-test was subjected to the internal consistency technique using the Kuder-Richardson (K-R) 20 formula which is as follows:

$$KR_{20} = (K) (S^2 - \sum S^2) / (K-1)$$

Where:

$KR_{20}$  = Reliability coefficient of internal consistency

K = Number of items used to measure the concept

$S^2$  = Variance of all scores

$S^2$  = Variance of individual items

A high coefficient implies that items correlate highly among themselves indicating that there exists consistency among the items in measuring the concept of interest (Mugenda and Mugenda, 1999)

Data was analysed using qualitative and quantitative analysis. The researchers first described and summarized the data by use of descriptive statistics. This enabled the researcher meaningfully describe the distribution of results depending on the variables in the study and the scale of measurements used. Inferential statistics was used to make inferences about the population based on results obtained from samples. Researcher also used Chi-Square tests which attempted to establish the relationship between independent variables and the dependent variables which are categorical in nature. The reason for choice of Chi Square analysis was because the technique can be used on data that has been measured on nominal scale and can be used to see the difference between two or more groups of categories. The questionnaires were coded and the data keyed into the computer using Statistical Package for Social Science (SPSS V-17) as well as STATA (10/12) Statistical Software. The researchers presented the quantitative data using tables. Frequency tables are used. Qualitative data is presented through content narration.

#### IV. DISCUSSION AND PRESENTATION OF RESEARCH THE FINDINGS

##### 4.1 Introduction

The chapter presents the information as recorded from the field. The primary data is discussed within the chapter. The response based on the research instrument tabulated responses. Analysis of the findings is also captured in this chapter and presented based on the four research objectives.

##### 4.2 Response Rate

The questionnaire return rate is as shown in Table 4.1

**Table 4.1: Response Rate**

Respondent	Frequency response	Percentage (%)
Response	108	99
No response	3	1
Total	101	100

From Table 4.1, an entire 99% response rate was realized being far above the 70% that Mugenda and Mugenda (2003) say is excellent response.

##### 4.3 General Information

###### 4.3.1 Age of respondents

Out of the 108 population that respondent, 101 were above the age of 30 years and 7 below 30 years. The first category comprise of the business people and individuals visiting United Kingdom (UK) as well as those on transit. 5 of the respondents less than 30 years old were students seeking further studies in the United Kingdom (UK) and 2 were refugees moving to UK.

###### 4.3.2 Level of Education of Respondents

97 of the respondents were University graduates, 8 tertiary college graduates and 6 respondents did not indicate the level of education. On average, the respondents were educated up to the University level.

###### 4.3.4 Demographics of Respondents

Majority of respondents at 101 were of African Origin. Out of which 81 were Kenyans, 20 were from West African, but working in Kenya. 10 of the respondents were British citizens that comprised of 3 tourists whose visa expired while on touring Kenya, 7 had issues with the expiry dates of their passports. In general, all the respondents were residents in Kenya.

###### 4.4.5 Pilot Study Findings

All the 8 respondents were purposively chosen by the researcher. The instruments were found to be well for the topic. However 5 of the respondents proposed telephone call as a follow up the selected respondents on the delivered questionnaires rather than just waiting for their feedback. They also suggested that each of the five sections of the data collection instruments should be discussed in the findings as well as recommendations based on both independent and dependent variables.

##### 4.4 Front Office

The respondents' views on the front office are captured in frequency table in the next page

**Table 4.2 Front Office Response**

	<b>Agree</b>	<b>%</b>	<b>Disagree</b>	<b>%</b>
Poor coordination	97	96	3	3
Poor facilitation and communication	97	96	3	3
Poor handling and reliability	97	96	3	3
Lack assurance	90	89	11	10.9

There were a total of 97 responses that agreed on the level of poor coordination, facilitation and communication. 90 confirmed absence of assurance on the services and security related clearances. Cumulatively, a total of 97 agreed with the statements as framed. While 11 did not agree on the suggested statements in questionnaire. There was no clarity on the respondents' side regarding the visa processing, the relationship between British High Commission (BHC) and the Visa processing office in South Africa. No reliability of information attained from the front office at the pedestrian entry gate on the guideline for visa application. This is in agreement with Vallen et al. (2009) who argue that reliability, coordination and communication are the virtues of front office that either creates confidence in public or led to the loss of confidence based on the client judgement. Some of the security officers at the gate still believe the visas are applied and processed at the BHC office in Nairobi with backstopping from the South Africa office.

Front office, as mentioned in chapter two, the first customer face of the British High Commission (BHC) that clients meets, and the first port of call for the majority of clients with any enquiries and problems. The 97 respondents acknowledged the existence of poor coordination, facilitation and communication. This could be linked to the inconsistency of information from the front office staff regarding the services offered at BHC. The responses also related to the security officers that are create a sense of intimidation while armed and standing at the gate. The responses are in line with the arguments of Baker and Riley (2005) who argued that the front office is the first step that creates the first impression. The responses faced challenges in getting security clearance from the main gate even with appointments.

The unfriendly character of the security staff in providing clear guidance on the direction to the different offices contributed to the responses as captured. The transfer of visa processing to South Africa appears not to have been well communicated to the BHC staff at the front office. The understanding of some security officers that the visa processing

is still done at BHC is linked to misinformation regarding the new arrangements. The limited information within the front office creates a sense of uncoordinated team at BHC in meeting the customer satisfaction.

As argued by Vallen et al. (2009) in literature review, the front office is supposed to have general information regarding the services offered by BHC; unfortunately the team appears to have limited information rather than detailed awareness and guidance to the customers.

The respondents' views confirm absence of standard operating procedures and guideline on the services that are offered at the British High Commission. The front office team is less knowledgeable of both the standards and the services in place, in order for the objectives to be achieved. In relation to standards, it is the front office team's job to ensure that the customer's first contact with the BHC is a positive experience. This all important first impression will be based upon the welcome and the efficiency of the check-in process, both of which pertain to the standards in place. Incorporated into the delivery of these standards is customer service. In order for a front office team to be able to deliver these dimensions, it is important that they receive the correct training. This is down to the BHC management. It is based upon their experience, knowledge and management style that the customers can appreciate the services offered at the front office. The level of front office engagement with clients contributes to the perception of customers on the services offered at the BHC. In order for a front office team to be able to deliver these dimensions, it is important that they receive the correct training. This is down to the manager; it is based upon their experience, knowledge and management style.

**4.5 Back Office**

The respondents' views on the back office are captured in frequency table below.

**Table 4.3 Back office response**

<b>Type of response</b>	<b>Agree</b>	<b>%</b>	<b>Disagree</b>	<b>%</b>	<b>Total</b>
Documents accuracy	101	91	10	9	111
Customer experience	04	3.6	107	96.3	111
Use of feedback	08	7.2	103	92.8	111
Flexibility	0	0	111	100	111

The respondents raised concern on the level of accuracy on the visa documents. 10 of them complained of spelling errors on their names as well as gender, while 101 agreed on the accuracy of documents in visa processing. The standard level of accuracy is in agreement with Xerox Corporation (2012) that argues for fewer inaccuracies in the back office services. The visa processing staff had minimal inaccuracies on the processed visas. They argued that the request for correction of the visa and application documents takes over two weeks for the changes to be made. It becomes costly for some of the visa applicants who travel from far in requesting for changes arising from errors. It also creates inconvenience when the visa is to be amended because of the errors that are made. A total of 107 indicated that there was no utilisation of customer experience based on the feedback on the services. Out of the 107 respondents, 2 confirmed having raised concern on the delays of getting their visas processed. The British High Commission instead went on defensive by publishing a complementary page in the Kenyan newspapers outlining the processes for visa application.

The respondents indicated that there seem to be little lessons learnt from the past experience of clients. Another 103 were even not sure if their feedback had ever been analysed and considered. Most of the respondents were alarmed at the number inaccuracies despite the official complains raised earlier. All agreed that there was no flexibility on the back office services and coupled with inefficiencies in processing the visa. All the respondents noted the delays in getting their visas on time with no explanation and apologies from the visa office. Some of the visa staff attributed the delays due to the current office in South Africa. However, the respondents clearly indicated that the delays have been experienced even before the moving of visa office to Pretoria in South Africa.

Back office can affect the performance of staff in significant way. The low morale of staff contributes to the occurrences of errors on the visa processing of documents. Majority of the respondents, at 101 agreed on that the processed visas were accurate. The accuracy could be linked to the right systems and strategies in place, BHC effectively assesses and manages the back-office operations to increase productivity, reduce errors, minimize costs and maximize the customer experience. The back

office managers know the expectations in the service delivery as required by the customers. They understand the work and the cyclical nature of the services offered. They rely on experience and the good work ethics in ensuring smooth operation. The back office has the capacity, skills and good work schedules that manage large volumes of transactions in a consistently high-quality and efficient manner is challenging but critical to BHC's overall success. The response is in line with Xerox Corporation (2012) as noted in the literature review where the capacity of the staff contributes to the successful service delivery to customers. System related training has been rolled out among the staff that has ensured well-grounded staff in offering services to customers.

The 10 respondents that were not happy with the information characterised by inaccuracies, argued that the request for correction of the visa and application documents takes over two weeks for the changes to be made. This kind of response is linked to the period when the visa processing was in transition period of moving from Nairobi to Pretoria in South Africa. Because of the recruitment of new staff after the three year service of the United Kingdom based staff in the country office and the training that is involved, there is likely hood of errors on the documents while processing the visas. The use of customer experience feedback, especially related to the past complains is not a reference point because such experiences were specific and cannot be generalised within the back office services.

The issue of flexibility is not applicable within the visa back office team. This is a civil service work that is purely bureaucracy. As a bureaucracy, there are always specific ways of doing things. Any type of change has to go through the overall civil service reform which takes time. The flexibility issue also depends on specific scenario, but cannot be generalised. Where applicable, the British High Commission staff may use discretion powers in the service provision based on specific issue in consultation with other team members.

#### 4.6 Virtual Office Services

The respondents' views on the front office are captured in frequency table shown on the next page.

**Table 4.4 Virtual office response**

Level of response	Agree		Strongly agree		Disagree		Strongly disagree		Neutral		Total
	Count	%	Count	%	Count	%	Count	%	Count	%	
Consumer surveys	00	0	0	0	111	100	0	0	0	0	111
Social network	04	3.6	0	0	0	0	107	96.4	0	0	111
Effective technology	09	8.1	0	0	102	91.9	0	0	0	0	111

All the respondents noted that there were no consumer surveys that provide a clear perception on the services offered at the British High Commission. The finding collaborates with

Thornburg (2007) who argued that feedback mechanism through client survey was important in understanding the perception of customers of the virtual services. Some were of the view that the

individual feedback is never taken into consideration. The 107 individuals strongly disagreed that the use of media, social network and technology facilitates customer satisfaction. All the 107 of the respondents expressed their frustrations on using these facilities. There is preference for virtual meetings rather than one to one physical meeting. Some of the simplest things like enquiries are never answered on time. It takes an average of two week to get response from staff. According to 60 respondents, use of technology like the virtual meeting rooms through video conferencing has reduced the time taken in scheduling the physical one to one meetings. They also indicated that such facilities are not reliable since they most of the time they either breakdown during the session. They also are vulnerable to technical errors leading to failures during the remote session of the meetings. 9 agreed on effective use of technology and 102 disagreed based on their past experience.

The respondents noted that the normal telephone calls are not responded on time. The main reception takes time in receiving calls as well as connecting to the extension line of the respective staff. Because of the tight schedules, some of the staff requests for follow up call to the clients but they hardly call back, if they do then it is late. 40 respondents complained of being asked to cut short the teleconference to give room for another meeting, the reason provided is the scarcity of meeting rooms; hence some meetings are prioritised more than others depending on the staff arranging the meeting.

The delivery of customer service also requires an understanding and an efficient use of technology, as highlighted by Thornburg (2007). It was clear that, there was a varying level of understanding of information technology amongst the interviewees. This will impacts not only upon the individual, but also upon customers as well as the British High Commission visa

teams to deliver good customer services that lead to service satisfaction.

