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# A Retrospective Study of Rigid Bronchoscopy in 58 Paediatric Cases with Acute Respiratory Distress

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## Abstract:

### Context:

Rigid bronchoscopy has been time tested modality for management of acute respiratory distress, especially in paediatric cases of foreign body in bronchus. However, there still persists dilemma regarding its application in conditions other than foreign body bronchus.

### Aims:

To explore extended indications of rigid bronchoscopy in paediatric cases with acute respiratory distress .

### Settings and Design:

Retrospective study of rigid bronchoscopy performed in paediatric cases with acute respiratory distress from January 2006 to July 2011 at tertiary care centre in India.

### Methods and Material:

All 58 paediatric cases who underwent emergency or elective rigid bronchoscopy for acute respiratory distress between January 2006 to July 2011 were included in the study.

### Results:

Out of the total 58 cases included in our study, 35 (60%) patients had foreign body aspiration history and 23(40%) had no history of foreign body bronchus. However, while doing rigid bronchoscopy in the latter cases, foreign body was found in 5 patients whereas 18 had secretions and mucus plugs. All 23 patients had swift clinical recovery after the procedure.

### Conclusions:

All paediatric cases presenting with acute onset of respiratory distress without history suggestive of foreign body aspiration should also be assessed by a diagnostic rigid bronchoscopy if they do not improve within 48 hours of medical treatment. Early diagnosis and intervention is the key to successful management.

## Index terms:

Rigid bronchoscopy, wheeze associated lower respiratory tract infection (WALRI), foreign body bronchus

## Key Messages:

If performed skilfully, rigid bronchoscopy proves to be a life-saving procedure in conditions simulating foreign body bronchus in paediatric patients. The unnecessary delay in doing this procedure due to its invasive nature may worsen the prognosis and hence it should be a part of standard protocol for management of paediatric acute respiratory distress.

## I. INTRODUCTION

Dr. Gustav Killian, who introduced rigid bronchoscopy to the world, once famously quoted that "One must have had the experience of seeing a child that at 4pm aspirated a little stone, and that, after the stone has been bronchoscopically removed at 6pm, may happily return home at 8pm after anaesthesia has faded away. Even if bronchoscopy was ten times more difficult as it really is, we would have to perform it just for having these results". This speaks volumes of the procedure and its success in treating foreign body bronchus.<sup>1</sup>

Rigid bronchoscopy is the trans-oral or trans-tracheotomy passage of rigid instruments for diagnostic or therapeutic purposes in the tracheobronchial tree. The practice of rigid bronchoscopy greatly decreased following the invention of the flexible bronchoscope<sup>2</sup>. But the value of rigid bronchoscopy in paediatric patients with severe atelectasis, pneumonia and wheeze associated lower airway infection (WALRI) has been a matter of great confusion. Although bronchoscopy may not be indicated as an initial procedure to remove respiratory tract secretions, it may provide a beneficial option in cases where less invasive methods prove to be ineffective in removing secretions and mucous plugs<sup>3</sup>. The rigid bronchoscope provides superior airway control especially in cases of significant airway bleeding. It is also superior to flexible bronchoscopy for removal of foreign bodies in bronchus. For acute central airway obstruction (CAO), rigid bronchoscopy is the airway stabilization procedure of choice<sup>4</sup>.

The aim of the study was to direct the focus of surgeons to this procedure of rigid bronchoscopy especially in acute respiratory distress in paediatric patients.

## II. SUBJECTS & METHODS

Fifty eight paediatric patients, all less than 14 years of age, who presented with acute respiratory distress to our tertiary care centre between January 2006 and July 2011 were included in our study. All cases were clinically evaluated and investigated by consultant ENT surgeons and Paediatrician in emergency department. After initial resuscitation, blood investigations and chest X ray PA view were done.

In 35 out of 58 cases with preceding history of foreign body ingestion and radiological finding suggestive of atelectasis, emergency diagnostic and therapeutic rigid bronchoscopy was conducted. Post procedure child was monitored clinically and radiologically in ICU with antibiotics and supportive care (Venturi mask oxygen administration, age and weight adjusted tapered steroid) in association with paediatrician for minimum of 24 hours.

In cases without classical history of foreign body ingestion, primary treatment was conferred by paediatrician in ICU with supportive care (Venturi mask oxygen administration, steroid & antibiotics). Deterioration or non-improvement of clinical and/or radiological condition of child was considered as indication for elective diagnostic cum therapeutic rigid bronchoscopy. Post procedure treatment was continued as described above.

All rigid bronchoscopies were performed under apnea hyper-ventilation technique of general anaesthesia. Patient positioned supine with extension of neck and placement of shoulder bag. Age matched size of rigid bronchoscope was introduced and tunnelled through trachea, carina and into the respective bronchus. The forcep space is judged and with appropriate instrumentation the foreign body was removed in minimum attempts to avoid laryngeal edema. Tracheostomy was carried out if procedure required multiple attempts or there was persistent fall in oxygen saturation. Such patients were weaned off of tracheostomy in 7 days.

### III. RESULTS

Out of total 58 cases of acute respiratory distress we considered all children with history of foreign body ingestion as Group 1 and those without obvious history of foreign body ingestion as Group 2.

Demographic data:

Table I: Age statistics

| Group 1 (age in years) |     | Group 2 (age in years) |
|------------------------|-----|------------------------|
| Mean                   | 4.2 | 6.4                    |

Table II: Gender statistics

| Group 1 (n=35) |    | Group 2 (n=23) |
|----------------|----|----------------|
| Males          | 24 | 12             |
| Females        | 11 | 11             |

Table III: Type of foreign body

| Group 1 (n=35) |    |
|----------------|----|
| Vegetative     | 22 |
| Metallic       | 13 |

Table IV: Bronchus involved

| Group 1 (n=35)           |    |
|--------------------------|----|
| Right                    | 22 |
| Carina and left bronchus | 13 |

Table V: Tracheostomy required

| Group 1 (n=35) |    | Group 2 (n=23) |
|----------------|----|----------------|
| Yes            | 6  | 11             |
| No             | 29 | 12             |

On analysing the retrospective data certain observations noted are as follows

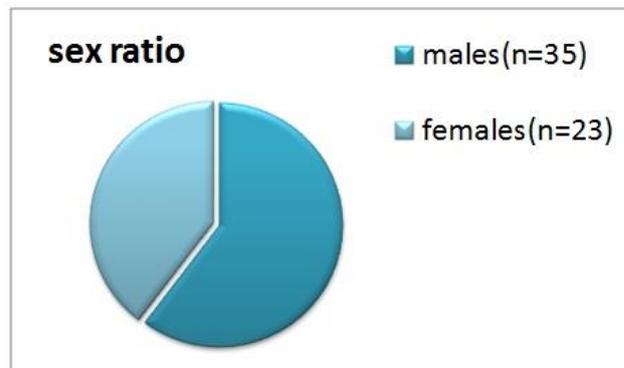


Figure 1: Gender distribution

It was noted that of total n=58 cases included in study, 23 cases had no history of foreign body whereas 35 cases had positive history of foreign body and which was retrieved on rigid bronchoscopy in all cases. However out of the 23 cases which were taken for bronchoscopy based on clinical suspicion of surgeon, 5 cases were such that foreign body was retrieved even though no obvious history of same noted suggesting old and accidental ingestions while the rest 18 cases had retained secretions. These secretions were secondary to infective pathology in 8 cases and inflammatory in 10 cases. In terms of percentage 40% cases had no history of foreign body but were subjected to the procedure for diagnostic purpose and turned out to be therapeutic. From this 40%, 22% presented foreign body at the time of bronchoscopy and 78% were a combination of secretions of pneumonia 35% and asthma /WALRI 43%.

In the above data we can see that cases without history of foreign body but presenting with acute respiratory distress were treated by therapeutic bronchoscopy by removing the accidentally noted foreign body and secretions of pneumonia, the only patients subjected to this invasive procedure with little benefit were asthma and WALRI. Hence risk benefit ratio favours towards the treatment. Benefitted patients were 57% cases versus 43% risked to the procedure of bronchoscopy in cases with asthma and WALRI.

Major Observations are as follows :

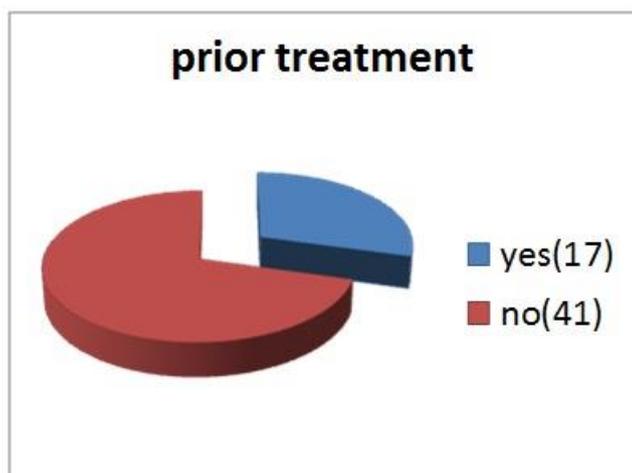


Figure 2: Past history of treatment at other centre on presentation.



Figure 5: Unilateral collapse of lung

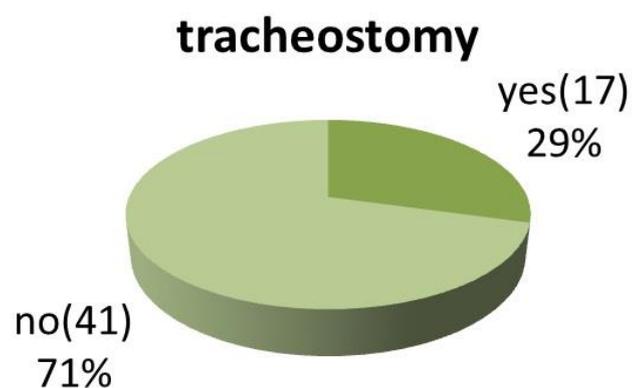


Figure 3: Distribution of patients undergoing tracheostomy

Other important findings were:

The most common foreign body were vegetative foreign body of which peanuts and seeds of imli maximally encountered. Both were notorious in management, as these foreign bodies have hydrophilic action and swells up.

The cases without foreign bodies were the ones presenting with mucous plugs and thick secretions blocking the secondary bronchioles, a meticulous suction was performed for same on bronchoscopy.

Tracheostomy was done for 17 cases out of 58 as a sequelae to bronchoscopy but were weaned off within average period of 7 days.

#### IV. DISCUSSION

In India, the most commonly reported use of rigid bronchoscopy is for foreign body removal.

Diagnosis largely depends on the first physicians to see the patient because clinical history is the most important element to make diagnosis of FBA (foreign body aspiration). In the literature, history has been considered an important diagnostic method.<sup>5,6,7</sup> A witnessed episode of choking is considered to be an important component of the history that leads to the correct diagnosis of aspiration. A history of choking episode can usually be obtained from parents or caretaker. Stridor is a common symptom in infants. However, the chances of missing significant structural pathology in the airway are high if the stridor is severe, persistent, associated with apnoea, failure to thrive, an abnormal cry and a prior ventilated child. Endoscopic examination of the airway is indicated in this group of children.<sup>8</sup> Unilateral or unresponsive wheeze may also indicate structural abnormality in the lower airway or even an inhaled foreign body and bronchoscopy is a logical investigation of these symptoms. Persistent cough is a common paediatric symptom. If it is refractory to treatment, bronchoscopy may be indicated but the diagnostic value is relatively low in the absence of other symptoms or signs, for example haemoptysis, persistently productive cough, localised wheeze, or radiological abnormalities. In a child with intractable symptoms bronchoscopy can be of great reassurance, even if normal. Bronchoscopy is indicated for persistent atelectasis. If radiological changes persist despite

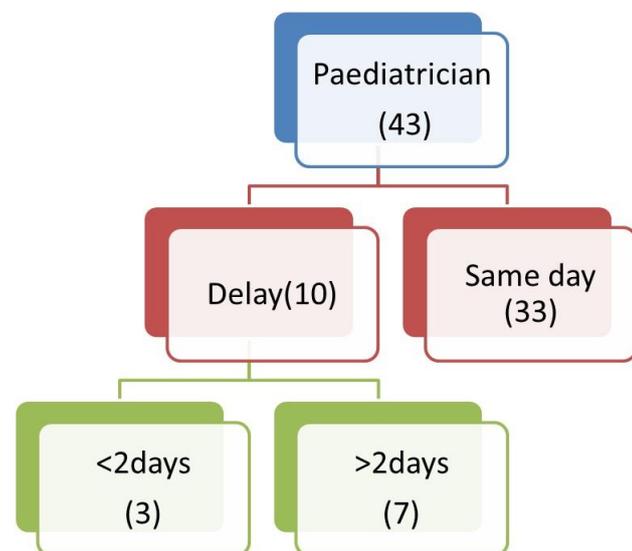


Figure 4: Paediatrician referral of cases and delays in same.

On analysing radiological data of the above patients it was concluded that unilateral collapse (figure -5) was a definitive indication for rigid bronchoscopy but a unilateral focal radio opaque shadow if not resolved with higher antibiotic and ICU management, a check bronchoscopy is indicated.

apparently adequate treatment, bronchoscopy should be considered to exclude a foreign body and obtain specimens for microbiological and cytological examination. Extensive atelectasis in young children will usually respond to selective bronchoalveolar lavage and suction. Inhaled foreign bodies can be remarkably capricious and may present with any of the symptoms discussed above<sup>9</sup>. The presence of a foreign body in the tracheobronchial tree cannot be excluded without bronchoscopy. When the history is suspicious bronchoscopy should be performed promptly.

Retrieval of foreign bodies with a flexible bronchoscope is extremely difficult and this is regarded as one of the few absolute indications for rigid bronchoscopy. Bronchoscopy has become a valuable tool for the investigation of pulmonary infections. Bronchoalveolar lavage has a high yield in three particular groups of children: the immunosuppressed, children who fail to respond to broad spectrum antibiotics, and children who present with symptoms suggestive of an atypical pneumonia<sup>10,11,12</sup>. Bronchoalveolar lavage can be directed to areas of radiological abnormality.

In our study we saw 43 patients primarily presented to paediatrician with delay of 10 days on an average before otolaryngologist came into managing the cases. The golden period of 48 hours was lost in 7 cases whereas rest 3 cases were timely intervened and managed. Fortunately no fatal complication occurred due to delay in treatment.

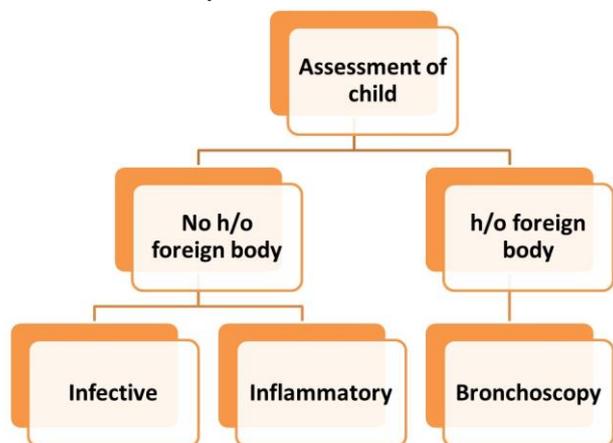


Figure 6 : Protocol for management of paediatric cases of acute respiratory distress.

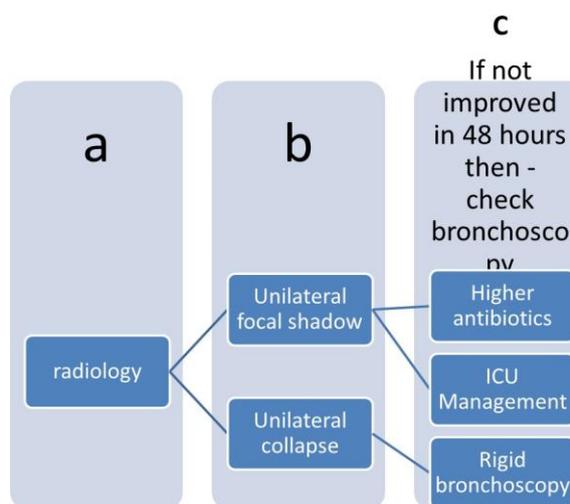


Figure 7 : Radiological protocol for management of paediatric cases of acute respiratory distress.

## V. CONCLUSION

To summarize, rigid bronchoscopy should be included in the standard protocol for management of paediatric cases of acute respiratory distress Figure-6 &7. On presentation from history and clinical signs if suspicious of foreign body straight away head to rigid bronchoscopy if not then keeping the probable infective and inflammatory respiratory pathologies as diagnosis and manage patient on medical lines. After 48 hours of medical intensive care management, perform a check bronchoscopy. Hence as a surgeon we should remember that all cases of stridor are not foreign body and not all foreign body present as stridor making bronchoscopy an essential investigation. Early diagnosis on high index of suspicion is the key to rewarding results of paediatric rigid bronchoscopy

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# Synthesis, FT-IR and NMR characterization of new 1,3-bis(2-(2-hydroxyphenylaminomethyl)phenoxyethyl)-2,4,6-trimethylbenzene

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**Abstract-** A new ligand ( $L_3$ ) 1,3-bis(2-(2-hydroxyphenylaminomethyl)phenoxyethyl)-2,4,6-trimethylbenzene is synthesized. The generic synthetic pathways for the new starting materials ( $L_1$ ) and ( $L_2$ ) were presented. The structural features of all the new compounds are studied by FT-IR (mid),  $^1\text{H}$  and  $^{13}\text{C}$  NMR spectroscopy. Structural comparison between ( $L_1$ ) ( $L_2$ ) and ( $L_3$ ) were also reported.

**Index Terms-** Dialdehyde, Diamine, Di-imine, Diols, FT-IR, Macromolecules, NMR, spectroscopy.

## I. INTRODUCTION

For many years, design and synthesis of macrohetero-multidonor ligands have constituted one of the largest areas of research in organic and coordination chemistry [1-5]. Various literatures reported the synthesis and characterization of many macromolecular compounds and there has been continuous research to explore more of the biologically important macromolecules and their respective metal complexes. In most cases, nature prefers macrocyclic derivatives for many fundamental biological functions such as photosynthesis, storage and transport of oxygen in mammalian and other respiratory systems. Schiff base macromolecules featuring di-aza compounds, peptides, esters and ethers were among the potentially active biological compounds of the recent time, and are considered among the successfully discovered macromolecular and macrocyclic compounds of great medical and biological importance [6-9].

Having various donor centres, macrocycles ligands has exciting possibilities toward construction of novel supramolecular arrangements that are capable of performing highly specific and important molecular functions. For instant, the precise molecular recognition between these macromolecular ligands and their guests, mostly transition metal ions or biomolecules (nucleic acids, proteins.), provides a good opportunity for studying key aspects of supramolecular chemistry, which are also significant in a various other disciplines such as bioorganic chemistry, bio-coordination chemistry, biology, medicine and related science and technology [10-15].

The macrocyclic Schiff bases form a unique family of compartmental ligands, and modifications can be made to their basic structure such as the provision of different lateral or side chains, provision of additional donor atoms on one or more lateral chain, and partial or full saturation at the azomethine linkages. For macromolecules which have been hydrogenated or saturated at the azomethine groups, a potential donor group can be attached on the aminic nitrogen as a pendant arm. It has been scientifically suggested that the biological and medical behaviour

expressed by Schiff base macromolecules such as anticancer, antitumor, herbicidal and anti-fungal properties were attributed to the azomethine linkage in the molecules [16-20].

In this study, synthesis of macromolecular dialdehyde, di-imine and their corresponding di-amines were carried out. Schiff bases of such kind have been found to be extensively useful in elaborating and determining the molecular processes occurring in biochemistry, material science, catalysis, encapsulation, activation, ion-transport and separation phenomena, hydrometallurgy, and a lot more [20-24].

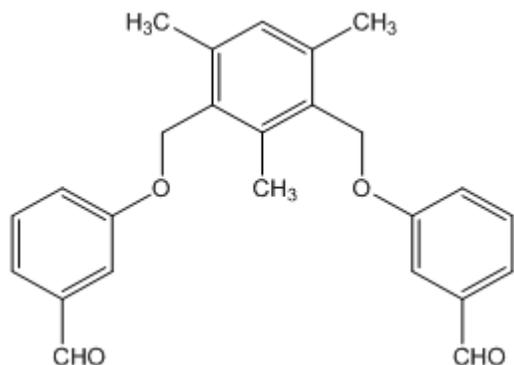
## II. EXPERIMENTAL

### A. Chemistry

Chemicals, reagents and solvents of standard grade were used as purchased without further purification. Melting points were determined using Electro-thermal 9100 melting point apparatus. FT-IR spectra were recorded on the Bruker Alpha-P in the range of 4000-400  $\text{cm}^{-1}$ . Routine  $^1\text{H}$  (400 MHz) and  $^{13}\text{C}$  (100 MHz) spectra were recorded in  $\text{DMSO-d}_6$  or  $\text{CDCl}_3$  at ambient temperature on a Bruker Ultrashield Plus 400MHz instrument. Chemical shifts ( $\delta$ ) are expressed in units of parts per million relative to TMS. The analytical and spectral data and physical properties were summarized for each experiment.

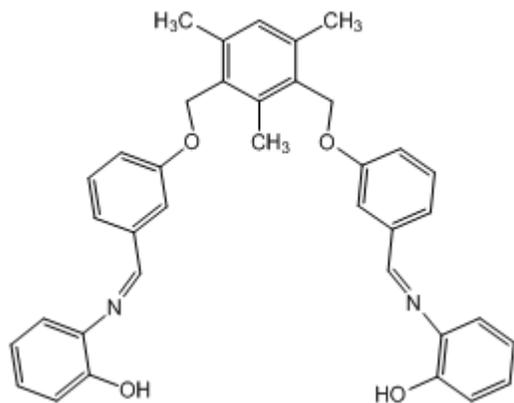
### B. Synthesis

1,3-bis(3-formylphenoxyethyl)-2,4,6-trimethylbenzene ( $L_1$ ). To a solution of KOH (600 mg, 10.70 mmol) in ethanol (20 mL) was added *meta*-hydroxybenzaldehyde (1.20 g, 9.80 mmol) and stirred at 60°C for 45 minutes in an external oil bath. 2,4-bis(chloromethyl)-1,3,5-trimethylbenzene (1.0 g, 4.60 mmol) was then added slowly at 30 minutes interval and the mixture was stirred overnight at the same temperature. The resulting product was stirred in cold distilled water, in order to remove unreacted starting materials. The purification was repeated two more times and a white solid was obtained.  $\text{C}_{25}\text{H}_{24}\text{O}_4$ : 2.24 g, yield 80%, MP: (125-127°C ref.<sup>[34]</sup> 126-127°C). FT-IR (solid  $\text{cm}^{-1}$ ): 3123  $\nu(\text{C}\equiv\text{C}-\text{H})$ , 2862 and 2760  $\nu(\text{CHO})$ , 1687  $\nu(\text{C}=\text{O})$ , 1594  $\nu(\text{C}\equiv\text{C})$ , 1217  $\nu(\text{C}-\text{O})$ , 753  $\delta(\text{C}\equiv\text{C}-\text{H})$ .  $^1\text{H}$ NMR ( $\text{CDCl}_3$ ),  $\delta_{\text{H}}$  ppm: 2.41 (s, 6H,  $\text{CH}_3$ ), 2.43 (s, 3H,  $\text{CH}_3$ ), 5.19 (s, 4H,  $\text{CH}_2$ ), 7.03 (s, 1H), 7.07 (t,  $J = 7.53$  Hz, 2H), 7.22 (d,  $J = 8.28$  Hz, 2H), 7.61 (t,  $J = 7.03$  Hz, 2H), 7.86 (dd,  $J = 7.65$ , 1.63 Hz, 2H), 10.39 (s, 2H, CHO).  $^{13}\text{C}$ NMR ( $\text{CDCl}_3$ ),  $\delta_{\text{C}}$  ppm: 15.55 ( $\text{CH}_3$ ), 19.91 ( $2\text{CH}_3$ ), 65.54 ( $\text{CH}_2$ ), 112.86, 121.09, 125.23, 128.33, 130.59, 130.71, 136.03, 138.78, 138.98, 161.59, 189.73 (CHO).



**Figure 1: 1,3-bis(3-formylphenoxy)methyl)-2,4,6-trimethylbenzene (L<sub>1</sub>)**

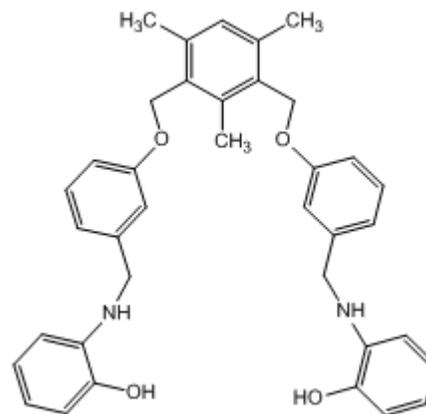
1,3-bis(3-(2-hydroxyphenyliminomethyl)phenoxy)methyl)-2,4,6-trimethylbenzene (L<sub>2</sub>). To a stirred solution of *ortho*-aminophenol (180 mg, 1.65 mmol) in methanol (7 mL) was added ligand (L<sub>1</sub>) (300 mg, 0.77 mmol). The reaction mixture was stirred for 3 hours at 70°C. The resulting product was cooled, filtered and cleaned two times with methanol (5 mL). A pure pale yellow solid di-imines (L<sub>2</sub>) was obtained. C<sub>37</sub>H<sub>34</sub>N<sub>2</sub>O<sub>4</sub>: 408 mg, yield 85%. Mp: 181-183°C, FT-IR: (solid, cm<sup>-1</sup>): 3336  $\nu$ (OH), 3065  $\nu$ (C≡C-H), 1621  $\nu$ (C=N), 1215  $\nu$ (C-O), 1590  $\nu$ (C≡C), 745  $\delta$ (C≡C-H). <sup>1</sup>HNMR (CDCl<sub>3</sub>),  $\delta$ <sub>H</sub> ppm: 2.38 (s, 6H, CH<sub>3</sub>), 2.43 (s, 3H, CH<sub>3</sub>), 5.15 (s, 4H, CH<sub>2</sub>), 6.77 (td, *J* = 7.65, 1.25 Hz, 2H), 6.95 (d, *J* = 1.25 Hz, 2H), 6.97 (d, *J* = 1.25 Hz, 2H), 7.00 (s, 1H), 7.09 (m, 4H), 7.14 (d, *J* = 1.51 Hz, 2H), 7.12 (d, *J* = 2.76 Hz, 2H), 7.50 (t, *J* = 8.53, 7.28, 1.76 Hz, 2H), 8.15 (d, *J* = 1.76 Hz, 2H, 2CHN), 8.98 (s, 2H, OH).



**Figure 2: 1,3-bis(3-(2-hydroxyphenyliminomethyl)phenoxy)methyl)-2,4,6-trimethylbenzene (L<sub>2</sub>)**

1,3-bis(2-(2-hydroxyphenylaminomethyl)phenoxy)methyl)-2,4,6-trimethylbenzene (L<sub>3</sub>). To a mixture of methanol (4 mL) and tetrahydrofuran (6 mL) was added ligand (L<sub>2</sub>) (200 mg, 0.35 mmol) and stirred until dissolved. A solution NaBH<sub>4</sub> (60 mg, 1.58 mmol) in methanol (1 mL) was then added slowly within 15-20 minutes at room temperature until the pale yellow colour disappeared. The reaction was then monitored by TLC until complete disappearance of starting materials was observed. The colourless solution was then precipitated in cold distilled water at pH of 5-7 and then filtered. A brown solid ligand (L<sub>3</sub>) was obtained. C<sub>37</sub>H<sub>38</sub>N<sub>2</sub>O<sub>4</sub>: 200 mg, yield 77%, MP: 68-71°C, FT-IR

(solid cm<sup>-1</sup>): 3419  $\nu$ (NH), 3329  $\nu$ (OH), 3061  $\nu$ (C≡C-H), 1600  $\nu$ (C≡C), 1226  $\nu$ (C-O), 738  $\delta$ (C≡C-H). <sup>1</sup>HNMR (CDCl<sub>3</sub>),  $\delta$ <sub>H</sub> ppm: 2.38 (s, 6H, CH<sub>3</sub>), 2.43 (s, 3H, CH<sub>3</sub>), 4.25 (s, 4H, CH<sub>2</sub>N), 5.09 (s, 4H, CH<sub>2</sub>O), 5.20 (s, 2H, NH), 6.52 (s, 1H), 6.62 (d, *J* = 7.53 Hz, 2H), 6.71 (d, 2 H), 6.92 (m, 2H), 7.01 ppm (m, 2H), 7.09 (d, *J* = 8.3 Hz, 2H), 7.24 (d, 2H), 7.28 (m, 2H). <sup>13</sup>CNMR (CDCl<sub>3</sub>),  $\delta$ <sub>C</sub> ppm: 15.40 (CH<sub>3</sub>), 19.83 (2CH<sub>3</sub>), 44.55 (CH<sub>2</sub>N), 65.06 (CH<sub>2</sub>O), 111.50, 113.31, 114.44, 118.13, 120.82, 121.17, 127.99, 128.41, 129.42, 130.46, 131.16, 136.81, 138.61, 139.11, 144.41, 157.20.



**Figure 3 : 1,3-bis(2-(2-hydroxyphenylaminomethyl)phenoxy)methyl)-2,4,6-trimethylbenzene (L<sub>3</sub>)**

### III. RESULT AND DISCUSSION

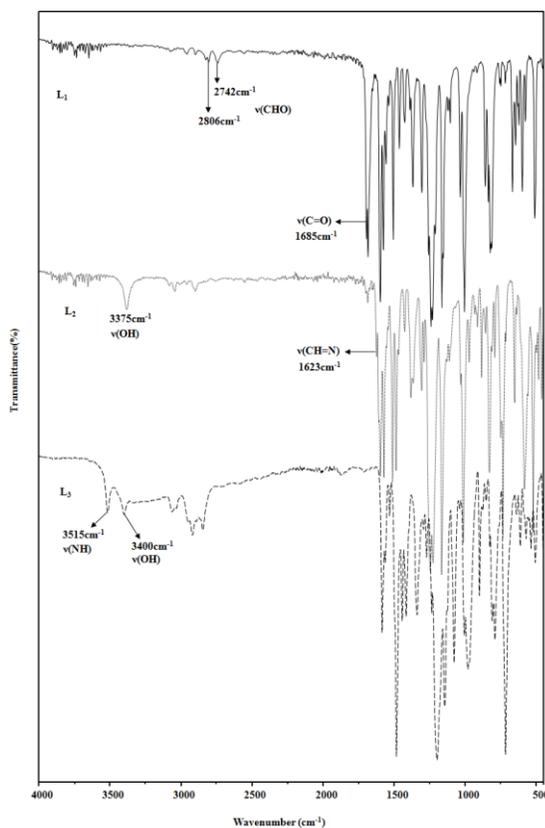
#### A. FT-IR analysis

The vibrational Spectroscopy of the compounds (L<sub>1</sub>, L<sub>2</sub> and L<sub>3</sub>) was studied in comparison so as to point out clearly the transformation of L<sub>1</sub> via L<sub>2</sub> to L<sub>3</sub> there by indicating the success of the reaction pathways.

For L<sub>1</sub>, the FT-IR spectrum was studied in terms of the prominent aldehydic peaks which include weak twin peaks around 2750 and 2850 cm<sup>-1</sup> for aldehydic  $\nu$ (C-H), and 1685-1700 cm<sup>-1</sup> strong for carbonyl  $\nu$ (C=O). The aromatic components of this ligand can be seen from 1580-1600 cm<sup>-1</sup> for  $\nu$ (C≡C) and 700 cm<sup>-1</sup> for  $\delta$ (C≡C-H).

In L<sub>2</sub>, the twin aldehydic hydrogen peaks disappear and a new bond around 1620-1630 cm<sup>-1</sup> for  $\nu$ (CH=N) was formed. This however indicates the reaction of the aldehyde functional groups into di-imines. The peak around 3360-3370 cm<sup>-1</sup> for phenyl  $\nu$ (OH) usually broad also observed. All other peaks remain slightly changed.

While in L<sub>3</sub>, the weak bands for  $\nu$ (CH=N) at 1610-1630 cm<sup>-1</sup> have disappeared due to hydrogenation of the double bonds, and a new peak between 3515cm<sup>-1</sup> for secondary  $\nu$ (N-H) have been observed. The (O-H) group was observed at 3380cm<sup>-1</sup> due to some slight changes.

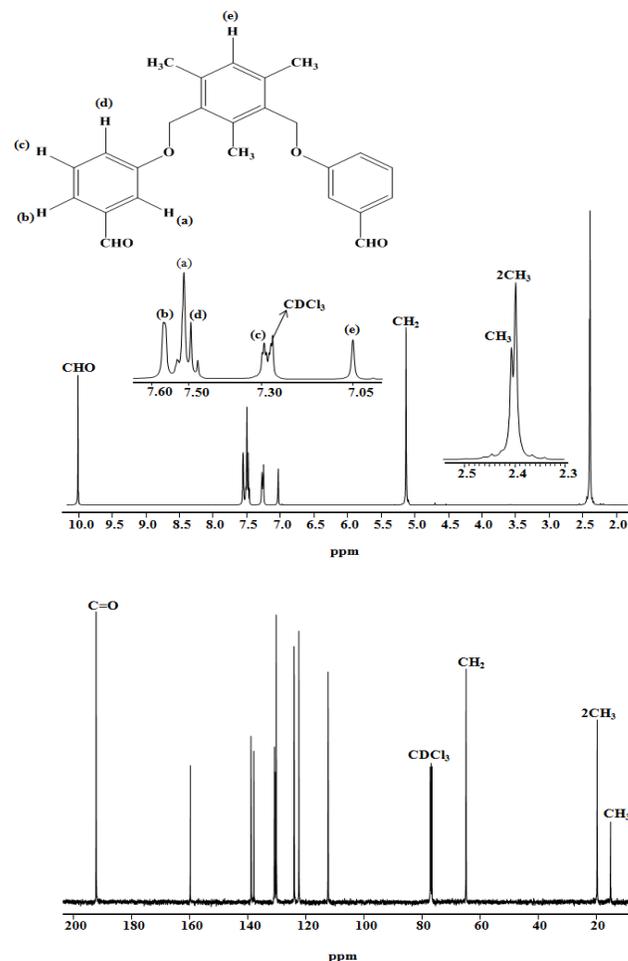


**Figure 4 : Combined FT-IR Spectra of L<sub>1</sub>, L<sub>2</sub> and L<sub>3</sub>**

**B. NMR analysis**

<sup>1</sup>H NMR of ligand L<sub>1</sub> shows a singlet for ethylene (–CH<sub>2</sub>–O) protons at around 5ppm, and (CHO) protons at around 10ppm. It also shows a monomethyl (CH<sub>3</sub>) and dimethyl (2CH<sub>3</sub>) protons within the region of 2.4ppm to 2.50ppm with integrations of (3H) and (6H) respectively, belonging to the three (CH<sub>3</sub>) that are in two different magnetic environments. The (CHO) protons and the (–CH<sub>2</sub>–O) protons have integrations of (2H) and (4H) respectively. The integration for aromatic protons is significantly consistent with the structure of L<sub>1</sub>.

<sup>13</sup>C NMR of L<sub>1</sub> shows fourteen different carbon atoms as in the chemical structure. It also shows the monomethyl (CH<sub>3</sub>) carbon at ~ 16 ppm and dimethyl (2CH<sub>3</sub>) carbons at ~ 20 ppm. Ethylene (–CH<sub>2</sub>–O) carbons were observed around the region 65-67 ppm and aldehydic (CHO) carbon at ~ 190 ppm. See figure 5



**Figure 5: <sup>1</sup>H NMR and <sup>13</sup>C NMR spectra of L<sub>1</sub> in CDCl<sub>3</sub>.**

<sup>1</sup>H NMR of L<sub>2</sub> shows singlet for the ethylene (–CH<sub>2</sub>–O) protons still around 5.2ppm. New peaks for (HC=N) protons at ~ 7.80 ppm and (OH) protons at around 8.70ppm were observed. The monomethyl (CH<sub>3</sub>) and dimethyl (2CH<sub>3</sub>) protons were still around 2.4 to 2.50ppm.

<sup>13</sup>C NMR of L<sub>2</sub> show expected number of carbon atoms as in the chemical structure. The monomethyl (CH<sub>3</sub>) carbons and the dimethyl (2CH<sub>3</sub>) carbons are at 16.50 and 19.90ppm respectively. Ethylene (–CH<sub>2</sub>–O) carbons were still at 65-67ppm while the new (HC=N) carbon is at 157ppm. The complete disappearance of aldehydic (C–H) proton and aldehydic (C=O) carbon indicate the reaction have taken place between L<sub>1</sub> and ortho-aminophenol. See figures 6.

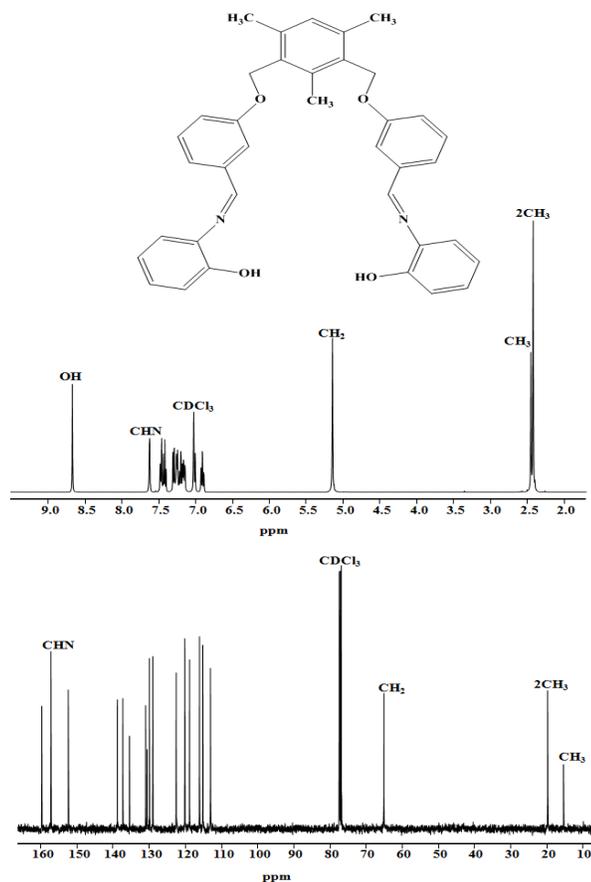


Figure 6:  $^1\text{H}$  NMR and  $^{13}\text{C}$  NMR spectra  $\text{L}_2$  in  $\text{CDCl}_3$ .

In  $\text{L}_3$ , the peak for (HC=N) proton which was at 8.70ppm disappeared and two new peaks for (–CH<sub>2</sub>–N) and (N–H) are subsequently observed at 4.3ppm and 5.3ppm respectively. Likewise in the  $^{13}\text{C}$  NMR of  $\text{L}_3$ , the (HC=N) carbon at 57ppm disappeared and subsequently new (–CH<sub>2</sub>–) carbon appeared at 48ppm. This proves the hydrogenation of the (HC=N) double bonds into (–CH<sub>2</sub>–) and (–NH–). Unlike  $\text{L}_1$  and  $\text{L}_2$ , the NMR of  $\text{L}_3$  is taken in DMSO–d<sub>6</sub> because  $\text{CDCl}_3$  was in available in the laboratory at the time of the experiment. See figure 7.

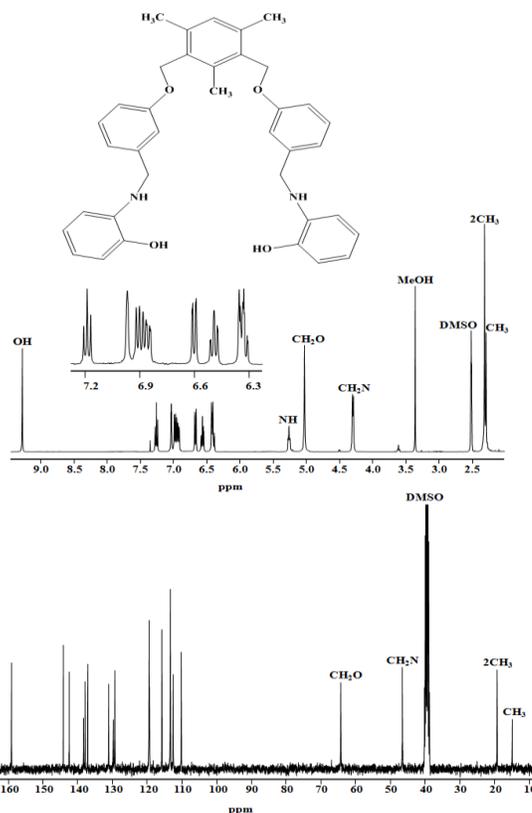


Figure 7:  $^1\text{H}$  NMR and  $^{13}\text{C}$  NMR spectra  $\text{L}_3$  in DMSO.

#### IV. CONCLUSION

Synthesis, FT-IR and NMR characterization of the new ligands have been accounted for. The synthetic steps have been carefully monitored and observed, the FT-IR and the NMR of  $\text{L}_1$ ,  $\text{L}_2$  and  $\text{L}_3$  have been compared in order to assure the success of the synthesis of one ligand from the other. Test on microbial and other biological activities of either the ligands alone or in metal complexes would be investigated.

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# Hiding Sensitive Rules with Minimal Compromise of Data Utility

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**Abstract-** Data mining extracts valuable knowledge from large amounts of data. It is a powerful new technology to help companies focus on the most important information in their data warehouses. Several issues need to be addressed when mining on data is performed that are bulk at size and geographically distributed at various sites. Privacy preserving data mining has emerged as promising way to mining knowledge from large databases securely. The techniques are classified as: data distribution, data modification, and data mining algorithm, rule hiding and privacy preservation. Our approach is based on heuristics of Association Rule Mining. The techniques involves modifying database to prevent sensitive rules from getting disclosed which leads to information loss of non-sensitive data. We propose an algorithm that hides sensitive item on either side of rule by selective modification of database with minimal information loss. The prime objective is the accuracy of algorithm in terms of rule hiding, ghost rules and missing rules.

**Index Terms-** privacy preserving data mining, association rule, confidence, support.

## I. INTRODUCTION

Progress in digital data acquisition and storage technology has resulted in the growth of huge database. The result of this lead to growth in the possibility of tapping these data and extracting from them information that might be of value to the owner of the database. This discipline concerned with the task has become known as data mining. [1] Extraction of useful information from database is definitely a fruitful investment for the owner but it is also a threat for them as this information might get an unauthorized access. This generates the need to provide privacy for it. Privacy preserving data mining solutions aim at achieving a data mining algorithm[2] to use data *without* ever actually “seeing” it.[3,4]

Association analysis is a powerful tool for discovering relationships which are hidden in large database. Mining of association rules between set of items in a large database is carried out using support and confidence as key heuristics. [6,7,8] Apriori algorithm is used for discovering all significant association rules between items in a large database.

Actually any given specific rules to be hidden, many approaches for hiding association, classification and clustering rules have been proposed. Maximum researchers have worked on the basis of reducing the support and confidence of sensitive association rules.[10-19] The association rule items whether in Left Hand Side (LHS) or Right Hand Side (RHS) of the generated

rule, should not be disclosed by mining process. [9] ISL and DSR are the common approaches used to hide the sensitive rules.

In our proposed approach we are hiding contain some sensitive information which can be on the Right hand side or Left hand side of the rule, so that rules containing confidential item can't be reveal. This is done on the basis of selective modification of the data. Selective modification achieves higher utility for the modified data given that the privacy is not jeopardized. The technique should minimize hiding failure, ghost rules and lost rules reducing execution time. The rest of the paper is organized as follows. Section 2 presents the statement of the problem and the notation used in the paper. Section 3 presents the proposed algorithms for hiding sensitive items. Section 4 shows example of the proposed algorithm. Section 5 analyses the result of the efficiency of proposed algorithm and shows how it is better than previously defined methods. Concluding remarks and future works are described in section 6.

## II. PROBLEM STATEMENT

The goal is to transform a given data set  $D$  into modified version  $D''$  that satisfies a given privacy requirement. A database  $D$  of transactions can describe the problem in Fig 1. We have a set of transactions  $T$ . Let  $I = \{I_1, I_2, I_3, \dots, I_m\}$  be a set of literals, called items. As shown in Fig. 1, the circled items are frequent and the rest are infrequent. Each transaction  $T$  is a set of items such that  $T \subseteq I$ . Each transaction is formed from the items in the set.