The consumer surveys are key to capture of the customer perceptions on the services offered by the British High Commission (BHC). The respondents noted that there were no consumer surveys done by BHC regarding the services. The response could be linked to the fact the consumer surveys are periodically carried out through random sampling. It is also possible that the respondents were not part of the sample population at the time when such survey was carried out. The respondents valued the use of virtual services like innovation and technology, even though the effective use of such facilities and technology was not properly put into use as captured from the field. As noted by Chad and Pat (2009), the importance of virtual services crucial to the provision of services without necessarily being physically present.

The challenges on the use of technology like the video and teleconference facilities are not limited to the British High Commission (BHC) virtual services but general to all system related technology. Some of the failures in using the virtual meeting rooms as an example is to great extent failure of the clients to use the facilities from their end leading to the breakdown of communication form the end. The successful use of such facilities reduces the time taken in scheduling the physical meetings that are time consuming for fixing actual meeting as well as getting security clearance at the main entrance to the premises.

#### 4.7 Customer Expectation

The respondents' views on the customer expectation are captured in frequency table below.

**Table 4.5 customer expectation response**

Response	Agree	%		Disagree	%		Strongly agree	%		Neutral	Total
Responsive to needs	10	9	2	1.8	99	89.2	0	0	0	0	111
Excess regulations	80	72.1	9	8.1	22	19.8	0	0	0	0	111
Static policies	100	90	4	3.6	07	6.3	0	0	0	0	111

98 % of the respondents disagreed that the use of video conferencing facilitates service delivery at the British High Commission (BHC). Though they agree that such facilities are expected to facilitate access to services and information sharing, they have instead become less helpful. The finding contradicts with Mullings (2002) that believes in customer service based on the consumer expectation. The use of social media by the by the High Commissioner in addressing some of the concerns does not respond to individual concerns but rather in general manner. The

client expectation is not realised in the use of the telephone services. The same percent as video conferencing expressed concern for the failure of telephone services from the BHC end failing to meet the clients' needs. Most of the time the telephones are jammed and those that go through are not answered in satisfactory way.

Some of the respondents expressed concern on the manner they are handled by the staff while making enquiry of phone. 67 out of the 111 respondents confirmed having been told to hold on

telephone line while the staff was sorting other issues. It creates a negative picture when the background discussions are heard by the clients while asked to hold on the line. At the same the BHC staff fails to understand that they clients are using their credit when asked to hold on the telephone while sorting out other tasks before attending to the clients on phone.

Customers' expectations are key determinants of their consumption experiences, satisfaction, and loyalty. Accordingly, it is critical for marketers to try to find out in advance what their customers' expectations are, because a failure to meet or exceed those expectations could lead to dissatisfaction and defection. The respondents raised concern on absence of facilities for the physically challenged customers.

The United Kingdom (UK) Government, the Home office through the British High Commission ensures all UK visa

applicants' detailed information is provided and confirmation of financial capability for maintenance while in the UK. However, the high requirement prohibits the potential emerging entrepreneurs from exhibiting their products at London exhibitions. The response of the respondents appears to create scenario as if it is the British High Commission that sets this requirements. These requirements are set in the Home office and it applies across all the foreign missions across the world.

#### 4.8 Customer satisfaction

The respondents' views on customer satisfaction are captured in frequency table 4.6

**Table 4.6 Customer satisfaction response**

Response	%		%		%		%		Total	
	Agree	Strongly agree	Disagree	Strongly disagree	Neutral					
Responsive to needs	10	9	2	1.8	99	0	0	0	111	
Excess regulations	80	72.1	9	8.1	21	0	0	1	0.9	111
Static policies	103	92.8	0	0	08	0	0	0	0	111

A total of 99 of the respondents disagreed that the British High Commission is responsive to the needs of the clients. Out the 99 responses, 10 are physically challenged and they found that there is no consideration for facilities like ramps that can offer comfort for the clients in such conditions. The expectation of such customers is thus not fully met. The finding collaborates with Bassey (2011) who argues that the level of satisfaction is linked to the kind of expectation of customers and the actual service received. While taking biometric details, the physically challenged are meant to follow the queue just like the other able clients. This category of clients expects special considerations which is normally not the case. 30 of the 89 respondents have been at one time denied the visa on the basis of not providing the details of their grandparents on the visa application form. Some of the visa applicants have no information of the grandparents' details required in the visa applications forms. Such required information causes frustration to the applicants. The large amount of money required in the bank account complicates the small scale business individuals whose travel intention is business related agenda. Over 100 small enterprises in agribusiness and textile industries expressed concern on the inconveniences experienced while applying for business visas. 10 of these 100 respondents received their visas two weeks after the 2014 London business exhibition event, thus denying them the opportunity to participate in the business event.

The long duration taken in processing the visas is at times as result of large number of applicants that submit their visa applications late when it is few days to the London business exhibition as the case in point in chapter three of this report. The duration taken in processing of visas affect the level of satisfaction derived by customers. In some cases the delays are caused by missing information on the application forms. Though the staff receiving the visa forms needs to check and confirm that all the details are well captured. However, it is the responsibility of the staff to ensure that all the required information and detailed are well captured. If this is observed, then there will be few cases of delayed visa processing because of missing information.

## V. SUMMARY, CONCLUSION AND RECOMMENDATIONS

### 5.1 Summary of major findings

#### 5.1.1 Front Office Services

There were 10 respondents that reported errors on their visa documents and 101 agreed on the accuracy of documents in visa processing. The correction of the errors takes time and costly in transport and time for customers in making appointment to the British High Commission. Majority of respondents acknowledged inconsistency information from the back office on the visa processing. No clarity on the process after moving some

of the visa processing procedures from Nairobi to Pretoria in South Africa. There was no individual staff that would be dedicated to providing response and update to specific client after visa application is made to the office. According to respondents, there was no flexibility at the British High Commission in the service provision irrespective of the status of the visa applicants, for example the physically challenged make queue just like other able persons.

### **5.1.2 Back Office Services**

There was poor level of coordination and communication by the front office. The response is a reflection of the security officers at the pedestrian gate who are the first face of the British High Commission. The security team appeared not fully informed on the visa application processes and requirements. There was a mismatch of information between the front office and the back office on visa application and processing. There were unnecessary inconveniences made by the visa staff by not honouring the appointment time with customers. They keep on re-scheduling the appointment even at a short notice. Such changes affect the planning of customers as it involves transport arrangements as well as security clearance.

### **5.1.3 Virtual Office Services**

Regarding the virtual services, the respondents noted that they were not aware of consumer satisfaction surveys that offer opportunity for their feedback on the services offered. With the existence of virtual services, it is much easier for such perception surveys to be done through the web page and consumer money survey. The use of virtual services on technology is faced with connectivity challenges that can be improved with time. The incomplete information on the visa application greatly affects the finalisation of the visa. The delays experienced in the visa processing are therefore as a result of both the customers and the BHC staff in the visa department. A report generated from the consumer satisfaction surveys that outlines the improvement action plan could build level of confidence among the consumers.

### **5.1.4 Customer Expectations**

Customers expect to attain the required services at the visa department on time. Most of the clients make their visa applications with objective of getting it on time so as to make their travel arrangements on time. The actual expectation on getting visa processed on time is at times contrary to the actual outcome of the process. Delays reflect the inconsistency on their understanding about the entire process. If the expectation is not made, then the customers feel that the actual service delivery is a deviation from the norm in their understanding. The actual outcome in the post evaluation of the service may influence the consumers to adjust their expectations based on the satisfaction derived. The service provider may also improve the services offered to comply with the customer expectations.

## **5.2 Conclusions**

So far, throughout the literature and the actual findings, it becomes evident that customer service standards are required, as they assure quality and a framework for employees to work within. They also ensure that organisations can guarantee a

service is delivered consistently in a uniform fashion. The front office may not fully be informed on the services that are offered in the different departments especially within the diplomatic mission like the British High Commission (BHC). Since the first contact of the front office are the security team and the reception team that is more concerned with the general overview of the mission rather than the specific details of each of the departments. The detailed information is attained from the respective department.

All the departments i.e. back office, front office and virtual services are important in the provision of visa services at the BHC. All departments collectively contribute to the customer expectations and the final satisfaction that may be either desirable or undesirable. Customer satisfaction is directly linked to the performance results that can be visible within the organisation. The process of achieving and satisfying the expectations of consumers is as important as the actual satisfaction derived from the services. Improvement to the service delivery should be the underlying principle in an organisation that learns from the past and consumer feedback.

## **5.3 Recommendations**

### **5.3.1 Effect of back office services on customer satisfaction**

The back office services needs to be well communicated to the customers on the respective roles and the services provided in each department. Clarity on the engagement of the specific back office and its related contribution to the visa processing should be clearly illustrated on the website as well as the pamphlet and brochures. The back office significantly contributes to the attainment of customer satisfaction through fulfilment of their expectation.

There is need for annual open days within the BHC that creates opportunity for the mission staff to engage with the local public regarding the visa services offered and other related services that are available. This creates awareness and understanding on the visa application process as well as confidence building among the clients in making their requests.

### **5.3.2 Front office services on customer satisfaction**

Create a friendly security and informed team at the main entrance is helpful in providing the required information on the visa processing services. The security team should not have knowledge limited to the issues in their domain. More understanding improves their awareness on the visa services as well as other services provided by the British High Commission in Nairobi. A detailed pamphlet can be printed in hard copies for the visiting customers to read through on the processes involved as well as posting the same on the website in simple and clear language for easy understanding. The relationship between the Pretoria office in South Africa and the Nairobi office at the BHC should be demystified for proper understanding on the roles of each office in visa processing.

### **5.3.3 Virtual service on customer satisfaction**

Well motivated staff in virtual service contributes to effective response to clients needs. All the visa departments cultivate room for the effective service among the staff and pro-activeness in service provision. The use of civil service procedures is good though more discretion by the staff on case

by case is important in cases like the physically challenged customers as well as urgent requests for visa application. The motivation for staff could not necessarily be monetary but other benefits like equality between the United Kingdom based staff working at the High Commission and the locally engaged staff on a number of areas like maternity benefits of nine months leave and further education sponsorship aimed at improving the staff capacity.

### 5.3.4 Customer service expectations on their satisfaction

A systematic perception survey for the services in a periodic time frame should be initiated. The survey report should identify the areas of weakness and improvement plan to be in place, including the duration that the action points should be addressed. This creates confidence in the public due to the perception that their concerns are addressed.

### 5.4 Recommendation for future research and identified gaps in the study

There is need for front office service review on its role in the visa service processing with emphasis on securitisation of the service through the armed private security service officers standing at the main entrance as well as within the compound of British High Commission. The review should demystify the relationship between the security services and the actual primary role of front office services. The current operation gives the power to security team to deny entry to the compound even for clarification and seeking enquiries from the visa processing staff.

The study could not reach all the target population because of the different geographical location. The sampled respondents cannot generally be used to show the perception of all the past customers of the British High Commission. The study did also not consider the environment and the specific time when the visa application were sought by customers. Some of the visa delays could be linked to the period of terror attacks in Kenya. For security reasons, the details of applicants had to be checked thoroughly to ensure they were not terror suspects flying out of Kenya.

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# Empowering Women Mathematically for the Attainment of Millennium Development Goals

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**Abstract-** Goals can easily be set, but attainment has been a great problem. The Millennium Development Goals (MDGs) are eight goals set to be achieved by 2015. That corresponds to the world's main development challenges which are meant to improve people's lives. The attainment of MDGs has been a serious concern all over the world. This study looks into how empowerment of women mathematically could serve as a required tool to the attainment of the goals. The paper considers: the concept of women empowerment, mathematics and women empowerment, how women can be empowered mathematically, mathematics, women empowerment and the attainment of the Millennium Development Goals (MDGs). Conclusion was reached.

**Index Terms-** Mathematics, Women Empowerment, Millennium ,Development, Goals.

## I. INTRODUCTION

Every development is expected to lead to good change of the society which may be in terms of material assets, intellectual resources, physical necessities of life, employment, and participation in government, political and economic independence.

Mathematics involves much of solving life's problems, riddles and puzzle; there is no technology without science and of course no science without mathematics. It is the key to opportunities, contributes to direct and fundamental ways to business, finance, health and defence. For students, it opens doors to careers, as it enables informed decisions, for citizens, it provides knowledge to compete in a technological economy.

The role mathematics plays in any society is enormous. It is the bedrock of any national development. This can be seen in the National objectives of primary and secondary education which were spelt out at the Benin conference of 1997. These include:

- i. To lay a solid foundation for the concept of numeracy and scientific thinking.
- ii. To give the child opportunities for developing manipulative skills that will enable him function effectively in the society within the limits of his capacity.
- iii. To provide the basic tools for further advancement as well as prepare him for trades and crafts of his locality.
- iv. To build on the foundation of primary level so that the child can make a useful living professionally, economically, politically and socially.

- v. To generate interest in mathematics and to provide a solid foundation for everyday life.
- vi. To develop computations skills and to develop ability to recognize problems and to solve them with related mathematics knowledge.

There is then the need for every one to have mathematical attitude. These are those attributes, behaviors, responses or actions which are peculiar to mathematicians. Such behaviors include that people who are good at mathematics do things quickly and do a lot of work mentally, anxious to know, very eager to learn and do not rest until they have learnt. They are also persistent, self-confident and patient, skeptical, inquisitive, thorough, competent and resourceful. It is believed that if a teacher (woman) has all these attributes, her students (children) will imbibe some or all of these attributes.

In spite of the fact that the purpose of every development is to improve people's lives especially by their choices, freedom and dignity yet gender imbalance exists at all levels of education system (Emunefe and Oyetunde, 2009).

Gilmer and Milwauree (2001) in their work " An African American Perspective, on Developing women in mathematics, state that mathematically oriented minds, especially women prefer brief, orderly, concise presentations of materials or directions. According to Uka(2006), anxiety and self-confidence are related to achievement. It takes an experienced and self-confident teacher (woman) to help her students (children develop self-confidence in mathematics. A teacher (woman) that is self-confident will also pass it on to her students (children) and thereby positively affecting their achievement . A child who has confidence in himself, is likely to achieve higher in mathematics, and by extension in all aspect of life.

Women in order words should be mathematically strong which makes them empowered in order to be scientifically developed as to be able to achieve the MDGs.

The attainment of Millennium Development Goals (MDGs) has been the problem which occupied the attention of scholars, politicians, activists, development workers and international organizations. The MDGs are eight goals to be achieved by 2015 that respond to the world's main development challenges. MDGs was adopted by 189 nations and signed by 147 Heads of State and Governments during the Millennium Summit in September 2000.

The MDGs are:

- 1 Eradicate extreme poverty and hunger.
- 2 Achieve universal primary education.
- 3 Promote gender equality and empower women.
- 4 Reduce child mortality.
- 5 Improve maternal health.

- 6 Combat HIV/AIDS, Malaria and other diseases.
- 7 Ensure environmental sustainability.
- 8 Develop a global partnership for development.

## II. THE CONCEPT OF WOMEN EMPOWERMENT

Empowerment means moving from position of enforced powerlessness to one of power. It can range from personal empowerment that can exist within the existing social order. Thus this kind of empowerment would correspond to the right to make one's own choices to increase.

Women empowerment is the process by which women gain greater share of control over resources – maternal, human and intellectual knowledge, information, ideas and financial resources – and access to money and control over decision – making in the home, community, society and nation, and to gain “power”.

True women empowerment takes place when women challenge the existing norms and culture, to effectively improve their well being. In the feminist paradigm, empowerment goes beyond economic betterment and well-being, to strategic gender interest.

The empowerment of women is one of the central issues in the process of development of countries all over the world. Infact it is a global issue, that is why in September 2000 the millennium development goals (MDGs) was signed up at the United Nations in which the third goal was “promote gender equity and empower women.” The issue of gender equality and women empowerment are discussed in world conferences, national and international conferences, etc.

In order to give a fillip to empowerment of women, appropriate institutional mechanisms and interventions have been consciously built into the development design; separate institutions for women and child development, departments at the central and state levels, creations of the National Commission for women and also state commission for women in several states are some of the important developments for the betterment and prosperity of women.

Infact the government of India declared 2001 as the year of “Women's Empowerment”.

The year 1975 was proclaimed the international women's year by the United Nations General Assembly. The year was a turning point in that it put women's issues on the agenda.

The United Nations decade for women (1979-85) was a world – wide effort to examine the state and rights of women and to bring women into decision making at all level. In 1979, the General Assembly adopted the convention on the Elimination of all forms of discrimination against women, which entered into force in 1981 and set an international standard for what was meant by equality between women and men.

Nations like Egypt, the United State of America and the United Kingdom signed the convention on 16 July 1980, 17 July 1980 and 22 July 1981 respectively.

The fourth world congress on women, Platform for Action, held in Beijing in 1995 aimed at accelerating the implementation of Nairobi forward – looking strategies for the advancement of women, aimed at removing all the obstacles to women's active participation in all areas of public and private life through full

and equal share in economic, social, cultural, and political decision-making.

Nigeria is not left out in the effort to bring women into lime light. Several efforts have been made in Nigeria in the area of empowerment of women. In January 1995, the Ministry of Women Affairs and Social Welfare was created by the federal government. The aim had been to ensure effective implementation and mobilization of women and children to be supported for primary health care and other related issues that are peculiar to women and also to ensure their greater participation in national development as well as empower them politically, socially, and otherwise.

In fact the spouses of successive Heads of State and Government in Nigeria in order to improve the lot of women had several projects\ programmes which include:

Family Support Programme (FSP) by Maryriam Babangida, The Family Economic Advancement Programme (FEAP) of Maryram Abacha, Child Care Project of Stella Obasanjo, Anti-Prostitution and Human Trafficking by Titi Atiku Abubakar and the Women for Change Initiative of Patience Jonathan.

Even the Affirmative Action Bill which says that 35% of political post/seats should be reserved for women, Nigeria is only 8% compliant is also an avenue of empowering women.

## III. MATHEMATICS AND WOMEN EMPOWERMENT

There is no goal especially developmental goal (including MDGs) that cannot be achieved scientifically.

Researches have established that women play enormous roles in the area of mathematics which invariably leads to a good scientific inclination. Below are some of such researches.

Mwamwenda and Mwamwenda(1989) in their studies found that students of female teachers had significantly higher achievement score in mathematics and other subjects than male teachers. Similarly Ryan (1972) in Uka (2006) found that female teachers rather than male teachers were more effective in urban schools.

According to Stake and Katz (1982) cited in Krieg (2004), female teachers provide a more positive overall classroom atmosphere. The study conducted by Meier (2004) found that female mathematics teachers were positively associated with girls mathematics score in grade 7 and 8 on the exit examination. This study also found that there was little difference in mathematics examination scores in districts with female administrators, but mathematics in districts with female superintendents surpassed all other categories. The study concluded that for those seeking to increase girls' education benefits and mathematics scores, attention must be paid not only to the number of female teachers in the districts, but also to increase female representation among upper levels of the organization.

## IV. HOW WOMEN CAN BE EMPOWERED MATHEMATICALLY

Many factors are known to hinder the empowerment of women generally, particularly in mathematics. Among them include culture, ignorance, poverty, gender discrimination, high incidence of crime etc. This notwithstanding, there are measures

that can be employed in order to empower women mathematically. These include:

#### V. EDUCATION

Education of women is the most powerful instrument of changing their positions in the society. Education also brings about reduction in inequalities and also acts as a means to improve their status within the family. In order to encourage education of women at all levels, Indian government established schools and colleges and universities exclusively for women in the state, supplied books, boarding and lodging clothing for hostels, mid day meals, scholarships, etc. In other words, women should be educated to see the need to be mathematically oriented.

1. **Free Coaching Exclusively For Women Students.** Centers should be designated where women students should receive free coaching especially in mathematics and the sciences.
2. **Entrepreneurship Awareness, Development Training program:** This type of program will help bring out the talents of women and make them stand on their own. It will enable them see the roles mathematics plays in all facets of life especially in business.
3. **Capacity Building and skill information.** Government has to impart various types of mathematical training which is designed to not only promote self, but also wage employment.

#### **Mathematics, Women Empowerment and Attainment of Millennium Development Goals (MDGs)**

The National policy on Education (F R N, 2004) has spelt out that every Nigerian child shall have a right to equal educational opportunities. The efforts of Nigerian government in education have not yielded significant positive results on girls and women education (Akomolafe, 2010). Female enrolment dwindles as they move up the educational hierarchy (Onuebunwa, 2003), likewise, according to UNESCO (1996), empirical studies show that the number of women in Universities and research institutions drop at each stage of higher qualification. In the final analysis, only few women make science system both in research positions and in the science policy area. A recently concluded research by Iji and Uka (2010) shows that there are more male mathematics teachers than female mathematics teachers.

The statistics of Science and Technology enrolment of the Universities during 2004/2005 session shows that the males had 73% while that of female is 27% (Jamb, 2006).

According to UNESCO report (2006) cited in Akomolafe (2010), girls make up 60% of all out of school children and women represent two thirds of illiterate adults. Girls usually perform worse than boys in schools and that in some countries one in every four girls drops out before fifth grade. Roughly, 85% of boys' complete primary school compared to 76% of girls. Mathematics is the key to any development. Training (empowering) a woman is training a nation, so if the women are empowered mathematically the achievement of the MDGs is likely to be much easier

A sound mathematical knowledge will enable members of the society to have insight into the socio-cultural changes and control of the environment in which they live in (Eze, 2009). It is not a hidden information that the population of women /girls is more in number than that of men/boys.

This section discusses how empowering women mathematically can assist achieve the millennium development goals

#### **Eradicate Extreme Poverty and Hunger.**

When one talks about poverty in any nation like Nigeria, women are worst hit. Here, women and children trek a long distance in search of social amenities like water, firewood, coal etc, thereby wasting a lot of time they would have devoted to education. Fuel for cooking such as kerosene and cooking gas are reserved for the very few rich women while some of the domestics' facilities like pipe – borne water, electricity, kerosene, and cooking gas are not within the reach of an average Nigerian. Women and children are being subjected to hardship. Many women still live on menial jobs, and most jobs performed by women do not have economic values. All the work and activities that do not require financial reward are the responsibilities of women (Egunjobi, 2005).

Having seen the plight of the women, one can see with the researcher that women need not only to be empowered but to be empowered mathematically because of the drastic roles mathematics can play in this area.

When one has a gainful career job, poverty and hunger can be drastically reduced, if not eradicated. In any career and job opportunities in a technological society, a strong mathematical background is needed.

If women who are more in number and those low economically are empowered mathematically, the extreme poverty and hunger can be reduced if not eradicated.

To eradicate poverty and hunger we need to improve in our agriculture. An agriculturist cannot do without mathematics; he needs direct application of mathematics such as measurement of land or areas, average investment and expenditure, average return or income, cost of labor, time and work, seed rate, manure rate etc. Since women are involved more, if they imbibe the mathematical attitudes: persistence, patience, resourcefulness, thoroughness, etc, this goal can be achieved

#### **Achieve Universal Primary Education**

Examining the seven goals of primary education in the National policy of education in which one of them is to lay a sound basis of scientific and reflective thinking (FRN, 2004, P. 14), it is obvious that mathematics education is at the center; its actualization can be done through women. A sound basis of scientific and reflective thinking cannot be laid without a sound mathematical ability; this is why mathematics is made one of the core subjects in the school.

Generally if women are empowered it will go a long way in reducing child abuse. If women are empowered their children will receive more care and education. Naturally most children have more attachment to their mothers than their fathers. And if we must ensure that all boys and girls complete a full course of primary schooling, their mothers must be empowered educationally. The empowerment of such a mother is to be

mathematically for the scientific and reflective thinking to be achieved.