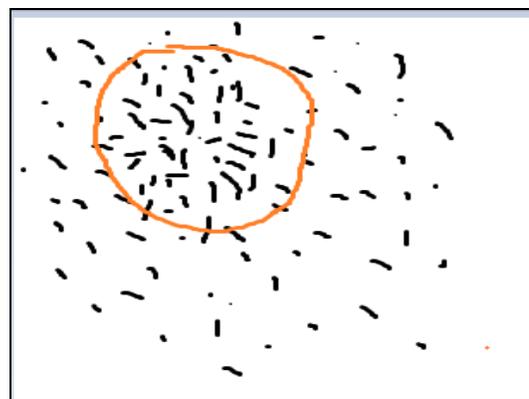


Figure1: A Database  $D$  containing set of transactions  $T$ .

Find all sets of items (itemsets) from the database transactions that have transaction support above minimum support. The support for an itemset is the number of transactions that contain

the itemset. Itemsets with minimum support are called large itemsets, and all others small itemsets. Use the large itemsets to generate the desired rules that satisfy minimum confidence.

An association rule is an expression  $X \rightarrow Y$ , where  $X \subseteq I$ ,  $Y \subseteq I$  and  $X \cap Y = \text{empty}$ . LHS and RHS of a rule is formed by items in the data set which doesn't have anything in common. The  $X$  and  $Y$  are called the body (left hand side) and head (right hand side) of the rule, where  $N$  is the total transactions of a database. The heuristics that are used for hiding sensitive items are:[20-22]

1. Confidence of a rule measures the degree of the correlation between item sets.

$$\text{Confidence} = \frac{|X \cup Y|}{|X|}$$

2. Support of a rule measures the significance of the correlation between item sets.

$$\text{Support} = \frac{|X \cup Y|}{\text{No. of transactions}}$$

### III. PROPOSED ALGORITHM

Association rule hiding aims to hide the sensitive rule. A rule is said to be sensitive if its disclosure risk is above a certain privacy threshold. Our focus is on hiding sensitive rules with minimal compromise of data utility. The approach for rule hiding is based on selectively modifying the database transactions. The modification is performed by data owners before publishing their data.

See following sample Table I which is the original dataset  $S$ . The sensitive item is FALSE. The minimum support & confidence is 40% & 50%. The instances in sample dataset are 14.

**Table I: Original Dataset S before applying Algorithm**

| [25] No. | [26] Outlook   | [27] Temperature | [28] Humidity | [29] Windy  | [30] Play |
|----------|----------------|------------------|---------------|-------------|-----------|
| [31] 1   | [32] Sunny     | [33] Hot         | [34] High     | [35] FALSE  | [36] No   |
| [37] 2   | [38] Sunny     | [39] Hot         | [40] High     | [41] TRUE   | [42] No   |
| [43] 3   | [44] Overcast  | [45] Hot         | [46] High     | [47] FALSE  | [48] Yes  |
| [49] 4   | [50] Rainy     | [51] Mild        | [52] High     | [53] FALSE  | [54] Yes  |
| [55] 5   | [56] Rainy     | [57] Cool        | [58] Normal   | [59] FALSE  | [60] Yes  |
| [61] 6   | [62] Rainy     | [63] Cool        | [64] Normal   | [65] TRUE   | [66] No   |
| [67] 7   | [68] Overcast  | [69] Cool        | [70] Normal   | [71] TRUE   | [72] Yes  |
| [73] 8   | [74] Sunny     | [75] Mild        | [76] High     | [77] FALSE  | [78] No   |
| [79] 9   | [80] Sunny     | [81] Cool        | [82] Normal   | [83] FALSE  | [84] Yes  |
| [85] 10  | [86] Rainy     | [87] Mild        | [88] Normal   | [89] FALSE  | [90] Yes  |
| [91] 11  | [92] Sunny     | [93] Mild        | [94] Normal   | [95] TRUE   | [96] Yes  |
| [97] 12  | [98] Overcast  | [99] Mild        | [100] High    | [101] TRUE  | [102] Yes |
| [103] 13 | [104] Overcast | [105] Hot        | [106] Normal  | [107] FALSE | [108] Yes |
| [109] 14 | [110] Rainy    | [111] Mild       | [112] High    | [113] TRUE  | [114] No  |

Data owners want the transformation to best preserve those domain-specific data properties that are critical for building meaningful data mining models, thus maintaining mining task specific data utility of the published datasets. [23] We will be working on data sets from UCI machine learning repository. In this work, we assume that only sensitive items are given and propose the algorithm to modify data. Given a transaction database  $D$ , a minimum support, a minimum confidence and a set of items  $H$  to be hidden, the objective is to modify the database  $D$  such that no association rules containing  $H$  on the any side of rule will be discovered. As an example, for a given database in Table 1

**Algorithm-** perturbation algorithm used for securing sensitive rules and provides data privacy.

**Input-** Dataset  $D$

Threshold value of support and confidence

**Output-** Association rules  $R'$

**Procedure-**

**Apriori Process ()**

```
{
    Date d1 = new Date ();
    Start1 = d1.getTime ();
    updated = 0;
    While (Entry flag==1)
    {
        level++;
        generate Candidates (level);
        If (C_level != empty)
            calculate Support (level);
        Else
            Set Entry flag to 0;
        If (level>=2 && frequent set! =0)
            generate Rules (level);
    }
}
```

```

}
If (final rules not empty)
    Take an input index of sensitive item;
    Find the sensitive item using index from C1;
    count sensitive item (sensitive item);
Else
    Display Dead End;
If (count sensitive item ==0)
    Display: Item not present in Rules;
    d1 = new Date ();
    End1 = d1.getTime ();
Time = (End1 – Start1)/1000;
Display: Time;
    Display: Association Rules R’;
    Display: Rules having sensitive item;
    d2 = new Date ();
    Start2 = d2.getTime ();
If (count sensitive item >0)
{
    Entry flag=1;
    While (Entry flag==1)
    {
        level++;
        generate Candidates (level);
        If (Clevel != empty)
            calculate Support (level);
        Else
            Set Entry flag to 0;
        If Flevel contains sensitive item
            update transaction (level, index, sensitive item);
    }
    If (level >= 2 && frequent set! =0)
        generate Rules (level);
}
    count sensitive item (sensitive item);
}
d2 = new Date ();
End2 = d2.getTime ();
Time = (End2 – Start2)/1000;
Display: Time;
Display: Association Rules R’;
Display: Rules having sensitive item;
}
generate Candidates (int level)
{
    If (level==1)
        Scan the dataset D and store the candidates in set Clevel;
    Else if (level==2)
        concatenate items from set F(level-1) to form a pair of two items
        and store it in set Clevel;
    Else
        generate all possible combinations of items from set F(level-1)
        and store each pair in set Clevel;
        If (Clevel is empty)
            Entry flag=0;
}
calculate Support (int level)
{
    If (level==1)

```

```

    For each item j in set Clevel, count its occurrence in each
    Transaction T of Dataset D and store in array count[j];
    Else
    {
        For each item j in set Clevel
        {
            Tokenize item j such that  $j = \{k_1, k_2, k_3, \dots, k_n\}$ ;
            where  $k_1, k_2, \dots$  are single items
            For each Transaction T in Dataset D
            {
                Find the occurrence of  $k_1, k_2, \dots, k_n$  and accordingly
                set match++;
                If (match==n)
                    Set count[j] ++;
            }
        }
        For each item j in set Clevel
        {
            support = (count[j]/no. of transactions);
            If (support >= min_supp)
                Store item j in set Flevel;
        }
    }
    If (Flevel != empty && level >1)
    {
        Store Flevel in Final Flevel;
    }
    Else
        Display message: No more frequent candidates generated.
}
generate Rules ( int level)
{
    For each candidate in set Flevel
    {
        Tokenize items of candidate m such that  $= \{k_1, k_2, \dots, k_n\}$ ;
        Generate all possible combination of rules of the form  $X \rightarrow Y$ 
        for item m and store in set R; where  $|X| = n-1$  and  $|Y|=1$ ; n is size
        of item m
    }
    For each rule r in set R
    {
         $r : X \rightarrow Y$ 
        confidence = count (X U Y) / count (X);
        If (confidence >= min_conf)
            Store the rule r in set R’;
    }
}
count sensitive item (sensitive item)
{
    For each rule in set R’
    {
        Tokenize items of rule r such that  $= \{r_1, r_2, \dots, m\}$ ;
        If (tokens ri contains sensitive item)
            Set count++;
    }
}
return: count;
}
update transaction (level, index, sensitive item)

```

```

{
If (level==1)
{
  For each Transaction T in Dataset D
  {
  For each candidate in set F' 1
  {
  Find the occurrence of each item k1, k2, ... ,kn of F' 1 in
T and accordingly set match++;
  If (match=level)
  Set count line [T] ++;
  If (T contains sensitive item)
  Set count sensitive++;
  Set line sensitive [T] ++;
  }
}
For each count c in count sensitive
sensitive array [count line[line sensitive[c]]];
Reorder sensitive array in descending order;
Reorder line sensitive accordingly;
Find support of sensitive item = (count sensitive/no. of transac-
tions);
Find difference of support= support of sensitive item – minimum
support;
If (difference ==0)
  difference= difference + 1;
extra occurrence= (difference * no. of transactions)/100;
Take drift as input from user;
Transactions to modify = (drift * extra occurrence)/100;
}
  initial= Transactions to modify * (level -1);
  updation = Transactions to modify + updated;
  For some i ranging from initial to updation
  If (T == line sensitive [i])
  Set update flag=1;
  Set updated ++;
If (update flag==1)
  Replace sensitive item with null string in T;
Else
  Continue;
Increment T;
}

```

IV. EXAMPLE

Table I is the sample dataset for simulation. We begin the execution by applying algorithm on the original dataset S, generating candidates and frequent sets. Minimum support is 40% & confidence is 50%. Thus for a candidate to pass the minimum support, it has to be present in 6 transactions at least. The sensitive item is FALSE.

Table II: 1-Candidates set of sample dataset S.

| [115]Candidate Items | [116]Support Count |
|----------------------|--------------------|
| [117]Sunny           | [118]5             |

|               |        |
|---------------|--------|
| [119]Overcast | [120]4 |
| [121]Rainy    | [122]5 |
| [123]Hot      | [124]4 |
| [125]Mild     | [126]6 |
| [127]Cool     | [128]4 |
| [129]High     | [130]7 |
| [131]Normal   | [132]7 |
| [133]TRUE     | [134]6 |
| [135]FALSE    | [136]8 |
| [137]Yes      | [138]9 |
| [139]No       | [140]5 |

Table III: 1-Frequent set of sample dataset S.

| [141]Candidate Items | [142]Support Count |
|----------------------|--------------------|
| [143]Mild            | [144]6             |
| [145]High            | [146]7             |
| [147]Normal          | [148]7             |
| [149]TRUE            | [150]6             |
| [151]FALSE           | [152]8             |
| [153]Yes             | [154]9             |

Table II & III explains how first candidate & frequent set is generated. Repeat steps 2 and 3 till candidates are generating. Table IV & shows 2<sup>nd</sup> level candidate & frequent set.

In the sample dataset, no candidates can be generated at third level because no prior item-set is common to form a third itemset. Thus final frequent set is obtained at 2<sup>nd</sup> level. Generate association rules from 2-frequent set using confidence.

Table IV: 2-Candidates set generated from 1-frequent set.

| [155]Candidate Items | [156]Support Count |
|----------------------|--------------------|
| [157]{Mild, High}    | [158]4             |
| [159]{Mild, Normal}  | [160]2             |
| [161]{Mild, TRUE}    | [162]3             |
| [163]{Mild, FALSE}   | [164]3             |
| [165]{Mild, yes}     | [166]4             |
| [167]{High, TRUE}    | [168]3             |
| [169]{High, FALSE}   | [170]4             |
| [171]{High, Yes}     | [172]3             |
| [173]{Normal, TRUE}  | [174]3             |
| [175]{Normal, FALSE} | [176]4             |
| [177]{Normal, Yes}   | [178]6             |

|                   |        |
|-------------------|--------|
| [179]{TRUE, Yes}  | [180]3 |
| [181]{FALSE, Yes} | [182]6 |

**Table V: 2-Frequent set generated from 1-frequent set.**

| [183]Candidate Items | [184]Support Count |
|----------------------|--------------------|
| [185]{Normal, Yes}   | [186]6             |
| [187]{FALSE, Yes}    | [188]6             |

**Table VI: Association Rules**

| [189]Candidate Items | [190]Support Count |
|----------------------|--------------------|
| [191]Yes → Normal    | [192]66.66%        |
| [193]Normal → Yes    | [194]85.71%        |
| [195]Yes → FALSE     | [196]66.66%        |
| [197]FALSE → Yes     | [198]75.00%        |

**Table VII: Final association Rules satisfying minimum confidence**

| [199]Candidate Items | [200]Support Count |
|----------------------|--------------------|
| [201]Yes → Normal    | [202]66.66%        |
| [203]Normal → Yes    | [204]85.71%        |
| [205]Yes → FALSE     | [206]66.66%        |
| [207]FALSE → Yes     | [208]75.00%        |

We can see that Table VI displays the rules generated. Table VII contains the rules satisfying minimum confidence. As all association rules have confidence greater than minimum confidence value (50%). Select a sensitive item, say, FALSE from the rules. There are two rules having FALSE. The support of FALSE in the dataset S (Figure 4.1):

$$Support (FALSE) = \frac{8}{14} \times 100 = 57.14\%$$

This means out of 14 transactions, FALSE is present in 8 of them. The difference between its support and minimum support is 17.14%. This difference indicates by how much percentage the item has crossed the threshold value of support.

We can find the no. of transactions from the difference percentage.

$$= \frac{Difference \times No. of transactions}{100} = \frac{17.14 \times 14}{100} = 3$$

Deciding the drift percentage which will be used to indicate in how many transactions modification is done at each level of item set generation. Suppose we choose drift percentage equals to 25%. So it will modify 25% of difference value at each level, till the item occurs in the frequent set. Transaction to modify at each level is given by:

$$= \frac{Drift \times Difference value}{100} = \frac{25 \times 3}{100} = 1$$

We now begin the process again using modification algorithm. Generate candidates and frequent set. Check if the sensitive item occurs in 1-frequent set.

**Table VIII: Transactions Count Value**

| [209]Transaction No. | [210]Support Count |
|----------------------|--------------------|
| [211]1               | [212]2             |
| [213]2               | [214]2             |
| [215]3               | [216]3             |
| [217]4               | [218]4             |
| [219]5               | [220]3             |
| [221]6               | [222]2             |
| [223]7               | [224]3             |
| [225]8               | [226]3             |
| [227]9               | [228]3             |
| [229]10              | [230]4             |
| [231]11              | [232]4             |
| [233]12              | [234]4             |
| [235]13              | [236]3             |
| [237]14              | [238]3             |

**Table IX: Transactions having sensitive item FALSE.**

| [239]Transaction No. | [240]Support Count |
|----------------------|--------------------|
| [241]1               | [242]2             |
| [243]3               | [244]3             |
| [245]4               | [246]4             |
| [247]5               | [248]3             |
| [249]8               | [250]3             |
| [251]9               | [252]3             |
| [253]10              | [254]4             |
| [255]13              | [256]3             |

Find the count value of transactions using 1-frequent set. Reorder transactions based on descending order of count. Modification is done in the transaction having maximum value of count as calculated above. Table VIII shows the count value of all transactions. Table IX contains only those transactions and their count having sensitive item, FALSE.

**Table X: Descending order of count value & re-arranged index of transactions.**

| [257]Transaction No. | [258]Support Count |
|----------------------|--------------------|
| [259] <b>4</b>       | [260]4             |
| [261] <b>10</b>      | [262]4             |
| [263] <b>5</b>       | [264]3             |
| [265] <b>8</b>       | [266]3             |
| [267] <b>9</b>       | [268]3             |
| [269] <b>3</b>       | [270]3             |
| [271] <b>13</b>      | [272]3             |
| [273] <b>1</b>       | [274]2             |

We select transactions based on Table X. Modify the transaction no. 4, replacing sensitive item with null string. Now continue process of generating candidates from step 3 followed by step 4. The candidates and frequent set generated now will be different from the one generated before. The reason behind this is the modification done. If they are same, it means we need to perform more modifications. If we get a frequent set without sensitive item, the modification process ceases. After first modification process continue, generating 2-candidate using dataset transactions which have been modified, followed by 2-frequent set.

**Table XI: 2-candidates set after applying algorithm.**

| [275]Candidate Items | [276]Support Count |
|----------------------|--------------------|
| [277]{Mild, High}    | [278]4             |
| [279]{Mild, Normal}  | [280]2             |

**Table XIII: Modified Dataset S' after applying Algorithm**

| [307]No.       | [308]Outlook  | [309]Temperature | [310]Humidity | [311]Windy | [312]Play |
|----------------|---------------|------------------|---------------|------------|-----------|
| [313] <b>1</b> | [314]Sunny    | [315]Hot         | [316]High     | [317]FALSE | [318]No   |
| [319] <b>2</b> | [320]Sunny    | [321]Hot         | [322]High     | [323]TRUE  | [324]No   |
| [325] <b>3</b> | [326]Overcast | [327]Hot         | [328]High     | [329]FALSE | [330]Yes  |
| [331] <b>4</b> | [332]Rainy    | [333]Mild        | [334]High     | [335]null  | [336]Yes  |
| [337] <b>5</b> | [338]Rainy    | [339]Cool        | [340]Normal   | [341]FALSE | [342]Yes  |
| [343] <b>6</b> | [344]Rainy    | [345]Cool        | [346]Normal   | [347]TRUE  | [348]No   |
| [349] <b>7</b> | [350]Overcast | [351]Cool        | [352]Normal   | [353]TRUE  | [354]Yes  |
| [355] <b>8</b> | [356]Sunny    | [357]Mild        | [358]High     | [359]FALSE | [360]No   |
| [361] <b>9</b> | [362]Sunny    | [363]Cool        | [364]Normal   | [365]FALSE | [366]Yes  |

|                      |        |
|----------------------|--------|
| [281]{Mild, TRUE}    | [282]3 |
| [283]{Mild, FALSE}   | [284]2 |
| [285]{Mild, yes}     | [286]4 |
| [287]{High, TRUE}    | [288]3 |
| [289]{High, FALSE}   | [290]3 |
| [291]{High, Yes}     | [292]3 |
| [293]{Normal, TRUE}  | [294]3 |
| [295]{Normal, FALSE} | [296]4 |
| [297]{Normal, Yes}   | [298]6 |
| [299]{TRUE, Yes}     | [300]3 |
| [301]{FALSE, Yes}    | [302]5 |

**Table XII: 2-frequent set after applying algorithm.**

| [303]Candidate Items | [304]Support Count |
|----------------------|--------------------|
| [305]{Normal, Yes}   | [306]6             |

Table XI contains 2-candidate after first modification done on the dataset. Table XII contains transaction with count greater than minimum count.

The rows marked bold are the ones that indicate how performing modification has changed the count value of candidate item-sets. Previously, the counts of these candidates were 3, 4 and 6. The change is due to selective modification done on the transaction. Frequent set will have only one candidate which is different from previous results of 2 candidates.

FALSE, the sensitive item does not occurs in the frequent set. It contains only one item pair {Normal Yes}. This indicates that support of sensitive item is reduced, which affects the candidate pairs in the subsequent sets. Thus the candidates with that item will no longer be generated. At last association rules are generated satisfying minimum confidence, the rules will no longer have sensitive item present in them.

|         |               |           |             |            |          |
|---------|---------------|-----------|-------------|------------|----------|
| [367]10 | [368]Rainy    | [369]Mild | [370]Normal | [371]FALSE | [372]Yes |
| [373]11 | [374]Sunny    | [375]Mild | [376]Normal | [377]TRUE  | [378]Yes |
| [379]12 | [380]Overcast | [381]Mild | [382]High   | [383]TRUE  | [384]Yes |
| [385]13 | [386]Overcast | [387]Hot  | [388]Normal | [389]FALSE | [390]Yes |
| [391]14 | [392]Rainy    | [393]Mild | [394]High   | [395]TRUE  | [396]No  |

Association rules after algorithm are: {Yes \*\* Normal, Normal \*\* Yes}. If the item exists, it means the hiding failure occurs. The hiding failure indicates that sensitive item is not hidden completely from the dataset S. We can calculate the percentage of hiding failure. Time taken to execute the algorithm prior to modification is 4 seconds and after selective modification is 5 seconds. Thus the total taken to complete execution on sample dataset is 9 seconds.

V. ANALYSIS

This section analyzes some of the characteristics of the proposed algorithm. The table shows the association rules generated before algorithm and rules generated after selective modification on dataset. We have used Adult & Bank Marketing dataset.[24,25,26]

Results for Adult Dataset

Table XIV(1) & XIV(2). Adult Dataset with support=50%, confidence= 70% & drift= 40%; varying sensitive item

| Sensitive Item | Before applying algorithm |                                  | After applying algorithm |                                  |
|----------------|---------------------------|----------------------------------|--------------------------|----------------------------------|
|                | No. of Rules              | No. of Rules with sensitive item | No. of Rules             | No. of Rules with sensitive item |
| White          | 25                        | 20                               | 5                        | 0                                |
| Fnlwgt0        | 25                        | 20                               | 5                        | 0                                |
| CIO            | 25                        | 25                               | 20                       | 0                                |

| Execution time                  |                                | Analysis       |             |            |
|---------------------------------|--------------------------------|----------------|-------------|------------|
| before applying algorithm (sec) | after applying algorithm (sec) | Hiding Failure | Ghost Rules | Lost Rules |
| 78.42                           | 57.86                          | N              | 0           | 0          |
| 76.95                           | 63.56                          | N              | 0           | 0          |
| 79.61                           | 51.76                          | N              | 0           | 0          |

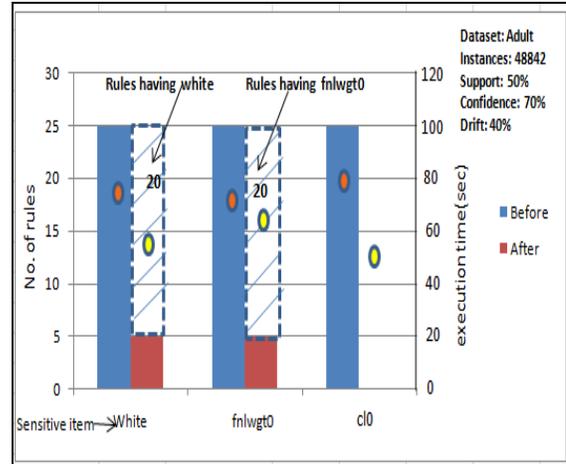


Figure 2: Adult Dataset: Changing sensitive item; keeping support, confidence, drift same.

The results produced are shown in column chart. X-axis indicating different parameters such as sensitive item, support, confidence, drift. Y-axis indicates the no. of rules generated at the last level. The level here represents the one generated prior to applying the proposed algorithm. Suppose before applying algorithm last level goes till 5<sup>th</sup> frequent set, leading to form rules. Out of which all rules are sensitive. So results of applying algorithm will remove all those rules which will cause it to reach up to 4<sup>th</sup> level. Execution time is displayed in seconds.

Table XV(1) & XV(2). Adult Dataset with confidence=70%, drift= 40% and sensitive item is White; varying support

| Support (%) | Before applying algorithm |                                  | After applying algorithm |                                  |
|-------------|---------------------------|----------------------------------|--------------------------|----------------------------------|
|             | No. of rules              | No. of rules with sensitive item | No. of rules             | No. of rules with sensitive item |
| 50          | 25                        | 20                               | 5                        | 0                                |
| 60          | 5                         | 5                                | 12                       | 0                                |
| 70          | 27                        | 12                               | 15                       | 0                                |

| Execution time                  |                                | Analysis       |             |            |
|---------------------------------|--------------------------------|----------------|-------------|------------|
| before applying algorithm (sec) | after applying algorithm (sec) | Hiding failure | Ghost rules | Lost rules |
| 78.42                           | 57.86                          | N              | 0           | 0          |
| 37.49                           | 41.50                          | N              | 0           | 0          |

|       |       |   |   |   |
|-------|-------|---|---|---|
| 17.36 | 27.22 | N | 0 | 0 |
|-------|-------|---|---|---|

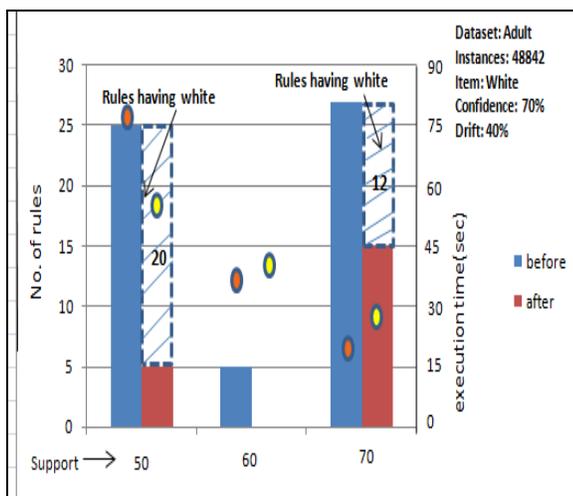


Figure 3: Adult Dataset: Changing support; keeping item, confidence, drift same

The graph shows the no. of rules before and after applying algorithm. Rules displayed are the one at last level of before applying proposed algorithm. It may happen before applying the proposed algorithm it reached up to 5<sup>th</sup> level but later goes up to 4<sup>th</sup> level.

Table XVI(1) & XVI(2). Adult Dataset with support = 60%, drift= 40% and sensitive item is White; varying confidence

| Confidence (%) | Before applying algorithm |                                  | After applying algorithm |                             |
|----------------|---------------------------|----------------------------------|--------------------------|-----------------------------|
|                | No. of rules              | No. of rules with sensitive item | No. of rules             | No. of rules with sensitive |
| 70             | 5                         | 5                                | 12                       | 0                           |
| 80             | 5                         | 5                                | 12                       | 0                           |
| 90             | 3                         | 3                                | 6                        | 0                           |

| Execution time                  |                                | Analysis       |             |            |
|---------------------------------|--------------------------------|----------------|-------------|------------|
| before applying algorithm (sec) | after applying algorithm (sec) | Hiding failure | Ghost rules | Lost rules |
| 37.49                           | 41.50                          | N              | 0           | 0          |
| 31.76                           | 37.02                          | N              | 0           | 0          |
| 28.32                           | 33.74                          | N              | 0           | 0          |

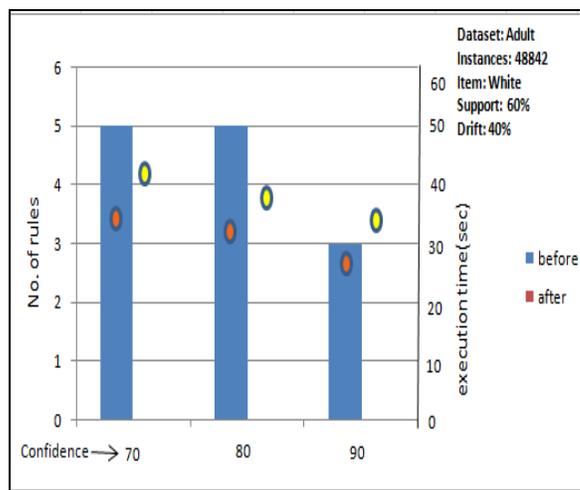
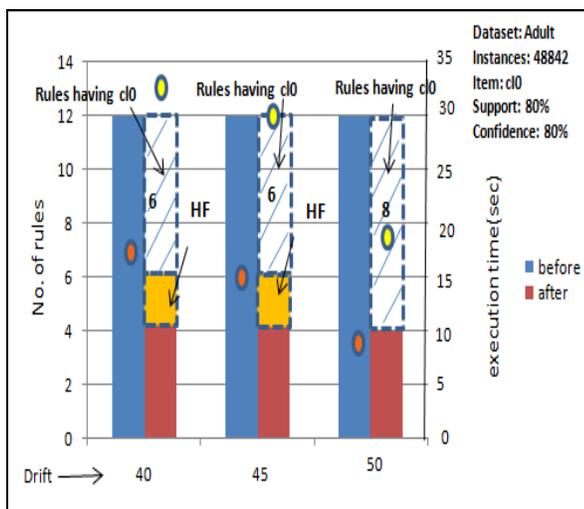


Figure 4: Adult Dataset: Changing confidence; keeping item, support, drift same.

Table XVII(1) & XVII(2). Adult Dataset with support = 80%, confidence= 80%, sensitive item is c10; varying drift.

| Drift (%) | Before applying algorithm |                                  | After applying algorithm |                             |
|-----------|---------------------------|----------------------------------|--------------------------|-----------------------------|
|           | No. of rules              | No. of rules with sensitive item | No. of rules             | No. of rules with sensitive |
| 40        | 12                        | 8                                | 6                        | 2                           |
| 45        | 12                        | 4                                | 10                       | 2                           |
| 50        | 12                        | 8                                | 4                        | 0                           |

| Execution time                  |                                | Analysis       |             |            |
|---------------------------------|--------------------------------|----------------|-------------|------------|
| before applying algorithm (sec) | after applying algorithm (sec) | Hiding failure | Ghost rules | Lost rules |
| 16.96                           | 33.43                          | Y              | 0           | 0          |
| 15.19                           | 32.10                          | Y              | 0           | 0          |
| 7.88                            | 19.20                          | N              | 0           | 0          |



**Figure 5: Adult Dataset: Changing drift; keeping support, confidence, item same.**

The results clearly indicate that in some cases hiding failure occurs. For example, if we vary drift value hiding failure can be overcome. It is clear that there are no ghost rules generated no missing rules effect.

In Table XIV to XVII we can see the results on adult dataset having 48842 records. The table displays the rules generated before and after applying proposed algorithm along with before and after execution time of proposed algorithm and evaluation parameters such as hiding failure, lost rules and ghost rules. First table show the result of varying sensitive item keeping support, confidence & drift constant. Table XV displays the results of altering support with confidence, drift and sensitive item constant. Table XVI displays the results of varying confidence with support, item and drift constant. Last Table XVII shows results when drift is changed with same support, confidence and sensitive item.

## VI. CONCLUSION & FUTURE WORK

The proposed algorithm carries out pre-processing of the dataset and performing selective modification to hide sensitive rules from being disclosed. As from our example we see that our approach is better in the way that it hides any rule which contains the user specified sensitive item without looking whether it is on LHS or RHS. The approach has been evaluated based on accuracy achieved in terms of sensitive rule hiding, data utility preserved, ghost rules and missing rules. We have obtained favourable results on both the datasets in terms of desired accuracy and affordable time complexity. The approach is easy to implement. Future work can include hiding items on specific side of association rule such as LHS or RHS. One can also focus on improving the execution time.

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# Neural Network Based State of Charge (SOC) Estimation of Electric Vehicle Batteries

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**Abstract-** Accurate estimation of state of the charge (SOC) is vital for electric vehicle batteries. This paper presents a novel method to estimate the SOC based on a neural network which can be programmed into a low cost microcontroller. The microcontroller monitors the battery voltage and takes four samples immediately after the battery is disconnected from the load and monitors the steady state terminal voltage when the vehicle is parked for more than 30 minutes to train a neural network. Each time the battery is disconnected from the load while driving, the microcontroller takes four voltage samples to estimate the SOC using the previously trained neural network. In order to increase the accuracy, the battery temperature is also taken as an input.

**Index Terms-** Battery State of Charge, Electric Vehicle, Microcontroller, Neural Network

## I. INTRODUCTION

Depleting fossil fuel sources made researchers to look for alternative energy sources to meet the ever increasing transportation needs. Hydrogen fuel powered vehicles, battery powered electric vehicles are two major new technologies. Plug-in Electric Vehicles, Hybrid Electric Vehicles are already in the market. Toyota Prius and Honda Insight are popular hybrid electric vehicles. Tesla Roadster and Nissan Leaf are plug-in electric vehicles but their popularity is not as good as Toyota Prius or Honda Insight. Major reasons for this are high price, limited range and prolong charging time. In hybrid electric vehicles, range is enhanced by a gasoline engine and hence charging time is not a crucial issue. As hybrid electric vehicles use gasoline engines which runs at much better fuel economy, researchers have found a solution only to reduce the demand on fossil fuel. Using renewable energy sources such as solar, wind or bio mass for charging plug-in electric vehicles is a long lasting permanent solution for depleting fossil fuel sources. There are many issues yet to be solved to make such a solution as a viable replacement for fossil fuel. Batteries having very high energy densities, quick charging time and reliable estimate of remaining battery capacity are few such issues related the batteries used in plug-in electric vehicles. In a gasoline powered vehicle, a variable resistor actuated by a floater is sufficient to drive the fuel gauge fixed on the dash-board. Such an indicator gives a very reliable estimate of the remaining amount of fuel and hence driver can refuel his vehicle to reach his destination. Estimating the remaining capacity of a battery is not a simple as above. Getting a very reliable estimate of the remaining battery capacity is very important for electric vehicles as the battery recharging time is high compared to the gasoline refueling time.

Pang et al. [3] proposed an algorithm for estimating the SOC through an extended Kalman filter by measuring the terminal voltage and discharge current. The extended Kalman filtering is computational intensive algorithm and is not suitable for vehicles. Sato and Kawamura [6] proposed an algorithm based on the least square error method by measuring the terminal voltage and internal resistance estimated by a current impulse. This method could not handle the reduction of the SOC due to aging of the battery.

This paper propose a technique to get a reliable estimate of the SOC only estimating the steady-state open-circuit voltage by measuring the battery voltage immediately after the load is disconnected and estimating the steady-state open-circuit voltage using a neural network. The network is trained each time the battery reaches its steady-state open-circuit voltage using the back propagation algorithm. The open-circuit voltage is measured immediately after the load is disconnected and subsequently there more samples are taken at regular intervals under no-load condition. These four measurements with the battery temperature are taken for estimation of the SOC. The algorithm continues to measure the open-circuit voltage and if the battery reaches the steady-state open-circuit voltage the neural network is retained.

## II. ESTIMATION OF SOC

Lead acid, Nickel cadmium, Nickel metal hydride and Lithium ion batteries are the most popular batteries used in electric vehicles. Out of these battery types, lead acid batteries are the cheapest while lithium ion batteries have the highest volumetric energy density (300 Wh/liter) and gravimetric energy density (125 Wh/kg). Further lithium ion batteries create least amount of hazardous waste during disposal. Therefore, many manufacturers of cheap electric vehicles such as electric scooters are using lead acid batteries while lithium ion will be most the prominent battery in future electric vehicles.

For lead acid and lithium ion batteries, open-circuit voltage is considered as an accurate indicator of the battery SOC following charge or discharge process provided sufficient time is allowed to stabilize the chemicals in the battery. For a lead acid battery, the SOC is linearly dependent on open-circuit voltage and specific gravity of the battery electrolyte. The steady-state open-circuit voltage ( $E$ ) of a lead acid battery and specific gravity ( $SG$ ) of the electrolyte is given by [5]:

$$E = SG + 0.84$$

The SOC and steady-state open-circuit voltage is given by [1]:

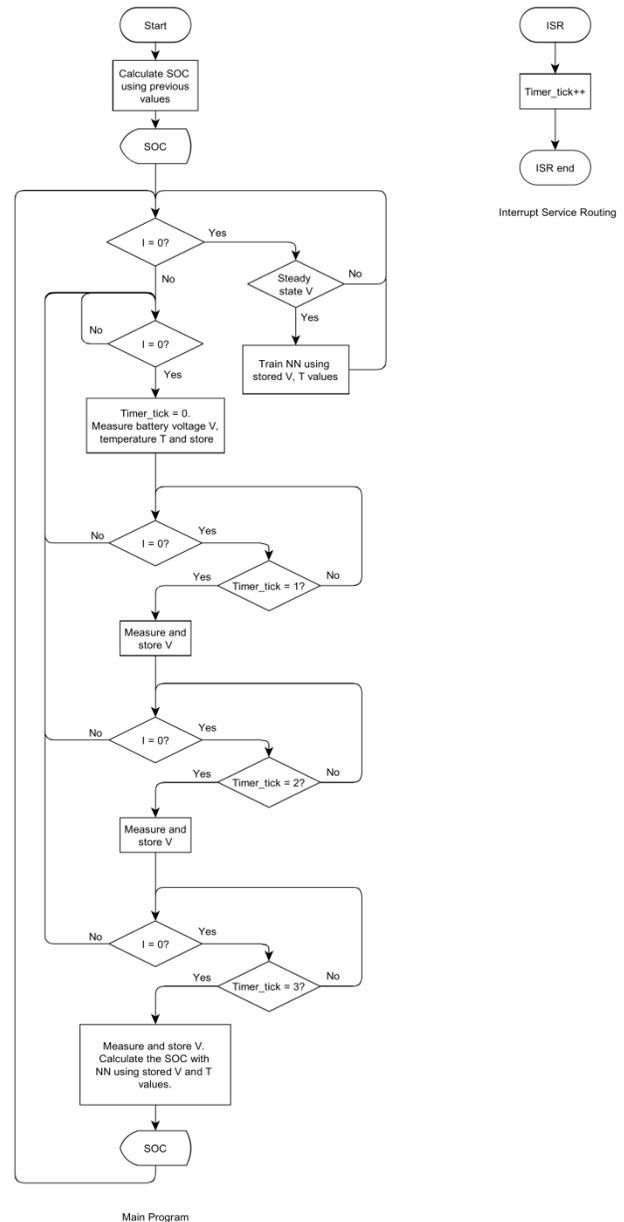
$$SOC = aE + b$$

where  $a$  and  $b$  are two constants determined by voltages of full and zero capacities. For lead acid battery the steady-state open-circuit voltage varies between 1.93 to 2.18 volts per cell approximately from 10%-100% SOC and it takes more than 30 minutes to reach the steady-state open-circuit voltage. The parameters  $a$  and  $b$  vary with the battery age.

For a lithium ion battery, the steady-state open-circuit voltage varies between 3.4 -4.1 volts per cell approximately from 10%-100% SOC [4], and the battery shows a dual gradient linear relationship from 10%-70% and 70% -100% with two different gradients. The battery takes more than 20 minutes to reach its steady state open circuit voltage after charging or discharging. In Lithiated Nickel Oxide (NCA) batteries, a single gradient linear relationship between the steady-state open circuited voltage and SOC extending from 10-100% [2].

If the vehicle is stopped for more than 30 minutes the battery will reach the steady-state open-circuit voltage and a very good estimate for the SOC can be obtained. However our attempt is to obtain an accurate SOC estimate while the vehicle is in use. Due to obstacles such as heavy traffic, traffic signals, road bends etc. it is usual that driver temporary takes the foot off the accelerator paddle. In case of an electric vehicle, this will disconnect the battery from the motor load and hence battery open-circuit voltage can be measured. In our proposed method, open-circuit voltage is measured at four regular sampling instants and a trained neural network is used to obtain an accurate estimate of the SOC. The neural network is trained every time the vehicle is stopped for more than 30 minutes.

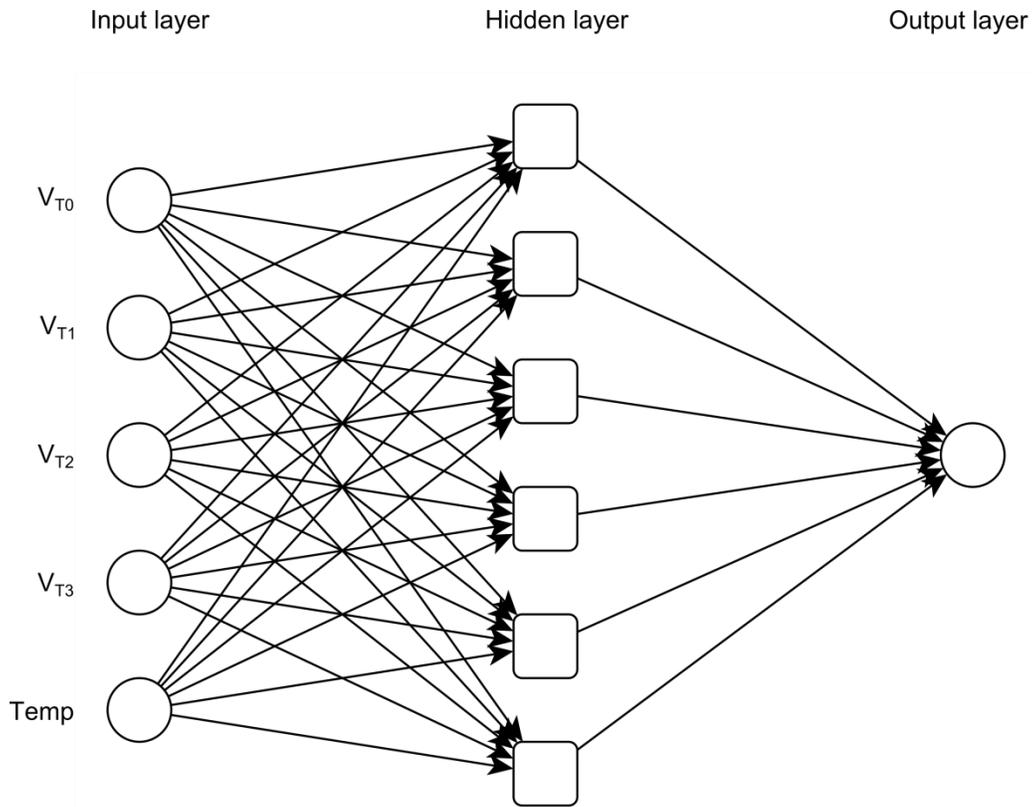
Figure 1 depicts the proposed SOC estimation algorithm. A sampling clock activates the algorithm to measure the battery voltage and current at regular intervals and computations are activated when the current drawn from the battery reaches zero. The algorithm stores the open-circuit battery voltage  $V(nT)$  for initial four samples and a trained neural network is used to compute the SOC and update the display. The sampling interval is in the order of 1 second and hence every time the load current is disconnected for more than 4 seconds, the SOC display is updated. The algorithm continues to measure the open-circuit voltage to find the steady-state open-circuit voltage. When the measured open-circuit voltage remains constant for few measurements under no-load condition, algorithm decides that sufficient time has elapsed and battery has reached its steady-state open-circuit voltage. This measured open-circuit voltage with the previously measured initial four samples is a training data set. Using this training data set, neural network is re-trained. This retraining process occurs every time the driver stops the vehicle for more than 30 minutes and hence the reduction of the battery capacity due to aging is taken into account. As the battery SOC is also depends on the battery temperature, battery temperature is also measured and used as an input for the neural network.



Main Program

**Figure 1: Algorithm Flow Chart**

Figure 2 depicts the block diagram of the neural network with five input nodes, one output node and hidden layer with six nodes. Our studies have reveal that only five input nodes and hidden layer with six nodes are sufficient to get a SOC estimate with 1% accuracy, whereby entire algorithm can be coded into a low cost microcontroller.



**Figure 2: Neural Network**

### III. IMPLEMENTATION

The block diagram the SOC estimator based on AT-Mega88PA microcontroller is depicted in Figure 3. It has three analog input ports to measure the battery voltage, current and temperature. It has a 96x65 dot matrix display to display the battery SOC with other relevant parameters such as degree of aging. Further, there is an analogue output indicating the SOC. As battery current is measured, the unit containing the microcontroller and dot-matrix display is fixed closed to the battery while the analog display is fixed on the dash-board. The detailed block diagram of the main controller is depicted in Figure 4. The inputs are low pass filtered and fed to three analog input ports of the micro controller. An 8-bit output port drives the LCD display. The analog display is driven by a wire-pair and a PWM signal having an average DC value proportional to the SOC is generated by the microcontroller.

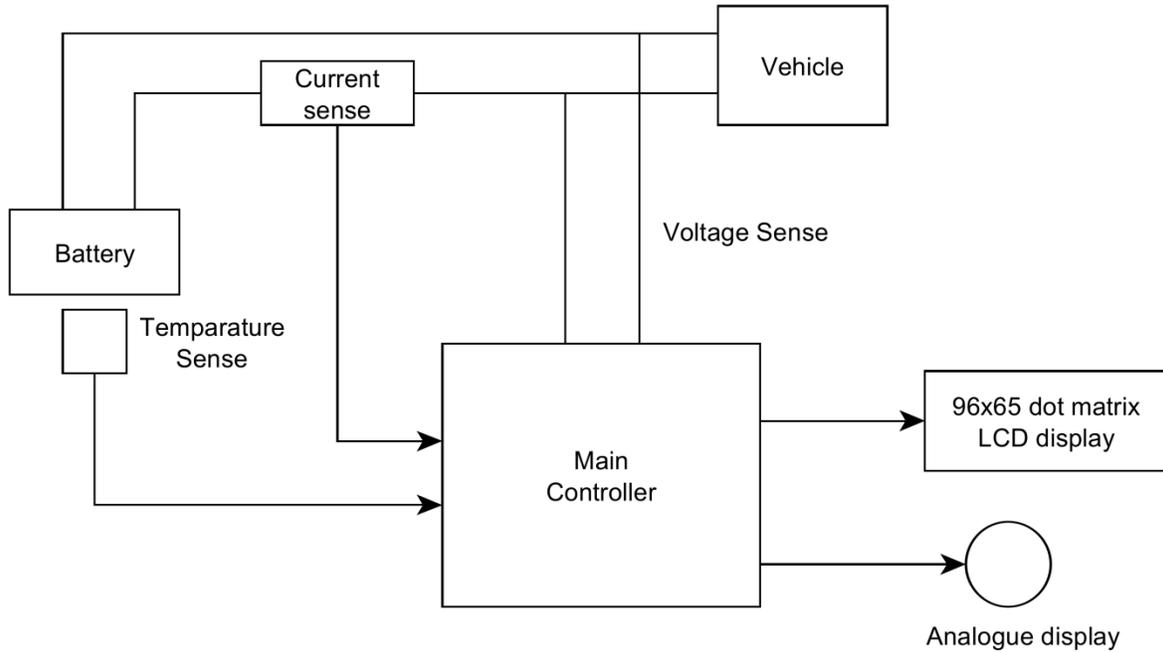


Figure 3: System Block Diagram

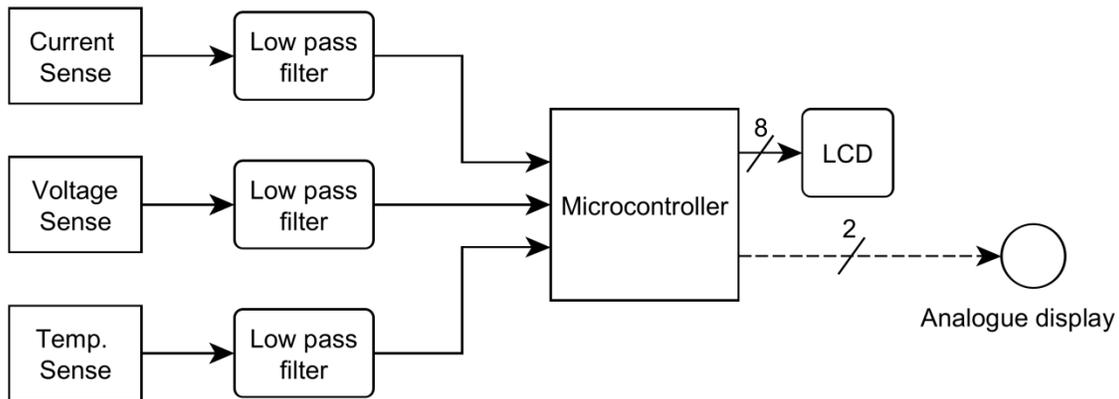
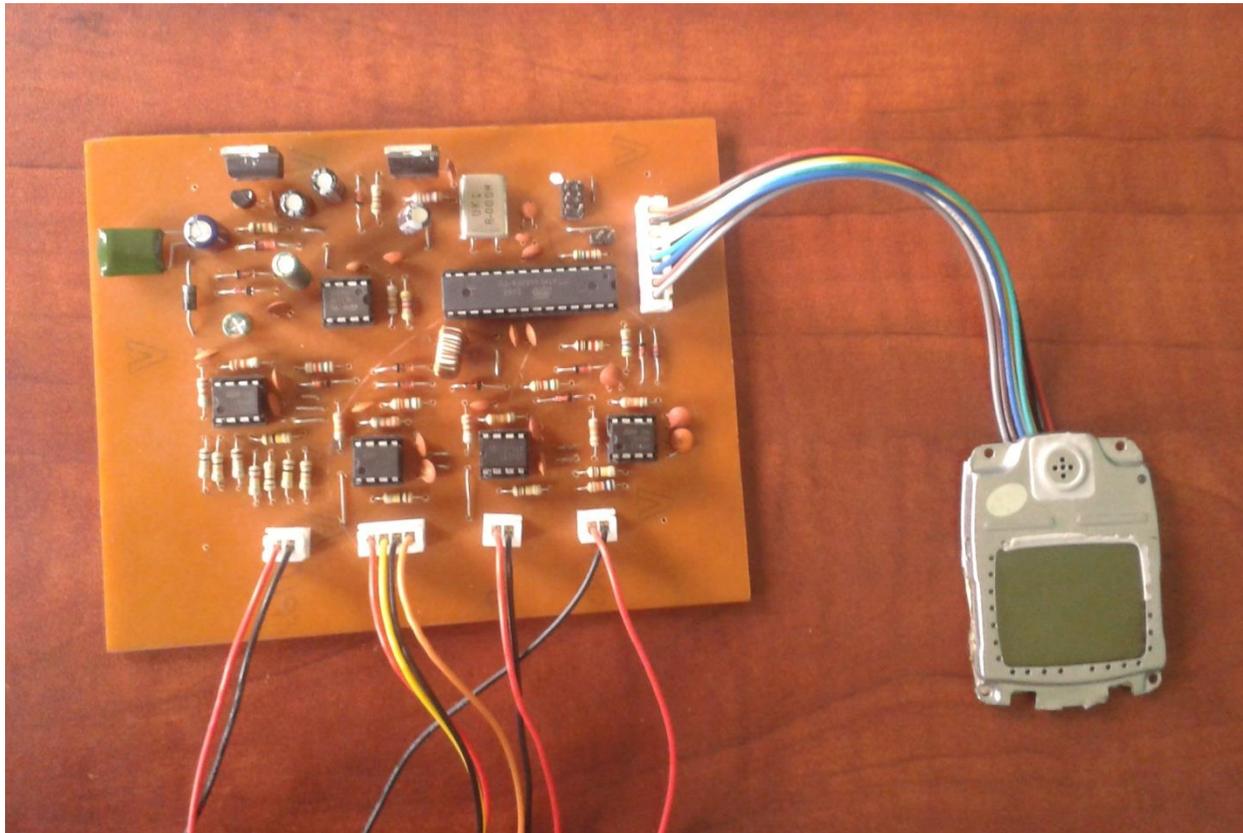


Figure 4: Main Controller Block Diagram

The photograph in Figure 5 shows the prototype implementation. Due to the simplicity of the algorithm the code is stored in a low cost microcontroller containing 8 kbytes program memory, 512 bytes EEPROM for storing data, 3 timer-counters for pro-

gram flow control. The cost of the prototype is Rs. 2000/= and hence can be used even with low-end electric vehicles such as electric scooters.



**Figure 5: Photograph of the prototype**

#### IV. CONCLUSION

A neural network based algorithm and its implementation on a low-cost microcontroller for getting very reliable estimate of the SOC of lead acid and lithium ion batteries used in electric vehicles is presented. The simplicity of the algorithm makes it possible to implement the system using a low cost microcontroller while the robustness of the algorithm make it possible to get a very reliable estimate for the SOC even taking the battery aging and temperature effects.

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# Online Reservation System Using QR Code based Android Application System

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**Abstract-** Indian Railway is world's largest human transport system, is currently dealing with a lot of problems, such as availability of confirming seat if available during immediate cancellation / getting down at destination where other waiting list passenger from that destination can board a train and reach the destination to avoid not allowing the other people who enter the train without buying tickets and then buy tickets from tc, reduce the burden of passenger to carry ticket. However there is no such system that presently in Indian railway gives accommodation to waiting list passengers during their journey and reducing the burden of carrying tickets. This paper proposes the new Seat Allocation system considering the advantage of QR code image that contains information about ticket and passenger info in form of 2d. Moreover, authentication seat allocation checking by tc is done using another android app for tc which verifies qr code information with the database and reduces the burden of tc. Through this research paper our approach is to make journey of waiting list passengers more convenient in Indian Railway.

**Index Terms-** Indian Railway, QRCodeImage(2d), Reservation System, waiting list Seat Allocation.

## I. INTRODUCTION

**I**A. Indian Railway  
Indian Railway is India's third largest human transport system over which 2 crore [1] passengers travel daily all over India. Even if there are seat available random people who don't buy tickets enter the compartment and buy tickets from the tc. Due to this, peak seasons take place and more than half of the passengers having tickets of waiting suffer. These waiting list passengers accomplish their journey from their source station to destination in standing mode. The number of passengers in Indian Railway has been increasing drastically in every year, in a rate of 25 to 50 percent from its previous year [1]. Such increase also increases the number of waiting list passengers in every train. Increasing number of waiting list passengers, increase rushes in train which results "happy journey" slogan of Indian Railway in to "unhappy journey".

## B. QR code 2d Image

There are forms of qr code ie 2d,3d,4d etc as the dimension increases process time and scanning time increases to avoid this we make use of qr code 2d image which reduces the time of scanning and makes the work of tc much faster.

## II. PROBLEMS IN CURRENT SYSTEM

There is more space for touts to book tickets illegally and sell them at exaggerated price, [4].

Less exposure of technology, for example Travelling Ticket Examiner (TTEs) still use pen and reservation charts to verify the passengers.

A passenger cannot get the reservation after chart is prepared; i.e. chart is prepared four hours earlier of train departure; however train may remain vacant.

Lack of optimization in seat allocation, for example whether passenger has boarded or not his seat remains reserved till his destination.

A seat can remain vacant if passenger has not arrived and if after departure of train he cancels the ticket then loss of revenue to the Railway.

There is no dynamic seat allocation for waitlisted passenger in place of vacant seats, if passengers with reserved ticket have not arrived.

Our proposed DSA model is an attempt to solve the above problem with the help of QR code. QR code is used to embed the URL in the ticket. It facilitates faster ticket checking process. One of the wireless standards is used for connectivity between HHT and DSA server by which authentication is provided to every ticket.

Very often, every journey starts with the purchase of the tickets at a ticket counter or from the machine such as personal computer. It would be convenient to have electronic systems which make the task of passenger easy and convenient. The expanded use of mobile phones, their computational capabilities and their ability to connect to the internet make them suitable. Several new technologies have been used for this purpose. A very interesting system is touch and travel which is operational in German Railway.

Many problems in Indian Railway still exist after the adoption of latest technologies in electrical, mechanical and commercial department. One of the problems is, with the waiting list passengers, because they are not able to get their confirm seat up to their destination due to rush. The Indian Railway has decided to solve this problem by increasing the number of coaches for waiting list passengers by making their tickets confirm. But still the problem continues because of non-availability of coaches, because near about 10,000 trains run every day all around India.

Through this research paper we are attempting to propose the DSA model which minimizes the problem of waiting list passenger's up-to a certain level. Moreover transparency in the system comes with use of technology. In this model we have enhanced the use of QR code with communication Network of Indian

Railway as technology. QR code is a 2 dimensional bar code that can be easily created and decoded with the help of smart phones. Therefore we have suggested the use of mobile phones for secure distributed document processing in the developing world since the smart phone is the pervasive information appliance of choice.

### III. RELATED WORKS

In the current scenario of Indian Railway a device called palmtop is given to ticket checker. This device will replace the reservation list carried by TTEs. Palmtop is connected to central server. From the Palmtop TTE update the passenger's presence in the train to central server. From this, the status of availability of seats would be shown on the railway network and that could be booked by anyone who is willing to travel in the train at the upcoming stations. But, here we proposed that, if there are waiting list passengers and if any seat is available during their journey then the seat is provided to that passenger which is having waitlist 1, which means available seat is allocated on first come first serve basis [5].

The Northern Railway have been decided to include the Palmtops in some Rajdhani and Shatabdi Trains, after the Pilot project introduced in 2009 have been successful. It brings efficiency and transparency in booking of tickets in running trains.

This system has been developed by the Center for Railway Information System (CRIS), a railway public sector company which provides consultancy and IT services to the human transport system. Presently, this system is operational in Amritsar, Ajmer and Dehradun Shatabdi Express [6]. But the Palmtops have connectivity problems on some stretches, so an alternative method should be sought.

Therefore the communication technology which is proposed to use for proper implementation of this assignment is based on that communication technology which are currently used in real time movements of trains in Satellite Imaging Rail Navigation (SIMRAN).

### IV. PROPOSED MODEL

The dynamic seat allocation system is the proposed model which is helpful to Indian Railway in many ways.

Check-in for all the boarded passengers.

If anyone willing to discontinue the journey then check-out procedure will be followed that gives the vacant seat information to the PRS and PRS will allot this seat to a non-confirmed passenger informing by an SMS.

In TTE's device there will be 3 interfaces as follows.

i. CHECK-IN

ii. CHECK-OUT

iii. BOOKING

Our proposed DSA model is divided in the following sub-module.

- (A) Little modification in current Passenger Reservation System.
- (B) Check-in, Check-out and Booking procedure.
- (C) Automatic up gradation procedure.
- (D) Allocation Procedure.

#### A. Little Modification in Current Passenger Reservation System

Today PRS is available at 8000 counters more than 2380 locations throughout the countries, including all major stations, and important non-railhead locations such as tourist centers and district head quarters. The PRS services are available to passengers for 23 hours in a day. Passengers can reserve a berth for any train 120 days in advance. In addition to the railway counters, multiple delivery channels have been provided to Rail passengers to access the PRS services. I-Ticketing and E-ticketing and through Internet was launched in year 2002 and 2005 respectively. Booking through Post offices was launched in year 2007 [7].

Besides all these facilities provided by Indian Railway one attempt that was tried to make is to reduce the usage of paper as much as possible. Passengers are requested to use their Mobile Phones as journey tickets, because the ticket is stored in Mobile Phone either as an SMS sent by IRCTC or in the PDF format store in memory card in the case of e-ticket [7].

In an attempt with the Indian Railway our proposed Model suggest the use of QR code in the ticket generated from the counter and e-ticket, which contains the URL, for example <http://xyz.in/nr/c4Lj9gM> which is passenger specific and give the detail of that passenger from whom the QR-Code is extracted. A sample of QR-Code image is given in the following Figure 1. The above URL has three parts which are described as:-

- A. **xyz.in**: server site of Indian Railway.
- B. **nr**: Northern Railway of Indian Rail network.
- C. **c4Lj9gM**: Passenger Specific unique Code randomly generated. It is same as user id of various mail servers.



Fig.1: Sample of a QR Code on a Ticket.

So the steps in above proceedings in passenger view points are:-

### START OF THE JOURNEY:

- A. Obtain the reservation ticket either confirm or waiting with the QR-code print over the ticket.
- B. In the case of mobile phone ticket QR Code image is sent to the multimedia handset of Passenger.

If the Passenger does not have any multimedia handset, he must take printout of the ticket.

### B. Check-In, Check-Out and Booking Procedure

Now from here the job of the TTEs starts to check each and every passenger's ticket and make the entry from his Hand Held Terminal. The Hand Held Terminal is equipped with the Android platform and operating system of smart phone, based on Linux Kernel [8]. In the proposed model passenger are required to check-in at the beginning of their journey with the help of HHT. Now the TTEs will perform the following steps to accomplish his job:-

#### 1. CHECK-IN

- A. TTEs make a request to passenger to show his ticket.
- B. Passenger places his Mobile Phone or ticket in his hand near Hand Held Terminal of TTEs to read QR barcode for check-in as shown in figure 2.
- C. A TTEs uses application of his Android HHT to read the QR Code over the ticket or from the screen of passenger's phone and verifies it.
- D. Application of HHT give the URL after decoding information from QR Code, this URL helps the TTEs to login in PRS server to extract the information in respect of passenger.
- E. The information obtained from PRS is then matched with the ticket of passenger.

If the information matched along with any identification proof carried by passenger then the TTEs will push the button of check-in shown in the figure below to make an entry of the presence of passenger to the DSA server.



Fig.2: A QR Code Having URL.

#### 2. CHECK-OUT

- A. TTE press the check-out interface and scan the QR code.
- B. HHT redirects to PRS server and fetch the passenger detail.
- C. TTE authenticate the passenger with the Information provided by PRS server and press OK

#### 3. BOOKING

This is used when a passenger is boarded in the train without ticket.

- A. TTE press the Booking interface in HHT and its camera is switched on to take a snap of passenger or her ID card or her photograph.
- B. Enters her name and journey detail.
- C. After payment ticket is booked and she is authorized to travel in the train.

Above three procedures can be accomplished through the TTEs, HHT device whose interface is shown in Figure 3.



Fig.3: An Interface of HHT for Check-In Check-Out and Booking.

### END OF THE JOURNEY:

- A. Now the check-out procedure is done automatically by the DSA system when the passenger completes his journey and leaves the train.
- B. But if the passenger left the journey in-between due to his personal reason then the TTEs will check-out to give the information to DSA for dynamically allocation of seat.

Now from here the job of the TTEs finishes after checking both confirm and waiting list passengers who are in the train.

### C. Automatic Upgradation Procedure

The automatic up gradation procedure of DSA server of Indian Railway makes the Reservation system dynamic. It means that now it is possible to make the reservation when the train is

running. This up gradation policy gives the transparency in berth or seat booking either through online or from the counter.

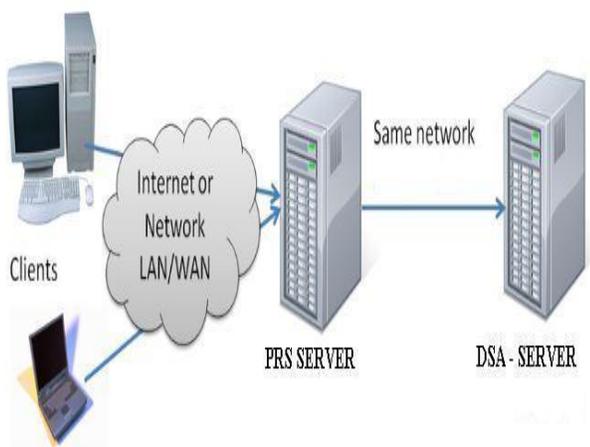
Here we have suggested one more server to be installed parallel to the PRS server, situated at five different cities such as New Delhi, Mumbai, Kolkata, Chennai and Secunderabad.

**DSA ARCHITECTURE:**

The DSA Architecture is based on 3-tier client-server distributed transaction paradigm as shown in Figure 4. The system has distributed architecture with 5 server clusters placed in server centers in five cities: Mumbai, New Delhi, Kolkata, Chennai and Secunderabad along with the PRS server. The server clusters are connected together by a core network based on a mesh of 02x02 Mbps leased lines using RTR (Reliable Transmission Router) as middleware.

## 3-Tier Deployment

Clients can be on the Internet or same network



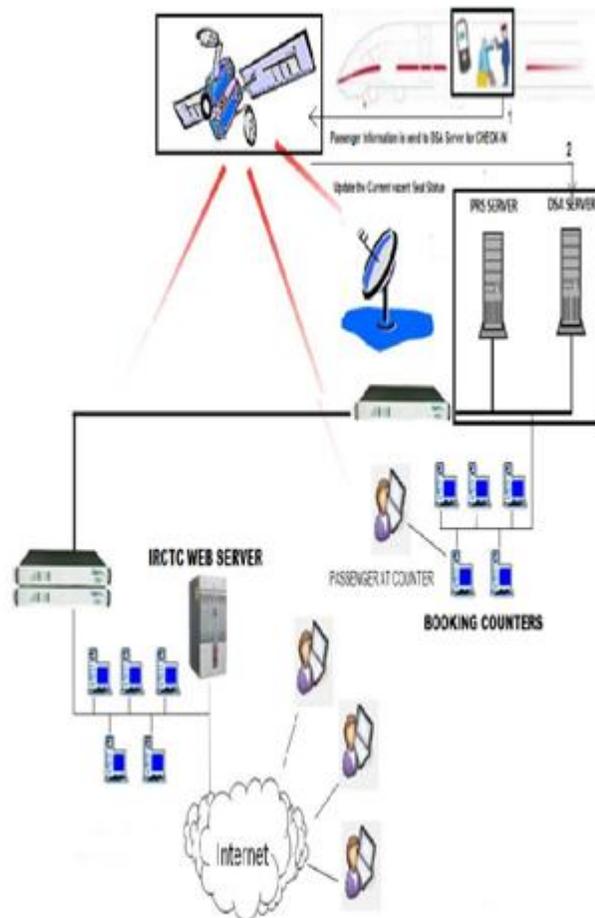
**Fig.4: 3-Tier Architecture of Indian Railway.**

**UPGRADATION POLICY:**

Availability of seat on train when it is running is depends upon the following policy.

- A. First the berth is provided to waiting list passengers who are on the train and only those waiting passenger are given first priority whose journey in km is maximum. It means waiting list passengers are arranged in descending order according to their distance to be travel.
- B. Second condition will apply if there will be no waiting list passengers, only then the seat or berth can be booked from counter or through online to the passenger who is willing to start the journey from the next station when the train has to arrive.

In Figure 5 explains all the above procedure which is going to happen.



**Fig.5: Network Scenario.**

**D. Allocation Procedure**

Once the DSA Server updates its database it will give the vacant seat information to the PRS server every time it will update. Next, if the waiting list passenger are on the train and the seat are vacant then DSA SERVER will automatically allocate the seat to waiting list passenger otherwise it will be booked from counter or through online. In this way it is possible to allocate seat dynamically during the journey of waiting list passenger. The above concept can be best understood by the figure 6.

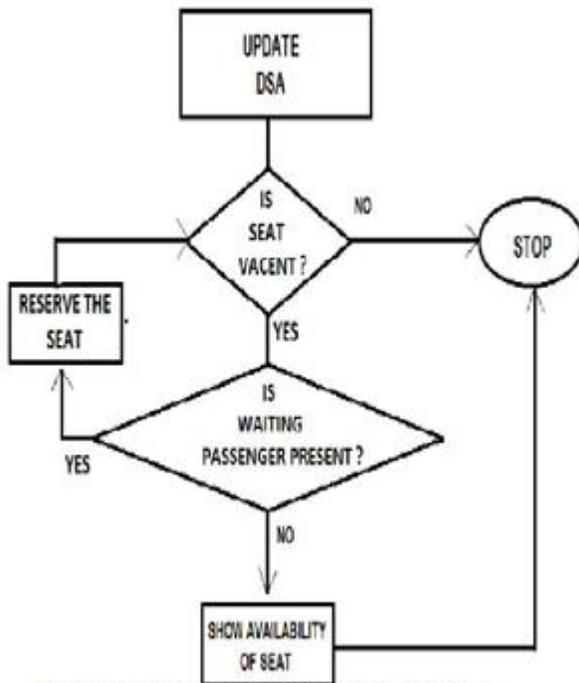


Fig.6: Flowchart of Allocation Procedure.

## V. BENEFITS

This technology will replace the complex reservation chart that is often carried by the TTEs.

Induction of this technology will facilitate travelling ticket examiners to allot vacant seats to short distance passengers.

It will enable TTEs to update the status of passengers who are turning up for the journey.

After this updating, reservation server will come to know about the seats of absent passengers and will allot those seats to RAC/WL passengers informing them by sending a SMS.

After allotting the seats to all the RAC/WL passengers, if some seats still remain vacant then it will be reflected as available seats across railway network and it could be booked by any passenger which is willing to travel from the upcoming station.

Revenue of railway is increased.

Procurement of tickets by touts is eliminated.

It attempts to reserve each and every seat even vacant for one station to next station.

It maintains the transparency in berth allocation and makes the ticket checking process fast.

## VI. CONCLUSION

This model proposes radical change in train operation and passenger experience. Hand Held Devices are given to TTEs for smooth and faster verification of passengers. QR code is printed on the tickets and this QR code is scanned by HHT devices. In QR code a passenger specific URL is stored, when HHT device encode this URL by Check-in process it redirects to PRS server and fetch stored data to verify the passenger. Check-in process updates the information of all passengers available in the train

and let the DSA server to make the seat reserve or vacant. DSA server allot the seats of absent passengers to waitlisted passengers and if still some seats remain vacant then reflect them as available across railway network from where any passenger willing to board on it can book the ticket. Apart from this Check-in, a Check-out and Booking process is also provided to the TTE by this HHT. Check-out process provides the passenger to break his journey at any station by getting his remaining money back and at the same time his vacant seat is provided to a waitlisted passenger. Booking interface provides capability to book the ticket for passengers on board. These technology inclusions in the railway bring transparency and reduce the activities of touts at peak seasons.

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# Text Extraction from Image and Displaying its Related Information

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**Abstract-** In this project we combine the best ideas from the text extraction with the help of character description and stroke configuration, web context search and web mining with the help of semantic web and synaptic web at low entropy. First, we design a discriminative character descriptor. Second, we model character structure at each character class by designing stroke configuration maps. With the help of web context search, the extracted text is searched over the net. In the proposed approach we have extended the context of user's interest and developed an unsupervised algorithm to find the items of interest for the user. Web mining is the application of data mining technique to automatically discover and gathered information from web documents. It is used to find out the relevant and efficient results from the web. Semantic-Synaptic web mining interlinks the web of data to different data sources at low entropy.

**Index Terms-** Character descriptors, stroke configuration, SWT, interest-item matching, Semantic Web, Synaptic Web, meta-data, entropy.

## I. INTRODUCTION

This paper aims at making a Mobile Application Which recognize the text from an image capture from a mobile camera and gives information related to it. This is done using Character Descriptor and Structure Configuration. Extracting text directly from natural scene image or videos is a challenging task because of diverse text patterns and variant background interferences. Previously proposed algorithms are applied to obtain text regions from scene image only. The best word recognition rate for scene images was only about 41.2%. To extract text information by mobile devices from natural scene, automatic and efficient scene text detection and recognition algorithms are essential. However, extracting scene text is a challenging task due to two main factors:

- 1) Cluttered backgrounds with noise and non-text outliers, and
- 2) Diverse text patterns such as character type, fonts, and size.

To solve these problems, scene text extraction is divided into two processes: text detection and text extraction. Extracting text from natural scene and displaying information related to it will help to know the surrounding environment. This application will help tourist who did not know local languages of particular country/area he will get information with the help of this application. This application will also help to know the information related to

any hand-held objects. As we will embed this application in a smart phone, there will be more mobility.

## II. RELATED WORK

Extracting text from image is a difficult task. To perform this task various techniques have been implemented before. Cluster classification [1] is one of the techniques which have high accuracy in detecting text area and non-text area. There is new trend towards content based document image retrieval technique without going through OCR process [2]. There is another technique named as sliding window detection which has high accuracy of detecting text in natural scene.

This paper uses different techniques for text extraction, web context search and web mining. Different techniques used are character descriptor and stroke configuration [4] for text detection and extraction, item ranking based on users interest [6] for web context search and semantic and synaptic web mining at low entropy for retrieving most relevant data from the web[7].

## III. SYSTEM ARCHITECTURE

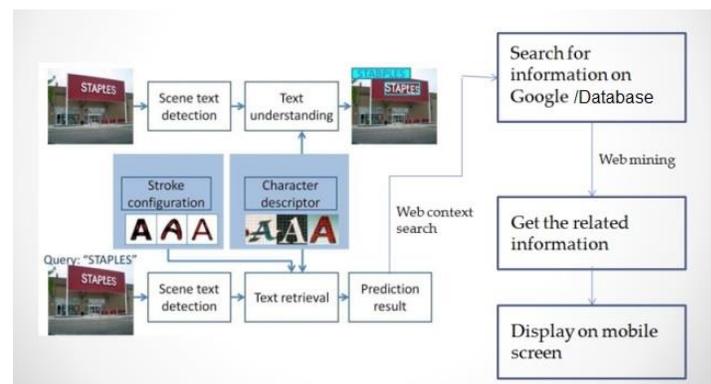


Figure 1: System Architecture

Objective of this system is the extraction of text from any image and then displaying its related information on the mobile screen. Main goal of this system is that if a person doesn't have or know any specific thing then he/she could get its information with the help of this android application. Different modules used in this system are as follows:

### A. Text Extraction:

In text extraction feature text is being extracted from the natural scene or an image. Here text extraction is done with the help of character description and stroke configuration [1]. Firstly the text will be detected, understood and then recognized.

**B. Searching:**

In searching process extracted text is being searched over net or in database. Here searching is done with the help of item ranking according to the item of interest. It basically derives meta data information about the item of interest by extending the user's given interest.

**C. Web Mining:**

In this mining process required information is retrieved from the web or from database in an efficient manner. This is done with the help of Semantic and Synaptic web mining at low entropy [7]. After retrieving the information successfully it is displayed on the mobile screen.

**IV. ALGORITHM AND FLOWCHART**

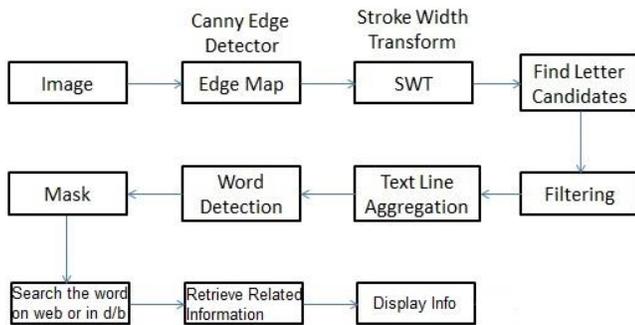


Figure 2: System Flowchart

**SWT:** Computes per pixel, width of the most likely stroke containing pixel [8].

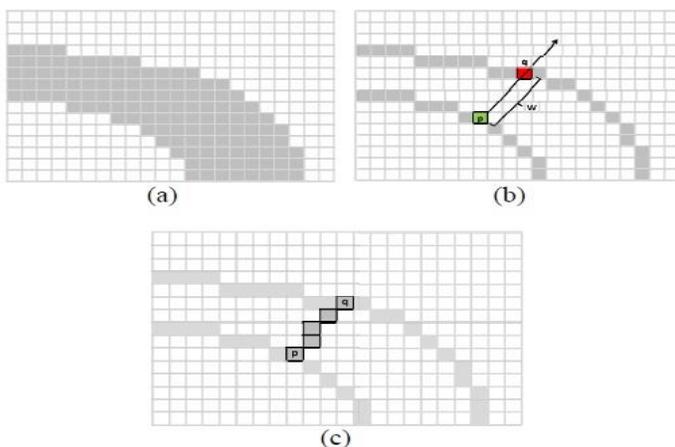


Figure 3: Stroke Width Transform

1. Initially set  $SWT = \infty$
2. Find edge by canny edge detector.
3. Follow the ray  $r=p+n*dp$ ,  $n>0$  until another edge is found.

4. If  $dq = -dp \pm \pi/6$  then  $SWT = |p - q|$  and  $dp++$  else discard the ray.
5. If  $SWT \text{ ratio} \leq 3$  then group neighbouring pixels.
6. If two letters are having similar stroke width, they can be grouped.
7. The output is a set of rectangles designating bounding boxes for detected words.
8. Search the text on web or in database.
9. Match the word, and retrieve the related information.
10. Display retrieved information on mobile screen.

**V. TECHNICAL SPECIFICATION**

**Advantages:**

- 1) Tilt text is detected.
- 2) High accuracy in natural scene.
- 3) Requires less text extraction database.
- 4) Most relevant and accurate data is retrieved from the web.

**Disadvantages:**

- 1) Handwritten text cannot be accurately recognized.

**Application:**

- 1) Analysis of documents can be easily done.
- 2) Industrial automation.

**VI. CONCLUSION**

Thus this paper achieves the objective of text extraction from image and displaying its information on android platform, with the help of text extraction algorithm, web context search algorithm and web mining algorithm.

**APPENDIX**

**GLOSSARY:**

- 1) HOG - It models character structure feature and cross correlation analysis of character similar from text recognition and detection.
- 2) Meta-data - A set of data that describes and gives information about other data.
- 3) Semantic Web - It is a technique to manage content and process with creation and use of semantic metadata.
- 4) Synaptic Web - Synapse is a biological term, it is the connection between different neurons in the brain, same as in the synaptic web like the human brain the synaptic connections between objects (Content/ Information) are more important than the object themselves makes the smarter web.
- 5) Entropy - In information theory the term generally refers to the Shannon entropy, is a measurement of uncertainty and inconsistency in random variable, which evaluate the information content in a message.

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# Congestion Control for Packet Switched Networks: A Survey

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**Abstract-** Congestion has been considered as one of the basic important issue in packet switched network [1][9]. Congestion control refers to the mechanisms and techniques to control the congestion and keep the load below the capacity. This paper provides an overview of category provided by congestion control .It also includes how TCP uses congestion control to avoid congestion or alleviate congestion in network. Computer networks have experienced an explosive growth over the past few years and with that growth have come severe congestion problems. This paper also concentrates on avoidance of congestion. This scheme allows a network to operate in the region of low delay and high throughput. In this paper, a survey on various mechanisms of congestion control and avoidance has been done.

**Index Terms-** Congestion Control, Transmission Control Protocol, Active Queue Management, Congestion Avoidance.

## I. INTRODUCTION

Congestion in a network may occur if the load on the network-the number of packets sent to the network is greater than the capacity of the network-the number of packets a network can handle..Network congestion occurs when a link or node is carrying so much data that its quality of service deteriorates. Typical effects include queuing, packet loss or the blocking of new connections. Congestion control is a method used for monitoring the process of regulating the total amount of data entering the network .so as to keep traffic levels at an acceptable value. This is done in order to avoid the telecommunication network reaching what is termed congestive collapse. Modern networks use congestion control and network congestion avoidance techniques to try to avoid congestion collapse. These include: exponential back off in protocols such as 802.11's CSMA/CA and the original Ethernet, window reduction in TCP, and fair queuing in devices such as routers Congestion avoidance techniques monitor network traffic loads in an effort to anticipate and avoid congestion a common network bottleneck.

## II. EFFECTS OF CONGESTION

Congestion affects two vital parameters of the network performance, namely *throughput* and *delay*. The throughput can be defined as the percentage utilization of the network capacity. Throughput is affected as offered load increases. Initially throughput increases linearly with offered load, because utilization of the network increases. However, as the offered load in-

creases beyond certain limit, say 60% of the capacity of the network, the throughput drops. If the offered load increases further, a point is reached when not a single packet is delivered to any destination, which is commonly known as *deadlock* situation. The ideal one corresponds to the situation when all the packet introduced are delivered to their destination up to the maximum capacity of the network. The second one corresponds to the situation when there is no congestion control. The third one is the case when some congestion control technique is used. This prevents the throughput collapse, but provides lesser throughput than the ideal condition due to overhead of the congestion control technique.

## III. CONGESTION CONTROL MECHANISMS

Congestion control mostly applies to packet-switching network. A wide variety of approaches have been proposed, however the "objective is to maintain the number of packets within the network below the level at which performance falls off dramatically.

### 3.1 TRANSMISSION CONTROL PROTOCOL (TCP):

There has been some serious discussion given to the potential of a large-scale Internet collapse due to network overload or congestion [2]. So far the Internet has survived, but there have been a number of incidents throughout the years where serious problems have disabled large parts of the network. Some of these incidents have been a result of algorithms used or not used in the Transmission Control Protocol (TCP) .The popularity of the Internet has heightened the need for more bandwidth throughout all tiers of the network. Home users need more bandwidth than the traditional 64Kb/s channel a telephone provider typically allows. Video, music, games, file sharing and browsing the web requires more and more bandwidth to avoid the "World Wide Wait" as it has come to be known by those with slower and often heavily congested connections. Internet Service Providers (ISPs) who provide the access to the average home customer have had to keep up as more and more users get connected to the information superhighway. Core backbone providers have had to ramp up their infrastructure to support the increasing demand from their customers below. Today it would be unusual to find someone in the U.S. that has not heard of the Internet, let alone experienced it in one form or another. The Internet has become the fastest growing technology of all time . So far, the Internet is still chugging along, but a good question to ask is "Will it continue to do so?" Although this paper does not attempt to answer that ques-

tion, it can help us to understand why it will or why it might not. Good and bad network performance is largely dependent on the effective implementation of network protocols. TCP, easily the most widely used protocol in the transport layer on the Internet (e.g. HTTP, TELNET, and SMTP), plays an integral role in determining overall network performance. Amazingly, TCP has changed very little since its initial design in the early 1980's. A few "tweaks" and "knobs" have been added, but for the most part, the protocol has withstood the test of time. However, there are still a number of performance problems on the Internet and fine tuning TCP software continues to be an area of work for a number of people [3].

Over the past few years, researchers have spent a great deal of effort exploring alternative and additional mechanisms for TCP and related technologies in lieu of potential network overload problems. Some techniques have been implemented; others left behind and still others remain on the drawing board. We'll begin our examination of TCP by trying to understand the underlying design concepts that have made it so successful.

This paper does not cover the basics of the TCP protocol itself, but rather the underlying designs and techniques as they apply to problems of network overload and congestion. For a brief description on the basics of TCP, .The End-to-End Argument The design of TCP was heavily influenced by what has come to be known as the end-to-end argument . The key component of the end-to-end argument for our purposes is in its method of handling congestion and network overload. The premise of the argument and fundamental to TCP's design is that the end stations are responsible for controlling the rate of data flow. In this model, there are no explicit signaling mechanisms in the network which tell the end stations how fast to transmit, when to transmit, when to speed up or when to slow down. The TCP software in each of the end stations is responsible for answering these questions from implicit knowledge it obtains from the network or the explicit knowledge it receives from the other TCP host

Basic congestion control schemes

- Slow start
- Fast retransmission and Fast Recovery(Reno)

**3.1.1 SLOW START:** Slow start reduces the burst affect when a host first transmits. It requires a host to start its transmissions slowly and then build up to the point where congestion starts to occur[5].The host does not initially know how many packets it can send, so it uses slow start as a way to gauge the network's capacity. A host starts a transmission by sending two packets to the receiver. When the receiver receives the segments, it returns ACKs (acknowledgements) as confirmation. The sender increments its window by two and sends four packets. This buildup continues with the sender doubling the number of packets it sends until an ACK is not received, indicating that the flow has reached the network's ability to handle traffic or the receivers ability to handle incoming traffic .Slow start does not prevent congestion, it simply prevents a host from causing an immediate congestion state. If the host is sending a large file, it will eventually reach a state where it overloads the network and packets begin to drop. Slow start is critical in avoiding the congestion collapse problem. But new applications such as voice over IP cannot tolerate the delay caused by slow start and in some cases;

slow start is disabled so the user can grab bandwidth. That trend will only lead to problems.

**3.1.2 FAST TRANSMIT AND RECOVERY (RENO):** Fast retransmit and fast recovery are algorithms that are designed to minimize the effect that dropping packets has on network throughput. The fast retransmit mechanism infers information from another TCP mechanism that a receiver uses to signal to the sender that it has received packets out of sequence [4]. The technique is to send several duplicate ACKs to the sender. Fast retransmit takes advantage of this feature by assuming that duplicate ACKs indicate dropped packets. Instead of waiting for an ACK until the timer expires, the source resends packets if three such duplicate ACKs are received. This occurs before the timeout period and thus improves network throughput. For example, if a host receives packet 5 and 7, but not 6, it will send a duplicate ACK for packet 5 when it receives packet 7(but not packet 6).Fast recovery is a mechanism that replaces slow start when fast retransmit is used. Note that while duplicate ACKs indicate that a segment has been lost, it also indicates that packets are still flowing since the source received a packet with a sequence number higher than the missing packet[5].In this case, the assumption is that a single packet has been dropped and that the network is not fully congested. Therefore, the sender does not need to drop fully back to slow start mode but to half the previous rate.

### **3.2 ACTIVE QUEUE MANAGEMENT (AQM):**

Dropping packets is inefficient. If a host is bursting and congestion occurs, a lot of packets will be lost. Therefore, it is useful to detect impending congestion conditions and actively manage congestion before it gets out of hand.

Active queue management is a technique in which routers actively drop packets from queues as a signal to senders that they should slow down.

#### **3.2.1 RANDOM EARLY DETECTION (RED):**

RED is an active queue management scheme that provides a mechanism for congestion avoidance. Unlike traditional congestion control schemes that drop packets at the end of full queues, RED uses statistical methods to drop packets in a "probabilistic" way before queues overflow[8][14]. Dropping packets in this way slows a source down enough to keep the queue steady and reduces the number of packets that would be lost when a queue overflows and a host is transmitting at a high rate. RED makes two important decisions. It decides when to drop packets and what packets to drop. RED keeps track of an average queue size and drops packets when the average queue size grows beyond a defined threshold. The average size is recalculated every time a new packet arrives at the queue. RED makes packet-drop decisions based on two parameters:

**Minimum threshold** Specifies the average queue size below which no packets will be dropped.

**Maximum threshold** Specifies the average queue size above which all packets will be dropped.

**3.2.2 FRED (Flow based Random Early Detection):** FRED acts just like RED, but with the following additions.

FRED introduces the parameters min. and max., goals for the minimum and maximum number of packets each flow should be allowed to buffer. FRED introduces the global variable, an estimate of the average per-flow buffer count; flows with fewer than the packets queued are over flows with more. FRED maintains count of buffered packets queue length for each flow that currently has any packets buffered. Finally, FRED maintains a variable strike for each flow, which counts the number of times the flow has failed to respond to congestion notification; FRED penalizes flows with high strike values.

**3.2.3 BLUE:** The key idea behind BLUE is to perform queue management based directly on packet loss and link utilization rather than on the instantaneous or average queue lengths[16]. This is in sharp contrast to all known active queue management schemes which use some form of queue occupancy in their managing the congestion. It maintains a single probability

$m P$ , which it uses to mark (or drop) packets when they are enquired. If the queue is continually dropping packets due to buffer overflow, BLUE increments  $m P$ , thus increasing the rate at which it sends back congestion notification. Conversely, if the queue becomes empty or if the link is idle, It decreases its marking probability. This effectively allows BLUE to “learn” the correct rate it needs to send back congestion notification.

**3.2.4 ADAPTIVE CHOKe:** Adaptive CHOKe enforces the concept of queue-based and flow information. It is desirable for AQM schemes to act without storing a lot of information otherwise it becomes a overhead and non-scalable[11]. This algorithm modifies the CHOKe algorithm to remove its drawback. This algorithm also calculates the average queue size of the buffer for every packet arrival. It also indicates two thresholds of the buffer, maximum and minimum It reduces both the packet loss rate and the variance in queuing delay.

| S.NO | ALGORITHM | ADVANTAGES   | DISADVANTAGES   |
|------|-----------|--|---|
| 1    | RED       | Early congestion.<br>No bias against traffic.<br>No global synchronization.  | Difficulty in parameter setting.<br>Insensitivity to traffic load and drain rates.                    |
| 2    | FRED      | Good protection from misbehaving flows.  | Per-flow state.<br>Difficulty in parameter setting.<br>Insensitivity to traffic load and drain rates. |
| 3    | BLUE      | Easy to understand.<br>High throughput.  | No early congestion detection.<br>Slow response.  |
| 4    | A-CHOKe   | To protect well-behaved flows from misbehaving flow and adaptive flows from non-adaptive flows. packet loss with well adaptive tuned parameters. | Heavy load and unresponsive flow.   |

**TABLE:1. ADVANTAGES AND DISADVANTAGES OF AQM ALGORITHMS**

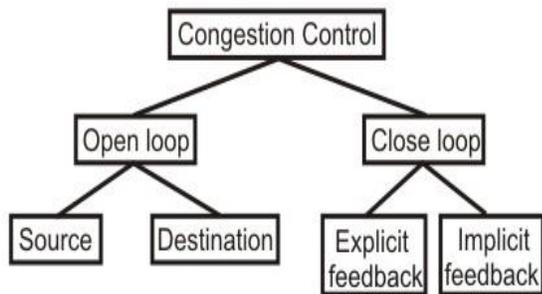
#### IV. CONGESTION CONTROL TECHNIQUES

Congestion control refers to the mechanisms and techniques used to control congestion and keep the traffic below the capacity of the network. Congestion control techniques can be broadly classified two broad categories:

**4.1 Open loop:** Protocols to prevent or avoid congestion, ensuring that the system never enters a Congested State. This category of solutions or protocols attempt to solve the problem by a good design, at first, to make sure that it doesn't occur at all. Once system is up and running midcourse corrections are not made. These solutions are congestion don't change much according to the current state of the system. Such Protocols are also known as Open Loop solutions. These rules or policies include deciding upon when to accept traffic, when to discard it, making scheduling decisions and so on. Main point here is that they make decision without taking into consideration the current state of the network. The open loop algorithms are further divided on the basis of whether these acts on source versus that act upon destination

**4.2 Close loop:** Protocols that allow system to enter congested state, detect it, and remove it. The second category is based on the concept of feedback. During operation, some system parameters are measured and feed back to portions of the subnet that can take action to reduce the congestion. This approach can be divided into 3 steps:

- Monitor the system (network) to detect whether the network is congested or not and what's the actual location and devices involved.
- To pass this information to the places where actions can be taken.
- Adjust the system operation to correct the problem.



**FIGURE 1: CONGESTION CONTROL CATEGORIES.**

## V. CONGESTION IN CONNECTIONLESS PACKET-SWITCHED NETWORKS

A network is congested when one or more network components must discard packets due to lack of buffer space. Given the above architecture, it is possible to see how network congestion can occur. A source of data flow on the network cannot reserve bandwidth across the network to its data's destination. It, therefore, is unable to determine what rate of data flow can be sustained between it and the destination. If a source transmits data at a rate too high to be sustained between it and the destination one or more routers will begin to queue the packets in their buffers. If the queuing continues, the buffers will become full and packets from the source will be discarded, causing losses of data. If the source is attempting to guarantee transmission reliability, retransmission of data and increased transmission time between the source and the destination is the result. As the load (rate of data transmitted) through the network increases, the throughput (rate of data reaching the destination) increases linearly. However, as the load reaches the network's capacity, the buffers in the routers begin to fill. This increases the response time (time for data to traverse the network between source and destination) and lowers the throughput.