Moreover, in most primary schools in Nigeria especially public schools, there are more female teachers than male teachers. Unfortunately, most of them are not mathematically inclined, yet the class teacher teaches all the subjects including mathematics. So if these teachers, in particular female teachers and mothers, are mathematically empowered, universal primary education can be achieved.

#### **Promote Gender Equality and Empower Women.**

The issue on women empowerment is of a very paramount importance and that is why it became one of the MDGs. It is also an obvious statement that there is no MDGs that does not need mathematics and women. As earlier discussed in this section, statistics has it that few women are in sciences especially in mathematics. Moreover, Akuboiroh (1990) cited in Ogundele (2009) found that the fear for mathematics normally affect females more than male students. Females normally experience higher emotional instability than their male counterparts. The females are then discouraged from mathematics education, yet these are the people who constitute a significant size of the population. It is known that every development relies on science and technological careers, which cannot be successful without mathematics yet greater population (women) fear this queen of science. It then means that something must be done to really encourage girls and women to be empowered mathematically if promotion of gender equality and women empowerment should be achieved.

#### **Reduce child mortality, Improve maternal health, Combat HIV(AIDS), Malaria, and other Diseases**

Three of the MDGs relate to health and of course the health of any nation, especially a developing nation like Nigeria will definitely affect her development.

When one talks about child mortality, maternal health, HIV/ AIDS, Malaria, and other diseases women are more affected and involved. Mathematical knowledge will assist in reducing these health matters especially if the women who are affected and involved more are mathematically inclined. Infact a scientific nation has a lot to achieve, that is why Mangena (2006) states, "we need to be a nation of scientist not only because we are competing with other nations, but more importantly, because we need to be a nation of scientists so that we can fight enemies such as poverty, infectious diseases like HIV and AIDS, Malaria, or Tuberculosis, and lifestyle related illness such as malnutrition, obesity and diabetes. We need science to calculate and mitigate the effects of global warming, severe storms, over fishing pollution and a host of other problems.

#### **Ensuring Environmental Sustainability.**

There is no environmental issue that does not need mathematics, be it land scaping, erosion control, planting of trees and flowers, digging of wells or laying of pipe born water etc that does not need concept of mathematics such as distance, measurement etc.

The role of mathematics in any environment is enormous. Our environment has more women than men, if these women are

empowered mathematically; the achievement of ensuring environmental sustainability becomes more feasible.

#### **Develop a Global Partnership for Development.**

Two of the targets are; to provide cooperation with pharmaceutical companies, access to affordable essential drugs in developing countries; to make available in cooperation with the private sector, the benefits of new technologies especially information and communication technology(ICT). It may no longer be news to the generality of the people that health issues and ICT cannot be possible without mathematics. It has earlier been established that women are more involved in health issues and consequently they need to be more informed technologically. Therefore, if the women are mathematically empowered, it will be easier to achieve this MDG.

### **VI. CONCLUSION**

The problem of achieving any developmental goal has been a global challenge and that of millennium development goals have occupied the attention of the world leaders. The aim of any developmental goal is to improve the lives of its populace, so there is need to actualize the MDGs.

Considering the roles of mathematics and women in any developing nation like Nigeria, this paper strongly opined that empowering women mathematically is very vital for the attainment of MDGs.

To be able to achieve this, the following areas need to be seriously looked into

- Women to be integrated in all aspects of the development process
- Establishment of international network of women scientists and mathematicians
- Promote the education of girls and women of all ages in science ,technology and mathematics(STM).This can be done through awards and scholarship
- Promote knowledge and sponsor research on the role of women( especially mathematics based)
- Increase women's share of seats in national parliament and local government bodies to ensure that they can participate in decision- making on equal footing with men
- Invest in infrastructure to reduce girls and women's time burdens
- More awareness to be created.

When the aforementioned issues and their likes are dealt with, it will help in empowering women mathematically which invariably will facilitate the attainment of the millennium development goals.

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# Assessment of Solid Waste Management in IFE North Local Government Area, Osun State, Nigeria

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**Abstract-** This paper assessed the existing solid waste management in Ife North Local Government Area in Osun state, Nigeria. The study adopted Stratified random sampling as the research purposively divided the study population into three residential areas namely: Ipetumodu, Moro and Edunabon. A total of one hundred and twenty (120) respondents were sampled with the aid of a well-structured questionnaire. Descriptive statistics was majorly used to analyse data provided for the study. The descriptive statistics shows that house refuse/organic thrash has the largest source with 70.0% while hospital waste (90.2%) is least generated sources in ths study area. 60.0% of the respondents agreed that agency was involved in the collection/disposal of solid wastes while 29.3% supported sanitary land fills disposal system. Majority (88.9%) of the respondents claimed that involvement of solid waste management result in considerable reduction in solid waste and 40.0% of the agency worker supported that landfills are unable to control leachate, 58.0% of the citizens in the study area are educated on waste disposal. The study concludes that assessment of solid waste management in the study area revealed house refuse, street garbage, farm waste and human waste are the most common waste in study area and that landfills are unable to control leachate. The study therefore recommends the need for monitoring and evaluation of the waste management process which would help to identify problematic areas thereby proffering necessary solutions.

**Index Terms-** Solid waste management, Assessment, Monitoring, Leachate, organic , disposal

## I. INTRODUCTION

**S**olid Waste Management has remained an intractable environmental problem in Nigeria. This problem has manifested in form of piles of indiscriminately disposed heaps of uncovered waste and illegal dumpsites along major roads and at street corners in cities and urban areas. It has compounded by the rapid urbanization and population growth which led to the generation of enormous quantities of solid waste which are often discarded by open dumping. Rushbroke (1999) describes open dumping of municipal solid waste as a primitive stage of waste disposal, practiced by three fourths of countries and territories round the world. Open dumps are the major causes of environmental degradation and public health concerns in many developing countries including Nigeria. These waste dumps may

contain a mixture of general waste and toxic, infectious or radioactive wastes and are susceptible to burning and exposure to scavengers. According to Babanawo (2006), waste generation is greatly influenced by geographic and physical factors. These factors include: geographic location, season of the year, the use of kitchen waste food grinders, waste collection frequency and the characteristics of the service area.

There are a number of major risks and impacts of the dumpsites on the environment. For instance, air pollution from open burning, due to emission of greenhouse gases such as methane and carbon dioxide; the air emissions and leachates generated as a result of decomposition of waste may contaminate air, surface and groundwater sources; fire hazards and explosions cause public health risks as well. The emission of greenhouse gases, rats and fly infestation and nuisance effects are among health and environmental impacts of poor solid waste management. Scattering of wastes by wind and scavenging by birds, animals and waste pickers creates aesthetic nuisance. Malodorous emanating due to the degradation of waste in the dumpsites has nuisance effect and decreases economic and social values in the locality. In many dumpsites, the waste is directly increasing global concern over public health impacts attributed to environmental pollution, in particular, the environmental quality and human health risks associated with the waste dumps.

The World Health Organization estimated that about a quarter of diseases facing mankind today occur to prolonged exposure to environmental pollution. Unfortunately, there seems to be no clear cut guidelines at the national or state levels on how to deal with these dumpsites in a sustainable manner, particularly in the developing countries where ironically the burden of environmental pollution seems to be highest. Land filing has been the most common method of solid waste disposal generated by different communities for many years (Komils *et al.*, 1999). Three types of landfills are an integral part of most solid waste systems. These are the open dump, the semi-controlled landfill, and the sanitary landfill. The majority of urban centers in the developing world (including Africa) use open dumping as their principal disposal method (Rushbrook, 1999). This presents a host of problems as the open dumps expose people, animals and the environment to serious risks. Most local authorities seem not to pay adequate attention to the dumps, because they do not know better systems and what happens there is out of their sights. It is important to operate them efficiently as possible so as to mitigate any health and environmental disasters that may result from the neglect of waste dumps.

Provision of adequate sanitation and water facilities in urban areas is an important means of ensuring health and well-being of the people living in cities, as well as protection of the environment. Solid waste management has remained an intractable environmental sanitation problem in Nigeria. This problem has manifested in form of piles of indiscriminately disposed heaps of uncovered waste and illegal dumpsites along major roads and at street corners in cities and urban areas. This problem is compounded by the rapid urbanization and population growth without commensurate waste management facility which has led to generation of enormous quantities of solid waste which are often discarded by open dumping. In Nigeria, Waste disposal remains a contentious issue, and with no end in sight, refuse is dumped on roadways, pedestrian work ways or even dropped in drainages or streams and rivers. The situation is more alarming during the rainy season as water no longer flows freely along the gutters; it remains stagnant, creating the conditions for mosquito to breed and also the spread of vector borne diseases like malaria. The rapid rate of urbanization witnessed in most Nigeria cities contributed to high increase in waste generation which has outgrown the capacity to evacuate them. Onibokun and Kumuyi (1999) confirm that whenever urbanization gets out of control, it poses a big challenge to urban management and government, with waste management inclusive. The problem of urban waste management in Nigeria persists due to many factors which include the rapid rate of uncontrolled and unplanned urbanization of majority of our states. According to Onibokun and Kumuyi (1999) the government, at all levels have created various agencies to look into the problems associated with waste management practices but most of these agencies have been less functional. The local government, saddled with the responsibility of managing sewage and solid waste disposal (FGN, 1979) are often ill-equipped to perform due to inadequacy of funds. Private participation in waste management as also suffered a setback due to lack of manpower, funds and technical support.

Oyeniya (2011) assess Waste Management in Contemporary Nigeria: The Abuja Example. The research revealed that Nigeria's federal capital, rapid urbanization, rural-urban migration, little or no town planning efforts coupled with attitudinal irresponsibility, lack of political will, ineptitude and graft have independently and collectively created environmental challenge. As the study also found, that solid waste management has overwhelmed Nigerian government. He also notes that the spirited efforts to combat the problem, which began, from Abuja in 1999 under President Olusegun Obasanjo regime has since been relaxed under President Sheu Musa Yar'Adua, the then President of Nigeria. Similarly, Ezeah (2010) explores the Analysis of Barriers and success Factors Affecting the Adoption of Sustainable Management of Municipal Solid Waste (MSW) in Abuja, Nigeria. The data analysis of his research reveals that the main barriers to sustainable MSW management in the city include low public awareness/education on MSW management, obsolete and insufficient equipment and funding limitation. On the other hand, the most important success factor affecting sustainable MSW management in Abuja was found to be burgeoning city population which has a huge potential for uptake of recycled products. The research concludes that the factor affecting MSW management in Abuja is typical of many tropical urban environments. Fundamental shifts in current

practices towards waste prevention; driven by a structured public education programme in MSW management is recommended, so as to bring about a more sustainable management regime. In addition, Ayoola *et al* (2012) wrote on Assessment of Housing Sanitation and Waste Management Practices in the Residential Core Areas of Oshogbo, Osun State Nigeria. The paper examines sanitation and waste management practices in the residential areas of Osogbo city, with a view of improving housing supply and sanitation to meet the millennium development goals (MDGs) on water and sanitation. It investigates the core areas of Osogbo which consists of Oja-Oba, Ita Olookan and part of Ayetoro. They noted that good environmental condition and livability of these settlements are affected partly by inadequate of infrastructural facilities which is a major factor that determines the level of sanitation and that the government should ensure that existing laws and regulations guiding environmental sanitation and health be reviewed and also enforced with stiffer actions in order to make it more effective. More so, they recommended that in order to avoid or minimize waste dumps, some strategies such as more frequent collection of waste could be implemented, while continuous educational campaigns informing the disadvantages of a dirty area is also an important way of motivating people to keep the community clean and this may reduce the dumping problem.