Once the routers' buffers begin to overflow, packet loss occurs. Increases in load beyond this point increase the probability of packet loss. Under extreme load, response time approaches infinity and the throughput approaches zero; this is the point of congestion collapse. This point is known as the cliff due to the extreme drop in throughput.

### 5.1 AVAILABLE BIT RATE CONGESTION CONTROL IN ATM NETWORKS:

Asynchronous Transfer Mode (ATM) networks are characterized as connection-oriented cell switched networks. Cells are fixed in size (53 octets), and virtual circuits are established across the network to propagate the traffic for each connection. ATM provides several service classes to the connections established between sources and destinations: Constant Bit Rate (CBR), Variable Bit Rate (VBR), Available Bit Rate (ABR) and Unspecified Bit Rate (UBR). Of the four service classes, only ABR provides service degradation congestion control. With ABR, a source of cell traffic can specify minimum and maximum cell rates at connection establishment. If the connection is granted, then the source can transmit at a rate between the specified minimum and maximum cell rates. However, if the network be-

comes congested, the source may need to reduce its current cell rate to reduce the congestion. Several rate-based congestion control mechanisms were proposed to control source cell rates for the ABR service. The main proposals are summarized below.

**5.1. BECN:** In BECN, the intermediate switches return special resource management (RM) cells to sources of cells if they believe the source is causing congestion. Congestion is identified by monitoring cell queue lengths within the switches. On receipt of an RM cell, a source is obliged to halve its transmission rate. If no RM cells arrive after a recovery period, the source may double its cell rate (without exceeding the maximum cell rate specified at connect time). The recovery period is proportional to the current cell rate: as the cell rate drops, the recovery period shortens. BECN can be seen to be analogous to the Source Quench scheme, controlling the flow of a specific ATM connection.

**5.2 PRCA (PROPORTIONAL RATE CONTROL ALGORITHM):** PRCA has the source set every Congestion Experienced Bit on, but leave one in N off. If any RM cells arrive with the Congestion Experienced Bit off, then the destination sends RM cells back to the source, which prompt a source rate increase. Again, Multiplicative Decrease and Additive Increase is used to control the source's cell rate. With this approach, the source cannot increase its rate unless RM cells are received. PRCA was found to have a fairness problem for long-path connections. If the probability of a cell having its Congestion Experienced Bit set by one ATM switch is  $p$ , then the probability of it being set over a  $p$ -switch path is  $p^n$ . Thus, long-path connections have a lower chance of receiving a rate increase RM cell than short-path connections. This is known as the beat-down problem.

**5.3 EPRCA (ENHANCED PROPORTIONAL RATE CONTROL ALGORITHM):** Enhanced PRCA (EPRCA) resulted from a combination of PRCA and the explicit cell rate scheme described above. Cell sources send a combination of RM cells and data cells with Congestion Experienced Bits. Switches along the path of a connection may calculate the Fair Share rate for the connection (and place the value in the RM cells), set the Congestion Experienced Bits if the connection is exceeding its fair share (or is causing congestion), or both. EPRCA allows switches to perform binary-feedback congestion control, explicit rate congestion control, or both [17]

## VI. A RATE-BASED FRAMEWORK FOR CONGESTION CONTROL

**Congestion** information from the network, and to use this to adjust transmission rates which will optimize the overall network power. The obvious paradigm for such a congestion control system is to be rate-based.

### 6.1 OVERVIEW OF THE FRAMEWORK

The framework spreads the mechanisms of congestion control across both the Transport and Network Layers, measuring and using information on sustainable rates of traffic flow through the Network. The below steps are followed

The Transport Layer uses a rate-based flow control scheme, using rate information provided by the Network Layer. The flow control and error control mechanisms are orthogonal, being per-

formed by the Flow Control and Packet Retransmission functions, respectively

A source admits packets for each traffic flow (a single data stream from an application) into the network uniformly spaced in time. This reduces short-term congestion due to the traffic: this is performed by the Packet Admission function. Routers should attempt to preserve the time spacing of packets in a traffic flow

The routers in the Network Layer implement a congestion control scheme, part of which measures the sustainable traffic rate across the network for each traffic flow; this is performed by the Sustainable Rate Measurement function. This sustainable rate measurement is passed to the destination machine and then via acknowledgment packets to the source machine.

Routers implement both congestion avoidance and congestion recovery mechanisms as the rest of the Network Layer congestion control scheme. Routers partition the available resources fairly amongst traffic flows, in both uncongested and congested operating regimes. Routers drop packets when in the operating region of the congestion cliff. These operations are performed by the Packet Selection, Packet Queuing and Packet Dropping functions [7].

### 6.2 ROUTER PACKET DROPPING FUNCTION:

Router may use any packet dropping function which meets the design decisions. Dropping functions which attempt to preserve packet spacing for each source may be useful. If the rate-based framework keeps the network operating at maximum power, packet loss will occur rarely, and the choice of functions for both Packet Queuing and Packet Dropping will have little effect on the framework.

### 6.3 ROUTER CONGESTION RECOVERY:

The congestion framework has congestion avoidance; there may be times when a router reaches the point of congestion collapse. For example, a new traffic flow may learn about its rate allocation before other large round-trip flows learn that their allocation has been reduced. For a small period of time, more packets will be admitted into the network than can be transmitted. The large round-trip flows will eventually learn about their new rates, but only after one round-trip. It should be possible to inform these flows about the problem in less than one round trip. This control mechanism must also not overburden the network with congestion control information. For this issue, the congestion recovery mechanism Rate Quench Packet Generation is used. When a router considers itself congested, it returns Rate Quench packets to the sources it believes are the cause of the congestion. These packets also have a Return Rate field, which the congested router sets to values which will alleviate congestion from each of the congesting sources. Upon receipt of a Rate Quench packet with a Return Rate field lower than the source's current rate, the source is obliged to immediately lower its rate to the value in the Rate Quench packet. Rate Quench packets can never raise a source's transmitting rate. In order to ensure stale Rate Quench packets are not used, a source must discard Rate Quench packets which have a sequence number less than the last valid Rate Quench packet received.

## VII. CONCLUSION

This paper presents the study of congestion control and elaborates various issues related with it. As the congestion control is the most important factor of any packet switching network, the whole performance and accuracy of network is directly related to it, the congestion control becomes more important. We briefly survey of various congestion control algorithms. It shows that at present there is no single algorithm that can resolve every problems of congestion control on computer networks. Further research work is needed in this direction.

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# Performance Evaluation and Ranking of Private Sector Banks using Data Envelopment Analysis and Super-efficiency Model

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**Abstract-** Private Sector banks played a vital role in catering the needs of common man as well as business community in early years and also in current time period. In this paper major private Sector banks are considered for evaluating their performance using Data Envelopment Analysis (DEA). Super-efficiency DEA model is also used to rank the private sector banks.

**Index Terms-** Data Envelopment Analysis, Private Sector banks, Performance evaluation, Ranking, Super-efficiency.

## I. INTRODUCTION

Banking system is a boon for any country's economy. Indian banking sector is a combination of public and private sector banks. Private sector bank is one in which majority of stakes are held by private shareholders. In early period of banking industry, private sector banks played a vital role in catering the needs of people as well as business community. But since 1969 the public sector banks dominated the private sector banks as a result of nationalization. Again in 1991, as a result of liberalization, ample scope had arisen to play a prime role for private sector banks.

In the circumstances explained above it is needed to evaluate the performance of private sector banks and to know how private sector banks are influencing the common man and Indian economy. In current paper 13 major private sector banks were considered for performance evaluation. The secondary data pertaining to 13 private sector banks during the eleventh five year plan (2007-2012) has been obtained from the website of Indian Bank Association. Primarily we have evaluated the private sector banks using Data Envelopment Analysis (DEA) by calculating efficiencies of private sector banks with respect to Constant Return to Scale (CRS), Variable Return to Scale (VRS) and Scale efficiencies are also obtained. Further we have used super-efficiency model for ranking the private sector banks.

## II. DEA MODEL

Several DEA models have been presented in the literature. The basic DEA model evaluates efficiency based on the productivity ratio which is the ratio of outputs to inputs. This study applied Charnes, Cooper and Rhode's (CCR) (1978) model and Banker, Charnes and Cooper (BCC) (1984) model. The production frontier has constant returns to scale in CCR model. The basic CCR model formulation (dual problem/ envelopment form) is given by :

A. The basic CCR model formulation (dual problem/ envelopment form)

$$\text{Min} \theta - \varepsilon \left( \sum_{i=1}^m s_i^- + \sum_{r=1}^s s_r^+ \right)$$

Subject to:

$$\sum_{j=1}^n \lambda_j x_{ij} + s_i^- = \theta x_{i0} \quad (i=1, \dots, m)$$

$$\sum_{j=1}^n \lambda_j y_{rj} - s_r^+ = y_{r0} \quad (r=1, \dots, s)$$

$$\lambda_j \geq 0 \quad (j=1, \dots, n)$$

Source :Zhu (2003, p.13)

where,  $\theta$  denotes the efficiency of DMU<sub>j</sub>, while  $y_{rj}$  is the amount of  $r^{\text{th}}$  output produced by DMU<sub>j</sub> using  $x_{ij}$  amount of  $i^{\text{th}}$  input. Both  $y_{rj}$  and  $x_{ij}$  are exogenous variables and  $\lambda_j$  represents the benchmarks for a specific DMU under evaluation (Zhu 2003). Slack variables are represented by  $s_i$  and  $s_r$ . According to Cooper, Seiford and Tone (2004) the constraints of this model are:

- i. the combination of the input of firm j is less than or equal to the linear combination of inputs for the firm on the frontier;
- ii. the output of firm j is less than or equal to the linear combination of outputs for the firm on the frontier; and
- iii. the main decision variable  $\theta_j$  lies between one and zero.

Further, the model assumes that all DMUs are operating at an optimal scale. However, imperfect competition and constraints to finance may cause DMUs to operate at some level different to the optimal scale (Coelli, Rao & Battese 1998). Hence, the Banker, Charnes and Cooper (1984) BCC model is developed with a production frontier that has variable returns to scale. The BCC model forms a convex combination of DMUs (Coelli, Rao & Battese 1998). Then the constant returns to scale linear programming problem can be modified to one with variable returns to scale by adding the convexity constraint  $\sum \lambda_j = 1$ . The model given below illustrates the basic BCC formulation (dual problem/envelopment form):

*B. The basic BCC model formulation (dual problem/envelopment form):*

$$\text{Min} \theta - \varepsilon \left( \sum_{i=1}^m s_i^- + \sum_{r=1}^s s_r^+ \right)$$

Subject to :

$$\sum_{j=1}^n \lambda_j x_{ij} + s_i^- = \theta x_{i0} \quad (i=1, \dots, m)$$

$$\sum_{j=1}^n \lambda_j y_{rj} - s_r^+ = y_{r0} \quad (r=1, \dots, s)$$

$$\lambda_j \geq 0 \quad (j=1, \dots, n)$$

$$\sum_{j=1}^n \lambda_j = 1$$

Source: Zhu (2003, p.13)

This approach forms a convex hull of intersecting planes (Coelli, Rao & Battese 1998). These planes envelop the data points more tightly than the constant returns to scale (CRS) conical hull. As a result, the variable returns to scale (VRS) approach provides technical efficiency (TE) scores that are greater than or equal to scores obtained from the CRS approach (Coelli, Rao & Battese 1998). Moreover, VRS specifications will permit the calculation of TE decomposed into two components: scale efficiency (SE) and pure technical efficiency (PTE). Hence, this study first uses the CCR model to assess TE then applies the BCC model to identify PTE and SE for each DMU. The relationship of these concepts is given below:

*C. Relationship between TE, PTE and SE :*

$$TE_{\text{CRS}} = PTE_{\text{VRS}} * SE$$

where  $TE_{\text{CRS}}$  = Technical efficiency of constant return to scale

$PTE_{\text{VRS}}$  = Technical efficiency of variable return to scale

SE = Scale efficiency

Source : Coelli, et al., (1998).

The above relationship, which is unique, depicts the sources of inefficiency, i.e., whether it is caused by inefficient operation (PTE) or by disadvantageous conditions displayed by the scale efficiency (SE) or by both. If the scale efficiency is less than 1, the DMU will be operating either at decreasing return to scale (DRS) if a proportional increase of all input levels produces a less-than-proportional increase in output levels or increasing return to scale (IRS) at the converse case. This implies that resources may be transferred from DMUs operating at DRS to those operating at IRS to increase average productivity at both sets of DMUs (Boussofiane et al.,1992).

*D. Super-efficiency DEA model:*

The main purpose of super-efficiency is to provide tie-breaking procedure for ranking DMUs which are efficient in traditional DEA models. When a DMU under evaluation is not included in the reference set of the original DEA models, then these models are called super-efficiency DEA models. Then super-efficiency DEA models can be obtained in two categories namely CRS and VRS. The CCR super-efficiency DEA model was developed under CRS by Andersen and Petersen (1993) (Called AP model). Thrall (1996) pointed

out that the AP model may result in infeasibility and instability when some inputs are close to zero. Similarly Zhu (2001) showed that super-efficiency DEA models with CRS could occur with infeasibility if and only if there is a zero in data.

The infeasibility of the related linear program is very likely to occur (see Banker et. al (1984) and Seiford and Zhu (1998)) when super-efficiency DEA model based on the BCC model (VRS super-efficiency model) is considered. Seiford and Zhu (1998) showed the necessary and sufficient conditions of infeasibility in VRS super-efficiency model. Yao (2003) stated that super-efficiency can be interpreted as input saving and output surplus achieved by an efficient DMU. By utilizing the Yao's interpretation, Said Ebadi (2012) proposed a VRS super-efficiency model which is known as input-output orientation super-efficiency model which is always feasible.

**The super efficiency model with input-output orientation:**

The model is as:

$$\begin{aligned}
 & \text{Min}(1 + \beta_0) \\
 & s.t \sum_{j=1, j \neq o}^n \lambda_j x_{ij} - (1 + \beta_0) x_{io} \leq 0 \quad i = 1, 2, \dots, m \\
 & \sum_{j=1, j \neq o}^n \lambda_j y_{rj} - (1 - \beta_0) y_{ro} \geq 0 \quad r = 1, 2, \dots, s \\
 & \sum_{j=1, j \neq o}^n \lambda_j = 1 \\
 & \lambda_j \geq 0 \quad j = 1, 2, \dots, n, j \neq o
 \end{aligned}$$

III. DATA AND VARIABLES FOR THE STUDY

The establishment of Private Sector banks at the National level was to serve as a substitute and to reduce the burden of Public sector banks. The primary duties of any bank are asset management and intermediation. But the primary duty of a Private Sector bank should be intermediation instead of asset management. DEA assumes that, the inputs and outputs have been correctly identified. Usually as the number of inputs and outputs increase, more DMUs tend to get an efficiency rating of 1 as they become too specialized to be evaluated with respect to other units. On the other hand, if there are too few inputs and outputs, more DMUs tend to be comparable. In any study, it is important to focus on correctly specifying inputs and outputs. DEA is commonly used to evaluate the efficiency of a number of DMUs and it is a multi-factor productivity analysis model for measuring the relative efficiency of a homogeneous set of DMUs. For every inefficient DMU, DEA identifies a set of corresponding efficient DMU that can be utilized as benchmarks for improvement of performance and productivity. DEA is developed based on two scale of assumptions viz., Constant Return to Scale (CRS) model and Variable Return to Scale (VRS) model. CRS means that the producers are able to linearly scale the inputs and outputs without increasing or decreasing efficiency. This is a significant assumption. The assumption of CRS may be valid over limited ranges but its use must be justified. As an aside, CRS tends to lower the efficiency scores while VRS tends to raise efficiency scores.

For enabling the study of evaluation of Private Sector banks, we have the following resources (inputs) and productivity indicators or outputs:

- Inputs:** X<sub>1</sub> – Interest expenditure on deposits as % of deposits (Rs. in Lakhs)
- X<sub>2</sub>. Deposits (accepted by banks) (Rs. in Lakhs)
- X<sub>3</sub> – Total expenses (Rs. in Lakhs),
- X<sub>4</sub> – Compensation to employees (Rs. in Lakhs)
- X<sub>5</sub> – Financial charges (Rs. in Lakhs)
- X<sub>6</sub>- Non-cash charges (Rs. in Lakhs)
- X<sub>7</sub>-Total interest expenses (Rs. in Lakhs)

- Outputs:** Y<sub>1</sub> – Total assets (Rs. in Lakhs)
- Y<sub>2</sub> – Net assets (Rs. in Lakhs)
- Y<sub>3</sub>- Total income (Rs. in Lakhs)
- Y<sub>4</sub>- Net worth (Rs. in Lakhs)
- Y<sub>5</sub> -Interest income (Rs. in Lakhs)
- Y<sub>6</sub>- Profit before depreciation, interest, taxes and amortization (Rs. in Lakhs)
- Y<sub>7</sub>- Interest income on advances as % of loans and advances (Rs. in Lakhs)

The study involves the application DEA to assess the efficiency of 13 Private Sector banks in India during the years 2006-07, 2007-08, 2008-09, 2009-10, 2010-11 and 2011-12. The data used for assessment was obtained from the annual reports published by Indian Bank Association and from website <www.iba.org.in>. DEA model is executed separately for each year using input-orientation with

radial distances to the efficient frontier. By running these programmes with the same data under CRS and VRS assumptions, measures of overall technical efficiency (TE) and ‘pure’ technical efficiency (PTE) are obtained.

#### IV. RESULTS AND DISCUSSION

The main theme of the present study is to assess the performance of 13 Private Sector banks in India. The study intends to assess the efficiency of Private Sector banks and thereby identifying the influence of them in improving the Indian economy.

The findings of DEA portrayed through Table 1 revealed the following salient information:

- Five banks among 13 Private Sector banks in India are operated at Constant Return to Scale (CRS) in the entire period of study that is 2006-07 to 2011-12. This indicates that the banks are operated with stability, balancing the inputs (resources contained in them) to satisfy the outputs i.e. the purpose of Private Sector banks. They are :

Table 1: Private Sector banks with Constant Return to Scale (CRS) :

| S.No. | Name of Private Sector Bank  | Return to Scale |      |      |      |      |      |
|-------|------------------------------|-----------------|------|------|------|------|------|
|       |                              | 2007            | 2008 | 2009 | 2010 | 2011 | 2012 |
| 1     | Axis Bank Ltd.               | crs             | crs  | crs  | crs  | crs  | crs  |
| 2     | City Union Bank Ltd.         | crs             | crs  | crs  | crs  | crs  | crs  |
| 3     | Development Credit Bank Ltd. | crs             | crs  | crs  | crs  | crs  | crs  |
| 4     | South Indian Bank Ltd.       | crs             | crs  | crs  | crs  | crs  | crs  |
| 5     | Yes Bank Ltd.                | crs             | crs  | crs  | crs  | crs  | crs  |

- It is also noticed that some of the Private Sector banks have shown a shift in the return to scale pattern i.e., either from IRS to CRS or vice-versa implying that, there is increased resource use efficiency with reference to the exploitation of resources usage. Hence, these Private Sector banks have shown an increased pace of return to scale. Also it is observed that few banks have shown a shift in the return to scale pattern i.e., either from DRS to CRS or vice-versa implying that, there is decreased resource use efficiency with reference to the exploitation of resources usage. These Private Sector banks are :

Table 2: Private Sector banks with trend of Scale during 2007-2012

| S.No. | Name of Private Sector Bank   | Return to Scale |      |      |      |      |      |
|-------|-------------------------------|-----------------|------|------|------|------|------|
|       |                               | 2007            | 2008 | 2009 | 2010 | 2011 | 2012 |
| 1     | Catholic Syrian Bank Ltd.     | crs             | irs  | crs  | DRS  | crs  | crs  |
| 2     | Dhanlaxmi Bank Ltd.           | crs             | crs  | crs  | irs  | crs  | crs  |
| 3     | Federal Bank Ltd.             | crs             | crs  | DRS  | crs  | crs  | crs  |
| 4     | Karnataka Bank Ltd.           | crs             | crs  | crs  | DRS  | crs  | irs  |
| 5     | Karur Vysya Bank Ltd.         | crs             | crs  | crs  | DRS  | crs  | DRS  |
| 6     | Lakshmi Vilas Bank Ltd.       | crs             | crs  | crs  | irs  | crs  | crs  |
| 7     | Ratnakar Bank Ltd.            | crs             | crs  | crs  | crs  | crs  | irs  |
| 8     | Tamilnad Mercantile Bank Ltd. | crs             | irs  | crs  | crs  | crs  | crs  |

In this paper as a second step, we tried to rank the private sector banks under study, then it is observed that many there are some efficient DMUs which demanded for the rank to be shared among them. So for resolving the tie-breaking we preferred super-efficiency DEA model. For executing the super- efficiency DEA model we have considered different **efficient banks** in different study years. The particulars of **efficient banks** are as follows:

Table 3: Efficiencies of Banks based on complete technical efficiency with CRS

| S.No. | Bank Name                    | 2007 | 2008  | 2009  | 2010  | 2011 | 2012  |
|-------|------------------------------|------|-------|-------|-------|------|-------|
| 1     | Axis Bank Ltd.               | 1    | 1     | 1     | 1     | 1    | 1     |
| 2     | Catholic Syrian Bank Ltd.    | 1    | 0.946 | 1     | 0.961 | 1    | 1     |
| 3     | City Union Bank Ltd.         | 1    | 1     | 1     | 1     | 1    | 1     |
| 4     | Development Credit Bank Ltd. | 1    | 1     | 1     | 1     | 1    | 1     |
| 5     | Dhanlaxmi Bank Ltd.          | 1    | 1     | 1     | 0.89  | 1    | 1     |
| 6     | Federal Bank Ltd.            | 1    | 1     | 0.955 | 1     | 1    | 1     |
| 7     | Karnataka Bank Ltd.          | 1    | 1     | 1     | 0.977 | 1    | 0.994 |
| 8     | Karur Vysya Bank Ltd.        | 1    | 1     | 1     | 0.973 | 1    | 0.961 |
| 9     | Lakshmi Vilas Bank Ltd.      | 1    | 1     | 1     | 0.968 | 1    | 1     |
| 10    | Ratnakar Bank Ltd.           | 1    | 1     | 1     | 1     | 1    | 1     |

| S.No. | Bank Name                     | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|-------|-------------------------------|------|------|------|------|------|------|
| 11    | South Indian Bank Ltd.        | 1    | 1    | 1    | 1    | 1    | 1    |
| 12    | Tamilnad Mercantile Bank Ltd. | 1    | 0.94 | 1    | 1    | 1    | 1    |
| 13    | Yes Bank Ltd.                 | 1    | 1    | 1    | 1    | 1    | 1    |

Based on the super-efficiencies, we have compared the ranks obtained through technical efficiencies and they are tabulated in the tables 4 and 5.

### V. CONCLUSIONS

Under technical efficiency, nearly 38 percent of private sector banks exhibited constant performance throughout the study period. Some of the banks showed mixed performance even though they exhibited constant performance in some years. Super-efficiency DEA model resolved tie-breaking of efficient banks under technical efficiency. South Indian Bank Ltd. attained first rank in the years 2007 and 2010. Development Credit Bank Ltd., City Union Bank Ltd., Tamilnadu Mercantile Bank Ltd. and Dhanalakshmi Bank Ltd. have stood first in rank in the years 2008, 2009, 2011 and 2012 respectively.

| S No. | Name of the Bank         | 2007 |      |        |      | 2008  |      |        |      | 2009  |      |        |      |
|-------|--------------------------|------|------|--------|------|-------|------|--------|------|-------|------|--------|------|
|       |                          | TE   | Rank | SE     | Rank | TE    | Rank | SE     | Rank | TE    | Rank | SE     | Rank |
| 1     | Axis Bank                | 1    | 1    | 1.8788 | 5    | 1     | 1    | 1.8389 | 6    | 1     | 1    | 1.8522 | 11   |
| 2     | Catholic Syrian Bank     | 1    | 1    | 1.907  | 3    | 0.946 | 12   | 0.946  | 12   | 1     | 1    | 1.4835 | 12   |
| 3     | City Union Bank          | 1    | 1    | 1      | 13   | 1     | 1    | 1.8128 | 10   | 1     | 1    | 1.969  | 1    |
| 4     | Development Credit Bank  | 1    | 1    | 1.7602 | 11   | 1     | 1    | 1.9724 | 1    | 1     | 1    | 1.9052 | 4    |
| 5     | Dhanlaxmi Bank           | 1    | 1    | 1.7313 | 12   | 1     | 1    | 1.8288 | 8    | 1     | 1    | 1.9162 | 3    |
| 6     | Federal Bank             | 1    | 1    | 1.8853 | 4    | 1     | 1    | 1.9106 | 2    | 0.955 | 13   | 0.955  | 13   |
| 7     | Karnataka Bank           | 1    | 1    | 1.8648 | 9    | 1     | 1    | 1.8322 | 7    | 1     | 1    | 1.8837 | 8    |
| 8     | Karur Vysya Bank         | 1    | 1    | 1.8725 | 7    | 1     | 1    | 1.8474 | 5    | 1     | 1    | 1.9018 | 5    |
| 9     | Lakshmi Vilas Bank       | 1    | 1    | 1.8679 | 8    | 1     | 1    | 1.8749 | 3    | 1     | 1    | 1.8874 | 7    |
| 10    | Ratnakar Bank            | 1    | 1    | 1.9396 | 2    | 1     | 1    | 1.793  | 11   | 1     | 1    | 1.8634 | 10   |
| 11    | South Indian Bank        | 1    | 1    | 1.9711 | 1    | 1     | 1    | 1.8552 | 4    | 1     | 1    | 1.925  | 2    |
| 12    | Tamilnad Mercantile Bank | 1    | 1    | 1.8197 | 10   | 0.94  | 13   | 0.94   | 13   | 1     | 1    | 1.8745 | 9    |
| 13    | Yes Bank                 | 1    | 1    | 1.8759 | 6    | 1     | 1    | 1.8143 | 9    | 1     | 1    | 1.8898 | 6    |

| S. No. | Name of the Bank         | 2010  |      |        |      | 2011 |      |        |      | 2012  |      |        |      |
|--------|--------------------------|-------|------|--------|------|------|------|--------|------|-------|------|--------|------|
|        |                          | TE    | Rank | SE     | Rank | TE   | Rank | SE     | Rank | TE    | Rank | SE     | Rank |
| 1      | Axis Bank                | 1     | 1    | 1.9463 | 3    | 1    | 1    | 1      | 13   | 1     | 1    | 1.8845 | 7    |
| 2      | Catholic Syrian Bank     | 0.961 | 12   | 0.961  | 12   | 1    | 1    | 1.9151 | 3    | 1     | 1    | 1.875  | 11   |
| 3      | City Union Bank          | 1     | 1    | 1.1786 | 8    | 1    | 1    | 1.9214 | 2    | 1     | 1    | 1.8753 | 10   |
| 4      | Development Credit Bank  | 1     | 1    | 1.7792 | 6    | 1    | 1    | 1.9042 | 4    | 1     | 1    | 1.8846 | 6    |
| 5      | Dhanlaxmi Bank           | 0.89  | 13   | 0.89   | 13   | 1    | 1    | 1.8495 | 12   | 1     | 1    | 1.9445 | 1    |
| 6      | Federal Bank             | 1     | 1    | 1.9627 | 2    | 1    | 1    | 1.8981 | 7    | 1     | 1    | 1.8823 | 8    |
| 7      | Karnataka Bank           | 0.977 | 9    | 0.977  | 9    | 1    | 1    | 1.8766 | 8    | 0.994 | 12   | 0.994  | 12   |
| 8      | Karur Vysya Bank         | 0.973 | 10   | 0.973  | 10   | 1    | 1    | 1.9009 | 6    | 0.961 | 13   | 0.961  | 13   |
| 9      | Lakshmi Vilas Bank       | 0.968 | 11   | 0.968  | 11   | 1    | 1    | 1.8706 | 9    | 1     | 1    | 1.8887 | 4    |
| 10     | Ratnakar Bank            | 1     | 1    | 1.5187 | 7    | 1    | 1    | 1.8677 | 10   | 1     | 1    | 1.877  | 9    |
| 11     | South Indian Bank        | 1     | 1    | 1.968  | 1    | 1    | 1    | 1.8636 | 11   | 1     | 1    | 1.8942 | 3    |
| 12     | Tamilnad Mercantile Bank | 1     | 1    | 1.825  | 4    | 1    | 1    | 1.9967 | 1    | 1     | 1    | 1.8884 | 5    |
| 13     | Yes Bank                 | 1     | 1    | 1.805  | 5    | 1    | 1    | 1.9033 | 5    | 1     | 1    | 1.9167 | 2    |

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# The influence of patient positioning to obtain adequate space for dissection in Video assisted thoracoscopic surgeries (VATS)

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**Abstract-** In thoracoscopy, there is a requirement for provision of adequate space to identify the anatomy and instrumentation for dissection. To obtain space lung is collapsed and the collapsed lung has to be retracted away from the field of dissection. This could be done with retractors which will need additional ports and assistants. Some of the procedures are traditionally being done as lateral decubitus position. We have used supine or prone positioning for the lung to fall away from the surgical field. Supine position for anterior and superior mediastinal procedures and prone position for posterior mediastinal procedures were used. The use of gravity to retract lung by positioning provided space, which is a major requirement for the success and safety of the surgery. There were no derangements observed in the physiological stability in supine or prone positions.

Therefore we may be permitted to conclude that the position used for thoracoscopic surgeries were satisfactory.

**Index Terms-** Thoracoscopy

## I. INTRODUCTION

Diagnostic and therapeutic procedures performed by thoracotomy or median sternotomy cause a significant morbidity<sup>1, 2, 3,4,5,6</sup>. Over the last 20 years there was an emerging interest and development of thoracoscopic surgeries which has cut off the morbidity related to the open access surgeries<sup>7,8,9,11</sup>

There is a requirement for provision of adequate space for instrumentation, identification of structures, dissection and resection. In thoracoscopy, space was obtained by total or partial collapse of one lung either by use of a double lumen endotracheal tube or by achieving a partial lung collapse following insufflation of CO<sub>2</sub> while ventilating both lungs using a standard endotracheal tube.

The collapsed lung has to be retracted away from the field of dissection. However as in open surgery multiple retractors cannot be used as it need additional ports and may lead to clashing of instruments. In minimal access surgery positioning is very important as it can be used to get organs fall away from the site<sup>9, 10,11,12,13</sup>

We have used supine and prone positions during a variety of thoracoscopic procedures performed in our institution.

The efficacy of positioning to obtain space for dissection during thoracoscopic surgeries was studied.

## II. PATIENTS AND METHODS

A retrospective analysis was made of thoracoscopic procedures done at the university surgical unit, Teaching Hospital Peradeniya, Sri Lanka. The position adapted, the ventilation details, pressure maintained during the capnothorax., location of the lesion, adequacy of space for dissection and the need for retractors were recorded. Adequate space for dissection is a key for successful completion of the procedure and as indices of this the blood loss, time of surgery and conversion to open surgery were noted.

## III. RESULTS

The same anaesthetic and surgical team led the procedures. All the procedures were performed under general anaesthesia., Lung collapse was obtained by single lung ventilation and capnothorax or double lung ventilation and capnothorax. The capnothorax used was 6-8mmHg.

The following procedures were performed with the patient in supine or prone position.

**Table 1-procedures performed and position of the patient**

| Supine position   | Prone position   |
|---|--|
| Thymectomy, Thyroidectomy for retrosternal goiter, Lung biopsies, Lymph node biopsy | Oesophagectomy, Thoracic sympathectomy Splanchnicectomy, |

**Table 2 –Number of procedure and per-operative parameters.**

| Procedure | Number | Average Time | Mean blood loss | Conversions |
|-----------|--------|--------------|-----------------|-------------|
|-----------|--------|--------------|-----------------|-------------|

|   |    |         |         |    |
|---|----|---------|---------|----|
| 1.Lymph node biopsy (LNB)   | 10 | 30 min  | minimal | No |
| 2.Lymph node dissection (LND)   | 2  | 4 hrs   | 150ml   | No |
| 3.Thymectomy ( TYM)   | 8  | 3.5 hrs | 150 ml  | No |
| 4.Retrosternal goiter ( RSG)  | 2  | 4.5 hr  | 150ml   | No |
| 5.Thoracic sympathectomy (TS)   | 8  | 30 min  | Minimal | No |
| 6.Bilateral splanchnicectomy (SPL)                                      | 6  | 1 hr    | minimal | No |
| 7.Lung biopsy (LB)  | 14 | 20 min  | minimal | No |
| 8.Mobilization of thoracic esophagus in three stage esophagectomy (OSE) | 15 | 2 hr    | 100-150 | No |

The patients respiratory and cardiovascular parameters were stable during surgeries. There were no per-operative complications or conversions to open surgery.

**Table 3 : scale for the anatomical location and dissection of the pathology**

|                |           |          |      |           |
|----------------|-----------|----------|------|-----------|
| Very Difficult | Difficult | Moderate | Easy | Very easy |
| 1              | 2         | 3        | 4    | 5         |

**Table 4-The location of the lesion and difficulty of dissection using above scale**

| Procedure  | Location Of the lesion |   |    |    |    | Dissection of the lesion |   |    |   |    | Additional port for Re-tractors | *OLV/ DLV |    |
|------------|------------------------|---|----|----|----|--------------------------|---|----|---|----|---------------------------------|-----------|----|
|            | 1                      | 2 | 3  | 4  | 5  | 1                        | 2 | 3  | 4 | 5  |                                 | O         | D  |
| LNB - (10) |                        |   |    | 10 |    |                          |   |    | 4 | 6  | nil                             |           | 10 |
| LND - (2)  |                        | 2 |    |    |    |                          | 2 |    |   |    | nil                             | 2         |    |
| TYM - (8)  |                        | 1 | 7  |    |    |                          |   | 8  |   |    | in one                          | 2         | 6  |
| RSG - (2)  |                        |   | 1  | 1  |    |                          |   | 1  | 1 |    | in one                          |           | 2  |
| TS - (8)   |                        |   |    | 1  | 7  |                          |   |    |   | 8  | nil                             |           | 8  |
| SPL - (6)  |                        |   |    |    | 6  |                          |   |    |   | 6  | nil                             |           | 6  |
| LB - (14)  |                        |   |    |    | 14 |                          |   |    |   | 14 | nil                             | 2         | 12 |
| OSE- (15)  |                        |   | 15 |    |    |                          |   | 15 |   |    | nil                             | 10        | 5  |

\*OLV – One Lung DLV- Both Lung ventilation

The difficulty of dissection is also reflected by the time taken and the blood loss. The space for dissection was not a predicament in any of the above surgeries. The collapsed lung stayed away from the field of dissection providing adequate room for visualization and dissection. Retractors were required only in two patients. In these two, retractor was to retract the large lesion, not

the collapsed lung. Positioning provided satisfactory retraction of the collapsed lung in all patients.

The blood loss in major resections; oesophagectomy, thymectomy, thyroidectomy and lymph node block dissection ranged from 100-150ml while in all other surgeries there was no measurable blood loss.

There were no conversions.

#### IV. DISCUSSION

Space for dissection is a mandatory requirement in both open and minimal access approaches. In open surgery it does not pose a problem with an adequate incision and the use of retractors. For space within the body additional retractors, packs and even hands of assistants are used.

Obtaining space in minimal access surgery is a challenge. In thoracoscopy space is created by collapsing the lung. Major VATS is usually performed under general anesthesia with one lung ventilation by using a double-lumen endotracheal tube or endobronchial blocker to collapse one lung. However in this series many surgeries were performed with a single-lumen endotracheal tube with both lung ventilation, a capnothorax being used to obtain lung collapse.

Once the lung is collapsed it has to be retracted away from the field of dissection. This may be achieved by the aid of gravity and use of retractors. Use of retractors will need additional ports, assistants and may hinder the dissecting instruments. Lung retraction in this study was gravity assisted by positioning. The procedures of the anterior and superior mediastinum; lymph node biopsy, thymectomy, thyroidectomy for retrosternal goiter, were performed with the patient supine. This allowed the lung to fall out posteriorly. The procedures of the posterior mediastinum ie, oesophagectomy, sympathectomy and splanchnicectomy, were performed with the patient prone. This helped the lung to fall anteriorly. During lung biopsy position of the collapsed lung is of no importance. Therefore patient was placed supine. The anatomy was clearly displayed and there was space for instrumentation and safe completion of the procedure. These positions helped the lung to fall away from the field of dissection and provided space for surgery. Retractors were not required.

The procedures were completed in an acceptable time with minimal blood loss. There were no conversions to open surgery.

#### V. CONCLUSION

Space for dissection in thoracoscopy is obtained by collapsing the lung. The collapsed lung can be kept away from the field of dissection by positioning the patient without using retractors. For procedures of the superior and anterior mediastinum supine position is useful. Prone position is useful for procedures of the posterior mediastinum,

#### AUTHORS CONTRIBUTION

Both Dr\_K.B Galketiya and Dr V.Pinto contributed to the creation of the concept and design of the article, drafting the manuscript and revising it critically for important intellectual content.

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# Evaluating Opinion Leadership Strategies Used to Communicate Adaptive Climate Change Information to Residents of Arid and Semi Arid Areas in Kenya

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**Abstract-** This study assessed the effectiveness of opinion leadership strategies used in communicating adaptive climate change information to residents of arid and semi arid areas (ASALs) in Kenya. It sought to achieve this by assessing (1) the knowledge levels on adaptive climate change information among residents of Kenyan ASALs (2) attributes of opinion leaders who communicate adaptive climate change information to residents of Kenyan ASALs and (3) strategies used by opinion leaders to communicate adaptive climate change information to residents of Kenyan ASALs. The study found that adaptive climate change information disseminated by opinion leaders is inadequate, shallow and confusing because it is not crafted in consideration of the unique situations affecting residents of Kenyan ASALs. It concluded that with training and support from communication and research experts, local opinion leaders can enhance access to and use of adaptive climate change information among Kenyan ASAL residents.

**Index Terms-** adaptive climate change information, opinion leadership strategies, interpersonal communication, ASALs of Kenya.

## I. INTRODUCTION

Kenyan arid and semi-arid lands (ASALs) are home to more than 30% of the country's population (NEMA, 2013). Majority of the ASALs' residents are pastoralists, supporting over 70% of the livestock in the country, and agro-pastoralists (NEMA, 2013). Livestock raised by pastoralists is worth US\$800 million per year (USAID, 2012). Therefore, the government under Vision 2030 (GoK, 2008) recognizes the potential of ASALs as an important driver for economic growth (Kitiem et al, 2012). However, climate change, a global challenge, is a huge threat to persons living in Kenyan ASALs not only because of their high dependency on climate-sensitive natural resources and high poverty rates (Ketiem et al, 2012) but also because of the status of adaptive capacity of the people and institutions (GoK, 2013).

Therefore, ASAL farmers and pastoralists, as well as policy makers, development and humanitarian programmes are searching for the best ways to adapt to the impacts of climate change (Percy, 2013). Improving development outcomes such as social networks and access to information services is critical to building adaptive capacity (NCCAP, 2012). In Kenya, although research, workshops, conferences and other engagements by various gov-

ernmental and non-governmental bodies from all over the world have resulted into a pool of invaluable information on the subject of climate change, such information is either consolidated or scattered at various levels of its management with evident challenges to its access by relevant stakeholders (NCCAP, 2012).

However, although to access climate change information communication plays a key role, lack of proper communication mechanisms has led to inadequate climate change adaptation among ASALs' residents (KCCWG, 2013). This study therefore sought to examine effectiveness of opinion leadership, a renowned interpersonal communication method, in communicating adaptive climate change information among residents of Kenyan ASALs.

## 1.1 Statement of the problem

The way in which adaptive climate change information is communicated needs to be understandable, accessible, and acceptable to the end users (Nderitu, 2013). Interpersonal communication methods (e.g. face to face, workshops, opinion leaders) which are rated as rich media for communicating change (Lengel and Daft, 1988), have been used in a bid to improve communication of the essential adaptive climate change information among Kenyan ASALs (KCCWG, 2013; Nderitu, 2013; Shaka, 2013). However, in spite of their application, awareness levels and adaptive capacity to climate change are still low (KCCWG, 2013). Adaptive climate change information is scanty or totally absent at community level in ASALs of Kenya (KCCWG, 2013). It is against this background that this study sought to assess opinion leadership strategies being used to communicate adaptive climate change information among residents of Kenyan ASALs.

## 1.2 Objectives

The study had three specific objectives:

- (i) to assess the knowledge levels on adaptive climate change information among residents of Kenyan ASALs
- (ii) to evaluate attributes of opinion leaders who communicate adaptive climate change information to residents of Kenyan ASALs
- (iii) to examine the strategies used by opinion leaders to communicate adaptive climate change information to residents of Kenyan ASALs

## II. THEORETICAL BACKGROUND (LITERATURE REVIEW)

### 2.1 Knowledge levels on adaptive climate change information in Kenyan ASALs.

On 30<sup>th</sup> August 1994, Kenya ratified the United Nations Framework Convention on Climate Change (UNFCCC) thereby signifying her determination to join the international community in combating the problem of climate change (NEMA, 2005). Kenya then moved to prepare its Initial National Communication (INC) and presented it to the Conference of the Parties (COP) to the UNFCCC in 2002. The INC concluded amongst other issues, major effort was required to educate, train and inform the public about climate issues in a responsible and effective way (NEMA, 2005).

A capacity needs assessment in the area of climate change awareness in 2005 largely confirmed that the level of awareness of climate change in Kenya at the time was very low. With the growing concern on climate change, the Kenyan government established the National Climate Change Activities Coordinating Committee (NCCACC) and among the aims of the NCCACC is creation of public information and awareness (Ogola, 2011). Today, climate change awareness in Kenya is different from 2005 especially because various events that have raised climate awareness have occurred since then.

However, climate change awareness in Kenya is still quite low; there is still a lack of general awareness about climate change issues, about the existence of the UNFCCC, and about the opportunities it provides for mitigation and adaptation to climate change (Ogolla, 2011). An opinion poll carried out between 2007 and 2008 by the Gallup, revealed that over 44% of Kenyans have no knowledge of climate change (HBF, 2010). Similarly, the survey undertaken during the development of the National Climate Change Action Plan (NCCAP) in 2012 confirmed that public awareness about climate change in Kenya is very low, confirming similar findings during the development of the National Climate Change Response Strategy (NCCRS, 2013-2017). NCCAP states that even though significant climate change knowledge is currently generated by Kenyan institutions and individuals including government, research and academic institutions, civil society organisations (CSOs) and private sector companies, there is limited sharing of climate change information and knowledge. Its access and use have been inhibited by factors such as language barrier, unsuitable mode of communication, poor infrastructure, and poor repackaging of the information (KCCWG, 2013).

This low level of awareness is even worse in the ASALs of Kenya. In the published '*report on access and use of climate change information in the ASALS*', KCCWG (2013) noted that although majority of the people across ASAL counties in Kenya were aware of the fact that something is happening to their climate, they did not rightly associate it with the concept and phenomenon of climate change; and that though they were able to identify the impacts of climate change, they lacked access to climate change information. Very few ASAL districts in Kenya to date receive radio and television coverage even after the liberalization of the airwaves (UNDP, 2010). Although, there are some magazines in the country that specialize on climate change reporting (e.g. *Joto Afrika*, a quarterly magazine that carries climate change research briefings by African scientists launched in

2011, and *The Weatherman*, a monthly publication by the Kenya Meteorological Society), the number of ASAL residents who can access or have literacy skills to benefit from these publications remains limited.

This notwithstanding, access to information on climate change characteristics is a very powerful tool that can be used to enhance the adoption and implementation of adaptation strategies by households in Sub-Saharan Africa (SSA) (Antwi-Agyei et al, 2013) where Kenya is. This is particularly important because most farming in SSA depends on rain-fed agricultural systems and as such lack of appropriate climate information could be critical for food security (IPCC, 2007; Antwi-Agyei et al, 2013). A majority of this group are poor rural people. Access and use of climate change information would empower such vulnerable communities to make their own calculated and climate informed decisions on livelihood and risk management choices (Percy, 2013) and as such be able to successfully implement climate adaptation strategies (Lee, 2007).

Sadly, there have been information access barriers to successful implementation of adaptation practices in SSA (Antwi-Agyei et al, 2013) and to increase the low knowledge levels, adaptive climate change information needs to be communicated in ways that are affordable and understandable by Kenyan ASAL residents who have long been marginalized politically, socially and economically (FAO, 2013). Like many other publics, residents of ASALs are increasingly distrustful of both news and advertising from mass media, preferring instead recommendations from friends, family, coworkers, and peers (Keller & Berry, 2003). This is where opinion leadership communicative interventions come in handy and there is therefore need to understand individuals who act as opinion leaders on the subject of climate change in ASALs.

### 2.2 Attributes of opinion leaders who communicate adaptive climate change information to residents of Kenyan ASALs.

For effective opinion leadership campaigns, it is important to first recruit individuals in a social system that can make effective opinion leaders (OLs). This recruitment should be based on desired traits and behaviours of such personalities which according to Katz (1957) can be divided into a few dimensions: *Who one is* - certain personality characteristics or values held by the individual; *What one knows* - the degree of knowledge and expertise that one has about a particular issue or product; and *Whom one knows* - the number of contacts one has as part of their circle of friends and acquaintances.

According to Katz, OLs seem evenly distributed among the social, economical, and educational levels within their community, but very similar in these areas to those they influence. Loudon and Britta (1979) corroborate this when they say that OLs have approximately the same social-class position as non leaders, although they may have higher social status within the class. As such OLs do not necessarily hold formal positions of power or prestige in communities but rather serve as the connective communication tissue that alert their peers to what matters among political events, social issues, and consumer choices (Nisbet & Kotcher, 2009; Vaneck, Jager & Leefalang, 2011).

However, OLs are better educated and more affluent than the average person and it is their interest and belief that they can make a difference in the world around them that makes them

influential (Nisbet & Kotcher, 2009). They are individuals who pay close attention to an issue, frequently discuss the issue, and consider themselves more persuasive in convincing others to adopt an opinion. When compared to their peers, OLs tend to be more exposed to all forms of external communication (Flodgren et al, 2011); they are active media users who interpret the meaning of media content for lower-end media users. This two-step flow process effectively bounces the message off the OL into the minds of his/her followers.

OLs are people who are seen as likeable, trustworthy and influential (Flodgren et al, 2011). The Social Learning Theory hypothesizes that such individuals are likely to be persuasive agents of behavioural change. They hold a unique and influential position in their system's communication structure; they are at the centre of interpersonal communication networks (Flodgren et al, 2011). OLs are more gregarious than nonleaders (Loudon & Britta, 1979). Individuals with strong personality traits of confidence, leadership, and persuasiveness are found to be socially connected to a greater number of other community members and more likely to influence the opinions of others (Weimann, 1994).

Until only very recently, public communication initiatives have ignored such special individuals across communities and social groups that can serve as vital go-betweens and information brokers, passing on messages about climate change that speak directly to their otherwise inattentive peers, co-workers and friends; they remain an overlooked yet necessary resource when it comes to catalyzing collective action on climate change (Nisbet & Kotcher, 2009). In Kenya, OLs have started being appreciated in cascading of climate change information among the vulnerable ASAL communities.

As reported in *Joto Afrika* in June 2013, in Garissa (an ASAL County), "When the area Chief received a phone call about the impending floods due to excessive rainfall in areas upstream of River Tana, he informed the community about it. The community members did not ignore the early warning as they used to do before" (Nderitu, 2013:6). In Kitui, another ASAL County in the country, community leaders, religious leaders, government officers and NGO officials in their line of duty have been engaging residents on adaptive climate change topics such as livelihood diversification (KCCWG, 2013). Residents reported that, "Most of the information on climate change was dispensed through government officers (27.4%) while 22.6% said that they had accessed the information through community leaders. Another 17.7% had learnt from local community farmers and herders, while 9.7% learnt from Oxfam and other NGOs. Others had got information from religious leaders (3.2%)" (KCCWG, 2013: 17).

Although, these individuals have characteristics similar to those highlighted by Katz (1957) and other scholars (Nisbet & Kotcher, 2009; Flodgren et al, 2011; Weimann, 1994), the more important question to ponder is whether or not these OLs have been influential in enhancing access to adaptive climate change information among residents of Kenyan ASALs.

Research in four ASAL counties (Wajir, Kajiado, Kitui and Turkana) of Kenya by KCCWG (2013) establishes that information similar to climate change dispensed by community leaders, religious leaders, government and NGO officials in their line of duty is inadequate, shallow and almost confusing. The researchers conclude that it was not specifically packaged as cli-

mate change information. Extension workers, for instance, confirmed that they did not package the information as climate change information but as agriculture information which they then disseminated during farmer field days. Likewise information on livestock management, disseminated by livestock officers and NGOs like VSF Belgium and VSF Germany, was not given out specifically as climate change information (KCCWG, 2013). Could such impediments to effective dissemination of adaptive climate change information be caused by the strategies used by these OLs?

### **2.3 Strategies used by opinion leaders to communicate adaptive climate change information to residents of Kenyan ASALs.**

In climate change opinion leadership campaigns, identification and recruitment are just the first stages of organizing (Nisbet and Kotcher, 2009). Crafting suitable strategies of influencing change form the core of the campaign. These strategies, according to Nisbet and Kotcher (2009) range from methods of message development, framing and packaging; choice of channels and methods that OLs will use to disseminate information; education, training and support of OLs by key stakeholders; to regular monitoring and evaluation of the processes in use.

For effectiveness, messages need to be tailored to core ideas and values that resonate with the social background of the OL. Moreover, the OL needs to be trained on how to deliver these messages to their social network. This includes introducing OLs to the research that went in to designing the message along with extensive role playing for how that message might be delivered across contacts. In particular, when possible, carefully framed messages should be matched to an OL's demographic using micro-targeting data, cluster analysis, or other market segmentation techniques (Nisbet & Kotcher, 2009). In Kenyan ASALs, according to the KCCWG (2013) report, projects by network partners on the ground address adaptation to climate change impacts but the implementers (OLs) do not quite relate the activities to climate change when communicating to residents.

For many residents of Kenyan ASALs, a complex issue such as climate change can be the ultimate ambiguous threat; meaning that depending on how the problem is framed the public will pay more attention to certain dimensions or considerations of climate change over others. These framed messages can lead to very specific attributions about the nature and personal relevance of climate change, who or what might be responsible for the problem, and what should be done in terms of policy, political activity, or personal behavior (Nisbet, 2009; Nisbet & Mooney, 2007; Nisbet, Scheufele, 2007). **According to Jones (2010)**, the key to success in OL campaigns is in the ability to keep things simple and flexible. In this context, 'simple' means two things; firstly, having a learning goal that is not overly ambitious, and then creating an experience that is easy for the OL and target audience to understand and participate. The communication challenge is to shift climate change from the mental box of "uncertain science" to a new cognitive reference point that connects to something the specific intended audience already understands (Nisbet & Kotcher, 2009). Since literacy levels in ASAL districts of Kenya are as low as 3% compared with a national average of 79.3% (UNDP, 2010) the need for simplified messages cannot be over-emphasized.

Theoretically, OLs use a range of interpersonal communication skills and methods in order to achieve desired behavioural change. Studies show that face-to-face recommendations are still overwhelmingly preferred over digital sources of information (Berry & Keller, 2006; Carl, 2006; Xue & Phelps, 2004) among many publics. Informal one to one teaching, community outreach education visits, small group teaching, academic detailing and preceptor-ships are examples of strategies used by OLs for disseminating and implementing change (Doumit et al, 2007). OLs also use formal strategies, such as delivering didactic lectures. Ryan (2002) says that whereas it is unclear whether information delivered by OLs in an informal way is more persuasive compared with formal strategies, it has been suggested that OLs may be less influential when their role is formalized through mail-outs, workshops or teaching rounds. From ASALs of Kenya, when Mbeere farmers reported that access to forecast information enabled timely decisions and action for on-farm operations, twenty groups of farmers rated face to face access as their preferred method, with radio and mobile phones next” (Njuki, 2013: 5).

According to Nisbet & Kotcher (2009), OLs can also be used to sponsor civic voice through engaging in activities that communicate to policy makers, institutions, corporations, and other citizens’ their concern and policy preferences. Examples include contacting an elected official such as a governor or senator, writing a letter to the editor of a newsstudy, calling in to a radio/television show, posting on a blog or any other social network, signing a petition, or attempting to persuade peers on the issue. When surges in communication and public attention are needed, such as surrounding the release of a future Intergovernmental Panel on Climate Change (IPCC) report, OLs can be activated with talking points to share in conversations with friends and coworkers. Networks of OLs can be activated in reaction to major natural disasters and focusing events such as droughts, wildfires, and extreme weather. From reviewed literature, exploitation of these strategies is yet to be seen in use by OLs in the ASALs of Kenya as they communicate adaptive climate change information.

Research also suggests that the setting (such as a complex social network) of an OL may be important for success (Grimshaw et al, 2006). Strongly held beliefs, cultural practices, value systems and the worldviews of individuals or groups, greatly influence the way they perceive climate change and thereby their subsequent adaptation strategies (Antwi-Agyei et al, 2013). Jones and Boyd (2011) observed that societal norms and values act as major barrier to successful climate adaptation. In addition, poorly developed communication and marketing infrastructures complicate the task of developing location-specific responses that effectively address the impacts of climate change (Farauta, et al, 2011). In this regard, the appreciation of the communication context within which climate adaptation takes place is quite critical if OL influence is to be effective. In Kenya, it is definitely not an easy task to communicate adaptive climate change information when dealing with the socio-economically marginalized ASAL audiences who are from diverse ethnic and cultural orientations. The new County governance system in the country is yet to be understood so that getting support resources to overcome such barriers is quite difficult for OLs.

This notwithstanding, opinion leaders continue to be used in Kenya to boost ASALs’ residents cognitive engagement on the issue of climate change adaptation and increase the frequency of community discussion on the topic. However, the efforts of these opinion leaders are fragmented and disjointed and they do not come out clear on the subject of climate change (KCCWG, 2013). As such, the process requires a monitoring and evaluation component for effectiveness of programs and impacts.

All in all, the role of opinion leaders in moving forward the climate change agenda and communicating relevant information among the Kenyan ASAL residents cannot be underscored if appropriate utilization of the abundant knowledge and information on climate change effects on human survival is to be achieved.

### III. METHODOLOGY

This study was based on literature review related to the knowledge levels on adaptive climate change information among residents of Kenyan ASALs and attributes of opinion leaders who communicate adaptive climate change information to residents of Kenyan ASALs. In addition, the study examined ways in which these opinion leaders communicate adaptive climate change information to residents of Kenyan ASALs. Online and print literature of journals, reports and working papers among other publications were reviewed.

### IV. CONCLUSION

The study has made the following conclusions based on the reviewed literature:

Specific kinds of barriers to adaptation to climate change can be softened by interpersonal influence and the strategic use of opinion leaders. This is because since as early as the 1940s, scholars have understood the general importance of opinion leaders in shaping public preferences, informing fellow citizens, and altering behavior. In addition, people do not feel they are being tricked into thinking a certain way about something when they get it from someone they know. As such opinion leaders have been successfully used in climate change campaigns and they can therefore be used successfully among Kenyan ASALs’ residents.

However, effective opinion leadership is earned and sustained by the individual’s communication prowess, social accessibility, and adherence to socio-cultural norms of the target group. In addition, in order to effectively use opinion leadership to resolve the low awareness levels on climate change among residents of Kenyan ASALs, crafting and packaging this rather complex issue into simpler specific messages that connect to the day to day activities of the ASAL populace is important.

### V. RECOMMENDATION

- Opinion leaders who communicate adaptive climate change information among residents of Kenyan ASALs need to be acquainted with communication skills to enable them to carefully consider the cultural, social and psychological contexts of communication among residents of Kenyan ASALs when designing adaptive cli-

mate change messages. As such, they will successfully craft relevant, acceptable and simple messages on climate change adaptation that are more likely to result in to effective discourse.

- The OLs should be supported and trained on how to strategically initiate informal conversations with friends and acquaintances so that they can deliberately frame messages in ways that are more persuasive to the low literate and socio-economically challenged ASAL populace of Kenya.
- Opinion leaders should also engage in audience research to continually get information that will enable them develop successful messages about climate change adaptation. They should be therefore be trained on basic research skills.
- County governance can liaise with communication and climate change experts across the country to offer such training. Such experts can provide examples of well crafted climate change conversational messages, show models of how conversations might play out, and use role play to illustrate different types of conversational situations.
- Regular monitoring and evaluation of OLs efforts should be part of OLs' strategies. This will enable tracking of effectiveness of their strategies so that improvement can be done regularly. OLs and communication experts can work together to develop scalable methods and strategies for assessing OL campaign impacts regularly.

By taking these steps, the influence of opinion leadership on climate change adaptation among residents of Kenyan ASALs will be enhanced.

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# Household Scale Clean Water Disinfection Technique with Chlorination Method

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**Abstract-** Disinfection is preventive efforts against the entry of pathogenic bacteria to the human body. Chlorination is one effort to give prevention with chlorine. The research objective was to determine of diffusion and mass transfer coefficients and then to develop of a chlorinated tool model. Effect of water flow rate on chlorine transport and granule size was studied to develop their relationship. The flow rates discharge used were 8 liters/minute, 14 liters/minute, and 20 liters/minute, whereas the granule sizes were 2.36 – 4.75 ml, 4.75-9.5 ml, and 9.5 - 16 ml. Diffusion coefficients and mass transfer determined by least summed of square of error. Diffusion coefficient and mass transfer used for disinfection technique was  $0.4371 \text{ cm}^2 \text{ minute}^{-1}$  and  $0.0039\text{-minute}^{-1}$ , as well as flow rate and granule size used was 9.5 ml - 16 ml and 8 liters/minute. Experiment testing of chlorination performed to ensure of them was potentially for chlorination. Raw water chlorinated then was found of free chlorine residual and the total coliform met the quality standards based on regulation the Ministry of Health of Republic of Indonesia's number 416 of 1990 about the terms of supervision and the quality of water.

Key word: Disinfection, chlorine, total coliform, breakpoint chlorination.

## 1. INTRODUCTION

Disinfection is a process of annihilating microorganism which causes disease. Referring to Said (2007) disinfects which a stronghold of humans against exposure by pathogenic microorganism that caused diseases, including those viruses, bacteria and parasitic protozoan. One of them, disinfect of microorganism is being conducted by chlorine. Referring to Cheriaa et al. (2011), chlorine killed *Pseudomonas aeruginosa* effectively when the clarification process had done. Referring to Wang et al. (2010), *Escherichia coli* and *Legionella beliardensis* lost the integrity of their cell membranes at lower chlorine concentrations by chemical method. Referring to Wojcicka et al. (2007), *Brevundimonas vesicularis*, *Pseudomonas fluorescens*, and *Sphingomonas paucimobitis* were susceptible by chloramines as a byproduct.

Law of mass conservation declared that mass was not being created nor destroyed. Referring to Welty et al. (2004), summed between the rate mass accumulation and difference rate flux mass moved out and entered was zero. Mass in undergoes diffusion, advection and transfers mass during the process of transport (Doreswamy et al. 2012). The transport process of mass can be written as equation (1) (Zhi et al. 2004; Azarpazhooh and Ramaswamy 2010; Setyadji 2011).

$$\frac{\partial C(t)}{\partial t} = -v \frac{\partial C(t)}{\partial x} + D \frac{\partial^2 C(t)}{\partial x^2} - kC(t) \quad (1)$$

$v$  as flow rate (cm/s);  $D$  as diffusion coefficients ( $\text{cm}^2 \text{ minute}$ );  $k$  as mass transfer coefficients ( $\text{minute}^{-1}$ );  $C(t)$  as concentration (grams  $\text{cm}^{-3}$ ).

An equation (1) was solved numerically by finite difference method (Mahreni and Mulyani 2002; Siswani and Kristianingrum 2006; Costa et al. 2010).

$$\frac{\partial C(t)_i}{\partial x} = \frac{C(t)_{i+1} - C(t)_{i-1}}{2 \cdot \Delta x} \quad (2)$$

$$\frac{\partial^2 C(t)_i}{\partial x^2} = \frac{C(t)_{i+1} - 2 \cdot C(t)_i + C(t)_{i-1}}{\Delta x^2} \quad (3)$$

Referring to Setyadji (2011), equation (2) and (3) substituted to equation (1) and its obtained equation (4).

$$\frac{\partial C(t)_i}{\partial t} = [\alpha + \beta]C(t)_{i+1} - [2 \cdot \beta + k]C(t)_i - [\alpha - \beta] \quad (4)$$

For,  $\alpha = -\frac{v}{2 \cdot \Delta x}$  and  $\beta = \frac{D}{\Delta x^2}$

For  $i = 1$  was being used as initial condition.

$$C(t)_1 (x, t = 0) = C_0$$

For  $i = N$  (finite) was being used as boundary condition

$$C(t) (x, t) = \text{finite}$$

$$\frac{\partial C(t)_i}{\partial t} = 0 \tag{5}$$

$$\frac{\partial C(t)_i}{\partial x} = \frac{C(t)_{i+1} - C(t)_{i-1}}{2 \cdot \Delta x} = 0 \tag{6}$$

$$C(t)_{i+1} = C(t)_{i-1} \tag{7}$$

Equation (7) substituted to equation (4) have met an equation (8) and (9) (Setyadji 2011).

$$\frac{\partial C(t)_i}{\partial t} = (2 \cdot \beta) C(t)_{i-1} - [2 \cdot \beta + k] C(t)_i \tag{8}$$

$$C(t)_{i+1} = C(t)_i + \Delta t [(2 \cdot \beta) C(t)_{i-1} - (2 \cdot \beta + k) C(t)_i] \tag{9}$$

$C$  as concentration is proportional between chlorine's weights and volume of chlorine's chamber ( $V$ ), and can be written equation (10).

$$w(t)_{i+1} = w(t)_i + \Delta t [(2\beta) w(t)_{i-1} - (2\beta + k) w(t)_i] \tag{10}$$

$w$  is weights of chlorine (grams);  $\Delta t$  is flow periods (minutes).

The best value of diffusion and mass transfer coefficients obtained by least sum of square of error (Budi and Sasongko 2009; Makhtur et al. 2012). The result of determine was used to develop of a chlorinated tool model.

## 2. MATERIAL AND METHODS

### 2.1 Material and Instruments

The materials and instruments used during the laboratory experiments were chlorine tablets with ingredients 60% -70% , pure water (sterilized aqua), DPD (N,N-diethyl-p-phenylenediamine), chlorine's granules were 2.36 mm – 4.75 mm, 4.75 mm – 9.5 mm and 9.5 mm – 16 mm. Chlorine pipe chamber whose diameter of 3/4 inch (Figure 1), chlorine meter [HACH], oven [Mettler], water-pump by Shimizu 266 BIT, reservoir, analytical balance [Sartorius; DJ series], PVC pipes, PVC fittings, hand hacksaw, laboratory glasses, and personal computer with excel and AutoCad applications.



Figure 1 Chlorine pipe chamber

### 2.2 Data Collected and Method

This study was carried out in December 2013 to June 2014. Series of the measurements were carried out at the Environmental Engineering laboratory of Department of Civil and Environmental Engineering IPB and Rightful Technology laboratory in Jakarta Technical Laboratory for Environmental Health and Disease Control. Data was collected to analyze for chlorination technique. Data collected were weights of chlorine, the total coliform as MPN index/100 mL of water, and free chlorine as mg/L of  $Cl_2$ . The method is presented in Figure 2.

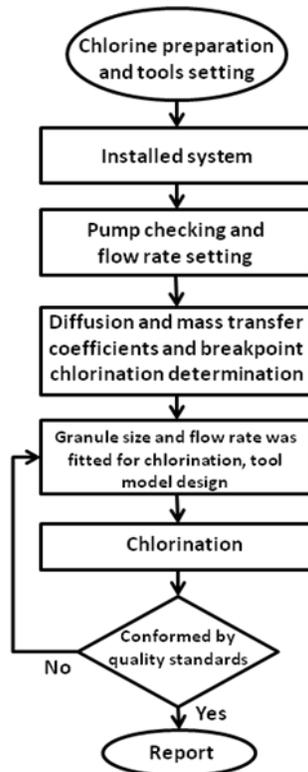


Figure 2 Method of the chlorination technique research

### 2.3 Experimental Procedure and Analysis

Pump discharges were arranged by valve to 8 liters/minute, 14 liters/minute and 20 liters/minute. Raw water was distributed by pumps to the chlorine pipe chamber (Figure 3).

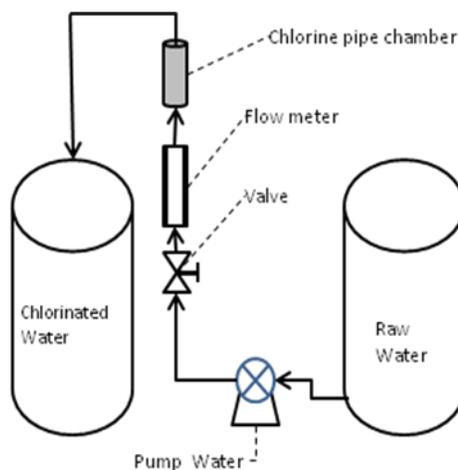


Figure 3 Flow chart of chlorination

First step, the empty chlorine pipe chamber was weighed, then put in as much of chlorine for each pipe and weighed it. Next step, the chlorine pipe chamber was installed such Figure 3. First chamber had been draining for 10 minutes, second chamber for 20 minutes and the last one for 30 minutes. Theirs dried for 24 hours then their weighed.

Diffusion and mass transfer coefficients were obtained by computation, which used solver application in Microsoft Windows 2007. The best value was based on least sum of square of error (SSE). An equation of SSE can be written as equation (11) (Budi and Sa-songko 2009; Makhtur et al. 2012).

$$SSE = [Simulation\ Data - Experiment\ Data]^2 \quad (11)$$

Besides, the data collected to obtain a relationship of chlorine's remains percentage and time's series. Chlorine of weights remains a percentage can be written as equation (12).

$$\text{Chlorine weights remains (\%)} = \frac{w(t)_{i+1}}{w(t)_0} \times 100 \quad (12)$$

$w(t)_{i+1}$  was obtained by equation (10) and  $w(t)_0$  as initial weights. Breakpoint chlorination (BPC) curve which depicts relationships between dosed and the measured chlorine was made to effective chlorine dosage. Chlorine powder weighed was 0.05 grams and then was diluted by sterilized pure water. Solution was sampled to determine those concentrations and then volume as much as 1, 2, 3, 4, 5, 6 and 7 mL of solution and was put into 200 mL of raw water. Chlorinated water was allowed to 30 minutes (WHO 2004) and then was determined of chlorine concentrations.

Table 1 Determination result of diffusion ( $D$ ) and mass transfer coefficients ( $k$ ) on rate discharges and granule sizes

| Granule size was 9.75 mm – 16 mm.   |                |                        |        |        |                     |  |                                 |
|-------------------------------------|----------------|------------------------|--------|--------|---------------------|--|---------------------------------|
| Rate discharge<br>(liter/minute)    |                | flow periods (minutes) |        |        | Sum Square<br>Error | $D$<br>( $\text{cm}^2 \text{ minute}^{-1}$ ) | $k$<br>( $\text{minute}^{-1}$ ) |
|                                     |                | 10                     | 20     | 30     |                     |  |                                 |
| 8                                   | Simulation (g) | 9.94                   | 10.02  | 7.35   | -                   | 0.4371                                       | 0.0039                          |
|                                     | Experiment (g) | 10.07                  | 9.57   | 7.64   | -                   |  |                                 |
|                                     | Error square   | 0.0172                 | 0.2059 | 0.0826 | 0.3057              |  |                                 |
| 14                                  | Simulation (g) | 8.92                   | 8.77   | 8.02   | -                   | 0.4804                                       | 0.0048                          |
|                                     | Experiment (g) | 8.95                   | 8.64   | 8.09   | -                   |  |                                 |
|                                     | Error square   | 0.0009                 | 0.0167 | 0.0045 | 0.0221              |  |                                 |
| 20                                  | Simulation (g) | 7.78                   | 7.22   | 5.83   | -                   | 0.6861                                       | 0.0073                          |
|                                     | Experiment (g) | 7.76                   | 6.76   | 6.13   | -                   |  |                                 |
|                                     | Error square   | 0.0002                 | 0.2162 | 0.0910 | 0.3074              |  |                                 |
| Granule size was 4.75 mm – 9.75 mm. |                |                        |        |        |                     |  |                                 |
| Rate discharge<br>(liter/minute)    |                | flow periods (minutes) |        |        | Sum Square<br>Error | $D$<br>( $\text{cm}^2 \text{ minute}^{-1}$ ) | $k$<br>( $\text{minute}^{-1}$ ) |
|                                     |                | 10                     | 20     | 30     |                     |  |                                 |
| 8                                   | Simulation (g) | 9.65                   | 8.57   | 7.15   | -                   | 0.5935                                       | 0.0086                          |
|                                     | Experiment (g) | 9.67                   | 8.34   | 7.29   | -                   |  |                                 |
|                                     | Error square   | 0.0003                 | 0.0544 | 0.0194 | 0.0741              |  |                                 |
| 14                                  | Simulation (g) | 6.76                   | 3.83   | 1.16   | -                   | 0.6755                                       | 0.0340                          |
|                                     | Experiment (g) | 6.73                   | 3.81   | 1.22   | -                   |  |                                 |
|                                     | Error square   | 0.0006                 | 0.0004 | 0.0031 | 0.0042              |  |                                 |
| 20                                  | Simulation (g) | 6.37                   | 2.90   | 0.67   | -                   | 0.5552                                       | 0.0388                          |
|                                     | Experiment (g) | 6.32                   | 2.85   | 0.87   | -                   |  |                                 |
|                                     | Error square   | 0.0022                 | 0.0021 | 0.0393 | 0.0437              |  |                                 |

Chlorine needed was calculated to add in a reservoir by equation (13).

$$BPC (gr) = \frac{Vx [C]}{0.2} \times Q \times \Delta t \times 2.02 \times 10^{-3} \quad (13)$$

$V$  as volume of dosage (liters);  $[C]$  as concentration of chlorine's solution (mg/L);  $Q$  as flow rate discharge (liters/ minute);  $\Delta t$  as flow periods (minutes); 2.02 as inversely proportional to molecules weights  $\text{Ca}(\text{OCl})_2$  and  $\text{Cl}_2$ .

Chlorination experiment was performed on flow rate discharge and granule size which potential for chlorination technique. Pump used was 14 liters/minute which was based on average rate of public discharge and it had been working for 30 minutes. Chlorine weight needed was controlled by control charts. The control charts included were breakpoint chlorination (BPC) (equation 13), chlorine weights remain (equation 10), chlorine transported, and maximum chlorine added. Chlorinated water was sampled to measure of residual free chlorine and total coliform.

**3. RESULT AND DISCUSSION**

**3.1 Determination of diffusion coefficient (*D*) and mass transfer coefficient (*k*)**

| Granule size was 2.36 mm - 4.75 mm |                |                        |        |        |                     |   |                                     |
|------------------------------------|----------------|------------------------|--------|--------|---------------------|---|-------------------------------------|
| Rate discharge<br>(liter/minute)   |                | flow periods (minutes) |        |        | Sum Square<br>Error | <i>D</i><br>(cm <sup>2</sup> minute <sup>-1</sup> ) | <i>k</i><br>(minute <sup>-1</sup> ) |
|                                    |                | 10                     | 20     | 30     |                     |   |                                     |
| 8                                  | Simulation (g) | 3.68                   | 1.18   | 0.15   | -                   | 0.5350  | 0.0517                              |
|                                    | Experiment (g) | 3.56                   | 1.27   | 0.45   | -                   |   |                                     |
|                                    | Error square   | 0.0147                 | 0.0084 | 0.0894 | 0.1125              |   |                                     |
| 14                                 | Simulation (g) | 1.77                   | 0.60   | -0.11  | -                   | 0.3610  | 0.0751                              |
|                                    | Experiment (g) | 1.42                   | 0.64   | 0.14   | -                   |   |                                     |
|                                    | Error square   | 0.1236                 | 0.0012 | 0.0645 | 0.1893              |   |                                     |

The result of computation on mass transfer coefficients (*k*) rose when flow rate discharge was increased. Mass transfer was occurred of chlorine to soluble or reacts within water (Rohim 2006; Said 2007; Sarbatly and Duduku 2009; Setiawan et al. 2013) and also was eroded by water or both of them. Transport of mass was strongly influenced by flow rate discharge (Welasih 2006). Table 1 shows the coefficients of mass transfer up within granule size was decreased.

Diffusion coefficient (*D*) rose when flow rate discharge had risen for granule of 9.5 mm – 16 mm and fluctuated for 4.74 mm – 9.5 mm, thus down for 2.36 mm – 4.75 mm. A coefficient diffusion affected by temperature, pressure, substances compound, and nature of solvent (Mortimer 2008). Referring to Connell (1993), coefficient diffusion was inversely proportional to the diameter of molecules and the others declared as a root square of molecule’s weights. Referring to Wati and Budiman – Sastrowardoyo (2007), density was inversely proportional to the diffusion coefficient. Table 1 shows the coefficients of mass transfer increases and it the meanings of chlorine transfer rises. Chlorine transported from solids to liquids in chlorine pipe chamber, and it was causing of density increased. Thereby, diffusion coefficient declined.

**3.2 The influence of flow rate discharges and granule sizes on weight change**

Figure 4 shows of chlorine weights remain declines when water flow rate discharge rises for common granule size. Flow rate discharge is multiplying between the velocity and crossed sectional square. So, flow discharge rises to causes velocity increases. Change velocity generates momentum whose makes forces (Geankoplis 1993). Forces made chlorine eroded. Besides, chlorine is soluble or reacts within part of water (Patnaik 2002). Flow discharge of water rose to make chlorine’s weight declined. It’s caused more freshly water was solved.

Figure 4 shows of granule size’s declines when chlorine’s weights increases for common flow rate discharge. Surfaces area increased when granule size was being shrinking. Referring to Geankoplis (1993), Surfaces area increased that caused of collision regions was enlarged. Consequently, chlorine fragmentation was being formed and carried off by water. The rate of flux out mass is strongly influenced by region’s space contact (Welty *et al.* 2004).

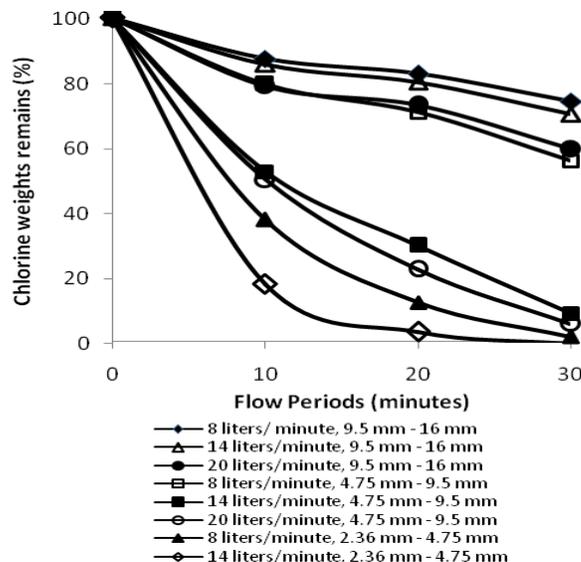


Figure 4 Percentage of chlorine weights remains on influenced by flow rate discharge and granule size.

### 3.3 Chlorination and Prototype Tool Design

Chlorine needed as disinfect was determined by breakpoint chlorination (BPC). Referring to Rosyidi (2010), BPC was accomplished by chlorine addition which to oxidized all of water compounds included of ammonia to convert nitrogen gases (Figure 5). Consequently, chlorine was declined.

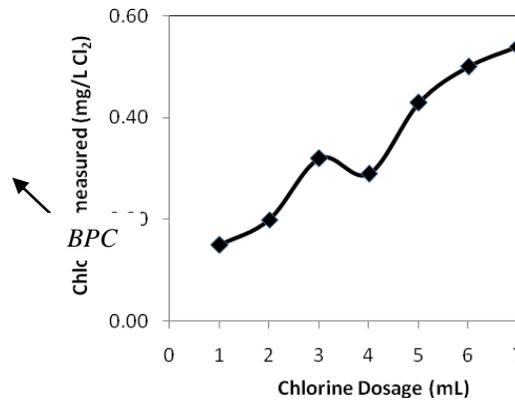


Figure 5 Breakpoint chlorination of raw water

Chlorine required for breakpoint chlorination (BPC) was calculated by equation (13). Dosage used was 4 mL or 0.004 liters that it acquired 0.51 grams of chlorine to a reservoir filled by flow rate discharge 14 liters/minute during 30 minutes. Referring to White (2010), if chlorine added when it had been exceeding of BPC point, the next addition of chlorine to result up free chlorine residual (FCR) linearly. Figure 6 was shown of experiment resulted which it was exceeded.

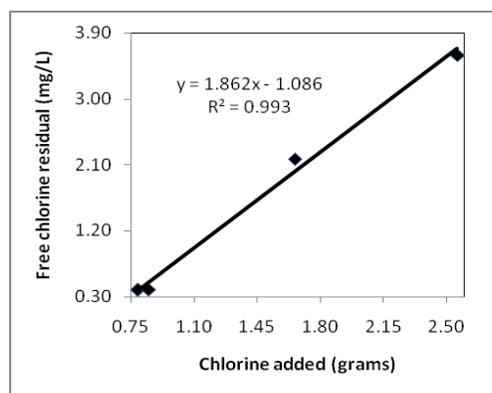


Figure 6 Chlorine added when it had been exceeding of BPC point.

The positive linear correlation has R-Sq value 99.33% and their correlation has value of 0.9967. Referring to Ministry of Health of Republic of Indonesia (1990), maximum FCR value is 0.5 mg /L. Result of interpolation with maximum chlorine added was 0.8518 grams so FCR was being fulfilled.

Chlorination experiment was performed which potentially used of chlorine's granules and flow rate discharge. There was 9.5 mm – 16 mm and 8 liters /minute. Theirs slightly shrank of chlorine's weights. Second, trends linearly graph was extrapolated to equation (10) (Figure 8), so that the ratio of raw water and chlorine added was leveling off. Chlorination experiment carried out of rate discharge on 14 liters/minute. Consequently, chlorine pipe chamber has been modified (Figure 7) and error rate level was obtained on Table 2.

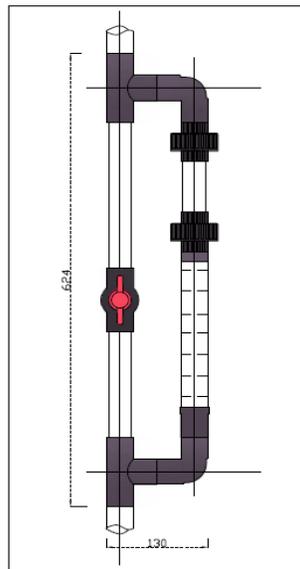


Figure 7 Prototype of chlorination tool model, code of AYH-01

Table 2 Error rate level of prototype model

| No                   | Chlorine's weight remains |            | Error (%) |
|----------------------|---------------------------|------------|-----------|
|                      | Simulation                | Experiment |           |
| 1                    | 2.38                      | 2.42       | 1.65      |
| 2                    | 2.27                      | 2.21       | 2.71      |
| 3                    | 2.34                      | 2.28       | 2.63      |
| Average of error (%) |                           |            | 2.33      |

Control chart of chlorination was made by computation (Figure 8). Chlorine transported was obtained by difference of chlorine's weights between initial and remains. Initial weight used was 3.06 grams of chlorine.

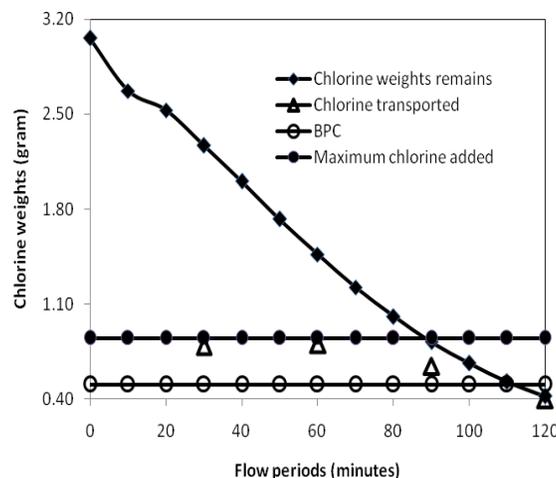


Figure 8 Control chart of chlorination by initial weights was 3.06 grams of chlorine.

Free chlorine residual measured was 0.40 mg/L and the total coliform was zero. Chlorine transported to a reservoir calculated was 0.85 grams that conformed by maximum chlorine added. Chlorine transported to a reservoir between at 90 to 120 minutes was not exceeded of BPC's point, but these conditions still had formed chloramines. The disinfection of bacteria was succeeded by chloramines (Li et al. 2005; Wojcicka et al. 2007). Referring to Said (2007), chloramines were killed bacteria, but it was less powerful compared by free chlorine.

Raw water added a lot of bacteria and then sampled contain 1600 per 100 mL of water. Furthermore, the total coliform was zero when it had chlorinated. Initial weights used 3.16 grams of chlorine and it transported to the reservoir was 0.88 grams which it ex-

ceeds on maximum chlorine added in, even though FCR found was 0.39 mg/L. It caused difference both of chlorine transported between added and no added of bacteria used to kill them.

#### 4. CONCLUSION

The conclusions of this research are:

1. Granule size of 9.5 mm – 16 mm and 8 liters/minute as well as a prototype of the AYH-01 model recommended for disinfection technique.
2. The error rate of the prototype model was 2.33%.
3. Chlorinated water met by the standard based on Ministry of Health of Republic of Indonesia' number 416 of 1990 about the terms of supervision and the quality of water.

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# Study on Challenges and Opportunities of Village Chicken Production in Haramaya District, Eastern Ethiopia

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**Abstract-** Survey on rural chicken production system was conducted in three peasant associations of Haramaya Woreda of Oromia regional state to generate information on the problems and constraints emending the developments of their community with particular emphasis on poultry production and to list the possible opportunities and strategies that could solve these problems. A total of 120 households were used for the survey work. Finally, all the data collected were analyzed using descriptive statistics. About 77.5% of all the respondents share family dwellings with poultry, attributed to the small flock size, low priority given to chicken and relatively high cost of poultry house construction. The results obtained clearly showed that poultry diseases are widely spread in the Woreda and farmers pointed out that, Newcastle Disease, fowl cholera; respiratory diseases and predators are responsible for the major losses of birds in the study sites. Almost all the respondents reported poultry and poultry product market price fluctuation attributed to limitation in land holding, disease occurrence and low purchasing power of the consumers. About 100% of the respondents reported to keep different classes of chicken together, the practice of which facilitates transmission of diseases. In summary the results of this study tends to indicate that production performance of indigenous chicken is low under traditional production practice and need to be improved.

**Index Terms-** Indigenous chicken, Haramaya, Survey, Traditional

## I. INTRODUCTION

Poultry refers to all domestic birds, kept for production of meat and eggs for human consumption such as chicken, turkey, ducks, geese, quails, ostrich, and guinea fowl (Kekeocha, 1984). The total Ethiopian poultry population is estimated to be 56.5 million of which 99% is made up of indigenous chickens (ILCA, 1993). Majority of the national chicken population 41.7% comprises of chickens 0-8 weeks of ages, characterized by high mortality of about 40-60%. The laying flock seems to be dominated by old age and surplus breeding males. About 30.9% of the total national chicken population is hens of which about 16% are none layers. The four regional states (Oromia, Amhara, SNNP, and Tigray) collectively accounts for about 96% of the total national poultry population. Chicken rearing is not common in lowland of Ethiopia i.e. Somali, Gambella, Afar, and Benishangul-Gumuz regional states which collectively own 3.24% of the total chicken population of which 2.2% is owned by Benishangul-Gumuz regional state (CACC, 2003).

The Ethiopian indigenous chickens are none descriptive breeds closely related to the Jungle fowl and vary in color, comb type, body conformation and weight and may or may not possess shank feather. Broodiness (maternal instinct) is pronounced (Demeke, 2008). They are characterized by slow growth, late maturity and low production performance. The mean annual egg production of indigenous chickens is estimated at 60 small eggs with thick shell and deep yellow yolk color (Yami and Dessie, 1997). Egg laying period and number of eggs laid per period are to some extent higher in urban than in rural areas (CACC, 2003).

The productivity of local scavenging hens is low, not only because of low egg production potential, but also due to high chick mortality. About 40-60% of the chicks hatched dies during the first 8 weeks of age (Hoyle, 1992, Tadele, 1996, and CACC, 2003) mainly due to disease and predator attack. It is estimated that, under scavenging conditions, the reproductive cycle consists of 20 days laying phase, 21 day incubation phase and finally a 56 days brooding phase (Alemu yami and Tadele dessie, 1997). This implies that the number of clutches size per hen per year is probably 2-3. Assuming 3 clutches per hen per year, the hen would have to stay for about 168 days out of production every year, entirely engaged in brooding activities.

The developments of innovative ideas for improving real poultry production require complete understanding of the system and its operators. Furthermore, research directions and strategies should be geared to addressing farmer real problems and constraints so as to help them expand and become self-sufficient. Hence important element is in the sustainable development of community is the active involvements of the community members in any development activities, which should start with their participation in identifying their own problem and constraints and deciding on the best alternatives and most appropriate strategies to meet such needs. There is, therefore, present study was designed to identify residents problems and constraints emending the developments of their community and to list the possible opportunities and strategies that could solve these problems.

## II. MATERIALS AND METHODS

### Study Area

The study was conducted in Haramaya district of east Hararghe zone of Oromia regional state. It is located 15km North of Harar capital city. Haramaya district is located in eastern Hararghe with altitude 1403 meters and maximum and minimum annual temperature is 20°C and 15°C, respectively. Its annual rainfall is 1290mm.

### Research Design and Methodology

The study was conducted through informal survey and diagnostic (formal) survey. Informal survey was used to describe the study area, to obtain base line data (secondary data). It was also used to collect data on general characteristics of the area like administrative boundary, agro-economic condition; physical, biological and socio-economic, demographic and institutional interventions on livestock production in general and particularly on challenges of chicken production at small scale data were collected through informal survey.

Focus group discussions were held with key informants. Moreover, direct observations were used to assess the current activities undertaken in relation to constraints and problems emending the developments of their community with particular emphasis on poultry production like the biophysical, economic and socio-cultural aspect of poultry production in the selected communities. And the possible opportunities and strategies that could solve these problems as well as possible entry points for introducing sustainable poultry developments to the area.

The information generated during the informal survey was used for the development of the questionnaire for the formal survey. Besides the information obtained from informal survey, the questionnaire will include the empirical knowledge from the researcher as well as consultation of experts in the zone agriculture office. In addition, relevant literature was consulted. The questionnaires were pre-tested on some sample households.

**Sampling Procedure**

Based on the information obtained during the rapid survey, the study sites were stratified and similarly the sample householders were also selected. All the sampling procedures were undertaken with the consultation of the responsible personnel in the office of zone agriculture and rural development.

**Data Management and Analysis**

The raw data collected from the survey work was entered in excel for data management. The data were analyzed using descriptive statistics.

**III. RESULTS AND DISCUSSIONS**

**Livestock Possession and Flock Structure**

The average reported livestock possessions are presented in Table 1. Respondents in Bate had significantly higher number of goat and chicken. However, there was no significant difference among three kebeles in donkey holding.

**Table 1. Livestock holdings per households in the study area**

| Categories | Bate<br>(n=40)  | Tinike<br>(n=40) | Adele<br>(n=40) | Overall<br>(n=120) |
|------------|-----------------|------------------|-----------------|--------------------|
|            | Mean<br>±<br>SE | Mean<br>±<br>SE  | Mean<br>±<br>SE | Mean<br>±<br>SE    |
| Cattle     | 1.33±0.2        | 1.80±0.2         | 1.80±0.2        | 1.63±0.1           |
| Sheep      | 2.43±0.3        | 2.35±0.3         | 2.60±0.3        | 2.45±0.2           |
| Goat       | 3.53±0.5        | 3.90±0.5         | 3.58±0.5        | 3.66±0.3           |
| Donkey     | 0.25±0.1        | 0.28±0.1         | 0.28±0.1        | 0.27±0.0           |
| Chicken    | 9.18±0.8        | 8.52±0.7         | 6.5±0.5         | 8.07±0.4           |

SE=standard Error

The mean average of adult hens accounted for about 4.20 ± 0.17 of the total flock. The mean average of hens (4.35 ± 0.35) was larger for Bate as compared to Tinike and Adele which are (4.01 ± 0.27) and (4.23±0.27) hens respectively. The lower proportion of pullets, Cockerels and chicks in all kebeles is related to the tradition of marketing young chicks. The flock structures in the all kebeles are listed below:

**Table 2. Chicken flock structures in the study area**

| Categories | Bate<br>(n=40)  | Tinike<br>(n=40) | Adele<br>(n=40) | Overall<br>(n=120) |
|------------|-----------------|------------------|-----------------|--------------------|
|            | Mean<br>±<br>SE | Mean<br>±<br>SE  | Mean<br>±<br>SE | Mean<br>±<br>SE    |
| Cocks      | 1.08±0.2        | 1.15±0.2         | 1.13±0.1        | 1.12±0.1           |
| Hens       | 4.35±0.4        | 4.01±0.3         | 4.23±0.3        | 4.20±0.2           |
| Pullet     | 2.10±0.3        | 2.2 ±0.3         | 2.10±0.3        | 2.13±0.1           |
| Cockerel   | 1.45±0.2        | 1.70±0.2         | 1.48±0.2        | 1.54±0.1           |
| Chicks     | 2.55±0.5        | 2.60±0.5         | 2.75±0.4        | 2.63±0.3           |

n= number of households; SE=standard error

**Chicken Production Practices**

**Housing**

The results of this study showed that, there are no separate poultry houses in the study areas in most of the cases (Table 4) and village chickens spent most of their time scavenging in the vicinity of human dwellings. About 77.5% of the respondents' households keep poultry in the same room with human being during night time as shown in Table 4. On the other side 11.67% household reported to have separate partition as night time enclosure for poultry within family dwellings. The remaining respondents reported to have separate poultry houses. The general indication is that about 77.5% of all the respondents share family dwellings with poultry, attributed to the small flock size, low priority given to chicken and relatively high cost of poultry house construction. Sharing family dwellings particularly during night times might also be associated with protection from predators.