In Osun state, where Ife is situated several attempts have been made to improve on proper solid waste management and sanitation in the State. These efforts consist of the mandatory sanitation which takes the last Saturdays of every month. Acquisition of the waste disposing vehicles by the government which will be going through the state to collect household waste, construction of boreholes by government, organizations and individuals, channelization of major rivers among others. Despite these efforts, the problem of waste management still exists. This poor waste management and sanitation has a lot of implications for sustainable urban development. However to be able to achieve the MDGs target that intends to halve the population of people without safe and basic sanitation in Africa, there is need for a better and richer understanding of existing waste management and sanitation services situation, especially in relative to rapid rate of urbanization witnessed in Sub-Sahara African countries.

The city of Ife is one of the cities which need to improve its waste management and sanitation infrastructure, since the existing ones are not environmentally friendly and does not provide its citizen with adequate services. Appropriate waste management plays an important role towards promoting a sustainable urban development within human settlements, with that in mind, and knowing that in most developing countries, the highest urban population growth rates occur in the low-income areas, Ife will require heavy investments in the installation of wastewater management systems both social and technical, to meet the MDGs, target for water and sanitation. Consequently, this paper seeks to assess the existing waste management and sanitation in Ife North Local Government Area (LGA), Osun State, Nigeria with the view to realizing MGDs safe water and sanitation target in 2015. The specific objectives however are to:

1. identify sources of solid waste in Ife North LGA;
2. examine the activities of solid waste management agencies in the LGA;

3. assess the effect of solid waste disposal in Ife North LGA;
4. determine the performance of Ife North LGA in solid waste management

## II. MATERIALS AND METHODS

**Study area:** Osun state is one of the six states that make up the South West geopolitical zone of Nigeria. It has interstate boundaries with Ondo State to the southeast, Kwara State to the north, Ekiti State to the northeast, Oyo State to the west, and Ogun State to the southwest. Its capital is Oshogbo. Ife North is a Local Government Area in Osun State, Nigeria. Its headquarters are in the town of Ipetumodu in the north. It has an area of 889km<sup>2</sup> and a population of 153,694. The following towns make up this LGA- Edunabon (1&2) Moro, Yakoyo, Ipetu (1&2) and Ashipa/Akinlalu.

**Sampling procedure and sample size:** The study population for this research was the waste generators (the residents, business and shop owners within Ife North LGA) and employees of relevant waste management agencies in the Local Government. The Ife north central LGA was divided into three areas (Ipetumodu, Moro and part of Edunabon) of residential development based on the pattern of city growth. In selecting the respondents, every third house was picked along each street or lane in the core. Two household heads were sampled in every house selected. This meant that twenty (20) houses were selected and forty (40) household heads were sampled in each residential area. Consequently, a total of one hundred and twenty (120) respondents were sampled. Besides, thirty (30) wastes management staff was also sampled. Also, Six (6) selected officers of relevant waste management agencies were interviewed. In sum, the sample size – this includes the respondents of the questionnaire, who are the residents of selected areas and the staff in the Department Environmental Sanitation and Waste management unit and the interviewees.

Stratified random sampling was adopted in this study as the research purposively divided the study population into three residential areas namely: Ipetumodu, Moro and Edunabon. Data were gathered from each of these stratified areas. The study areas were selected because they are central to the heart of Ife North LGA and have experienced expansion due to steady population increase in this semi-urban LGA. The questionnaires were administered to the residents who are the waste generators while the randomly selected workers of the waste management agencies were the interviewees, however, personal observation was carried out in the survey areas.

**Analytical procedure:** Descriptive statistics was majorly employed in analysing the data collected using frequencies and cross tabulation of variables. Tabular presentation, summation and percentages are the data presentation tools this adopted for analysis in this study. Percentages express the ratio of sets of data to a common base of 100.

## III. RESULTS AND DISCUSSION

### Sources of Solid Waste in Ife North Local Government Area (LGA)

The sources of solid waste in Ife North LGA were presented in Table 1. It was observed that house refuse/organic thrash in large source was (70.0%) and small source was (18.0%) respectively, it shows that house refuse exists as a source of waste product in the LGA. Majority of the respondent responded that the house refuse is one of the solid waste product generated in the LGA and it is being managed by the agency. Considering the response on industrial wastes, large source was (28.2%) and small source was (59.0%) respectively. Therefore, it is apparent that industrial waste is of a small source in Ife North LGA. It was also recorded that respondents agrees that poultry dumps is generated in smaller quantity compared to house refuse/organic thrash. It can also be observed from Table 1 that Hospital waste (90.2%), Electronic Waste (75.7), Industrial waste (59%), Constructive waste (60.5%) and Poultry dump (56.8%) are generated by the respondent (waste generator) in smaller quantity compared to the other sources of solid waste management which are generated in larger quantity such as: House refuse (70%), Street garbage dumps (58.4%), Farm waste (54.2%) and Human waste (46.5%). The reason why house refuse, street garbage dumps, farm waste and human waste are in larger quantity compared to the other sources of solid waste is that Ife North LGA is a rural area and there is no availability of big companies and establishments and there are also more residential areas, small scale industries and sole-proprietorship outlets. Besides the citizens are also involved in agriculture either as subsistent or commercial farming and hence it is expected that farm waste/poultry dumps will be generated. Also lack of basic infrastructures such as toilet facilities and incinerators also contributes to the large source of human waste littering on the streets in Ife North LGA.

**Table 1**  
**Solid Waste Management in Ife North Local Government Area LGA**

Solid waste management in Ife North LGA was presented in Table 2. It was observed from the study that out of the whole respondents (100%), substantial number identifies that there is a waste collection point in their neighbourhood where agency collects and transfers their solid waste. This is deducible if we consider the total percentage (60.0%) of respondent that agreed to a very large extent and their response showed that agency was involved in the collection/disposal of solid wastes in LGA. Furthermore, on private enterprises involvement in waste collection and transportation, only 16.7% agrees that that private enterprises are involved in the disposal of solid waste in the community. On the contrary 75.0% disagrees on the fact that private enterprises involves in the collection and transportation of solid waste which is far below the average percentage. From this, it can be said that the private sector participation in solid waste collection, transportation and disposal may not have been adequately encouraged in the community which may partly hinge on the fact that either private sectors are granted with limited right to involve in waste management or there is inability on the part of the various communities in Ife North LGA to pay private waste collecting companies/agencies. Also, 30.6% of the waste generators identified that the local government has maintained a good solid waste collection and disposal system which should aid the activities of the unit-Water and Environmental Sanitation unit

(WES). While 61.2% on the other hand claim that the local government has not maintained a good solid waste collection and disposal system. It is then obvious that majority of the respondents (the waste management staff and the waste generators) do not support the fact that local government runs a pleasant system of waste collection. Similarly, the majority of the respondents supported that there are open dump waste collection/disposal system (63.6%), landfills waste collection/disposal system (29.8%) and sanitary land fills disposal system (29.3%). it can be conclude that the local government area mangages an open dump waste collection system compared to all other management system. Lastly, it was observed that (84.6%) of the respondents agreed that incinerator usage is the least common waste management while on the other hand (5.1%) supported the most common usage of incinerator as a waste management system in Ife North LGA. The reason behind this is that the local government did not provide enough incinerators for the local government and the few ones provided are not well managed by the community members. However, the respondents also identified other means of solid waste management in Ife North LGA. Other means identified and practised by the respondents are open burning, control tipping and efforts of the sanitary inspection officers among other.

**Table 2**  
**Effect of Solid Waste Disposal in Ife North Local Government Area (LGA)**

The effect of solid waste disposal in Ife North LGA is presented in Table 3. The Table contains questions that are intended to assess both the negative and the positive effects and outcomes of solid waste disposal in Ife North LGA. The majority (88.9%) of the respondents claimed that involvement of solid waste management result in considerable reduction in solid waste while 11.1% disagree to similar claim. It was also observed that 80% of respondent agreed, 11% disagreed and 8.9% were undecided on the fact whether waste management creates job opportunities for unemployed youths in the community. It shows that management of solid waste in Ife North LGA creates employment for youths in form of 'Meshara' (a local name for cart pusher) and also labour is being employed in the Water and Environmental Sanitation (WES) unit in Ife North LGA. Also, the respondent pointed out to the fact that management of solid waste has health implication for residents in terms of odorous smells/diseases/health problems in the neighbourhood posed from nearby waste dumpsites or as a result of inappropriate waste management, therefore 75.0% of the respondent agreed, 20.0 % disagreed and 4.5% were undecided. The percentage that claimed that waste disposal has health implication for the resident was more. We can conclude that solid waste disposal in some cases if not properly managed affects the healthy living of the people. Another larger percentage of the solid waste agency workers also responded that the activities involved in collection and transfer of solid waste seems to have implication for the waste collectors. 62.2% agreed, 17.8% disagreed and 20.0% were undecided. Hence, the local government or its agencies are expected to provide adequate medical and preventive gadgets for the workers to encourage their efforts. Larger percentage also noted that inadequate waste disposal infrastructures in the LGA (57.9%) and poor environmental regulations (52.8%) are part of the

effects of solid waste disposal in Ife North LGA. It can be said then that inadequate waste disposal infrastructures in the LGA and poor environmental regulations can inhibit effective performance of the solid waste management activities and increase solid waste rather than its reduction. Finally, on the effect of solid waste in Ife North LGA, preponderance (40.0%) of the agency worker supported that landfills are unable to control leachate. Leachate is the liquid that has percolated through solid waste and has extracted, dissolved or suspended materials. In most landfills, leachate is composed of the liquid that has entered from external sources such as surface drainage, rainfall, groundwater, water from underground springs and the liquid produced from the decomposition of the waste. Its lack of control is detrimental because uncontrolled release of leachate may migrate down to underlying groundwater or to surface water. Health and environmental concerns associated with landfills are supposed to be managed through control of leachate but leachate is not controlled and managed in Ife North LGA. There are perhaps no measures to prevent leachate from percolating into the underground water take for instance lining the landfill at the construction stage.

**Table 3**  
**Performance of Ife North LGA in Solid Waste Management**

The residents who received the impact of the services rendered by the agency of solid waste management are in the best position to evaluate the success or failure of these services. The performance of Ife North LGA in solid waste management is presented in Table 4. This table comprises responses to some hypothetical questions intended to assess the performance of Ife North LGA in solid waste management. It can be observed that the only aspect that Ife North LGA has good performance is the education of the citizens on waste disposal (58.0%). In other areas evaluation it was observed that the respondents noted that the local government organises expansion recycling programs (30.8%), prompt disposal of waste from dump sites (26.0%) and the provision of clothes and gloves for workers (29.5%). All others have been scored low by these citizens and this revealed bad performance by the waste management agency; no provision of waste bins (79.2%) agreed to that, no modern waste disposal method adopted (87.2%) agreed with this, the old maintenance systems have been nelegected and no further efforts have been made to alleviate the situation (60%) agreed. In conclusion, it can be deduced that the performane of Ife North LGA in solid waste management is poor and inefficient.

**Table 4**  
**Summary**

This study was carried out to assess management of solid waste in Ife North LGA in Osun State, Nigeria. The study identified the sources of solid waste management in the study area. It was observed that house refuse/organic thrash has the largest source with 70.0%. Also, street garbage dumps (58.4%), farm waste (54.2%) and human waste (46.5%) are other sources of solid waste in the LGA generated in large quantity. Hospital waste (90.2%), Electronic Waste (75.7), industrial waste (59%), constructive waste (60.5%) and poultry dump (56.8%) are generated by the respondents in smaller quantity compared to the other sources of solid waste management which are generated in

larger quantity. Also, considering different solid waste management systems in the study area, 60.0% of respondent agreed that agency was involved in the collection/disposal of solid wastes, 16.7% agreed that that private enterprises are involved in the disposal of solid waste in the community, 30.6% of the respondents also maintained that the LGA has a good solid waste collection and disposal system. Similarly, the majority of the respondents supported that there are open dump waste collection/disposal system (63.6%), landfills waste collection/disposal system (29.8%) and sanitary land fills disposal system (29.3%). Considering the effect of solid waste disposal on the respondents in the study area it was observed that majority (88.9%) of the respondents claimed that involvement of solid waste management result in considerable reduction in solid waste, 80% of respondent agreed that waste management creates job opportunities for unemployed youths in the community, 75.0% of the respondent also claimed that waste disposal has health implication for the resident, 62.2% of the solid waste agency workers also responded that the activities involved in collection and transfer of solid waste seems to have implication for the waste collectors. Larger percentage also noted that inadequate waste disposal infrastructures in the LGA (57.9%), poor environmental regulations (52.8%) are part of the effects of solid waste disposal in the study area. Finally, (40.0%) of the agency worker supported that landfills are unable to control leachate. In terms of the performance of Ife North LGA in waste management it can be observed that the only aspect that the study area has good performance is the education of the citizens on waste disposal (58.0%).