The results of the discussions made with key informants indicated that most of the farmers of the study area are not aware of the importance of separate poultry house construction from the point of view of productivity and bio-security. Moreover, the separate poultry houses constructed in the study area lack internal facilities like egg laying nest, roosts and feeder. This result is in agreement with the findings of Kitaly (1998) and the Resource-Center (2005) who reported that both in Ethiopia and in Kenya, the majority of chickens are housed either in family dwellings or in the kitchens.

About 25, 42.5 and 32.5% of all the respondents reported to clean their poultry houses daily, weekly and twice a week, respectively. Lack of frequent cleaning of poultry shelter could

easily cause diseases conditions and increase morbidity and mortality.

**Table 4. Housing of Rural chickens by the households in studied Kebeles (%)**

| Housing types   | Bate | Tinike | Adele | Overall |
|---|------|--------|-------|---------|
| Share the same room with family                               | 72.5 | 77.5   | 82.5  | 77.5    |
| Have a different shelter for night enclosure in the same roof | 15   | 12.5   | 7.5   | 11.67   |
| Separate house constructed entirely for chicken               | 12.5 | 10     | 10    | 10.83   |

There is no well recognized design for the construction of poultry house in the study area and most of the available poultry houses are constructed from sorghum stalk and bamboo trees. The result of this study is in line to the report of Meseret (2010) who reported that Bamboos and sticks are occasionally used for construction of perches within the family houses in Gomma Woreda.

**Feeds and feeding**

There is no purposeful feeding of rural household chickens in Ethiopia and the scavenging feed resource is almost the only source of feed. According to the results of this study, all of the respondents (100%) reported to practice scavenging system with supplementary feeding. This result seems to be in line with that of Bassei (1993), Taddelle (1996) and Maphosa *et al.* (2004) who stated that village chickens don't receive regular and adequate supplementary feeding.

All the respondents reported that baby chicks and layers are given priority for supplementary feeding. According to the results of the discussion made with the key informants priority of supplementation is given to young chicks since young chicks could not fulfill part of their nutritional requirement by scavenging as compared to mature chickens. In contrast to this result Meseret (2010) reported that supplementary feed materials are offered indiscriminately to all classes of chicken on bare ground. This result is in line with that of Leulseged (1998) who reported severe scarcity of scavenging feed resource during wet seasons indicating that availability of scavenging feed resource basis depends on seasons and backyard conditions.

**Table 3. Practice of feed supplementation for scavenging chickens in the study area (%)**

| Responses              | Bate<br>(n=40) | Tinike<br>(n=40) | Adele<br>(n=40) | Over-<br>all(n=120) |
|------------------------|----------------|------------------|-----------------|---------------------|
| <b>Extra feed sup-</b> |                |                  |                 |                     |

|                            |      |      |      |       |
|----------------------------|------|------|------|-------|
| <b>plementation (%)</b>    |      |      |      |       |
| Yes                        | 42.5 | 27.5 | 32.5 | 34.17 |
| No                         | 57.5 | 72.5 | 67.5 | 65.83 |
| <b>Maize grain (%)</b>     |      |      |      |       |
| Yes                        | 67.5 | 87.5 | 60   | 71.67 |
| No                         | 32.5 | 12.5 | 40   | 28.33 |
| <b>Foods left over (%)</b> |      |      |      |       |
| Yes                        | 100  | 100  | 100  | 100   |
| No                         | 0    | 0    | 0    | 0     |
| <b>Kitchen wastes (%)</b>  |      |      |      |       |
| Yes                        | 100  | 100  | 100  | 100   |

**Disease and predators**

The traditional poultry disease control method practiced in the study area is shown in Table 5. Disease prevention measures practiced differs from place to place. About 60% of the overall respondents in the study areas reported to practice treatments of sick birds with traditional medicine and 90.83% dispose their dead birds by throwing away to dogs.

**Table 5. Recorded highest mortality and methods of disposal of dead birds (%)**

| Parameters                             | Bate | Tinike | Adele | Overall |
|--|------|--------|-------|---------|
| <b>Most affected classes</b>           |      |        |       |         |
| Chicks                                 | 95   | 90     | 90    | 91.67   |
| All classes                            | 5    | 10     | 10    | 8.33    |
| <b>Methods of disposing dead birds</b> |      |        |       |         |
| throwing away to dogs                  | 92.5 | 87.5   | 92.5  | 90.83   |
| Burying                                | 7.5  | 12.5   | 7.5   | 9.17    |

According to the result of this study, losses of chicks attributed to predation are significantly high (Table 5). The most common predators reported to occur in the study area include wild cat (local name Adala), hawk (birds of prey), domestic cat, rats, and dogs. All of the respondents reported to have used their own means of protecting chickens from predators.

**Breeding**

The traditional poultry production system is characterized by lack of systematic breeding program. According to Table 6, poor productivity and sickness are the two major factors of culling chickens from the flock in the study areas. The majority of the respondents (81.67%) practice culling. About 5.83 and 94.17% of the respondents cull chickens from the flock for consumption and sale purpose respectively. Poor productivity, old age and sickness accounts for about 27.5, 17.5 and 55% of culling chickens from the flock in the study area, respectively. This study was

in agreement with report of Mammo (2006) who reported that culling of unproductive chickens through consumption and sale.

**Table 61. Reason and methods for culling chickens in the study area (%)**

| Parameters                          | Bate | Tinike | Adele | Overall |
|-------------------------------------|------|--------|-------|---------|
| <b>Culling Practice</b>             |      |        |       |         |
| Yes                                 | 92.5 | 85     | 67.5  | 81.67   |
| No                                  | 7.5  | 15     | 37.5  | 18.33   |
| <b>Ways of Culling</b>              |      |        |       |         |
| By selling                          | 95   | 100    | 87.5  | 94.17   |
| By Consuming at Home                | 5    | 0      | 12.5  | 5.83    |
| <b>Factors to determine Culling</b> |      |        |       |         |
| Poor productivity                   | 25   | 42.5   | 15    | 27.5    |
| Old age                             | 12.5 | 17.5   | 22.5  | 17.5    |
| Sickness                            | 62.5 | 40     | 62.5  | 55      |

**Marketing of chicken and eggs**

There is no formal poultry and poultry product marketing channel in the study areas and informal marketing of live birds and eggs involving open markets are common throughout the Woreda. The farmers directly sell their chicken to consumers and/or to small retail traders who take them to large urban centers. Live chickens and eggs are sold either at the farm gate, small village market (primary market) or at larger Woreda market (Secondary market in the town). The results of this study clearly showed that both eggs and chickens pass through different individuals before reaching consumer. About 78.33% of all the respondents reported to sale their poultry and poultry products in the Woreda market (secondary market) during market days. The remaining 21.67% of the respondents sold poultry and poultry products within their Kebeles (primary market) during market days. This situation warrants the existence of market constraints and access to market in the study area is determined by distance. Improving access to market information, development of better infrastructure and organization of poultry producers into market cooperatives are some of the recommendations aimed at correcting market deficiencies in rural Ethiopia (Aklilu, 2007)

**Table 7. Determinants of chickens market price and marketing of chickens in the study area (%)**

| Criteria                | Bate | Tinike | Adele | Overall |
|-------------------------|------|--------|-------|---------|
| <b>Pricing Criteria</b> |      |        |       |         |
| Plumage Color           | 12.5 | 5      | 12.5  | 10      |
| Body Weight             | 75   | 87.5   | 62.5  | 75      |
| Breeds                  | 12.5 | 7.5    | 25    | 15      |

|                                |      |      |     |       |
|--------------------------------|------|------|-----|-------|
| Beak Length                    | -    | -    | -   |       |
| <b>Ways of Marketing</b>       |      |      |     |       |
| Main Market                    | 87.5 | 62.5 | 75  | 78.33 |
| Within the Kebeles             | 12.5 | 27.5 | 25  | 21.67 |
| <b>Means of transportation</b> |      |      |     |       |
| Carrying by hand themselves    | 100  | 100  | 100 | 100   |
| Using pack animals             | 0    | 0    | 0   | 0     |

About 100% of the entire respondent carries their chickens to market places either on foot or using public transportations causing physical injury and other complications on the chickens which in turn reduce the quality of the products. The results of this study are in agreement with that of Solomon (2008) who reported that indigenous birds and eggs are transported over longer distances to supply town market which results in quality deterioration. Limitation in land holding, predominance of poultry disease and predations and extremely low family income are the major determinants of the purchasing power of the farming population. Young pullets are less priced than the counterpart cockerels. Cockerels with good feather colors had been priced higher for the reason of socio religious commitments.

**Table 8. Market price of chickens and eggs in the study area (in Birr)**

| Market Price (Birr) | Bate | Tinike | Adele | Overall |
|---------------------|------|--------|-------|---------|
| <b>Indigenous</b>   |      |        |       |         |
| Pullets             | 37.5 | 30.5   | 35.5  | 34.5    |
| Hens                | 62.5 | 65.5   | 69.5  | 65.83   |
| Cocks               | 75   | 72.5   | 82.25 | 76.58   |
| Cockerels           | 39.5 | 31.5   | 40.25 | 37.08   |
| <b>Eggs</b>         | 2.35 | 2.45   | 2.25  | 2.35    |

**Problems of Chicken Production in the Study Area**

Major constraints of chicken production in the study area are presented in Table 9. About 52.7% of all the respondents ranked disease as the most important constraint to rural poultry production in the study areas. The remaining respondents mentioned marketing and market related economic problem as the major problem to poultry production in the study areas. The results of this study is in line with that of Tesfu (2006) who ranked predation and disease conditions as the major problem of chicken production in Ethiopia.

About 70% of the respondents reported that disease and predations account for the largest annual poultry losses in Ethiopia. The predators involved in chicken losses include eagles, hawk, and crown, rats, wildcats, monkey and dogs while ants and mosquitoes are the insect pest that kills chicks especially in rainy

season. On top of these there is lack of vaccination program and knowledge about the causes and transmission of disease.

**Table 9. Constraints of poultry production in the study area (%)**

| Constraints       | Bate | Tinike | Adele | Overall |
|-------------------|------|--------|-------|---------|
| Disease           | 52.5 | 45.5   | 60    | 52.67   |
| Predators         | 27.5 | 37.5   | 12.5  | 25.83   |
| Economic problems | 12.5 | 7.5    | 15    | 11.67   |
| Marketing         | 7.5  | 9.5    | 12.5  | 9.83    |

#### IV. CONCLUSIONS

In the study area all farmers share family dwellings with poultry, attributed to the small flock size, low priority given to chicken and relatively high cost of poultry house construction. Sharing family dwellings particularly during night times might also be associated with protection from predators. Limitation in land holding, predominance of poultry disease and predations and extremely low family income are the major determinants of the purchasing power of the farming population. Almost all the respondents reported poultry and poultry product market price fluctuation attributed to limitation in land holding, disease occurrence and low purchasing power of the consumers. The use of hay box brooder was found to be effective in reduction of mortality and releasing the broody hen to go back to laying. Popularization of the technology within the farming population including the provision of constructional and operational manual in local language seems to be desirable. Provision of basic education on market oriented small scale poultry production and management should be given through the existing extension system with special emphasis placed on women. The existing poultry extension package also need to place special emphasis on important veterinary issues, since poultry diseases are widely spread in the Woreda.

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# Challenges Facing Micro and Small Enterprises in Accessing Credit Facilities in Kangemi Harambee Market in Nairobi City County, Kenya

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**ABSTRACT:** Micro and Small (MSEs) play an important economic role in many countries. In Kenya, for example the MSE sector contributes over 50 per cent of new jobs created but despite their significance. The purpose of this study was to determine the challenges facing Micro and Small Enterprises in accessing credit facilities in Kangemi Harambee Market in Nairobi City County, Kenya. The study used descriptive research design. The study targeted a sample of 241 from a target population of 656 MSEs located in Kangemi Harambee market. Stratified random sampling was utilized in selecting the respondents for the study. Primary data was collected from the study respondents using questionnaires which were self-administered and others researcher administered. Data was analyzed descriptively and presented through figures, tables, percentages, bar charts, arithmetic means, standard deviations, pie charts and tabulation to show differences in frequencies. Statistical Package for Social Sciences (SPSS) version 21.0 was used to aid in coding, entry and analysis of quantitative data obtained from the closed ended questions. The study revealed that the key challenges hindering micro and small enterprises from accessing credit facilities to be high cost of repayment, strict collateral requirements, unwillingness of people to act as guarantors, high credit facilities' processing fees and short repayment period. Therefore it is recommended that financial institutions set more flexible, affordable and attractive requirements in financing micro and small enterprises.

**KEY WORDS:** Micro and Small Enterprises, credit facilities, financial institutions

## 1. INTRODUCTION

### 1.1 Background of the study

Micro and Small Enterprises (MSEs) are lifeblood of most economies. To be successful in this and other business sectors, finance plays a major role. As far as MSEs are concerned as part of business enterprises, they need finance to start up, expand, diversify and for working capital of the business firms. Without finance, no one business enterprise can achieve its objectives. Finance is the backbone of MSEs and any other business enterprise (Mckernan & Chen, 2005). Both in the developing and developed world small firms have been found to have less access to external finance and to be more constrained in their operation and growth (Galindo & Schiantarelli, 2003).

Micro, Small and Medium Enterprises (MSMEs) are viewed as a key driver of economic and social development in the African context. They represent a large number of businesses in a country, generate much wealth and employment and are widely considered to be vital to a country's competitiveness. MSMEs are hailed for their pivotal role in promoting grassroots economic growth and equitable sustainable development (Pelham 2000). MSMEs tend to be large in number, accounting for about 90 percent of all enterprises in many African countries and over 80 percent of new jobs in a given country (Reinecke, 2002).

In Kenya, the small business sector has both the potential and the historic task of bringing millions of people from the survivalist level including the informal economy to the mainstream economy. According to the last comprehensive survey conducted in 1999, the sector was estimated to employ over 50 per cent of the working population (accounting for 2.3 million people). As much as majority of the MSEs in Kenya operate informally, there are over 35,000 formal MSEs that employ over 40 per cent of the working population (Kenya Economic Report, 2013).

Recognizing the critical role small businesses play in the Kenya economy, the Government through Kenya Vision 2030 envisages the strengthening of MSMEs to become the key industries of tomorrow by improving their productivity and innovation (Ministry of Planning, National Development & Vision 2030 [MPNDV2030], 2007). However, it is generally recognized that MSMEs face unique challenges, which affect their growth and profitability and hence, diminish their ability to contribute effectively to sustainable development. The International Finance Corporation (IFC) (2011) has identified various challenges faced by MSMEs including lack of innovative capacity, lack of managerial training and experience, inadequate education and skills, technological change, poor infrastructure, scanty market information and lack of access to credit.

The catalytic roles of micro and cottage businesses have been displayed in many countries of the world such as Malaysia, Japan, South Korea, Zambia, and India among other countries. They contribute substantially to the Gross Domestic Production (GDP), export earnings and employment opportunities of these countries. MSEs have been widely acknowledged as the springboard for sustainable economic development (Osotimehin, Jegede, Akinlabi, & Olajide, 2012). Apart from the fact that it contributes to the increase in per capita income and output, it also creates employment opportunities, encourage the development of indigenous entrepreneurship, enhance regional economic balance through industrial dispersal and generally promote effective resource utilization that are considered to be critical in the area of engineering economic development (Oboh, 2004; Odeh, 2005).

The MSEs play a key role in triggering and sustaining economic growth and equitable development in both developed and developing countries. According to Government of Kenya Sessional Paper No.2 of 2005 on Development of MSEs cut across all sectors of the country's economy. They also provide one of the most prolific sources of employment, not to mention the breeding ground for entrepreneurs in medium and large industries, which are critical for industrialization. The exploitation of the potential of the indigenous sector as an engine for growth, using local resources and appropriate technology which is the nature of MSEs, is seen as an alternative development model to the traditional large-scale intensive "stages of growth" paradigm in developing economies (OECD, 2004). The MSE sector in Africa is a vibrant example of small enterprises activities leading to successful growth and development of African economies (Hope, 2001).

Despite their significance, past statistics indicate that 3 out of 5 businesses fail within the first few months of operation and those that continue 80 per cent fail before the fifth year (Kenya National Bureau of Statistics, 2007). This menace is attributed to poor financial management among small businesses. Accessing credit is a major constraint to the development and growth of MSEs and also to poor rural and urban households. This is mainly due to the behaviour of lenders in terms of hedging against borrowers' risks by demanding collateral, which they lack, and also information asymmetry. Consequently borrowers who are willing to pay prevailing credit interest rates cannot access the funds at those rates because lenders are unwilling to lend to them due to dearth of information about them and lack of collateralisable assets, severely constraining their access to credit. This behaviour is common amongst formal financial institutions. Evidence shows that such borrowers may then be forced to limit their investments to retained earnings (International Finance Corporation, 2000) thereby restricting enterprises growth and development.

A crucial element in the development of the MSE sector is access to finance, particularly to bank financing, given the relative importance of the banking sector in serving this segment. Firm-level data collected by the World Bank show that access to finance is perceived as one of the main obstacles to doing business. A number of studies have shown that financing is a greater obstacle for MSEs than it is for large firms, particularly in the developing world, and that access to finance adversely affect the growth of the MSE sector more than that of large companies (Schiffer, & Weder, 2001; Beck, T., Demirgüç-Kunt, & Maksimovic, 2005). It is, therefore, unsurprising that the international development community has listed small and micro enterprises (SMEs) access to finance as an important policy priority.

Africa's MSEs have little access to finance, which thus hampers their emergence and eventual growth. Their main sources of capital are their retained earnings and informal savings and loan associations, which are unpredictable, not very secure and have little scope for risk sharing because of their regional or sectoral focus. Access to formal finance is poor because of the high risk of default among MSEs and due to inadequate financial facilities. Small businesses in Africa can rarely meet the conditions set by financial institutions, which see MSEs as a risk because of poor guarantees and lack of information about their ability to repay loans.

The financial system in most of Africa is under-developed however and so provides few financial instruments. Capital markets are in their infancy, shareholding is rare and no long-term financing is available for MSEs. Non-bank financial intermediaries, such as microcredit institutions, could be a big help in lending money to the smallest MSEs but they do not have the resources to follow up their customers when they expand (Kauffmann, 2005).

## 1.2 *Statement of the Problem*

In almost all economies of the world especially in developing countries in Africa, micro and small enterprises are crucial and are a key factor for sustained growth and development. MSEs play pivotal roles in creating dynamic, market oriented economic growth, employing the growing workforce in developing countries, alleviating poverty and promoting democratization.

Upon attainment of independence in 1963, the country's economic policy was articulated in Sessional paper No.10 of 1965, titled "*African socialism and its application to planning in Kenya*". The paper defined the strategy to promote rapid economic growth through public sector programmes, encouragement of both small-scale and large-scale farming, and the pursuit of accelerated growth of private sector investment representing 74 percent of Kenya labour force (Obwocha, 2006).

The MSEs in Kenya have not performed creditably well and hence has not played expected vital and vibrant role in the economic growth and development of Kenya. This situation has been of great concern to the government, citizenry, operator's practitioners, and the organized private sector groups' year in year out. The government through its budget allocations, policies and pronouncements have signified interest and acknowledgement of the crucial role of the MSEs, sub-sectors of the economy and hence made policies for

energizing the same. The Kenya National Bureau of Statistics, (2007) found that three out of five businesses in Kenya failed within the first few months of operation and those that continued 80 per cent failed before the fifth year. MSEs have unique issues, which affect their growth and profitability and hence, diminish their ability to contribute effectively to sustainable development of the economy. Among those issues is inadequate access to credit facilities.

Despite the efforts by various stakeholders, lack of access to credit is almost universally indicated as a key problem facing MSE's. These credit constraints operate in variety of ways in Kenya where undeveloped capital market forces entrepreneurs to rely on self-financing or borrowing from friends or relatives. It also forces them to rely on high cost short term finance which is also complicated. The study sought to establish the challenges facing MSEs in accessing credit facilities in Kangemi Harambee Market in Nairobi City County, Kenya. The specific objectives were; to establish the influence of collateral requirements on accessibility of credit facilities by MSEs in Kangemi Harambee market in Nairobi City County, Kenya; to determine the influence of cost of credit on accessibility of credit facilities by MSEs in Kangemi Harambee market in Nairobi City County, Kenya; to investigate the influence of availability of information on accessibility of credit facilities by MSEs in Kangemi Harambee market in Nairobi City County, Kenya and to establish the influence of business risks on accessibility of credit facilities by MSEs in Kangemi Harambee market in Nairobi City County, Kenya.

Considering the significance of MSEs in Kenya, it is important to understand the challenges facing MSEs in accessing credit facilities in Kangemi Harambee Market. The research is expected to benefit various groups of stakeholders as follows:

*I. Policy makers*

The research will enable the policy makers to come up with a viable and focused entrepreneurship strategy that can help MSEs access to credit facilities. The study will also generate empirical data and information beneficial to the Government and the University level.

*II. Academicians and researchers*

The study will be a source of reference material for future researchers on other related topics; it will also help other academicians who undertake the same topic in their studies.

*III. Research institutions*

The research will contribute to the future research materials for the research institutions.

*IV. Financial institutions*

The research will come up with products which are tailor made to fit into entrepreneurship financial needs.

*V. Other Stakeholders*

To stakeholders like financial institutions, investors, shareholders, employees, pressure groups, etc., the research provides information for suggesting improvement in service delivery of the respective credit facilities providers in Kenya.

*VI. Scope of the Study*

The study focused on MSEs in Kangemi Harambee Market in Nairobi CityCounty, Kenya and challenges they face in accessing credit facilities. The total number of MSEs registered with the Kangemi Harambee Market Association is 656 out of which 241 were selected for the research purposes.

## 2. LITERATURE REVIEW

### 2.1 Introduction

This chapter on literature reviews various theories that underpin challenges facing MSEs in accessing credit facilities. Specifically, pecking order theory and credit rationing theory. This is followed by the conceptual framework, empirical review of literature related to the topic under study and the critique of this literature. Finally, the chapter delved on the gaps that arose from this literature and then the summary.

### 2.2 Theoretical Framework

#### 2.2.1 Pecking Order Theory

Myers (1984) and Myers & Majluf (1984) developed the Pecking Order Theory (POT) based on the premise that 'inside' management are better informed of the true value of the firm than the 'outside' investors. These information asymmetries result in varying costs of additional external finance, as potential investors perceive equity to be riskier than debt. They propose that firms seek to overcome problems of undervaluation arising from information asymmetries, preferring to finance investment projects with internal funds in the first instance. When internal equity is exhausted, firms use debt financing before resulting to external equity. Authors state that the POT is even more relevant for the SME sector because the relatively greater information asymmetries and the higher cost of external equity for SMEs (Ibbotson, Sindelar & Ritter, 2001). Additionally, a common phenomenon in the sector is the desire of the firm owners to retain control of the firm and maintain managerial independence (Jordan, Lowe & Taylor, 1998).

These factors suggest that MSE owners source their capital from a pecking order of, first, their "own" money (personal savings and retained earnings); second, short-term borrowings; third, longer term debt; and, least preferred of all, from the introduction of new equity investors, which represents the maximum intrusion. Empirical evidence supports applicability of the POT in explaining the finance of MSEs (Ou & Haynes, 2006). These studies emphasize that small firms rely on internal sources of finance and external borrowing to finance operations and growth, and only a very small number of firms use external equity. A number of studies report that firms operate under a constrained pecking order, and do not even consider raising external equity (Howorth, 2001).

Adherence to the POT is dependent not only on demand-side preferences, but also on the availability of the preferred source of financing. The supply of finance depends on many factors, particularly the stage of development of the firm. The most important source of funding for start-up and nascent firms are the personal funds of the firm owner, and funding from friends and family. Howorth (2001) investigated the pecking order, although the theory emerged in other literature: entrepreneurs tend to seek finance first from their own resources, and then friends and families, and then from other sources such as banks. Indeed, the money from family and friends is often essential (and often regarded as quasi-equity by the banks) to unlock support from commercial institutions.

#### 2.2.2 Credit Rationing Theory

One of the most important theories that focused on financing gap analysis is the Credit Rationing Theory by Stiglitz & Weiss (1981). In their formulation, Stiglitz and Weiss (1981) argued that agency problems (a conflict of interest between management (agents) and the shareholders (owners) of the organization) and information asymmetries are the major reason why SMEs have constrained access to finance. They argued that only SMEs know their real financial structure, the real strength of the investment project and the effective intention to repay the debt, that is, firms have superior private information (asymmetric information). Hence, the bank manager makes decisions under asymmetric information, and operates under a moral hazard and adverse selection risk.

Stiglitz and Weiss (1981) explained the choice among different financing sources under conditions of asymmetric information and credit rationing. Asymmetric information can lead to credit rationing conditions by modifying the risk-return distribution; this fact encourages banks to refuse capital for investments and produces divergence between capital demand and supply (Alfo & Trovato, 2006). Constrained access to finance derived from financial institutions' credit rationing behavior might not be efficient because managers work under conditions of asymmetric information. This may result in less profitable investments getting financed while more profitable investments are being left out and thus resulting in adverse selection and moral hazard risks. Therefore, asymmetric information can explain asymmetric of credit among firms with identical characteristics, the lenders not being aware of the exact bankruptcy likelihood for the firms, know only that this likelihood is positive and therefore choose to increase debts' cost.

Start-up small firms are more likely to be affected by information asymmetry problems. Deakins, North, Baldock and Whittam (2008) argued those information asymmetries are more acute in new and technology-based propositions. They argued at an early stage, information is limited and not always transparent and assets are often knowledge based exclusive associated with the founding entrepreneur. Especially with manufacturing and technology based firms, entrepreneurs may be reluctant to provide full information about the opportunity because of concerns that disclosure may make it easier for others to exploit.

There are some categories of SMEs that will face additional problems due to lack of security, such as young entrepreneurs or those from deprived areas. In addition, there may be asymmetries arising from location as well as sector. For example, owners of MSEs in rural environments may face difficulties with access to bank finance. Small firms are more likely to be rationed because they are seen as particularly risky. Although they might be willing to pay more to compensate for the additional risk, the banks will refuse to raise the interest rate sufficiently to equate supply and demand.

According to Atieno, (2001) also pointed out that access to credit by borrowers is affected mainly by credit rationing behavior of lending institutions who used descriptive statistics to analyze the role of institutional lending policies of formal and informal credit institutions in determining access to and uses of credit facilities by small-scale entrepreneurs in Kenya. Lack of information about credit and

lack of required security are the major reasons and that the amount applied for was higher than the amount received from both formal and informal sources suggesting credit rationing by the institutions.

2.3 Conceptual Framework

A conceptual framework is a product of qualitative process of theorization which interlinks concept that together provides a comprehensive understanding of a phenomenon or phenomena (Jabareen, 2009). The concepts that constitute a conceptual framework support one another, articulate their respective phenomena, and establish a framework-specific philosophy that defines relationships. The conceptual framework of this study relates to independent variables; collateral requirements, cost of credit, availability of information on finance, business risks and the dependent variable; Access to credit facilities by micro and small enterprises in Kangemi Harambee market, Nairobi City County, Kenya.

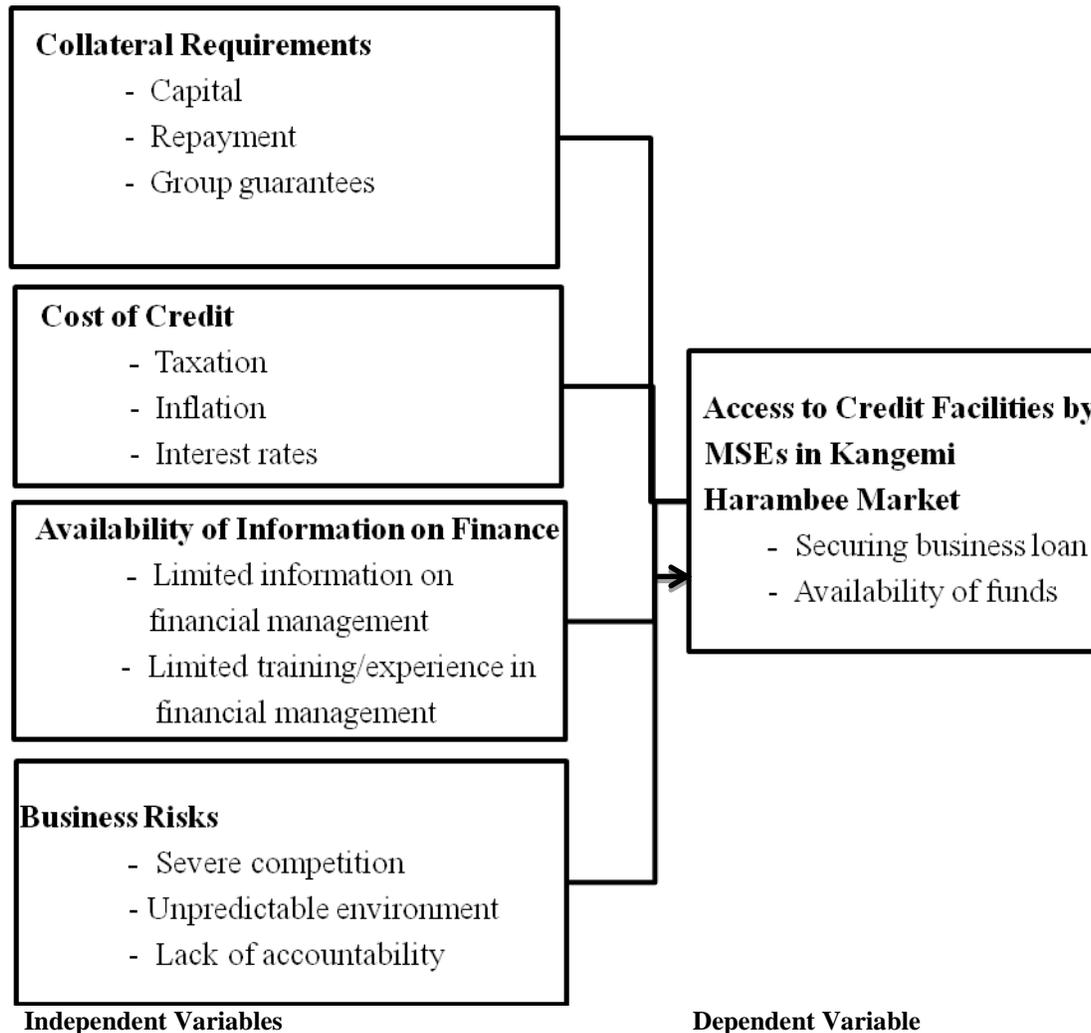


Figure 2.1: Conceptual Framework

2.3.1 Collateral Requirements

Historical development and the associated culture, of the banking system underpin the problem of the emphasis on the provision of collateral as a primary condition in lending. Banks have always adopted a risk adverse stance towards small firms, with an accompanying inability to focus on the income generating potential of the venture, when analyzing the likelihood of loan repayment (Beaver, 2002).

Credit constraints can occur when banks increase collaterals for loans. As a result, low interest borrowers (including MSEs) may be removed from the list of potential customers and banks may skip these customers (Stiglitz & Weiss, 1981). Gangata & Matavire, (2013) in their study on challenges facing MSEs in accessing finance from financial institutions, found out that very few MSEs succeed in accessing funding from financial institutions, the main reason being failure to meet lending requirements, chief among them being provision of collateral security.

A study was done on challenges faced by Small & Medium Enterprises (SMEs) in obtaining credit in Ghana. Based on the responses received through the questionnaires circulated, it became evident that SMEs in Ghana like most SMEs in other countries are faced with major challenges in accessing credit. These challenges were revealed by the study to include, the inability of SMEs to provide collateral and other information needed by banks such as audited financial statement couple with the high cost of loan in terms of high interest rates make it extremely difficult to access bank loans (Vuvor&Ackah, 2011).

Cressy and Toivanen (2001) say that, "better borrowers get larger loans and lower interest rates; collateral provision and loan size reduce the interest rate paid .....the bank is shown to use qualitative as well as quantitative information in the structuring of loan contracts to small businesses." In effect, it may therefore be that simple because banks approach the lending process in a risk-averse way (in order to protect the funds of savers), and thus turn down a number of propositions perceived to be 'riskier', that there is an apparent 'discrimination' against for example women and ethnic minorities.

### *2.3.2 Cost of Credit*

The cost of credit accessibility refers to the amount of money the entrepreneurs pay in process of borrowing money from financial institutions. The key indicators of cost in this respect are processing fees, negotiation fees, interest rates, personal insurance, legal fees and travelling expenses that the entrepreneurs meet in the process of acquiring credit. Hallberg, (2002) singled out high risks associated in lending SMEs and fixed costs associated in acquiring sound information about the borrower by financial institutions as the major driving force to the high cost of credit.

High transaction costs do therefore not only increase the cost of borrowing, but can also restrict access to external finance for some borrower groups. While transaction costs are restraining for all borrowers, there are arguments that they are even more constraining for small and micro enterprises. Their diverse characteristics and their relative opaqueness increases assessment and monitoring costs. Unlike other credit categories, such as consumer credit or mortgage lending, SME lending is still considered a high-cost lending product. More specifically, unlike other lending products that can be reduced to simple transactions, SME lending often still depends heavily on relationships between borrowers and lenders (Berger&Udell, 2006).

Every business needs financing, even though at first glance it might appear that funding is unnecessary. It is important that financing be as efficient as possible, Stutely (2003). Stutely, argues that the borrower should be able to put the cost of all financing on the same basis, comparing them and come up with the one that gives the lowest cost financing option. Banks have often been criticized for having high interest rates charged on loans. But sometimes, there are factors beyond their control. For example, the amount of interest payable on loans depend on interest rates charged, which is driven by the base lending rate of interest set by the Central Bank of Kenya (CBK). The amount of interest rate charged is sometimes, intertwined with the security of the loan, and the use for which it is to be used, or the nature of the business. That is, the more secure loans are charged low interest rates due to, their low risks involved. This leads MSEs to the Micro Finance Institutions (MFIs), who lend unsustainable interests short term loans.

A study carried out by Mwangi and Bwisa, (2013) on challenges facing entrepreneurs in accessing credit: a case of youth entrepreneurs in Makuyu, Kenya found out that most of youth entrepreneurs faced challenges in accessing credit due high cost of credit evidenced in high loan processing fees, high rate of legal fee, high rate of interest, high cost of credit insurance and high expenses incurred in travelling in the process looking for credit. The research recommends that the financial institutions should look for ways of developing credit products that would attract the youth. The lenders and other stakeholders should explore lowering rate of interest for credit products meant for the youth. Another study was done one effects of access to financial credit on the growth of women owned small retail enterprises in Uasin Gishu County: a case of Kapseret Constituency. The study found out that interest rates affected access to credit by women entrepreneurs owning small scale business enterprises in Kapseret Constituency (Cheluget, 2013).

### *2.3.3 Availability of Information on finance*

The access to credit information and the technology in local lending environments determine the extent to which small enterprises obtain sufficient external financing to exploit profitable projects. The extent to which the business environment inhibits the optimal provision of credit determines the size of the funding gap that small enterprises might face (Berger et al., 2004). Access to information is important both from the MSEs perspective and from the perspective of the providers of financial services and products. The MSE requires information with which to identify the potential suppliers of the financial products. It requires this information to evaluate the cost of the financial services and products that are being offered. The financial service providers require information with which to evaluate the risk of the MSE which is applying for finance, and to assess the prospects of the MSEs within the market segment.

One of the problems faced by small firms when attempting to raise finance is information asymmetry in that they cannot prove the quality of their investment projects to the provider of finance (usually banks). Small firm managers often suffer from a lack of financial sophistication, as they are often product or service specialist, not specialists in the area of finance. Thus, the information asymmetry problem is partly one relating to difficulties in the spheres of communication and credibility. This is compounded by the fact that new or recent start-ups businesses may be unable to provide evidence of a good financial performance track record. Banks in particular rely on past financial performance as an indicator for the future profitability of projects (Tucker & Lean, 2003).

Access to information is therefore a basic condition for providing loans to firms. Often the problem of inadequate information is mentioned as one of the main aspects limiting bank finance to MSEs (Observatory of European SMEs, 2003; Udell, 2004). Most of the information banks obtain from MSE operators come from the borrowers themselves: investment plans, working capital requirements and balance sheets. The required information is then scrutinized for internal consistency, and compared to other information the bank has at its disposal. However, interaction with the borrower is the next possible source of information for the bank from the MSE borrowers. By handling the borrower's accounts, the bank knows the borrower's volume of transaction and the trend of his/her business. As a result borrowers are most likely to obtain loans and overdraft facilities from a bank that they have been banking with for years.

According to the Observatory of European SMEs (2003:23), 60% of the SMEs in Europe regularly provide this type of information. The report further indicates that there is a positive correlation between the size of the enterprise and the information provided to banks. It further indicates that 70% of the SMEs without credit lines do not share financial information with the bank. The situation is even worse in the lesser developed countries where the level of literacy is dismally low. However, provision of information to the bank may be a necessity for creating a rating culture among MSEs for purposes of accessing external finance.

Small business owners most often possess more information about the potential of their own businesses but in some situations it can be difficult for business owners to articulate and give detailed information about the business as the financiers want. Additionally, some small business managers tend to be restrictive when it comes to providing external financiers with detailed information about the core of the business, since they believe in one way or the other, information about their business may leak through to competitors (Winborg & Landstrom, 2000). The importance of keeping proper accounts in promoting the growth of small businesses has been acknowledged in prior studies on small business growth and development (Abor & Biekpe, 2006). Kinyanjui, (2006) records that some entrepreneurs felt that it was difficult to obtain loans as they had to show credit records and they did not fully understand the requirements of getting and paying loans.

#### *2.3.4 Business Risks*

Risk factor is another aspect that explains the access to credit facilities by MSEs. Total risk (both business and financial risk) may be a dimension across which a financing gap might exist. A firm's business risk (which focuses on a firm's operations), represents the uncertainty of the firm's return on its assets (Correia, Flynn & Wormald, 2008). Whereas, financial risks occurs when a firm makes use of debt (that is, financial leverage). In such instances, the firm takes on additional responsibility of financing the debt which is paying interest payments on time. The inability of the firm to pay the interest payments or repay the principal will result in a default that might lead to bankruptcy. As the amount of debt used by the firm increases, the chances of it defaulting will also go up due to constraints on its cash flows as a result of the interest payments. MSEs rely more on external financing, thus the financial risk in the MSE sector is most likely to be very high.

Green (2003) argued that commercial banks tend to impute a high risk to small enterprises and are therefore reluctant to extend credit to them. Due to their small size and inherent vulnerability to market fluctuations, the mortality rates of small enterprises are relatively high. These firms are, by their very nature, often relatively young and consequently lack a financial history and a track-record of profitable projects. In addition, organization and administrative deficiencies, lower quality management and a lack of appropriate accounting systems may compromise the accessibility and reliability of information from small firms on their repayment capacity.

The difficulties faced by MSEs in accessing credit facilities are attributed to their perceived higher risk profile. Lending institutions regard MSEs as riskier enterprises for a number of reasons which include: uncertain competitive environment; inadequate accounting systems; more unpredictable operating environment in the developing and emerging markets; assets not properly registered; delayed payments for the products and services rendered; less equipped in terms of both human and financial resources to withstand economic resources (Van Aardt & Fatoki, 2012).

#### *2.3.5 Access to Credit Facilities*

Access to finance helps all firms to grow and prosper. However, lack of access to credit is a major impediment inhibiting the growth of micro enterprises (GOK, 2005). Furthermore, firms with greater access to capital are more able to exploit growth and investment opportunities (Beck, Demirgüç-Kunt, Laeven, & Maksimovic, 2006). There is no structured institutional mechanism in Kenya to facilitate the flow of financial resources from the formal sector through micro finance institutions to such enterprises. Generally, such enterprises operate on tight budgets, often financed through owner's own contribution, loans from friends and relatives and some bank credit. They are often unable to procure adequate financial resources for the purchase of machinery, equipment and raw materials as well as for meeting day-to-day expenses. This is because, on account of their low goodwill and little fixed investment, they find it difficult to borrow at reasonable interest rates. As a result, they have to depend largely on internal resources. The problem is even acute in rural areas where banks branches are far apart or non-existent (GOK, 2005).

As emphasized by Hatega, (2007), Kauffmann (2005) and the IFC (2006) report "Making finance work for Africa", it is relatively clear that weakly functioning financial markets is the far most important obstacle for SME entry, growth investment. Ntakobajira, (2013), in his study found out that access to finance affected performance of SMEs to a great extent because it limited the entrepreneurs' ability to take advantage of opportunity as and when they arose. Nalwelishe (2003) as cited in Ondieki, Nashappi, and Moraa (2013) carried out a research on sources of finance available to small scale enterprises in Nairobi. His objectives were to identify which types of credit are easily obtainable by SSEs and to evaluate the credit policies of SSEs. On access to credit, majority of entrepreneurs relied on limited own and family savings for start-up and additional capital. They hardly rely on external sources of finance.

Therefore, these enterprises have poor access to credit. Concerning supply of credit; urban-located enterprises were noted to have achieved a higher success rate than the rural ones.

Interest in access to finance has increased significantly in recent years, as growing evidence suggests that lack of access to credit prevents low-income household and small firms from financing high return investment projects, having an adverse effect on growth and poverty alleviation. They examined literature on the causal relationship between access to financial services and its impact on agricultural production. The literature, mostly observation from a few case studies, reveals that access to financial services by the rural people (or low income population segments) can improve their incomes and therefore their welfare (Mutua & Oyugi, 2005). According to de la Torre et al. (2008) cited in Njeru, Namusonge & Kihoro, (2012), given the small scale entrepreneurial projects and a higher information asymmetry and higher risk, financial institutions find it costly to monitor small businesses, even if advances in technology (including the risk scoring techniques) imply that the banking sector is capable of handling the entrepreneurial finance better than in the past.

#### 2.4 Empirical Review

Access to external sources of finance may increase growth possibilities since it facilitates the development and improvement of firm's products and services or hire new employees. In transition economies, the development that financial markets experience may create barriers linked to the access to finance. Hence, academic research considers financial constraints as an important obstacle for entrepreneurship and firm growth. Empirical evidence supporting the importance of access to external finance for business growth can be found in Brown, Earlem & Lup, (2005), who examines firm growth determinants. Conversely, Johnson, McMillan and Woodruff (2000) evaluate institutional reforms in five Eastern European countries (including Romania), and they conclude that access to bank finance does not prevent business growth.

Lack of access to credit facilities is almost universally indicated as key problem for small and micro enterprises. In most cases, even where credit is available mainly through banks, the entrepreneurs may lack freedom of choice because the banks' lending conditions may force the purchase of heavy, immovable equipment that can serve as collateral for the bank. Credit constraints operate in variety of ways in Kenya where undeveloped capital market forces entrepreneurs to rely on self-financing or borrowing from friends and relatives. Lack of access to long-term credit for micro, small and medium enterprise forces them to rely on high cost short term finance (Wanjohi & Mugure, 2008).

Matavire et al., (2013), in their study on challenges facing SMEs in accessing finance from financial institutions: The case of Belaway, Zimbabwe found out that SMEs fail to secure loans because of restrictive requirements of the financial institutions, top among them being collateral security. Among their recommendations is that the government should play its role of enabling SMEs to obtain finance from financial institutions. Makena, et al., (2014), in their study on challenges facing women entrepreneurs in accessing business finance in Kenya: Case of Ruiru Township, Kiambu County, lack of collateral was one of the objectives. However, the study found out that lack of collateral was a greater hindrance to credit accessibility by women entrepreneurs. This is due to lack of tangible assets like land, which are used as assets to secure credits. Among their recommendations is that the government should play its role of enabling SMEs to obtain finance from financial institutions.

Gitari, (2012) in her study on factors affecting women entrepreneurs' financial performance in Kenya: a case of Ngara Market found out that lack of information on who is offering what and the cost of obtaining such services limit them and that high inventory costing are some of the major drawbacks for success in women entrepreneurship. The high cost of running the entrepreneurs is a big threat to the women development due to lack of adequate capital and on the other hand lack of information on how to access funds to boost the business also is a major threat. Ntakobajira, (2013), did a study on factors affecting the performance of MSEs traders at City Park hawkers market in Nairobi County, Kenya. The study concluded that access to finance affected performance of MSEs to a great extent because it limited the entrepreneurs' ability to take advantage of opportunity as and when they arose.

Another study was done which sought to identify critical factors that influence access to bank credit by MSEs. The study indicated that entrepreneurial orientation is a direct determinant of access to credit by MSEs. Further, knowledge-based resources gained from maturation (age), training, previous startup experience and vicariously through entrepreneurial parents were found to be associated with greater levels of entrepreneurial orientation. Overall, these findings support the literature that underscores the primacy of entrepreneurial factors, over operating environment in facilitating small enterprises' access to bank credit (Wagama, 2006). Nalyanya, (2012) in his study on investigation into factors affecting the performance of small scale enterprises in ASAL areas Hola Town – Tana River District, recommended that the government could consider giving cheap loans to small scale enterprises without collaterals.

#### 2.5 Critique of Existing Literature Relevant to the Study

Although most studies indicated that there were problems relating to cost of credit, availability of information on finance, collateral requirements and business risks, there have been few studies that have dealt with all in combination. For instance, Gitari, (2012) found in her study on factors affecting women entrepreneurs' financial performance in Kenya: a case of Ngara Market that lack of information on who is offering what and the cost of obtaining such services limit them and that high inventory costing are some of the major drawbacks for success in women entrepreneurship. She however did not study the effect of cost of credit and collateral provision on accessibility of credit facilities.

Mira and Ogollah, (2013) in their study on challenges facing accessibility of credit facilities among women owned enterprises in Nairobi Central Business in Kenya concluded that lack of information accessibility, insufficient skill and knowledge level, lack of collaterals required and socio-cultural roles had a strong and negative influence towards the accessibility of finance. However, they did not look at the effect of cost of credit on accessibility of credit facilities. This study therefore sought to find out how collateral requirements, cost of credit, availability of information on finance and business risks affect accessibility of credit facilities by MSEs in Kangemi Harambee Market in Nairobi City County, Kenya.

### 2.6 Research Gaps

A lot of research has been carried out locally and internationally reviewing challenges facing micro and small enterprises in accessing credit facilities. Most of these researches concentrated on their study areas based on their own objectives. The literature available does not concern itself on collateral requirements, cost of credit, and availability of information on finance and business risks in one combination. Therefore, the study sought to address the challenges facing micro and small enterprises in accessing credit facilities in Kangemi Harambee Market in Nairobi City County, Kenya.

### 2.7 Summary

The independent variables were collateral requirements, cost of credit, and availability of information on finance and business risks. The dependent variable was access to credit facilities by micro and small entrepreneurs in Kangemi Harambee market in Nairobi City County, Kenya. The theories were pecking order theory and credit rationing theory.

## 2. METHODOLOGY

### 3.1 Introduction

This chapter on research methodology presents the research design adopted by the study, target population, sample frame, sample size and sampling technique, data collection instruments, data collection procedure, data analysis and data presentation.

### 3.2 Research Design

This study adopted descriptive research design. A research design is the strategy for a study and the plan by which the strategy is to be carried out. It specifies the methods and procedures for the collection, measurement, and analysis of data. The main purpose of this design was to describe what was prevalent with respect to the issue or problem under study. It provided answers to questions like *who, what, when, where and sometimes how*. It enables respondents to give more information freely. It also determines and reports the way things are and attempts to describe such things as possible behavior, attitudes, values and characters (Mugenda&Mugenda, 2003).

### 3.2 Target Population

The target population was drawn from all micro and small enterprises in Kangemi Harambee market in Nairobi City County, Kenya. Currently the total micro and small enterprises registered with Kangemi Harambee Market Association (2014) are 656. The businesses in operation are mainly in green groceries, clothing and shoe vendors, food vendors, salons, cereals vendors, and poultry vendors. This is shown in Table 3.1.

The business owners responded to the questionnaires since most of these businesses are ran by the owners.

**Table 3.1 Population**

| Nature of Business      | Population |
|-------------------------|------------|
| Green groceries         | 193        |
| Clothing & shoe vendors | 357        |
| Food vendors            | 39         |
| Salons                  | 20         |
| Cereals vendors         | 25         |
| Poultry vendors         | 22         |
| <b>Total</b>            | <b>656</b> |

### 3.3 Sampling and Sampling Techniques

This section discussed how the sample size was arrived at and the sampling techniques used.

#### 3.3.1 Sample Size

As described by Mugenda and Mugenda (2003) a simplified formula for calculating sample size of a population that is less than 10,000 is given.

$$n$$

$$nf = \frac{1 + n/N}{1 + 384/656} = 241$$

nf= the desired sample size when the population is less than 10,000  
 n = the desired sample when the population is more than 10,000  
 N = the estimate of the population size  
 384

**Table 3.2 Sample Size**

| Nature of Business      | Population | Sample size 37% |
|-------------------------|------------|-----------------|
| Green groceries         | 193        | 71              |
| Clothing & shoe vendors | 357        | 132             |
| Food vendors            | 39         | 14              |
| Salons                  | 20         | 7               |
| Cereals vendors         | 25         | 9               |
| Poultry vendors         | 22         | 8               |
| <b>Total</b>            | <b>656</b> | <b>241</b>      |

3.3.2 Sampling Techniques

The study used stratified random sampling technique to select the sample. The study grouped the population into strata. From each stratum the study used simple random sampling to select 241 respondents. This sampling design was used because the population of study was not homogenous and was to be sub-divided into sub-units namely green groceries, clothing and shoe vendors, food vendors, salons, cereals vendors, and poultry vendors. Kothari (2004) recommends stratified random sampling because it is accurate, easily accessible, divisible into relevant strata and it enhances better comparison; hence representation across strata. Another advantage of stratified random sampling is said to be its ability to ensure inclusion of sub-groups, which would otherwise be omitted entirely by other sampling methods because of their small number in the population.

3.4 Data Collection Instruments

The study used questionnaires to collect data. Questionnaires were constructed based on the research objectives. Questionnaires were preferred since they were easy to administer and time saving (Mugenda&Mugenda, 2003). The questionnaire contained closed-ended questions using a liker scale (ranging from 1= No Extent; 2= Little Extent; 3= Moderate Extent; 4= Large Extent; 5=Very Large Extent).A few open-ended questions which elicited qualitative data on subjective thoughts and different responses related to access to credit facilities. Self-administered questionnaires were completed by those who could interpret the questionnaire. The researcher administered questionnaires to respondents who did not have the ability to easily interpret the questions probably because of their educational or literacy levels. The questionnaires had three sections: Section I gave general information on business enterprises, Section II provided information on collateral challenges facing micro and small enterprises in accessing credit facilities.

3.5 Data Collection Procedure

The study used two categories of data which were primary and secondary data. Primary data was collected using self-administered questionnaires and researcher administered questionnaires to sampled MSEs respondents. For the self-administered, drop and pick method was used. This allowed the respondents to give their responses in a free environment and helped the researcher get information that would not be given if interviews were to be used. The questionnaires consisted of close and open-ended questions. The open-ended questions provided additional information that would not be captured in the close-ended questions. The researcher trained two research assistants on all issues pertaining to the data collection procedures and techniques before carrying out the study. The research assistants assisted the researcher in gathering the information. A set of 241questionnaires were issued to micro and small entrepreneurs in Kangemi Harambee market in Nairobi City County. Secondary data was retrieved from online and other sources such as books, journals, research articles, brochures and previous reports.

Prior to data collection, an introduction letter authorizing data collection was obtained from the School of Human Resource Development, Jomo Kenyatta University of Agriculture and Technology. Other relevant authorities from the Kangemi Harambee Market Association were also obtained to facilitate the data collection process.

### 3.6 Data Analysis and Presentation

This section discusses how data was analyzed and how it was presented.

#### 3.6.1 Data Analysis

According to Mugenda and Mugenda (2003) data obtained from the field in raw form is difficult to interpret unless it is cleaned, coded and analyzed. Qualitative analysis consisted of examining, categorizing, tabulating and recombining evidences to address the research questions. Qualitative data was grouped into meaningful patterns and themes that were observed to help in the summarizing and organization of the data. Quantitative analysis was analyzed through the use of statistical techniques such as frequency counts, percentages, arithmetic means, standard deviations, pie charts and tabulation to show differences in frequencies. Qualitative data was analyzed descriptively through the use of questionnaires. Bar charts were used to display nominal or ordinal data. Statistical Package for Social Sciences (SPSS) version 21.0 was used to aid in coding, entry and analysis of quantitative data obtained from the closed ended questions.

#### 3.6.2 Data Presentation

Quantitative data was presented through the use of statistical techniques such as bar charts, pie charts, percentages and frequency counts. Qualitative data was presented descriptively.

## 3. FINDINGS AND DISCUSSION

### 4.1 Introduction

This chapter presents the analysis of data collected from respondents. The collected data was edited and cleaned for completeness and consistency in preparation for coding. Once coded, the data was keyed into the Statistical Package for Social Sciences (SPSS) for analysis.

### 4.2 Results of the Pilot Study

#### 4.2.1 Data Reliability

A pre-test of 5% of the population size was conducted to give a representation of the selected population thus the designed questionnaire was tested on 12 potential respondents (Mugenda and Mugenda, 2003). To test the internal consistency of the Likert scale used in this study, reliability analysis was done using Cronbach's Alpha as the measure. A reliability co-efficient of  $\alpha \geq 0.7$  was considered adequate. A co-efficient of 0.761 was registered indicating that the scale used had a high level of internal consistency. This indicated that the scale was reliable enough to test the extent to which micro and small enterprises faced challenges in accessing credit facilities. The results of the reliability analysis are shown in Table 4.1;

**Table 4.1: Results of the Pilot Study**

| Reliability Statistics |  |            |
|------------------------|--|------------|
| Cronbach's Alpha       | Cronbach's Alpha Based on Standardized Items | N of Items |
| 0.761                  | 0.780  | 22         |

## 4.3 Demographic Information

### 4.3.1 Response Rate

The researcher administered a total of 241 questionnaires and 169 were completed and returned. This represents a response rate of 70.12% as shown in Table 4.2. This response rate was adequate to allow the researcher to continue with the analysis. The questionnaires were composed of questions that addressed the objectives of the study. The study sought to establish the influence of collateral requirements, cost of credit, availability of information and business risks on accessibility of credit facilities by MSEs in Kangemi Harambee market in Nairobi City County, Kenya.

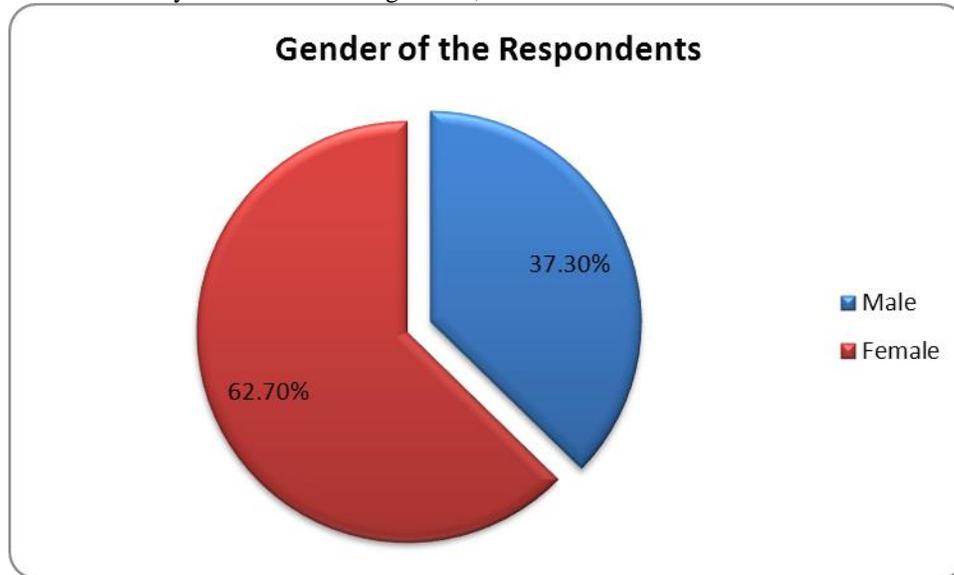
**Table 4.2: Response Rate**

| Response rate          | Frequency  | Percentage |
|------------------------|------------|------------|
| Completed and Returned | 169        | 70.12      |
| Not Returned           | 72         | 29.88      |
| <b>Total</b>           | <b>241</b> | <b>100</b> |

### 4.3.2 Gender of the Respondents

The study sought to know the distribution of the respondents by gender. The study findings indicated that 62.7% of the respondents were female while 37.3% were male. This implied that the businesses at Kangemi Harambee market in Nairobi City County were dom-

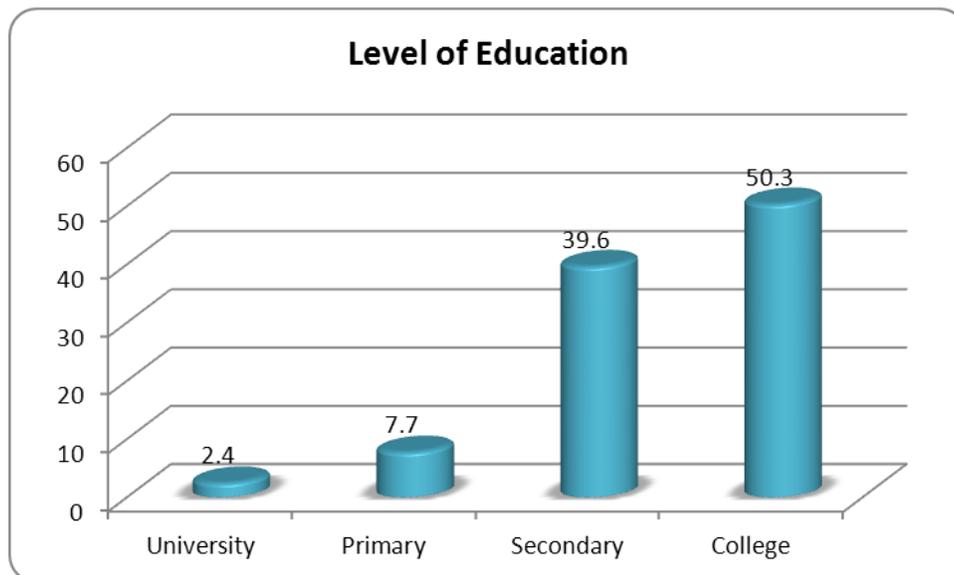
inated by the female gender. The findings also indicated that the researcher observed gender balance during the administration of questionnaires. The results of the study are as shown in Figure 4.1;



**Figure 4.1: Gender of the Respondents**

#### 4.3.3 Level of Education

The study also sought the distribution of the respondents by their level of education. The study established that most (50.3%) of the respondents' were college leavers followed by secondary school leavers at 39.6% and then primary school leavers at 7.7%. Only 2.4% had a university level education. This implies that the respondents were educated enough to understand the issues being sought by the researcher. The results of the study are as shown in Table 4.2;



**Figure 4.2: Level of Education**

#### 4.3.4 Main Business Activity

In this section, the study sought to know the distribution of respondents by the nature of business they were engaged in. According to the study findings, most (47.3%) of the respondents were in the clothing and shoes followed by 28.4% of green grocery dealers. Cereals dealers accounted for 9.5%. This indicates that the researcher sought views from people of diverse businesses to avoid any bias. The findings are shown in Table 4.3;

**Table 4.3: Main Business Activity**

|                  | Frequency  | Percent      |
|------------------|------------|--------------|
| Clothing & Shoes | 80         | 47.3         |
| Green grocery    | 48         | 28.4         |
| Cereals          | 16         | 9.5          |
| Hotel            | 11         | 6.5          |
| Salon            | 9          | 5.3          |
| Poultry          | 4          | 2.4          |
| Others           | 1          | 0.6          |
| <b>Total</b>     | <b>169</b> | <b>100.0</b> |

4.3.5 Duration of Business Existence

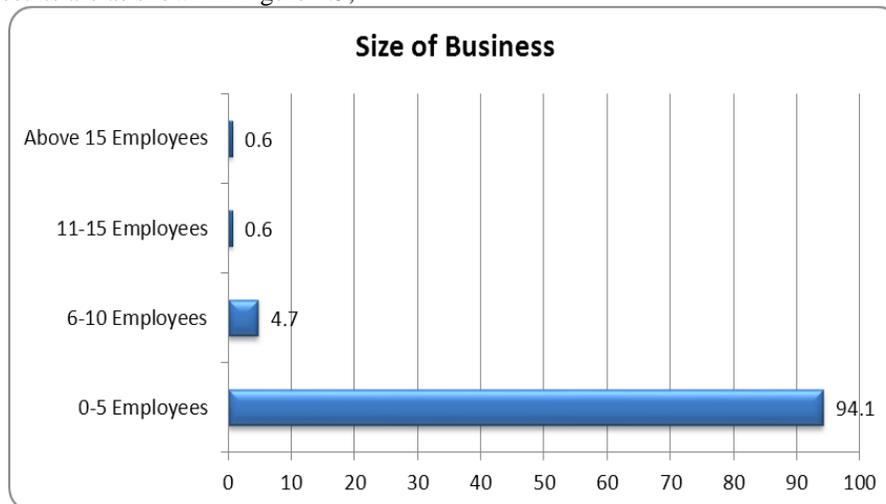
The study further sought to know the duration the businesses had been in existence. The study found out that most (52.1%) of the businesses had been in existence for 2-4 years followed by 25.4% of the businesses that had been existence for 5-7 years. Only 10.2% of the businesses had less than 2 years' existence. This implies that the researcher sought opinions from respondents who had been in business long enough to understand the challenges faced when trying to access credit facilities. The study findings are as shown in Table 4.4;

**Table 4.4: Duration of Business Existence**

|                   | Frequency  | Percent      |
|-------------------|------------|--------------|
| 2 - 4 years       | 88         | 52.1         |
| 5 - 7 years       | 43         | 25.4         |
| 8 - 10 years      | 20         | 11.8         |
| Less than 2 years | 18         | 10.7         |
| <b>Total</b>      | <b>169</b> | <b>100.0</b> |

4.3.6 Size of Business

The study sought to know the size of the business by virtue of the number of employees that they had. The study established that majority of the business consisted of only 0-5 employees followed by 4.7% of the businesses with 6-10 employees. Those with 11-15 employees and above consisted of 0.6% each. This implies that the researcher sought views of micro and small enterprises in Kangemi Harambee Market. The results are as shown in Figure 4.3;



**Figure 4.3: Size of Business**

4.3.7 Source of Start-up Capital

The respondents were requested to indicate where they obtained their start-up capital. The study found out that majority (69.2%) of the respondents obtained their start-up capital from personal savings followed by 11.2% of the respondents who obtained theirs from family/relatives. Only a 10.7% obtained start-up capital from banking institutions.

This means that the respondents chose to get their start-up capital from sources that didn't have strict requirements such as collateral security and high repayment cost. The results of the study are as shown in Figure 4.3;

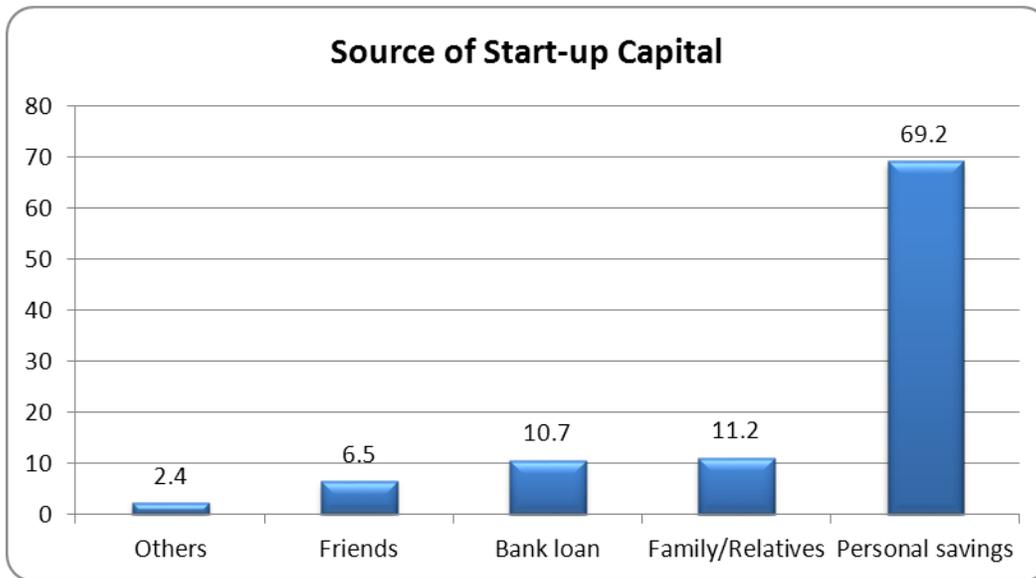
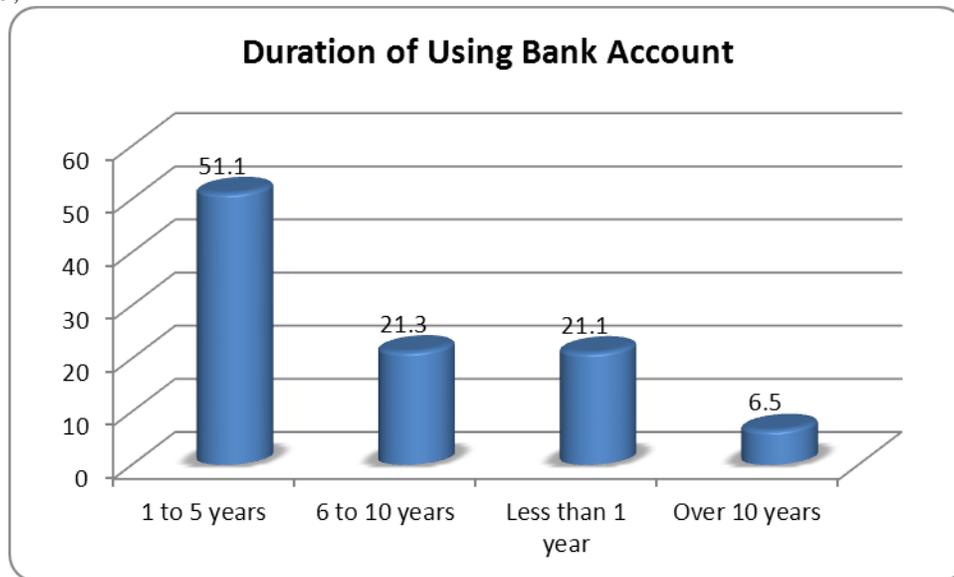


Figure 4.4: Source of Start-up Capital

4.3.8 Business Bank Account

The respondents were further requested to indicate if their businesses had bank accounts and the duration they had been operating the accounts if they had any. The study found out that 65.7% of the businesses had bank accounts while 34.3% had no bank accounts for their businesses. Further, the study found out that most (51.1%) of the respondents' with bank accounts had been using them for 1-5 years followed by those using theirs for 6-10 years. Only 6.5% of the respondents had been using their bank accounts for over 10 years. This implies that there are a huge number of businesses that have not yet accessed banking services. The results of the study are as shown in Figure 4.5;



4.5. Duration of Using Bank Account

Factors Influencing Accessing to Credit Facilities

The study sought to know the extent to which various factors influenced access to credit facilities for micro and small enterprises in Kangemi Harambee Market. The extent to which the factors influenced access to credit was measured on a Likert scale of 1-5 where 1- No extent, 2- Small Extent, 3- To a Moderate Extent, 4- To a Great Extent and 5- To a very great extent. The key for interpreting the means recorded is as shown in Table 4.5;

Table 4.5: Means Interpretation Key

| Range | Extent of Influence |
|-------|---------------------|
|-------|---------------------|

|           |                   |
|-----------|-------------------|
| 1.0 – 1.5 | No Extent         |
| 1.6 – 2.5 | Small Extent      |
| 2.6 – 3.5 | Moderate Extent   |
| 3.5 – 4.5 | Great Extent      |
| 4.6 – 5.0 | Very Great Extent |

4.4 Collateral Requirements

The study found out that group guarantees influenced access to credit facilities to a moderate extent ( $M= 3.05, SD= 0.701$ ) while individual guarantors influenced access to financing to a moderate extent also ( $M= 2.98, SD= 0.631$ ). The influence of having a bank account was to a moderate extent ( $M= 2.86, SD= 0.684$ ) and so did ownership of assets such as title deeds, log books ( $M= 2.80, SD= 0.559$ ). Equity capital had the least influence but still it was to a moderate extent ( $M= 2.79, SD= 0.547$ ). The standard deviations indicated the extent to which the responses were dispersed from the mean. Overall, collateral requirements influenced access to credit facilities only to a moderate extent ( $M= 2.90, SD= 0.624$ ). This implies that access to credit was highly limited by strict collateral requirements such as group guarantees, individual guarantors, having a bank account, having equity capital and assets such as title deeds and log books. The results are as shown in Table 4.6. These findings are in line with those of Matavire et al (2013) who their study on challenges facing SMEs in accessing finance from financial institutions, the case of Belaway, Zimbabwe found out that SMEs fail to secure loans because of restrictive requirements, top among them being collateral security.

**Table 4.6 Collateral Requirements**

| Factors Under Consideration         | Mean        | Std. Deviation |
|-------------------------------------|-------------|----------------|
| Group guarantees                    | 3.05        | .701           |
| Individual guarantors               | 2.98        | .631           |
| An account                          | 2.86        | .684           |
| Assets: Title deeds, log books etc. | 2.80        | .559           |
| Equity capital                      | 2.79        | .547           |
| <b>Average</b>                      | <b>2.90</b> | <b>0.624</b>   |

4.5 Cost of Credit

On the extent to which cost of credit influenced access to credit, the study found out that the influence was to a moderate extent ( $M= 3.42, SD= 0.73$ ). Repayment period influenced access to credit to a great extent ( $M= 3.50, SD= 0.817$ ) followed by taxation at a moderate extent ( $M= 3.44, SD= 0.697$ ) and then fluctuation of interest rates also at a moderate extent ( $M= 3.43, SD= 0.713$ ). Amount of interest paid on loan had an influence to a moderate extent ( $M= 3.38, SD= 0.731$ ) while the amount of credit facilities processing fees also influenced access to credit facility to a moderate extent ( $M= 3.35, SD= 0.692$ ). The results are as shown in Table 4.7. These findings reflect those of a study carried out by Mwangi and Bwisa, (2013) on challenges facing entrepreneurs in accessing credit: a case of youth entrepreneurs in Makuyu, Kenya where they found out that most of youth entrepreneurs faced challenges in accessing credit due high cost of credit. This was evidenced by high loan processing fees, high rate of legal fee, high rate of interests, high cost of credit insurance and high expenses incurred in travelling in the process looking for credit.

**Table 4.7 Cost of Credit**

| Factors Under Consideration                 | Mean        | Std. Deviation |
|---|-------------|----------------|
| Repayment period                            | 3.50        | .817           |
| Taxation                                    | 3.44        | .697           |
| Fluctuation interest rates                  | 3.43        | .713           |
| Amount of interest paid on loan             | 3.38        | .731           |
| Amount of credit facilities processing fees | 3.35        | .692           |
| <b>Average</b>                              | <b>3.42</b> | <b>0.73</b>    |

4.6 Availability of Information on Finance

The study revealed that availability of information on finance influenced access to credit facilities only to a small extent ( $M= 2.11, SD= 0.551$ ). Availability of information on how to go about securing credit facility was the only one that had a moderate influence ( $M= 2.91, SD= 0.934$ ). The other factors had  $M \leq 2.5 \geq 1.6$  indicating their influence was only to a small extent. The factor with the

least influence was training on financial management ( $M= 2.05, SD= 0.565$ ). The results are as shown in Table 4.8. These results are support of the findings of the study conducted by Kinyanjui, (2006) where some entrepreneurs felt that it was difficult to obtain loans as they had to show credit records and they did not fully understand the requirements of getting and paying loans.

**Table 4.8: Availability of Information on Finance**

| <b>Factors Under Consideration</b>                                 | <b>Mean</b> | <b>Std. Deviation</b> |
|--|-------------|-----------------------|
| Availability of info on how to go about securing credit facilities | 2.91        | .934                  |
| Availability of info on who is offering credit facilities          | 2.22        | .543                  |
| Ability to compile financial records and accounts                  | 2.12        | .502                  |
| Experience on financial management                                 | 2.09        | .576                  |
| Business plan knowledge  | 2.08        | .571                  |
| Training on financial management                                   | 2.05        | .565                  |
| <b>Average</b>   | <b>2.11</b> | <b>.551</b>           |

*4.7 Business Risks*

In regard to the extent to which business risks influenced access to credit facilities by the micro and small enterprises, the study established that business risk had an influence to a great extent ( $M= 4.20, SD= 0.689$ ). The risk of severe competition influenced access to credit to a great extent ( $M= 4.38, SD= 0.645$ ) while the risk of accountability had an influence to a great extent ( $M= 4.33, SD= 0.730$ ). The factor with the least influence was the risk of inadequate human and financial capital which influenced access to credit also to a great extent. The results of the study are as shown in Table 4.9. These findings are supported by Green (2003), who argued that commercial banks tend to impute a high risk to small enterprises and are therefore reluctant to extend credit to them especially due to their small size and inherent vulnerability to market fluctuations and the mortality rates of small enterprises.

**Table 4.9: Business Risks**

| <b>Factors Under Consideration</b>     | <b>Mean</b> | <b>Std. Deviation</b> |
|--|-------------|-----------------------|
| Severe competition                     | 4.38        | .645                  |
| Accountability                         | 4.33        | .643                  |
| Unpredictable operating environment    | 4.30        | .730                  |
| Poor inventory management              | 4.21        | .656                  |
| Delayed payments                       | 4.11        | .655                  |
| Inadequate human and financial capital | 4.06        | .761                  |
| <b>Average</b>                         | <b>4.20</b> | <b>.689</b>           |

*4.8 Access to Credit Facilities*

*4.8.1 Extent of Access to Credit*

The study sought to know the extent to which businesses in KangemiHarambee Market are able to access credit facilities. The study found out that 36.1% could access credit facilities only to a little extent while 26% could only access credit to a moderate extent. Only 4.2% could not access credit at all. This indicates that more than half of the respondents can barely access credit facilities. The results of the study are as shown in Table 5.0;

**Table 5.0: Extent of Access to Credit**

|  | Frequency | Percent |
|--|-----------|---------|
|--|-----------|---------|

|                   |            |              |
|-------------------|------------|--------------|
| Little extent     | 61         | 36.1         |
| Moderate extent   | 44         | 26.0         |
| Large extent      | 39         | 23.1         |
| Very large extent | 18         | 10.7         |
| No extent         | 7          | 4.2          |
| <b>Total</b>      | <b>169</b> | <b>100.0</b> |

4.9 Application for Credit Facilities

The study sought to know if the respondents had ever applied for credit facilities and whether they received any financing after applying for it. The studies found out that majority (94.7%) of the respondents have at one time applied for a credit facility to expand their businesses while 5.3% had never applied for any credit facility.

The results for the study are as shown in Table 5.1. Further, the study revealed that 94.7% of those who applied for the credit were successful in getting the financing while 5.3% were not successful.

5.1 Application for Credit Facilities

|              | Frequency  | Percent      |
|--------------|------------|--------------|
| Yes          | 160        | 94.7         |
| No           | 9          | 5.3          |
| <b>Total</b> | <b>169</b> | <b>100.0</b> |

4.10 Frequency of Application for Credit

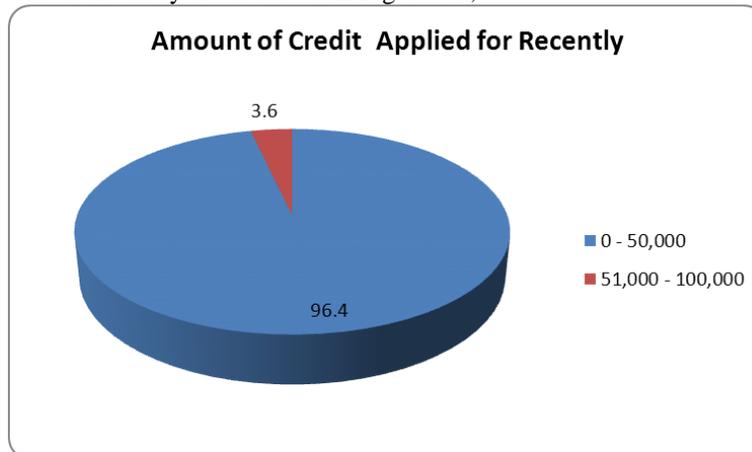
In this section, the study sought to know the frequency with which the respondents apply for credit facilities from banking and non-banking institutions. The study found out that majority (60%) apply for credit facilities from non-banking institutions very frequently while 75.7% of the respondents rarely apply for credit facilities from banking institutions. This implies that the respondents' prefer to get financing from non-banking institutions where the terms are more lenient. The study findings are as shown in Table 5.2;

**Table 5.2: Frequency of Application for Credit**

| Frequency       | Non-Banking (%) | Banking (%)  |
|-----------------|-----------------|--------------|
| Very frequently | 60.0            | 0.0          |
| Frequently      | 42.6            | 24.3         |
| Rarely          | 2.4             | 75.7         |
| <b>Total</b>    | <b>100.0</b>    | <b>100.0</b> |

4.11 Amount for Credit Applied for Recently

The study further sought to know the amount of credit applied for by the respondents recently. The study revealed that 96.4% of the respondents' have applied for credits amounting between Ksh. 0 – 50,000 recently while only 3.6% have applied for a credit ranging between Ksh. 51,000 – 100, 000. This indicates that the businesses at KangemiHarambee Market apply for little amount of credit to expand their businesses. The results of the study are as shown in Figure 4.6;



**Figure 4.6: Amount for Credit Applied for Recently**

*4.12 Performance of Commercial Banks*

The study further sought to know how the commercial banks were performing in relation to offering of credit facilities. The study found out that the commercial banks were rated to be performing fairly by 58.6% of the respondents while 34.3% felt that the performance of banks was good. Only 3.6% of the respondents said the performance was either very good or bad. This implies that the commercial banks are not doing enough to ease access to credit by the micro and small enterprises as shown in Table 5.3;

**Table 5.3: Performance of Commercial Banks**

|              | Frequency  | Percent      |
|--------------|------------|--------------|
| Fair         | 99         | 58.6         |
| Good         | 58         | 34.3         |
| Very good    | 6          | 3.6          |
| Bad          | 6          | 3.6          |
| <b>Total</b> | <b>169</b> | <b>100.0</b> |

*4.13 Government Support*

The study further sought the opinion of the respondent on whether the government was doing enough to support the micro and small enterprises in accessing credit facilities in Kenya. The study found out that 40.6% of the respondents felt that the government was doing enough while 59.4% felt it was not doing enough in helping the micro and small enterprises in accessing credit facilities.

*4.14 Key Challenges Faced when Accessing Credit Facilities*

The study also sought to know the key challenges being faced by micro and small enterprises when accessing credit facilities. The study found out that the key challenges hindering micro and small enterprises from accessing credit facilities were found out to be high cost of repayment, strict collateral requirements, not getting the exact amount applied for, unwillingness of people to act as guarantors, lack of enough collateral and short payment period.

*4.15 Measures of Improving Access to Credit*

Lastly, the study sought to know the measures that can be taken to ease access to credit facilities by the micro and small enterprises. The respondents suggested various strategies that needed to be adopted. These include lowering the interest rates, lengthening the loan payment period, reconsidering of the collateral security policy, and expansion of product portfolios, constant project appraisal and increase in the customer outreach. Barry, (2000); Cheston, Susy and Larry Reed (1999) also supported the above strategies. Much as the strategies have to be put in place, there is need of considering the investors motives of targeting a particular rate of return on investment.

**4. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

*5.1 Introduction*

This chapter provides a summary of major findings, discussions and conclusions drawn thereof. The researcher then presents the recommendations for both the research and for the policy change and practice.

*5.2 Summary of Major Findings*

The study sought to establish the extent to which collateral requirements, cost of credit, availability of information and business risks influence access to credit facilities by MSEs in Kangemi Harambee market in Nairobi City County, Kenya. A total of 241 questionnaires were administered and the study managed to obtain 169 completed questionnaires representing 70.12% response rate. The questionnaires contained questions that addressed the objectives of the study.

*5.2.1 Collateral Requirements*

The study established that majority of the respondents obtained their start-up capital from personal savings followed by family and relatives indicating that the respondents chose to get their start-up capital from sources that do not have strict requirements such as collateral security and high repayment cost.

*5.2.2 Cost of Credit*

The study established that repayment period, taxation, loan processing fees and fluctuation of interest rates influenced access to credit to a great extent.

*5.2.3 Availability of Information on Finance*

The study revealed that availability of information on finance influenced access to credit facilities only to a small extent. These results support the findings of the study conducted by Kinyanjui, (2006) where some entrepreneurs felt that it was difficult to obtain loans as they had to show credit records and they did not fully understand the requirements of getting and paying loans.

#### *5.2.4 Business Risks*

On business risks, the study established that the financial institutions tend to impute a high risk to small enterprises and are therefore reluctant to extend credit to them especially due to small size, severe competition and inherent vulnerability to market fluctuations.

#### *5.2.5 Access to Credit*

The study found out that the key challenges hindering micro and small enterprises from accessing credit facilities to be high cost of repayment, strict collateral requirements, not getting the exact amount applied for, unwillingness of people to act as guarantors, lack of enough collateral, high credit facilities processing fees and short payment period. Measures proposed to improve access to credit were lowering the interest rates, lengthening the loan payment period, reconsidering of the collateral security policy, and expansion of product portfolio and increase in the customer outreach. Barry, (2000); Cheston, Susy and Larry (1999) also supported these strategies.

#### *5.3 Conclusions*

The study sought to establish the extent to which collateral requirements, cost of credit, availability of information and business risks influence access to credit facilities by MSEs in Kangemi Harambee market in Nairobi City County, Kenya. From the study findings, this study concludes that business risks influences accessibility to credit facilities to a great extent followed by collateral requirements and cost of credit which influenced access to credit facilities to a moderate extent and then availability of information on finance which has an influence in accessing credit facilities for micro and small enterprises only to a small extent.

The study concludes further that the respondents preferred to get their start-up capital from personal savings, relatives and friends because the collateral requirements and high repayment costs by financial institutions.

#### *5.4 Recommendations*

The study findings yielded the following recommendations in view of the challenges faced by MSEs when accessing credit facilities for the expansion of their businesses.

The study found out that many respondents did not have bank accounts for their businesses. The management of banks should stretch further to more business people so as to be able to serve their banking needs. This will serve in increasing their chance of securing credit facilities.

##### *5.4.1 Collateral Requirements*

The study found out that access to credit facilities was highly limited by strict collateral requirements such as group guarantees, individual guarantors, having a bank account, having equity capital and assets as title deeds and log books. This study therefore recommended that credit giving institutions should come up with products for MSEs where collateral requirements are lenient.

##### *5.4.2 Cost of Credit*

The study found out that access to credit facilities by micro and small enterprises is highly limited by high repayment cost of credit given. This study therefore recommends that the management of credit giving institutions should consider lowering their interest rates as a way of encouraging MSEs to borrow from them.

##### *5.4.3 Availability of Information on Finance*

The study found out that some micro and small enterprises find it difficult to obtain credit facilities since they do not fully understand the requirements and procedures of acquiring credit facilities. This study recommends that the credit giving institutions come up with programmes of educating the MSEs on how they can go about obtaining credit facilities. The study therefore recommends that the management of these businesses should put in place proper accounting practices and adequate internal control systems which will counter problems of information asymmetry that make MSEs risky for credit giving institutions.

##### *5.4.4 Business Risks*

The study found out that the business risks hinder micro and small enterprises from accessing credit facilities to a great extent. This is because the credit giving institutions consider MSEs to be highly risky due to the small size and vulnerability to market fluctuations. The study recommends that the management of MSEs should differentiate their products and services as a way of coping with severe competition and other business risks.

##### *5.4.5 Access to credit facilities*

The study found out that very few MSEs have access to credit facilities. Most of the respondents preferred to use personal savings and contributions from relatives and friends since they find it difficult to access to credit from credit giving institutions. They study therefore recommends that the management of the institutions should increase their product portfolios they offered to MSEs. The marketing departments should endeavor to research on the clients' desired options and be able to include the probable and realistic ones onto the list. This will help to reach out to the MSEs that cannot access to credit facilities.

#### *5.5 Areas for Further Research*

The study recommends further research in the following areas; the effect of credit on the profitability of micro and small enterprises; the effect of information technology on MSEs access to credit facilities in Kenya.

In future, a similar research should be done covering other towns as this research only covered micro and small enterprises in Kangemi Harambee Market.

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# BAND GAP ENERGY PROFILE OF BSFT $\text{Ba}_{0.6}\text{Sr}_{0.4}\text{Fe}_x\text{Ti}_{(1-x)}\text{O}_{3-\delta}(x=0.1)$

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**Abstract-** A new nano ceramic material **BSFT** was prepared via a conventional solid state reaction technique and UV-VIS analysis of the sample was carried to study the optical properties. Tunable band gaps can be obtained by varying annealing temperatures. An exponentially varying absorption edge was observed and explained in terms of the Urbach's tail. The refractive index was calculated and the results obtained also showed a systematic variation with temperature. The EDX measurements confirmed the composition of the sample.

**Index Terms-** BSFT, TAUC plot, Urbach energy, band gap energy

## I. INTRODUCTION

Nano composite materials are of great interest to researchers in the world over for various reasons. One drive for such research is the potential application in next-generation electronic and photonic devices. Particles of a nano meter size exhibit unique properties such as quantum effects, short interface migration distances for photo induced holes and electrons in photochemical and photo catalytic systems, and increased sensitivity in thin film sensors [1]. Nanoparticles have properties (optical, electrical, or magnetic) depending directly on their size.

The development of lead-free piezoelectric materials has gained good attention for the consideration of environmental protection. There has been a continuous succession of new materials and technology developments leading to a significant number of industrial and commercial applications after the discovery of ferroelectric ceramics in polycrystalline barium titanate [2].  $\text{BaTiO}_3$  have been attracted considerable interest for a wide variety of applications. It has a perovskite structure that possesses a high dielectric constant [1] and widely used in multilayer ceramic capacitors (MLCCs), dynamic random-access ferroelectric memories (DRAMs) [4]

Measuring the band gap is an important factor determining the electrical conductivity in nano material industries. The band gap energy of insulators is large ( $> 4\text{eV}$ ), but lower for semiconductors ( $< 3\text{eV}$ ). In solid state physics a band gap, is an energy range in an ideal solid where no electron states can exist. This is equivalent to the energy required to free an outer shell electron from

its orbit about the nucleus to become a mobile charge carrier, able to move freely within the solid material [3].

In the present work the authors describes the optical behaviour of **BSFT**, a lead free material since they are now at the top as ferroelectric and piezoelectric materials. Barium titanate compounds are well suited for optical applications because of its high optical transparency and its large linear and non-linear electro-optic coefficients. Since barium compounds have varied applications & properties, doping with other materials like Sr, Fe etc. will improve its characteristics. With that understanding a new nano material with the formula BSFT was synthesized. The energy band gap values of sample are analyzed for different temperatures and they are fundamentally important to the design of practical devices [2]. The band gap energy values obtained using TAUC plot shows a direct relation with temperature. The Urbach energy of the sample is also calculated. The refractive index dependence on wavelength of the radiation has been discussed and such optical behaviour is rarely reported.

## 2. Experimental Methods

### 2.1. Preparation of the Sample:

The new ceramic sample BSFT ( $\text{Ba}_{0.6}\text{Sr}_{0.4}\text{Fe}_x\text{Ti}_{(1-x)}\text{O}_{3-\delta}(x=0.1)$ ) is prepared by the solid-state reaction technique according to their molecular formula using a high-energy ball milling process through mechanically assisted synthesis. For preparing sample, the reagent grade chemicals of high purity Barium Carbonate, Strontium Carbonate, Ferric Oxide and Titanium dioxide powders were used as the raw materials and weighed according to their molecular formula.

The sample was ball milled for three weeks with suitable zirconium balls to insure homogeneity and milling. Then it was attrition milled for three hours. After milling the material was calcined at four different temperatures,  $30^\circ\text{C}$ ,  $550^\circ\text{C}$ ,  $850^\circ\text{C}$  &  $950^\circ\text{C}$  in a special furnace with oxygen flow arrangements. The temperature of the furnace was increased in steps. On cooling oxygen flow was allowed immensely into the sample inside the furnace. High temperature is needed for metal oxide phase transformation [5].