#### IV. CONCLUSION

It can thus be concluded from the study that assessment of waste management in Ife North LGA revealed that house refuse, street garbage, farm waste and human waste are the most common waste in the study area. Alarming hospital waste generation in the area calls for a proactive attention and good management practice because of the nature of such waste –they are toxic and could be carcinogenic, mutagenic and neurotoxic. Leachates from such into water bodies should be mitigated to safe the public. Moreover it was also discovered that decomposed wastes are not effectively managed. Open dump waste disposal system and neighbourhood level collection point are the most effective and efficient method of solid waste management. The local government solid waste agency does not collect and transport waste promptly from dumping sites in their neighbourhood. This was due to inadequate modern means of waste collection. It was observed that the disposal of solid waste in the LGA is poor in spite the efforts of the solid waste agency. Also, the activities of solid waste management to a large extend results to a considerable reduction in waste disposal. Although there are very few waste disposal infrastructures in the LGA, they are not adequate. This prevents effective performance of the solid waste management activities. Leachate is not controlled and managed properly in the LGA. There are perhaps little or no measures to prevent leachate from percolating into the underground water. Landfills and waste disposal sites are not actually well managed in the LGA. Ife North Local Government waste management hardly has or provides recycling programmes.

#### In the light of the forgoing conclusions, the study therefore has the following recommendations

1. The need to assess underground and surface water quality around the so called landfills where human lives or that are nearer to residential areas is a necessity since the community mainly rely on landfills, this will go a long way to help both the individual and government regulate well digging and to what use water can be put in the area
2. There is need for the monitoring and evaluation of the waste management process, this would identify problematic areas and help in finding solutions
3. Government effort should be intensified in areas of awareness campaigns, provision of equipment and personnel in removing solid wastes as well as ensuring compliances with existing environmental laws.
4. Public awareness and attitudes to wastes can affect the population's willingness to participate and cooperate in adequate waste management practices. The population needs to be reminded time and again of the importance of environmental awareness and the health risks associated with poor waste management practices. Residents and dumpsite users should realize the importance of waste management services.
5. The local government needs to realize that open dumping remains the most viable option in solid waste disposal, due to its affordability. However, in its current forms of operation it is not sustainable and dumping should be regulated. There is an urgent need to improve the open dumping system. It may be necessary to upgrade it to semi controlled landfills to reduce infiltration of leachate to ground water. The waste should be covered with soil on a regular basis to prevent diseases, vectors, such as flies from getting to the waste. This would reduce the amount of odor that is released from dumpsites.
6. Resources recovery and recycling activities should be encouraged and supported by local authorities and companies who ultimately use the recovered materials. This will provide employment for the collectors/scavengers.
7. Environmental laws and regulations in Ife LGA should be enforced. Government should reinforce waste collection and disposal systems in every state while strengthening and enforcing the appropriate laws to prevent serious environmental disaster in Nigeria, priority should be given to waste management.

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Tables

**Table 1: Sources of solid waste in Ife North LGA**

Sources of solid waste	Largest Source (%)	Smallest Source (%)	Not Really (%)	Total (%)
House refuse/Organic thrash	70.0	18.0	12.0	100.0
Industrial waste	28.2	59.0	12.8	100.0
Poultry dump/litter	31.9	56.8	11.4	100.0
Electronic Waste	10.8	75.7	13.5	100.0
Hospital/medical/garbage	4.8	90.2	5.0	100.0
Construction Waste	23.7	60.5	15.8	100.0
Human Waste	46.5	46.5	7.0	100.0
Organic/Farm Waste (vegetable materials)	54.2	35.4	10.4	100.0
Street Garbage Dumps	58.4	25.0	16.6	100.0

Source: Field Survey, 2014

**Table 2: Solid Waste Management in Ife North LGA**

Management of Solid Waste	Most Common Waste Management (%)	Least Common Waste Management (%)	Not Sure (%)	Total (%)
Neighbourhood Level Collection Point	60	30	10	100.0
Private Enterprise waste transportation and disposal	16.7	75.0	8.3	100.0

Local government Waste collection and Disposal	30.6	61.2	8.2	100.0
Landfills waste collection/disposal system	29.8	40.5	29.7	100.0
Open dump waste collection and disposal system	63.6	31.8	4.6	100.0
Sanitary land fills waste disposal system (waste allowed to decomposed)	29.3	58.5	12.2	100.0
There is incinerator in the local government used in waste management	5.1	84.6	10.3	100.0

Source: Field Survey, 2014.

Table 3: Effect of Solid Waste Disposal in Ife North LGA

Effect of Solid Waste Management	Total Agree	Total Disagree	Undecided	Total (%)
Health implication for residents	75.5	20.0	4.5	100.0
Employment generation for the unemployed youth	80	11.1	8.9	100.0
Air pollution for residents	65.7	21.1	13.2	100.0
health implication for waste collectors	62.2	17.8	20.0	100.0
It result in solid waste reduction	88.9	11.1	0.0	100.0
poor safe disposal infrastructure in the LGA	46.1	30.8	23.1	100.0
Inadequate waste disposal infrastructure in the LGA	57.9	26.3	15.8	100.0
Poor environmental regulations	52.8	30.6	16.6	100.0
Inability of landfills to control leachate	40.0	37.1	22.9	100.0

Source: Field Survey, 2014

**Table 4: Performance of Ife North in Solid Waste Management.**

	<b>Good Performance (%)</b>	<b>Bad Performance (%)</b>	<b>Indifferent (%)</b>	<b>Total (%)</b>
Rapid collection of waste from dump sites	26.0	60.0	14.0	100.0
Efficient and effective in solid waste disposal	14.0	60.0	26.0	100.0
Adequate management of disposal and landfill sites	18.4	73.5	8.2	100.0
Provision of waste collection bins	14.6	79.2	6.3	100.0
Provision of clothes and gloves for workers	29.5	63.6	6.8	100.0
Education of citizens of the LGA on waste disposal	58.0	34.0	8.0	100.0
Expansion of recycling programmes	30.8	56.4	12.8	100.0
Provides organized refuse collection	14.9	66.0	19.1	100.0
Modern means of waste collection	4.2	87.2	8.5	100.0

**Source: Field Survey, 2014.**

# Gartner Research Reviews on Middleware

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**Abstract-** Middleware becomes a strong research area. The reason is the ability of middleware technologies to solve all the integration problems in an enterprise. This technology combined with other technologies can solve pressing problems for mankind.

**Index Terms-** Middleware, Integration, PreSales, Request for Information, Request for Proposal, Gartner Studies

## 1. Gartner views on Worldwide Application Infrastructure and Middleware Market Revenue

Gartner study says "Application infrastructure and middleware projects increasingly span on-premises, cloud and external business partners," said Fabrizio Biscotti, research director at Gartner. "The impacts of using multiple delivery models, increased reliance on governance technologies, and convergence of application and data integration requirements are driving organizations to sustain significant investment in AIM technologies and skills."

"Cloud computing is increasingly becoming mainstream and gaining traction in the market. Middleware vendors should leverage their expertise to offer competitive cloud services in addition to on-premises software products," said Mr. Biscotti, Research Director at Gartner. "Although the transition from on-premises to cloud computing will take an extended period of time, the demand for hybrid use of platform technologies is present now, and is projected to grow rapidly during the next two to four years. End users can judge the long-term viability of a platform as a service (PaaS) provider in part by its ability to attract independent software vendors (ISVs) and other partners into its ecosystem."

Several segments showed a double-digit growth rate including application servers, where the performance of application PaaS vendors has been strong. Service oriented architecture (SOA) governance technologies, portal products and user interaction tools also performed well.

"Business process management (BPM) suites continued to grow at a sustained pace as some providers are evolving their offerings into next-generation application infrastructure platforms that Gartner defines as iBPMSs. These platforms address the growing need to account for social interactions, mobility and decision management in the process management context," said Mr. Biscotti, Research Director at Gartner.

## 2. Gartner Magic Quadrant for Application Infrastructure for Systematic Application Integration Projects

Enterprises need functionality that ranges from basic robust messaging to advanced support for B2B that can be applied to application integration. We examine vendors whose products address the needs of systematic A2A, B2B and cloud-to-on-premises application integration projects.

The objective of data consistency integration is to make data across all applications consistent. For example, if a customer changes a billing address in a CRM application, that event is pushed out to other applications (such as accounting, billing and ERP) so that the applications can update their databases with the current data.

The development of composite applications is growing rapidly as organizations seek to leverage established assets (including the services created using service-oriented architecture [SOA]), and to minimize the amount of new code that must be developed and maintained.

This Magic Quadrant emphasizes the product capabilities most relevant to projects that have as their primary objective applying the above styles to:

- Integrate applications deployed on-premises and externally (i.e., at trading partners or in the cloud, e.g., as software as a service [SaaS]).
- Create business services and business object services using existing assets.

These projects deliver increased cohesion and unified access to all types of resources, including packaged applications, legacy applications, and applications that are new and custom-designed. When evaluating products to meet these requirements, an important goal of systematic application integration projects is to acquire as many technical capabilities as possible from one vendor.

To succeed in the modern business computing environment, organizations must have the flexibility to experiment and innovate, while preserving the overall integrity and quality of service of their core systems. To achieve this, most enterprises are engaged in two kinds of projects:

- Systematic projects: These are designed to advance core, enterprise-computing capabilities.
- Opportunistic projects: These are projects with a less-formal approach to design, review, testing, documentation, etc.

The product and vendor evaluations in this Magic Quadrant can be used to select products for both project types, but the evaluation criteria are most heavily weighted toward supporting systematic projects, because these projects require a more

comprehensive set of product features that best reflects the vendors' ability to provide and support enterprise application infrastructures for larger, more demanding IT projects.

### 3. Magic Quadrant for Application Infrastructure for Systematic SOA Infrastructure Projects

The deployment of an infrastructure, shared across multiple applications and enabling interoperability and governance, is vital for service-oriented architecture initiatives. We assess application infrastructure middleware vendors providing support for the implementation of this infrastructure.

When organizations develop their service-oriented architecture (SOA) application infrastructure, the choice of SOA containers and other SOA capabilities is, in some cases, made upfront in the life cycle of an SOA initiative, especially when it comes to selecting a comprehensive set of components to address multiple and related systematically oriented SOA applications. However, this selection is often done in the context of specific projects, driven by a variety of technical and local convenience considerations.

Increasingly, the choice of technologies and products aimed at supporting the implementation of the SOA infrastructure for the whole initiative is done "once and for all," because the resulting platform is, almost by definition, shared among all the SOA application projects in the enterprise (or in a specific SOA domain). Therefore, the process of defining the SOA infrastructure architecture, selecting, integrating, implementing and deploying suitable products is a key enabling project in most large-scale SOA initiatives, and must be pursued with systematic rigor.

Such a project may be kicked off after the organization has successfully implemented multiple stand-alone SOA application projects, as long as it realizes that a common infrastructure, shared across established and future SOA applications, would be most cost-effective and more manageable. However, a systematic SOA infrastructure deployment project increasingly precedes every SOA-style application project, because it is intended to provide an infrastructure that all the SOA application projects framed in that particular initiative will share.

In the early days of SOA adoption (circa the mid-1990s), the SOA infrastructure was implemented by leading-edge organizations by aggregating products from multiple vendors, often complemented by significant custom developments (for example, many early SOA adopters custom-developed their own

SOA registries/repositories). The advent of Web services in the early 2000s created a standard foundation for SOA, which fostered industry excitement. Therefore, many vendors — both established and startup — developed specific products for SOA infrastructure, and several can now provide the full set of capabilities, either as integrated suites or collections of related products. Because SOA has entered a phase of widespread adoption, mainstream organizations, traditionally reluctant to deal with too many vendors, now look at single sourcing their SOA infrastructure technology from one strategic vendor.

### CONCLUSION

Based on the research reviews, middleware professionals can help customers and product companies to understand, get the requirements and use their competencies to build a framework for suggesting the successful architecture using middleware technologies. The previous article on middleware presales and this current one along with case study approach will pave way for arriving at the framework for middleware presales consulting.

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# Solar Energy and Its Future Role in India and Iran

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**Abstract-** There are various factors such as negative impacts on environment, increasing in fossil fuels prices, limitation of fossil fuel resources which have made many energy and environment experts and politicians move toward the development of a modern structure to secure supply of energy, environment protection. Therefore, most countries have begun to realize that the need for sustainability in energy production and consumption is significantly vital. Therefore, tracking the progress of sustainability is essential.

Solar Energy is a clean renewable resource with zero emission. Most of the developed countries are switching over to solar energy as one of the prime renewable energy source.

The National Solar Mission is a major initiative of the Government of India and State Governments to promote ecologically sustainable growth. It will also constitute a major contribution by India to the global effort to meet the challenges of climate change. The study is motivated by the need to transform the basis of energy systems from fossil fuels to renewable sources.

Moreover, regarding the increasing rate of the population, solar energy can play a serious role in sustainability of environmental issues as a renewable energy.

The objective of present study is concentrate on role, situation and developing solar energy in India and Iran to recognize the Investment and Potential Opportunities in society and economic for achievements of sustainable energy.

**Keywords:** Solar Energy, fossil fuel resources, clean renewable resource, Iran, India.

## I. Introduction

Energy is the prime mover of economic growth, and is vital to sustaining a modern economy and society. Future economic

growth significantly depends on the longterm availability of energy from sources that are affordable, accessible and secure. (ICLEI South Asia, 2007) .

A public concern over the environmental consequences of greenhouse gas emissions from fossil fuels, increasing trends in use of renewable energy sources became an important energy policy target in most parts of the world. Use of renewable energy sources can reduce the speed of global warming and serious impacts of climate change from burning fossil fuels. Renewable energy is derived from sources that are being replaced by nature, such as water, wind, solar or biomass (Hiremath, R.B., B. Kumar, P. Balachandra & et al, 2009). Renewable energy sources are the fastest growing energy source in the world and various projections indicate that these resources will have huge contribution in the future (Amer, M. and T.U. Daim, 2011; EIA, 2009; Jefferson, M., 2006).

The concept of sustainable development (SD) was adopted by the World Commission on Environment and Development. There is agreement that SD involves a comprehensive and integrated approach to economic, social and environmental processes (Karakosta, C. and D. Askounis, 2010; WCED-World Commission on Environment and Development, 1987). A sustainable development approach aims to deliver services that meet basic human needs, but in a cleaner and more efficient manner that can be sustained for long term (Winkler, H., 2007).

Greenhouse gases and CO<sub>2</sub> have risen to the top of the list of the energy sector's environmental impacts, as the source of human-made climate change which the main CO<sub>2</sub> emissions are because of the combustion of fossil fuels to provide energy in transportation sectors.

## Solar energy:

Solar energy is the most abundant energy resource and it is available for use in its direct (solar radiation) and indirect (wind, biomass, hydro, ocean etc.) forms. About 60% of the total energy emitted by the sun reaches the Earth's surface. Even if only 0.1% of this energy could be converted at an efficiency of 10%, it would be four times larger than the total world's electricity generating capacity of about 5 000GW.

The use of solar energy is growing strongly around the world, in part due to the rapidly declining solar panel manufacturing costs (World Energy Council, 2013). Solar energy is cited as a clean alternative to fossil fuels. Solar panels generate energy without producing ambient pollution. It is a clean renewable energy and green energy source. The important advantage is related to the reduced CO<sub>2</sub> emission and air pollution prevention to the environment, it is a method for producing energy which also has some economic benefit. Solar energy allows human to generate energy in cheap way. (Hafshejani, M. K., Baheri A., Ojakeh M. & et al, 2012)

Solar energy applications have the wide area. One of the most important areas is the generation of electrical power (Sukhatme S., 1997). Some of these applications are such as solar desalination using, solar heat, solar still method, solar water heating pipes and solar space heating and cooling (Badran O O., 2001).

## **Methodology**

This study is conducted with qualitative method. Information is acquired through defining the advantages and limitations based on the overviews from solar energy along with literature review and investigate the related issues of solar energy and studied some cases of current solar energy in India and Iran and finally create a guideline toward solar energy.

## **Qualitative Research**

Qualitative research is the most common approach for collecting raw data in explorative research projects, whereby researchers are either trying to identify a business problem/opportunity or simply collecting required information to

obtain preliminary insights in an unexplored field of research. Moreover it is a tool to develop (Hair, Busch, & Ortinau, 2000).

The main advantage of qualitative research compared to quantitative research is that it is more economical and less time-consuming due to the reduced sample size used. Furthermore, detailed data on personal attitudes, emotions, perceptions and beliefs concerning the research topic can be collected and actual behavior can be investigated and recorded (Hair, Brush & Ortinau, 2000).

Whereas journals and articles was constituted the source for secondary data for the research.

## **II. Research Elaborations:**

### **1. India's Scenario:**

India was the fourth-largest energy consumer in the world after China, the United States, and Russia in 2011, and its need for energy supply continues to climb as a result of the country's dynamic economic growth and modernization over the past several years.

Primary energy consumption in India has more than doubled between 1990 and 2012, reaching an estimated 32 quadrillion British thermal units (Btu). The country has the second-largest population in the world, at more than 1.2 billion people in 2012, growing about 1.3% each year since 2008, according to World Bank data. At the same time, India's per capita energy consumption is one-third of the global average, according to the International Energy Agency (IEA), indicating potentially higher energy demand in the long term as the country continues its path of economic development. In the International Energy Outlook 2013, EIA projects India and China will account for about half of global energy demand growth through 2040, with India's energy demand growing at 2.8% per year.

India's largest energy source is coal, followed by petroleum and traditional biomass and waste. Since the beginning of the New Economic Policy in 1991, India's population increasingly has moved to cities, and urban households have shifted away from traditional biomass and waste to other energy sources such as hydrocarbons, nuclear, biofuels, and other renewables. The power sector is the largest and fastest-growing area of energy

demand, rising from 22% to 36% of total energy consumption between 1990 and 2011, according to the IEA. India's National Sample Survey Organization estimates that about 25% of the population (over 300 million people) lack basic access to electricity, while electrified areas suffer from rolling electricity blackouts. The government seeks to balance the country's growing need for electricity with environmental concerns from the use of coal and other energy sources to produce that electricity. India's transportation sector, primarily fueled by petroleum products, is set to expand as the country focuses on improving road and railway transit. The government plans to mandate some alternative fuel use, particularly with biofuel blends, and develop greater use of mass transit systems to limit oil demand growth (U.S. Energy Information Administration, 2014).

The International Energy Agency (IEA) notes that India will become the single-largest source of global oil demand after 2020 (PTI, 2013). Crude oil imports are the biggest contributor to India's bloated current account deficit. The outlook for India's energy production seems stark as it is estimated the country will face a shortage of 6.7 percent in 2013-2014 (Lok Sabha, Unstarred Q., 2013). Southern India, consisting Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and Puducherry, showed a combined economic growth rate of 7.85 percent in 2013. However, this trajectory would be negatively affected owing to a projected 20 percent shortage in electricity (Ibid). The primary reason for the electricity shortage is an over-reliance on thermal energy from coal and gas. Further, 100000 out of nearly 600000 (Lok Sabha, Unstarred Q., 2012) villages in India do not have access to electricity (Gevorg Sargsyan et al., 2011). Against this backdrop, renewable energy presents a more sustainable and financially sound option for the long term.

### 1.1. Solar Power Generation across States

India is blessed with the potential for a significant amount of solar energy generation. At 300 to 330 days of sun per year, the country plans to establish mega solar power plants to capitalize on this important domestic resource. As in many other sectors, India's states seek to drive change and attract investment in solar

power, too (the top five states in solar power generation added in the last three years are shown in figure 1). MNRE has finalized plans to set up the world's largest solar power project in Rajasthan, with a capacity of 4000 MW. The first phase of the project is anticipated to be complete by 2016. (Press Information Bureau, Government of India: 2013). Land has already been located for a project in Gujarat. The government also plans to set up mega projects in Kargil and Ladakh with capacities of 2000 MW and 5000 MW respectively (More ultra-mega solar plants on anvil", The Hindu, 2013).

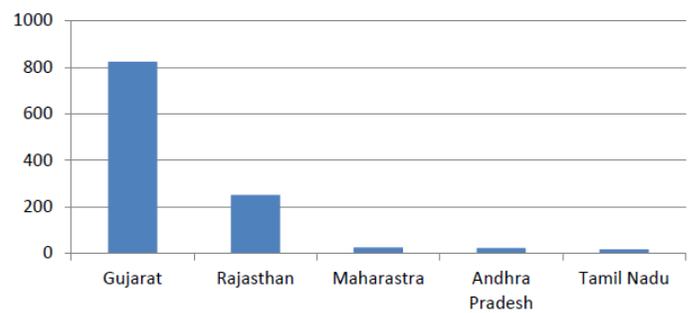


Figure 1: Top Five States in Solar Power Generation Capacity added in last 3 years (MW)

(Lok Sabha, Unstarred Q., 2013).

### 1.2. Solar sectors in India:

Prior to 2008, solar power generation in India was restricted to some off-grid applications generating a few hundred megawatts. Domestic manufacturing capacity was less than 200MW. However, the launch of the Jawaharlal Nehru National Solar Mission (NSM) in 2010 changed this situation. Together with the development of solar policies in some states, the NSM saw installed capacity in solar power rising to 2.18GW by the end of 2013. Given its relatively short lifespan, the solar sector remains small and immature compared with wind.

As well as diffusing both solar photovoltaic (PV) and solar thermal generation, the NSM was designed to create R&D capacity and promote domestic production of solar technologies. The aims of the Mission are tied quite closely to India's obligations under the United Nations Framework Convention on Climate Change (UNFCCC), and its launch has been closely associated with the prime minister's National Action Plan on

Climate Change (NAPCC). The MNRE is the lead ministry, though a number of other key ministries have been involved with establishing the NSM.

The NSM is focused in Rajasthan, the state with the greatest solar resources. Under a different policy regime, Gujarat has also developed significant state-level capacity. The overwhelming majority of installed solar capacity is therefore concentrated in these two states, as shown in Figure 2.

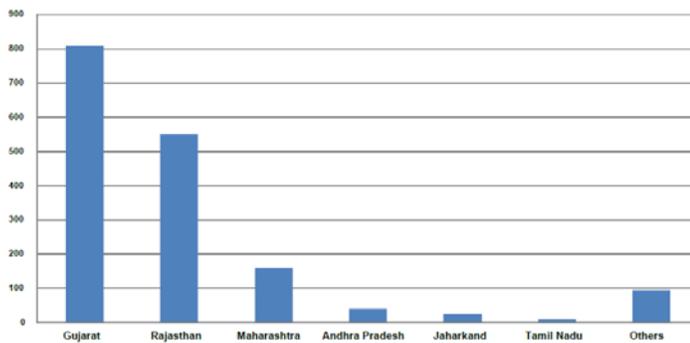


Figure 2. State-level installed solar capacity (MW)

Source: (Krishna *et al.*, 2014).

### 1.3. Role of Central and State Governments

India is the only country with a Ministry dedicated to New and Renewable Energy. There are nodal agencies in each State, which specifically work on enhancing the percentage of renewable energy in the power-mix. States such as Rajasthan, Karnataka, Maharashtra, Gujarat, and West Bengal have already taken initiatives for installation of large solar power plants. The MNRE also announced Generation Based Incentives (GBI) in 2008, to incentivize development of solar power plants(Sharma, 2011).

### 1.4. Ernst & Young LLP's Renewable Energy Country Attractiveness Index (RECAI)

India ranks ninth overall on Ernst and Young LLP's most recent renewables attractiveness index. Although the country's position has fallen on notch, India's ranking on the solar index has improved from fourth to third. According to the report, the macroeconomic outlook for India remains strong, and capacity

forecasts for onshore wind and solar PV have increased for the four-year outlook period.

The Indian government has launched Jawaharlal Nehru National Solar Mission (JNNSM) with a target of achieving 20000 MW by 2022. The goal is to make India one of the leaders in solar energy. Although Solar energy is still expensive today, but costs are coming down with technology development, right governmental policies and R and D efforts (Ernst & Young LLP, 2013).

India has an expanding solar energy sector: 9 solar cell manufactures, 22 PV module manufactures, and 50 PV systems manufacturers. Therefore, technology resources exist in country and a growing market would lead to job growth in country.( Meisen, P., 2006 )

### 1.5. India and future:

#### Jawaharlal Nehru National Solar Mission (JNNSM)

The mission will be carried out in three phases and aims to do the following: to create a policy framework for deployment of 20,000 MW by 2022; to add 1,000 MW of grid solar power by 2013, and another 3,000 MW by 2017. The target for 2017 may be higher based on the availability of international finance and technology transfer.

The scheme also aims at strengthening indigenous manufacturing capability, and achieving 15 million sq. meters solar thermal collector area by 2017 and 20 million by 2022. One of the steps to achieve this will be to make solar heaters mandatory by incorporating byelaws in the National Building Code. Deployment of 20 million solar lighting systems for rural areas by 2022 is also part of the scheme. This mission has received widespread support from agencies like the World Bank and the Clinton Initiative. Also, the launch of organizations like the Solar Thermal Federation of India (STFI) indicates that the industry is gearing up for a shift towards solar(Sharma, B D., 2011).

### 1.6. Energy Security

India needs to focus on developing its own sources of energy. The major energy sources, oil and coal, are imported in large quantities. Even with the development of nuclear energy, India

will be dependent on other nations for fuel. To sustain economic growth, to come out of the energy deficit situation and ensure that energy is available in every town and village, India must utilize its immense potential in solar energy (Sharma, B D., 2011).

The Indian solar industry has been maturing at a rapid clip, growing more than a hundredfold in four years to reach over 2.6 gig watts (GW) of installed capacity in 2014. Coupled with successful state-level policies in Gujarat and Rajasthan, the Jawaharlal Nehru National Solar Mission (Mission or NSM) has played a pivotal role in making the industry successful. Abundant policy instruments, such as feed-in tariffs (FiTs) and accelerated depreciation (AD), have been deployed at the state and national levels. These instruments have been vital to the rapid scale-up achieved by this industry so far and are now ready for adoption on a wider scale. Further, India's new government

has announced nationwide targets to harness solar power and enable every Indian home to run at least one light bulb by the year 2019( Council on Energy, Environment and Water

Natural Resources Defense Council, 2014).

Solar will become a crucial component of India's energy portfolio in the next decade- perhaps more so than it is in most other countries. We believe a solar market can develop fairly quickly going from nothing to several billion-dollar solar-centric firms within a decade( ATKearney, 2013).

### **Renewable Energy Motivation in Iran**

The necessity of renewable energy in Iran can be classified in two reasons: 1) Environmental pollution and 2) More oil and gas export. In fact, the most important environmental problem in Iran is air pollution.

## **2. Iran's Scenario:**

Iran is known as the second largest oil production member in Organization of Petrol Export Country (OPEC) with production near 3.5 million barrel oil per day and accounts for roughly 5% of global oil outputs. Also, Iran contains an estimated 812 Trillion Cubic Feet (TFC) in proven natural gas reserves,

surpassed only by Russia in the world (Energy Information Administration, 2000).

Electric power generation installed in Iran is about 32.5 Giga Watts (GW) with more than 87% being from thermal natural gas fired power plant. Currently, Iran has five small nuclear reactors used for peaceful purposes. Nuclear and renewable energy will enable Iran to export more gas and oil and increase its revenue, since 80% of Iran's revenue is based on oil and gas export (Energy-Iran-Profile, 2001 ).

Iran is one of the main non-renewable energy producers in the world due to its plentiful fossil fuel resources. The use of natural gas and petroleum in transportation and industrial sectors has been developed vastly in Iran because of their low prices. As a result, the increasing rate of pollutant formation and depletion of non-renewable fuels have emerged as new challenges in the energy scenario of this country. Since Iran has plenty of fossil fuel resources, alternative fuel and renewable resources have not been taken into consideration seriously. Recently, controlling the unbridled fossil fuel consumption has become one of the main targets of the Iranian Government. A variety of natural resources in different regions of Iran can be applied as the main sources of renewable energy and also it can be considered as the supplementary energy in the energy mix policies.

### **2.1. Solar Energy in Iran**

The average solar radiation for the whole of Iran is about 19.23 Mega joules per square meter, and it is even higher in the central part of Iran. The variation of radiation varies from 2.8 kWh/m<sup>2</sup> in the south-east part to 5.4 kWh/m<sup>2</sup> in central region. The calculations show that the amount of useful solar radiation hours in Iran exceeds 2800 hours per year.

For this reason, the first Photovoltaic (PV) site, with capacity of 5 kW DC was established in the central region of Iran in Doorbid village Yazd in 1993. Following this, in 1998, the second photovoltaic site with 27 kW AC capacity was installed in Hosseinian and Moalleman villages in Semnan 450 Km inland from Tehran. The capacity of these power plants has recently increased to 10 kW AC and 92 kW AC respectively. The power plant installed at Doorbid, works independently from the grid

system, while the one installed at Hosseinian and Moalleman, is connected to grid. It is worth mentioning that all equipment of these sites is made in Iran.

Use of solar energy to produce electricity in Iran is not very popular and the price of these type of sites is relatively high at about 3500 US\$/kW. But there are some projects designed to use solar energy combined with thermal power plant to produce electric energy. These projects were under consideration since 1999. (Kazemi Karegar, H., Zahedia, A., Ohis V., taleghani, G. and Khalaji, M.)

## 2.2. Iran's CO<sub>2</sub> emission:

Iran's CO<sub>2</sub> emission is considerable and placed the country among the top ten emitting countries (Saboori, B. and A. Soleymani, 2011). Due to the fact that Iran is one of the biggest producers of oil and gas in the world, so that the most of CO<sub>2</sub> produced is related to these sources of energy which are used in diverse industrial section such as power plants (Saeed, M., E. Roayaei, M. Jazayeri and et. al, 2012). As is illustrated in Fig. 3, Iran's CO<sub>2</sub> emissions indicator is ever increasing.

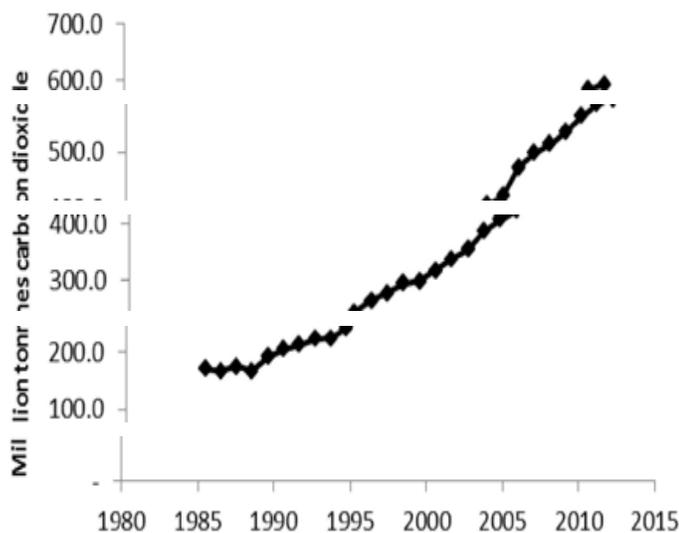


Fig. 3: Iran's CO<sub>2</sub> emissions 2 (British Petroleum, 2012)

## 2.3. Energy Trade:

Energy trade means both buying and selling of energy commodities such as oil, coal, natural gas and electricity from

where they are produced to where they are needed. Energy products are the main elements of world trade. According to statistics from the World Trade Organization (2009), world merchandise exports grew at an average annual rate of 12% between 2000 and 2008 (Sadorsky, P., 2011).

Iran's economy relies highly on its energy exports. Most of Iran's exports are oil and natural gas. In 2010, petroleum constituted 80 percent of all exports from Iran (Economy watch, 2010). Considering that the ratio of oil reserves to oil production amount in Iran is about 87 years and that up to the next 30 years, much of the energy of present buyers of oil will be supplied from renewable energies, it can be concluded that there is not a long time to convert oil wealth to a sustainable wealth. So, higher production of crude oil and its exports is quite economical. The best approach to Iran is development of domestic energy and non-oil economy and exporting more oil. Oil export revenues can be spent in long-term investment inside and outside the country. Industrial investment and technology promotion are the best strategy to use the oil capital, similar approach like Norway which develops its national economy with the profits of its oil revenues.

There are some barriers for development of renewable energies in Iran, which the most important are discussed as the followings:

- Inadequacy of specialists who are skilled in the field of solar energy.
- Poor knowledge about the importance of energy and inadequate advertisement by the government could result in less motivation by energy users and consequently the application of renewable energies could not gain significant rate.
- Insufficient funds to conduct projects.
- Slow process of contracting.
- Lack of sufficient and effective planning in this field by executive section.
- Insufficient legislative support and improper management.

Social acceptance of solar energy for growth and development of this energy is very important. The government must do a lot of effort to increase public awareness of the benefits and advantages of this energy source (Sajadi, S.M., S.M. Asadzadeh, V.M. Dalfard and et al., 2012.). It's the major barrier for solar energy and also renewable energy development in Iran.

### III. . CONCLUSION

It is clear that solar energy is becoming an important source of energy all over the World.

The study of solar energy in Iran shows that energy policy for mitigation of environmental impact and promote sustainable consumption has not yet been realized whereas in India Solar energy sector have been proposed many large projects. India is slowly gaining its prominence in the generation of solar power due to the comprehensive and ambitious state and the Centre's solar policies and projects and National Solar Mission. The finding of the study shows the bright picture as India's potential to be a solar power driven country of the world.

It is clear that private investments in technologies with long lifetimes and mid-term payback periods require stable economic conditions, clear objectives for the design of energy policies and the implementation of corresponding policy instruments. Paving the way towards a sustainable energy supply in Iran will not be successful without these prerequisites.

Lack of finances and public awareness and poor installation in Iran are the major hindrances to the ongoing adoption of solar energy in Iran. Whereas it can offer huge opportunities for social and economic development of Iran.

Cooperation of Officials of the Government of India and Iran in development of renewable energy sector particularly solar energy can create economic and environment opportunities For both countries, to secure Conservation of energy, environment protection. The two states can expand their relations in a number of key areas in solar energy and also in other renewable energy as a clean alternative to fossil fuels and create a healthier climate for future generations of human.

Some major recommendations for Iran to create more exploitation opportunities are as follows:

- Changing energy consumption and elevating public awareness and an information and training campaign at different levels.
- Government must provide financial support and encourage for private investors who plan to utilization solar energy power.
- Make public and government officials and the private sectors more and more sensitive to environmental issues.
- Solar energy could be made financially viable with government tax incentives and rebates.
- regulations to help private sector manufactures and researchers involved in the renewable energy projects particularly solar energy Make some practical.
- Create plans to reduce greenhouse gas emissions in the industry.

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