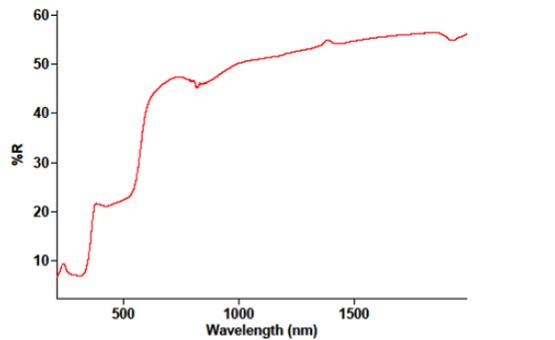
### 2.2. UV-VIS. Analysis:

Understanding the fundamental properties is essential for improving the material quality. Many properties of are unknown due to the increased difficulties to grow high quality materials. The UV analysis can be thought as a good quality check for the optical behaviour of the ceramic materials

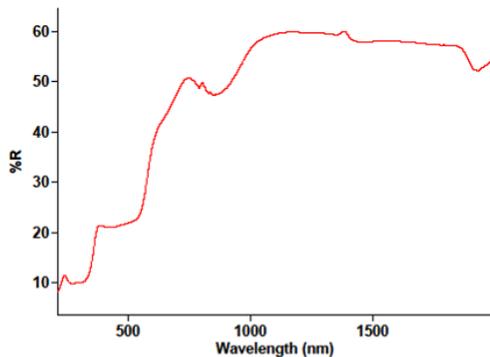
The sample obtained after calcination at different temperatures was subjected to UV-VIS-Near IR analysis using Varian, Cary 5000 Spectrophotometer over a spectral range of 175-3300nm with an accuracy of  $\pm 0.1\text{nm}$  (UV-Vis.). This type of sample has high mechanical hardness, high thermal conductivity, large dielectric constant, and high resistance to harsh environment.

Barium titanate compounds are one of the most attractive ferroelectric materials and show non-linear and electro optical properties because of the interaction between spontaneous polarization and polarized light. With regard to the optical band gap of nano scale, Matsuda et al. revealed that the band gap of barium titanate nano crystallites (10 nm) is approximately 0.1 eV larger than that of a single crystal by measuring the optical absorption of monolithic gels [6]. However, the above-mentioned report is the only available data on the size-driven band gap increment of barium compounds. This can be ascribed to a difficulty of the method for preparing ferroelectric nano particles.

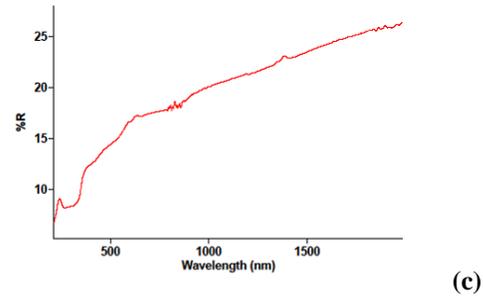
UV-Visible spectrum gives information about the excitonic and inter transition of nano materials [7]. Figure.1 shows the UV-VIS behaviour of the sample BSFT at different temperatures  $30^{\circ}\text{C}$ ,  $550^{\circ}\text{C}$ ,  $850^{\circ}\text{C}$  &  $950^{\circ}\text{C}$ .



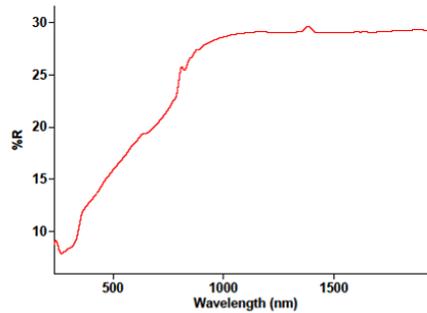
(a)



(b)



(c)



(d)

Figure.1(a)–(d)UV-VIS behaviour of BSFT at different temperatures  $30^{\circ}\text{C}$ ,  $550^{\circ}\text{C}$ ,  $850^{\circ}\text{C}$  &  $950^{\circ}\text{C}$  respectively.

The average transmittance in the visible part of the spectra (300-800nm) is about (80-90) %. The diffuse reflectance spectra were translated into the absorption spectra and absorption coefficient was calculated by the Kubelka-Munk equation [6].

### 2.2(1).TAUC PLOT

The band gap energy can be determined using the TAUC relation [8-13]. It is a convenient way of studying the optical absorption spectrum of a material. According to the TAUC relation, the absorption coefficient  $\alpha$  for material is given by  $\alpha h\nu = A(h\nu - E_g)^n$ , Where  $E_g$  the band gap, constant A is different for different transitions, ( $h\nu$ ) is energy of photon and n is an index which assumes the values  $1/2$ ,  $3/2$ , 2 and 3 depending on the nature of electronic transition responsible for the reflection. The value of the exponent n denotes the nature of the sample transition [9].

Band gaps were then calculated from the TAUC plots by fitting a line through the linear portion of the band edge region. A sample having an indirect band gap shows a linear dependence where the Kubelka – Munk function first shows distinct increase if  $n = 2$ , while one having a direct gap will shows a linear dependence when  $n = 1/2$  (Tauc et al., 1966) [14].

The TAUC plot of a sample defines the optical band gap as represented as the region A in fig.2

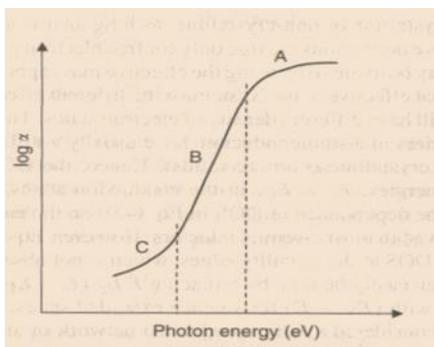


Fig.2 showing the variation of absorbance with photon energy.

The sample BSFT at temperatures 30°C, 550°C, 850°C & 950°C is analyzed and studied. Here we have taken the direct allowed transitions. The TAUC plot is plotted with  $h\nu$  along the X-axis and  $(h\nu\alpha)^2$  along the Y-axis. The TAUC plot for different temperatures are given below in Fig 2.

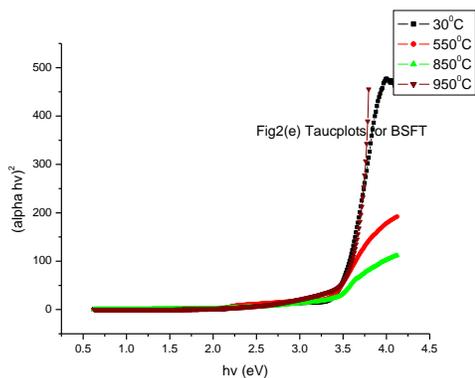


Fig2 TAUC plot of BSFT for temperatures 30°C,550°C,850°C &950°C.

The band gap energy values of BSFT calculated are listed in the table.1 given below

TABLE.1 band gap energy values of BSFT

| Temperature | Band gap energy in eV |
|-------------|-----------------------|
| 30°C        | 3.2                   |
| 550°C       | 3.25                  |
| 850°C       | 3.4                   |
| 950°C       | 3.49                  |

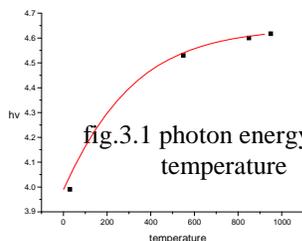


fig.3.1 photon energy with temperature

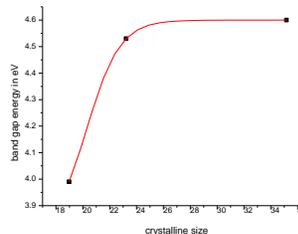


fig.3.2 photon energy with crystallite size.

From the results, it is confirmed that band gap energy increases with an increase in temperature(fig.3.1). The dependence of the crystallite size with the energy gap is also shown in fig3.2. The energy levels are dependent on the degree of structural order–disorder in the lattice. The band gap increases with the crystallite size but decreases as the perovskite phase is formed which proves the quantum confinement also decreasing the dislocation density.

### 2.2(2).URBACH ENERGY

The absorption coefficient at the photon energy below the optical gap (tail absorption) depends exponentially on the photon energy:  $\alpha(h\nu) \sim \exp(-h\nu/E_u)$  where  $E_u$  is called Urbach energy. The region B in the fig.2 represents the Urbach energy.

When the energy of the incident photon is lower than the band gap, absorption increases with an exponential decay of density of states of the localized band into the gap. The absorption edge here is called Urbach edge. The width of the Urbach tail is an indicator of defect levels in the forbidden gap. The exponential absorption tails, i.e. Urbach energy, depends on temperature, thermal vibrations in the lattice, induced disorder, static disorder, strong ionic bonds and on average photon energies [16].

Also it was deduced that the edge was most likely due to a radiative recombination between trapped electrons and trapped holes in tail and gap states as shown in Fig.2, and is dependent on the degree of structural and thermal disorder [14].

The natural logarithm of the absorption coefficient,  $\alpha(\nu)$ , was plotted as a function of the photon energy,  $h\nu$  (Fig.4). The value of  $E_u$  was calculated by taking the reciprocal of the slopes of the linear portion in the lower photon energy region of curves.

The Urbach Energy values decrease with temperature and the decrease is slightly more as the temperature increases. Sumi-Toyozawa (S-T model) explains the exponential shape of the absorption coefficient as the coexistence of free excitons and momentarily localized self-trapped excitons [16]. This theory can only be applied, however, to cases where the exciton radius is small and the effective mass of the hole is much larger than that of the electron. According to the S-T model,  $\sigma_0 \sim 0.6(B/S)$  and  $E_0 \sim E_g(0) - 0.8B$ , where S and B are the average exciton-phonon interaction energy and exciton binding energy. That is, the focal point  $E_0$  must be located below the band gap energy. In the present study, the focal point  $E_0$  is in a lower energy region than the band gap energy. The value of Urbach energy for the

sample under study is calculated. The Urbach energy is found to be 3.15eV. Accordingly, the S-T model can be readily applied to this study [17].

The measurement of temperature-dependent Urbach tails distinguishes a temperature-dependent tail and a temperature-independent part, which mainly are due to intrinsic defects. The latter can be controlled by improving the crystal growth and the purity of the ingredients. The temperature-dependent part of the Urbach tail, is purely of intrinsic reasons [18].

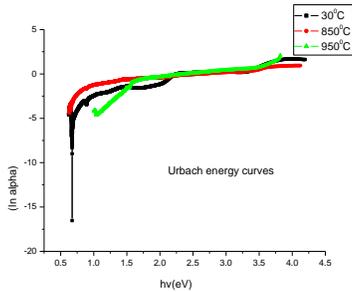


Fig.4.log of absorption coefficient plotted as a function of photon energy.

In addition, optical absorption by defects also appears at energy lower than optical gap region C of fig.2. This region is related to the structural properties of materials[15].

### 2.2(3) Refractive Index dependence

Refractive index with wavelength dependence is also studied. The refractive index values show a linear decrease with the increase in wavelength. Fig.5 shows the variation of the dispersion curve with annealing temperature. The refractive index values showed a linear decrease with the increase in wavelength. But refractive index value shows a slight increase with increasing annealing temperature when plotted with refractive index along the Y axis and photon energy along the X axis and attains a fixed value after a particular wavelength.

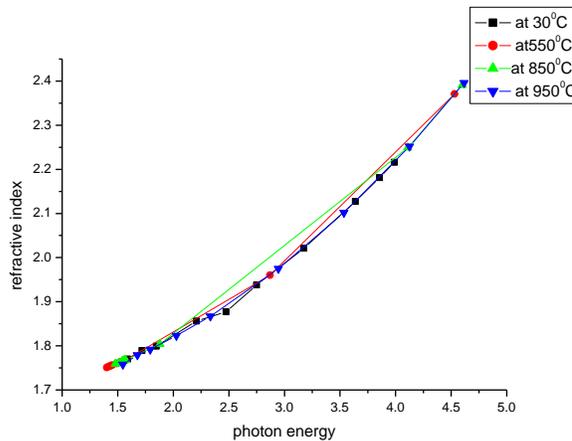
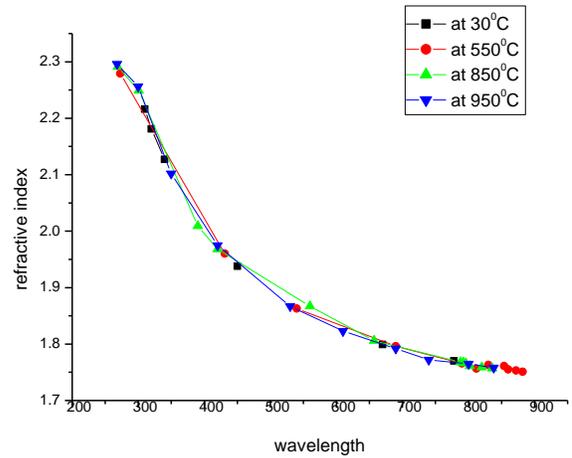
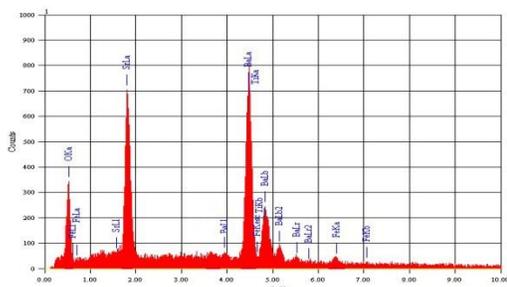


Fig.5. Refractive index variation with wavelength and photon energy for different temperatures.

### 3. Energy Dispersed X-Ray Spectrograph (EDX)

EDX shows the composition details of the prepared ceramic powders. The instrument used for this measurement is ISIS Link Oxford Instrument UK. This technique is generally associated with Scanning Electron Microscope (SEM). In this technique an electron beam of 10 - 20 KeV strikes the surface of a sample which causes X-ray to be emitted from point of incidence. The energy of the X-ray emitted depends on material under examination. When an X-ray strikes the detector, it will generate a photoelectron which in turn generates electron-hole pairs. A strong electric field attracts the electrons and holes towards the opposite ends of the detector. The size of the pulse thus generated depends on the number electron hole pairs created, which in turn depends on the energy of the incoming X-ray. In this method however elements with low atomic number are difficult to be detected. The detector which is lithium doped silicon is protected by a beryllium window and operated at liquid nitrogen temperatures. The absorption of the soft X-rays by the beryllium decreases the sensitivity below an atomic number 11.



**Figure.6. EDX of BaSr<sub>0.9</sub>Fe<sub>0.1</sub>TiO<sub>4</sub>** The EDX spectrum obtained give the composition of the material under study.

**Table.2 Material Content (EDX)**

| Material | content (%) |
|----------|-------------|
| Ba       | 44          |
| Sr       | 27          |
| Fe       | 2.14        |
| Ti       | 2.01        |
| O        | 24.85       |

From the EDX spectrum, the four dominant peak positions at 4.465keV (Ba Lα), 5.1.,5.5.8keV (Ba Lβ, Lγ, Lγ2), 1.806keV (Sr Lα), 0.705, 6.398keV (Fe Lα, Kα), 0.452, 4.508keV (Ti Lα, Kα), 0.525keV (O Kα) correspond quite well to the energy pattern of the corresponding materials (Ba, Sr, Fe, Ti, and O) reported in the EDAX international chart [3].

#### 4.Results

The Ceramic material prepared by solid state reaction technique in a special furnace with oxygen annealing in different temperatures in steps is successfully studied. .Optical analysis of the same is done using UV-Vis Spectro photometer. From UV-VIS. Analysis, the results very clearly confirm that band gap energy of the nano crystalline ceramic increases as the temperature is increased. This result is also a confirmation of the Wein’s law which states that higher the temperature, smaller the wavelength of the maximum emission i e

$$\lambda_{\max} = 0.0029\text{km/T or } \lambda \text{ inversely proportional to } 1/T - (1)$$

The crystallite size of the sample increases at different treating temperatures [3]. When the temperature reaches its sintering value, the band gap energy tries to decrease. The crystallite size of the sample at different temperatures are calculated [5] using the Debye Scherrer formula as  $D=K\lambda/\beta\cos \theta$ , where D represents the crystallite size in nm, K is a constant (=0.9),  $\beta$ , the full width at half maximum in radians and  $\theta$ ,the diffracting angle in degrees.

The UV-VIS behaviour of the sample at the different temperatures was thoroughly analyzed. TAUC plot data well confirms that the band gap energy of the sample increases slightly when the temperature is increased. As the temperature is increased the crystallite size also increases which shows an increase in band gap energy too. The energy levels are dependent on the degree of structural order–disorder in the lattice. Therefore, the increase of structural organization in nano ceramic leads to a reduction of the intermediary energy levels and consequently increases the  $E_g$  values. But the band gap decreases slightly at high temperature with increase in the crystallite size which very well proves the quantum confinement.

Urbach energy is calculated by plotting the natural logarithm of the absorption coefficient with the energy in eV. This value is found to be lower than the band gap energy and hence Sumi-Toyozawa (ST) model theory can be well applied to this material.

The refractive index of the sample at different values of temperature is also studied. Analysis (Fig.5) clearly shows that refractive index of the sample decreases as the wavelength increases (varies from 2.27 to 1.76) and attains a definite value at all temperatures. Fig.5 also shows the dependence of the refractive index with the energy. This linear variation of the refractive index with the wavelength/energy is due to dispersion of light energy at the different interstitial layers. The refractive index of perovskites is known to be proportional to their electronic polarization per unit volume which is inversely proportional to distance between atomic planes. This result can be explained by an increase in crystallite size as already reported [3]. The increase in refractive index is due to crystallization of the perovskite phase.

The EDX analysis indicates that the elements exist in the sample and they agree with the chemical formula of the prepared compound. The mechano chemical process has an advantage due to low-costs and widely available materials, leading to a simplified process.

#### 5.Conclusion

The optical properties of the new nano ceramic material BSFT can be taken as a better candidate for UV\_VIS shielding applications. A sound understanding of the band gap variations of the sample with different temperatures are noted. It is confirmed that tunable band gaps are obtained by varying annealing temperatures. The increase in the band gap energy increases the dielectric properties of the material. The EDX measurements confirmed the composition of the sample. New generation capacitors are credited to the engineering and synthesis of new nano dielectric ceramic materials. Hence BSFT or Fe doped Barium Strontium titanate materials will definitely provide better future for power electronics.

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# Towards Improving the Effectiveness of Management of World Heritage Sites

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**Abstract-** World heritage sites are very vital cultural and natural areas that need to be effectively protected and improved in order to remain relevant and be used by future generations. UNESCO went ahead and shortlisted over 851 sites across the globe as being heritage sites of global stature. This was seen as a good effort aimed at recognizing and conserving the sites. However, these efforts are not enough. There have been efforts to manage these sites locally through following certain set standards or guidelines. Many of the management of these world heritage sites have failed to meet these quality standards, while some have been seen to succeed. This paper looks at the evaluation process for effective management of the improvement efforts for these world heritage sites. It also mentions tourism as a conflicting factor in the management process. A short look at the Alhambra site as one of the success stories in managing world heritage sites improvements is also given.

**Index Terms-** World Heritage Sites (WHS), UNESCO, Effective management evaluation, Architectural conservation

## I. INTRODUCTION

The issue of first identifying the most important cultural and natural sites in the world and protecting them through better management practices has elicited the imagination as well as the commitment of many stakeholders including the public, governments, and the private sector players. This explains the origin of the world heritage convention of 1972 and the subsequent ratifications that followed in over 180 countries around the world. There has been a serious commitment from these countries towards the preservation, conservation, and management of the world heritage sites. The countries have taken it as an individual initiative to protect and conserve their endowed cultural and natural sites from the destructions witnessed from mankind. A world heritage list is in place and is always updated time after time to include new areas or sites that have been discovered. Currently, the figure on the list stands at 851 sites. Out of these 851 sites, 200 have been listed based on the natural values they hold. This inclusion of world heritage sites on the list is seen as an important step towards the protection of these sites. However, what many have failed to realize is the fact that this listing alone cannot in itself guarantee the protection of these sites. This is why management must come in to help in the protection initiatives being fronted by the international bodies such as the UN habitat among others that have shown interest in the protection and management of these world heritage sites. Many countries have put in concerted efforts in protecting their own sites but this is still to the lower threshold and thus better management has failed to be achieved in many instances. Many of these sites thus remain under pressure from the human activities, interests, as well as long term neglect. There are benefits that are derived from these world heritage sites. For instance, the attraction they bring to tourists alone has over the years accounted for a huge percentage of many countries' GDP. In fact, there are countries that are not endowed with natural resources and thus depend solely on tourism from these sites as their only source of income and contribution to their GDP is over 70%.

The time that the world heritage sites committee is always taken up with many discussions that relate to the huge pressures being faced by the world heritage sites, looking at the many reports from monitoring and evaluations done on these sites, proposals put forward with the aim of listing new sites or de-listing some, and working with the individual countries to ensure that the sites are well protected (Sweatman, 1997). This has been lauded as the broader initiative from the global arena that helps in the conservation of these world heritage sites. These efforts are not enough and this is why individual governments as well as appointed managements for various sites across the world have been singled out as being quite strategic in realizing the goals of this committee. Many governments and international bodies have gone as far as setting up management for individual world heritage sites so that they are well cared for. However, the efforts put forward by these managements have been ineffective in properly managing these world heritage sites and this has led them to be desolate, vulnerable to destructions, and depletion. This paper takes a critical look at the world heritage sites and how they are managed by considering the improvements of the effectiveness of management being done on world heritage sites.

## II. OBJECTIVE

The main objective for this paper is to show evaluation of the effectiveness of the management of world heritage sites across the world in meeting the improvement needs of these world heritage sites. This is because many resources, including money, land and personnel have been employed in the conservation and protection measures of these sites yet there still remains a huge gap between

meeting the goals of improvement and the efforts being put forward. Many observers have argued that putting in place resources and international efforts are not enough in ensuring that these world heritage sites are well cared for and managed as expected. This is why management from individual countries has been thought of as being able to play an important role in the improvement of these sites to the required status. Whether this goal has been met or not is still not clear and this is the objective that this paper is setting out to meet.

### III. PROBLEM STATEMENT

The world heritage sites are very delicate places that could be defaced in a very short time with consistent interference with people in their human activities. Some are destroyed intentionally while others are normally depleted by people who are engaged in commercial black market activities. Some are also lost by natural forces such as flooding and soil erosion, which wash away the objects and deface the places. These are the reasons why the world heritage sites have received serious attention with calls from various corners asking for better forms of management so that the sites are improved and protected from human harm. The problem with this process has been realized with the level of managerial efforts that are being put in it and the effectiveness or ineffectiveness of management to fully meet the improvement requirements set for these sites. This is what the paper sets out to establish in this evaluation. In order to do this, the research is to conduct a literature review of the world heritage sites in general and try establishing the effectiveness achieved by the management of these sites. A case in question will be the case study conducted on a world heritage site called Alhambra Place which is found in Spain. The role that tourism play in this process will also be established in trying to see why management has succeeded or failed in the management of these world heritage sites and improving them to the required levels. Alhambra has been chosen as a case study for this research because it is listed as one of the world heritage sites on the list and thus its findings will be of use to this discussion in trying to demystify the problem.

### IV. EVALUATION

There has been a serious concern from the protected area professionals, the public, and the international bodies over the fate of world heritage sites. The argument has been that the sites are failing to live by the objectives they were meant to achieve and in many cases; these sites are fast losing the values that they were established for in the first place. Given this scenario, there has been a need to improve the management of these world heritage sites and this has been taken up as a major priority of the community across the world that is concerned with the protection and conservation of these areas. The most important step that has been singled out as being crucial to this process has been the conduction of assessments to establish the current status of things in terms of management efforts and their role in improving the world heritage sites. This assessment has always been done with the aim of shedding more light on what is thought to be the improvement process, whether it is working or not and if the objectives that were set out are actually met in practical settings. For that reason, assessing the level of success of management in the improvement of these world heritage sites has been lauded as a major contributor to the protection of these areas and has taken a high degree of consideration by many stakeholders (Wells, 2004).

The role played by the UNESCO world heritage Centre has been very vital in the process of world heritage sites' protection process and has widely supported the development of methodology that is used in the assessment of the management's effectiveness in improving these sites. There has also been a marked increase in the demands that are put on site managers to provide a report on the status of the sites they have a jurisdiction over. There have been calls for systematic, periodic reporting as well as the reactive forms of monitoring. The aim of these reports is merely to help guide the managers in their efforts to improve the world heritage sites, but they have been misunderstood for being the tool for effective management (Hockings, et al., 2008).

The evaluation of how effective management is carrying out its improvement activities is simply an assessment of how these world heritage sites are being managed in terms of being able to protect their inherited values, and realizing the goals and objectives that were initially achieved. This effectiveness of management takes on the designs of the world heritage sites; the adequacy and how appropriate the management systems as well as processes are; and the delivery of objectives which encompasses the values of conservation. The evaluation of the effectiveness of management is driven by four purposes: leading to better management of these world heritage sites in this volatile environment, helping in the allocation of resources in a very effective manner, promoting the transparency and accountability required in the management practices, and helping in the involvement of the community, promoting these protected sites and being able to build the required level of consistency.

There have been various studies conducted on the effectiveness of management in improving the world heritage sites and the scope of these researches has included the other protected areas. Most of these evaluations were more sporadic and individual in nature based on the visits made by individuals in these places. However, this trend was changed with the commissioning of a taskforce to evaluate management effectiveness that was done by the World Commission on Protected Areas (Parrish, et al., 2003).

There are many threats to the status of world heritage sites and none seems to be safe or immune from these threats. These threats to the protected areas have been singled out as being those related to the climatic changes, regional scale problems like the fragmentation of habitats and many problems that are localized to these places such as poaching, waste disposal, and many impacts brought about by visitors. The threats that are as a result of outside forces to a protected area like pollution of the air or change in climatic conditions are not within the control of management. However, they have to be considered while evaluating managerial effectiveness because of the impact that they have on the evaluation process.

Indeed, the status of world heritage sites in terms of the improvement efforts of management has been both successful and failed in some instances. Many sites across the world are however, faced with serious problems that threaten their sustained conservation. This has made the efforts made by management seem like a drop in the ocean and thus putting many people into a dilemma.

The evaluation process has to take into consideration various steps that are crucial in establishing the effectiveness of management in the process of improving these world heritage sites. These steps are: Identifying the values of the site and the objectives set out by the management in the first place. In this case, the evaluation tries to single out and list all the major values of the site and its relevant managerial objectives. These have the role of helping in deciding what exactly should be monitored and evaluated at the time when the process is being carried out. Identification of various threats faced by the site, where this process has the importance of helping the managers in the organization and making of any changes to the report based on the type and level of the identified threats to this site as well as being able to manage the different responses. Identification of the stakeholder's relationship with the site is another step. This one helps in finding out how effective stakeholder's management is being carried out by the management. This could also be looked at, how the management effectively handles the tourists who visit and the donor community involved in the conservation process as well as the public and the community around the site. The review of the national context is also done in order to assist in the understanding of the way the national as well as international policies related to the site, legislations and other government initiated actions are affecting the management of the site. The next step goes into assessing the management planning so that it can help evaluate the adequacy of the planning document that is being used as a guide to the management of the site (Parrish, et al., 2003).

The other step in the evaluation process is the designing of the evaluation where an assessment of the design meant for the site improvement is done. This should also incorporate the evaluation of how the size of the site, boundaries set and the location at which the site is do affect the capacity of managers to effectively improve and maintain the site. This is followed by a thorough evaluation of the management needs and the required inputs to aid in the effective management process. As such, the current staff is evaluated and compared to the needs of these staff and also the current budget is considered by comparing it to an ideal budgetary allocation.

The step that follows in this process is the assessment that is done on the processes of management where best practices are identified and the desired standards for the process of management as well as performance rates are found against these set standards. The management plan's implementation process is also evaluated. This has the capacity to show the progress made in the implementation of the plans outlined by the management in terms of general context and specific components. Output indicators for the site are then assessed and the achievement of annual site programs is evaluated in terms of targets met and other forms of indicators of output. The outcome of management processes employed is also evaluated. This stage does answer a very important question of whether the objectives that were set are being met or not in terms of improving the ecological integrity, cultural values, wildlife and landscapes of these world heritage sites. Finally, a review of the results that sought to establish the effectiveness of management in the improvement program is done to summarize and give priority to a list of actions to be undertaken (Hockings & Robyn, 2008).

The role played by tourism in ensuring that sites are well managed cannot be ignored. There are numerous perceived benefits that tourism activities bring to a given world heritage site and thus acts as a major motivator for the management of the sites. The economic impact of sites being listed as tourist attraction locations is huge. This also helps in increasing the degree of income generated from these places during visitations done by tourists. The data available is not enough to estimate the figures in terms of financial benefits. However, it has been noted that while tourism is a good venture and quite beneficial to both the country and world heritage site, it has a serious impact on the management and conservation of these sites. This is because of the tension it creates between the large pools of stakeholders that come into play when tourism is mentioned. When such a scenario is reached, then conservation measures are thrown to the wind and economic benefits take Centre stage, thereby leading to a serious depletion of these world heritage sites. This is attributed to the fact that each and every stakeholder ends up holding a very different view of the site, sets different agendas, and prioritization becomes an issue. In such an environment of confused and conflicting stakeholders, achieving a formidable consensus on the way forward and making effective managerial decisions become a problem that might not be solved in the short run before destruction sets in. As scholars have noted, tourism and conservation or effective management of these world heritage sites normally undergoes awkward relationships due to the conflict. At this point, it has been indicated that coming into formal agreements and partnerships with stakeholders as far as the tourism and world heritage site management are concerned is not the best solution to avert the crisis. What needs to be done is to find a way in which the stakeholders will appreciate the need to have the cultural tourism boom, while at the same time being able to recognize the need for conservation of the core values of the sites that have been defined in clear terms (Ervin, 2003).

Management planning needs to be done in protected sites so that conservation measures are seen to be effective. There are supposed to be set very clear and quite appropriate objectives for the world heritage sites and this should be fully supported by the management through planning and provision of adequate resources so that effective management of these sites is achieved. As has been seen, the evaluations do seek answers to issues related to planning and the objectives set which are available for use by managers. These plans and objectives have to be updated and should address all the values of the protected sites to avoid neglecting other sections. The quality of these plans in meeting the improvement needs of the site should always be put into question and improved over time. The scope of these plans together with how practical they are is an important way of addressing the effectiveness of managerial practices. The adequacy of resources allocated for the management of these sites has to be established. This is because without enough resources, management is found in a fix and might not carry out its intended improvement programs effectively. Thus, human capacity, information, facilities, operational finances as well as necessary equipment is vital resources that have to be availed to management so that they could effectively manage. The level required by these resources has to be established, the extent to which the resources could be made available, and the possibility of the resources being able to be utilized in the best was possible has to be known.

It is also important that benchmarking is done to find out the best managerial practices that have been effectively applied by other organizations in different countries like has been the case of Alhambra in Spain. This has the capacity to put in place guidelines that other site managers could follow in trying to effectively manage the improvement of their world heritage sites (Holling, 1978). Alternatively, the management could look at the published benchmark guidelines that are availed by conservation agencies which include policies, manuals, procedures, and other guidelines of best practice.

## V. CASE OF ALHAMBRA SITE IN SPAIN

This site was part of the Calat Alhambra site in Spain that was constructed in the middle of the 14th century by the then Moorish rulers of Emirate from Granada. It occupies the top of Assabica hill in the city of Granada. During the Reconquista by the Reyes in 1492, and the Christian rulers did use the portions of this site. This site was discovered by the scholars and travellers from Europe and restoration began. The Alhambra was discovered after many years of disrepair. Currently, it is one of the most tourist attractions in the country and shows the most important architecture of Islamic culture combined with the interventions made by the Christian settlers. The buildings have been well maintained after the discovery and restoration. However, there are instances where the site was vandalized and poorly judged because of the mixed religious aspects it shows (Jacobs & Fernández, 2009).

This site is a good example of how effective management of improvement of world heritage sites could go in ensuring that they are sustained for future generations. If the site is poorly managed, then the possibility of losing its face and values is very high. The country also stands to lose a lot in terms of tourist attraction and revenue that comes with it. This calls upon the site managers of places like this to take seriously the importance of effective management and give useful evaluation reports (Fernández & Antonio, 1998).

## VI. CONCLUSION

Effective management of the world heritage sites' improvement process is very crucial to the survival of these sites. Its contribution to the conservation process has been lauded as being more important than the international efforts being made. This is why the process of evaluating the effectiveness of the managerial measures being taken to do this is quite necessary and should be applied in all sites across the world. The benefits derived from this evaluation process are varied and the information gathered could be used in many ways. These include: managers could use the information to improve on their levels of performance by means of adaptive management. This is using information from the past with the view of making improvements in the future management of these sites. Changes may be instituted in this process of adaptive management. These changes that are implemented in the management process could still be fed back to the system through the evaluation process. The information could also be applied in the filling of gaps of knowledge through improvements on the monitoring and evaluation processes. The first time assessments could be applied as baseline data for subsequent surveys. There is the need to sustain evaluation practices to ensure that these world heritage sites are well managed.

Standards set for the evaluation processes must be adhered to in order to ensure that the actual situation on the ground is represented in the findings made. Effective management of these world heritage sites also entails good relationships with the community around, various stakeholders and the public as a whole. As has been noted above during the discussion, the role played by tourism could be both supportive and detrimental to the management process. In many cases, the priorities set by management for effectively handling these world heritage sites' improvements are normally in direct conflict with those of stakeholders. This friction brings about poor management decisions and thus fails the effectiveness test. A balance needs to be established between the cultural tourism and conservation measures being taken so that the sites are not neglected in preference to tourism. Many world heritage sites across the world do not meet the requirements of effective management and have thus failed to effectively improve the heritage sites. The sustainability of these management measures has to be put into consideration. If the conservation measure is not projected into the future needs of the heritage site, then it risks being de-listed from the list of world heritage sites in the world. Evaluation should also be made a constant activity that gets improved over time by use of baseline survey data that had been initially gathered and analyzed. All stakeholders need to realize the importance of coming on board and putting conservation measures ahead of their agendas and priorities so that the efforts are made by the management of these sites are seen to bear fruits. Failure to do so leaves the management isolated and this lowers its effectiveness in managing these sites.

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# Factors Affecting the Performance of Small and Micro Enterprises in Limuru Town Market of Kiambu County, Kenya

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**Abstract-** It is generally accepted that SMEs are becoming increasingly important in terms of employment, wealth creation, and the development of innovation. However many problems encounter SMEs and as a result, many firms perform dismally and fail to grow. In addition it is generally known and accepted that there is a high mortality rate of SMEs within the first two years. Given this high failure rate, it becomes vital to research the factors required to enable the SMEs to survive and indeed progress to the growth phase of the organizational life cycle. The study sought to establish the factors affecting the performance of small and micro enterprises (SMEs) traders at Limuru town market in Kiambu County, Kenya. The study employed a descriptive research design to achieve the objectives. The target population under study was the 965 licensed SMEs by Limuru sub-county operating in Limuru Market in 2014. The study used a questionnaire to collect the required data from a sample of 274 SMEs. The data collected was coded, quantified and analyzed quantitatively and qualitatively. Quantitative data was analyzed by the use of statistical package for social sciences (SPSS). The study concluded that access to finance and availability of management experience are the key socio-economic factors affecting the performance of businesses in Limuru Town Market. The other key factors that were found to affect businesses in Limuru Town Market positively are: access to business information, access to infrastructure and government policy and regulations. The study recommended that the government should start offering basic business and financial management skills as this will enable entrepreneurs to make informed investment decisions as well as enhance their entrepreneurial skills that enable them to recognize and exploit the available business opportunities.

**Index Terms-** Small And Micro Enterprises, Performance, Investment Decisions

## I. INTRODUCTION

SMEs are important both to the individual and to the nation. To the individual they provide employment and raise the standard of living of both employers and employees. To the nation, they complement large scale modern sector enterprises, they utilize agricultural and other raw materials that would have gone to waste, they serve limited or closed markets that warrant only small scale production, they mobilize resources otherwise left out

of the mainstream formal mobilization channels and they provide the necessary platform for take-off into large scale modern production by many indigenous Kenyans (Bwisa 2011). SMEs are the main source of employment in developed and developing countries comprising of over 90% of African business operations and contributing to over 50% of African employment and GDP (Okafor, 2006). The small and micro Enterprises play an important role in the Kenyan Economy. According to the economic survey (2006), the sector contributed over 50 per cent of new jobs created in the year 2005.

While the contributions of small businesses to development are generally acknowledged, SME entrepreneurs face many obstacles that limit their long term survival and development. Research on small business development has shown that the rate of failure in developing countries is higher than in the developed world (Arinaitwe, 2002). Past statistics indicate that three out of five businesses fail within the first few months of operation (Kenya National Bureau of Statistics, 2007).

Small businesses increasingly face competition not only from their peers but also from large corporations participating in niche markets once regarded as a preserve for small businesses (Ntakobajira, 2013). According to Amyx (2005), one of the most significant challenges is the negative perception towards SMEs. Potential clients perceive small businesses as lacking the ability to provide quality services and are unable to satisfy more than one critical project simultaneously. Often larger companies are selected and given business for their clout in the industry and name recognition alone (Bowen, Morara & Mureithi, 2009). Lack of planning, improper financing and poor management have been cited as the main causes of failure of small enterprises (Longenecker, 2006). Regardless of the high failure rate by SMEs in Kenya, their enormous contribution to the entire economy cannot be overlooked (Mbogo, 2011).

SMEs have been identified the world over as the stepping stones for industrialization. Robust economies like the United States of America and the United Kingdom trace their development from growth and development of their SMEs. Studies by Hatega (2007), Kauffmann (2005) attest that SMEs cover more than 95% of all firms in Sub-saharan Africa and their importance cannot be overestimated. Small and Medium Scale Enterprises are mostly found in the service sector of various economies which in most countries account for two-thirds of employment levels. In Kenya the SME sector contributes an estimated 18% of

the GDP as well as creating employment for 80% of the workforce population (Kithae, 2012).

Small and medium enterprises are widely recognized for their role in the social, political and economic development. Their importance is particularly apparent in its ability to provide reasonably priced goods, services, income and employment to a number of people (Kauffmann, 2006). There has therefore been a growing concern and interest by the government and development agencies for the improved performance and growth of the small and medium enterprises.

A positive relationship has been documented between small-business development and economic growth in developed countries (Harris and Gibson, 2006; Monk, 2000; Sauser, 2005). However, not much research has been conducted on this relationship in developing countries. Studies in small-business development and performance are necessary in countries like Kenya because of the dissimilarities in the process between developed and developing countries (Arinaitwe, 2002). It is also essential to understand the factors influencing small-business performance in African countries because they are significantly different from those facing developed countries. These factors include: availability of business information, access to finance, availability of managerial experience and access to infrastructure.

The First 1993 Small & Medium Enterprises (SME) baseline survey revealed that there were approximately 910,000 SMEs employing up to 2 million people. The second SME baseline survey (1995), estimated the size of the SME sector at 708,000 enterprises employing up to 1.2 million people. Compared to the other sectors of the economy, the contribution of the SME sector to the country's Gross Domestic Product (GDP) increased from 13.8% in 1993 to over 18% in 1999, (Sessional Paper No. 2 of 2005). Currently, it is estimated that the contribution to the GDP by this sector stands at over 25% (Economic Survey, 2012).

Despite the statistics, the Kenyan SME sector usually operates on small-scale, locally and at a subsistence level. They have fewer employees (especially home based enterprises), they operate for a shorter period, and have poor access to water and electricity and few sell outside the establishments where the entrepreneurs live (World Bank, 2006).

Majority of the SMEs are micro enterprises with fewer than 10 employees, while 70 per cent of them are one person, own account workers. This means that majority of SME entrepreneurs are operating at the bottom of the economy, with a significant percentage falling among the 53 percent of Kenyans living below the poverty line of USD 1 per day. The latter are largely for subsistence and engage in economically uncompetitive activities both in urban and rural areas (Kihonge, 2014).

At the fore front of challenges in Kenya lies the high unemployment rate among young people, which is estimated to be double the national level of unemployment of 12.7 percent. Those young people who have a job are often engaged in low-paying work. Hence, most of the unemployed people disproportionately stem from the youth segment of the population and belong to the bottom 40 percent of the income distribution (UNDP, 2013).

Several studies have been carried out focusing on performance of entrepreneurs. Mwanja, (2011), did a research on the effect of Biashara Boresha Loan on Performance of Micro and Small enterprises owned by KCB Ruiru branch customers. Ga-

thitu (2007) did a study on Factors affecting performance of entrepreneurs in privately run secondary schools in Thika district. Mugo, (2012), did a study on Factors affecting entrepreneurs' performance in Kenya dwelling on Nairobi women groups in the Central Business District. Kinyua, (2014), did a study on factors affecting the performance of Small and Medium Enterprises in the Jua Kali Sector in Nakuru town, Kenya.

Though the said studies dwelt on performance, they were done in their specific areas and covered specific objectives. Mwanja, (2011) for instance did not consider other factors that can affect performance apart from finance. Gathitu (2007) on the other hand was specific on the entrepreneurs investing in the education sector. Mugo (2012) only considered performance of women entrepreneurs and left out the male entrepreneur. Kinyua (2014) did study on the informal sector in Nakuru town specific to the area. These studies have been done in urban Centres of Nairobi, Nakuru, Thika and Ruiru.

Since SMEs in Limuru market employ a huge population, their positive performance can bring hope to the problem of unemployment in Kiambu County. This study seeks to establish the factors that influence performance of traders in Limuru town market of Kiambu County.

The main objective was to explore the factors affecting performance of small and micro enterprises in Limuru town market of Kiambu County. Specific objectives included: to establish the influence of access to business information on performance of small and micro enterprises in Limuru town market of Kiambu County, to examine the effect of access to finance on performance of small and micro enterprises in Limuru town market of Kiambu County, to determine the effect of availability of managerial experience on performance of small and micro enterprises in Limuru town market of Kiambu County and to determine the effect of access to infrastructure on performance of small and micro enterprises in Limuru town market of Kiambu County.

The study is beneficial to the following parties:

- I. The Central government of Kenya- for the purpose of policy formulation that will create a suitable environment for the small and micro entrepreneur to increase business growth and the consequent social standard improvement.
- II. County Government of Kiambu- the research will assist the county government of Kiambu when formulating policies on planning so as to assist them build holistic policies that will include all traders in the county including small and micro entrepreneurs.
- III. The Kenya Revenue Authority- for the purpose of taxation and also reaching out to this group of income earners who may not know that they have an obligation to pay tax as per the laws of Kenya.
- IV. Future researchers- the study is of much significance to research institutions, students and other researchers who would get the findings useful in their investigation in the area of study.

This research was limited to the factors affecting performance of small and micro enterprises in Limuru town market of Kiambu County and the 965 businesses the traders carry out therein. The study mainly depended on the data provided by the

respondents. This means that the accuracy of the data provided depended on the information provided. The researcher handled the problem by making follow-up calls to clarify any issues that were not clear.

Business information is usually confidential. Most of the respondents approached were reluctant in giving information due to fear of being victimized. The researcher handled the problem by carrying an introduction letter from the University so as to assure the respondents that the information would be treated as confidential and would be used for academic purposes only.

Further, the respondents had busy working schedules in the market which delayed the filling of questionnaires. The researcher had to exercise utmost patience and make extra effort in reminding respondents and making constant follow-ups so as to acquire sufficient data from respondents. This explains why only 58.76% of the respondents were able to complete the questionnaires.

## II. LITERATURE REVIEW

This chapter reviews existing literature on the subject of this study. It outlines the literature review, the theoretical and conceptual frameworks, empirical review, research gap and summary.

### 2.2 Theoretical Framework

#### 2.2.1 The Balanced Scorecard (BSC)

BSC suggests managers to view organization's performance from four dimensions, customer perspective, internal perspective, innovation & learning perspective, financial perspective (Kaplan and Norton 1996). BSC incorporates financial and non-financial measures in one measurement system. The objectives and measures of BSC are derived from an organization's vision and strategy. The Balanced Scorecard provides executives with a comprehensive framework that translates a company's vision and

strategy into a coherent set of performance measures. According to Kaplan & Norton (1996) the balanced scorecard not only allows the monitoring of present performance, but also tries to capture information about how well the organization is positioned to perform in the future. Furthermore, the Balanced Scorecard has evolved to become a core management tool, in that it helps CEOs not only to clarify and communicate strategy, but also to manage strategy. In practice, companies use the BSC approach to accomplish four critical management processes, clarify and translate vision and strategy, communicate and link strategic objectives and measures, plan, set targets, and align strategic initiatives and enhance strategic feedback and learning.

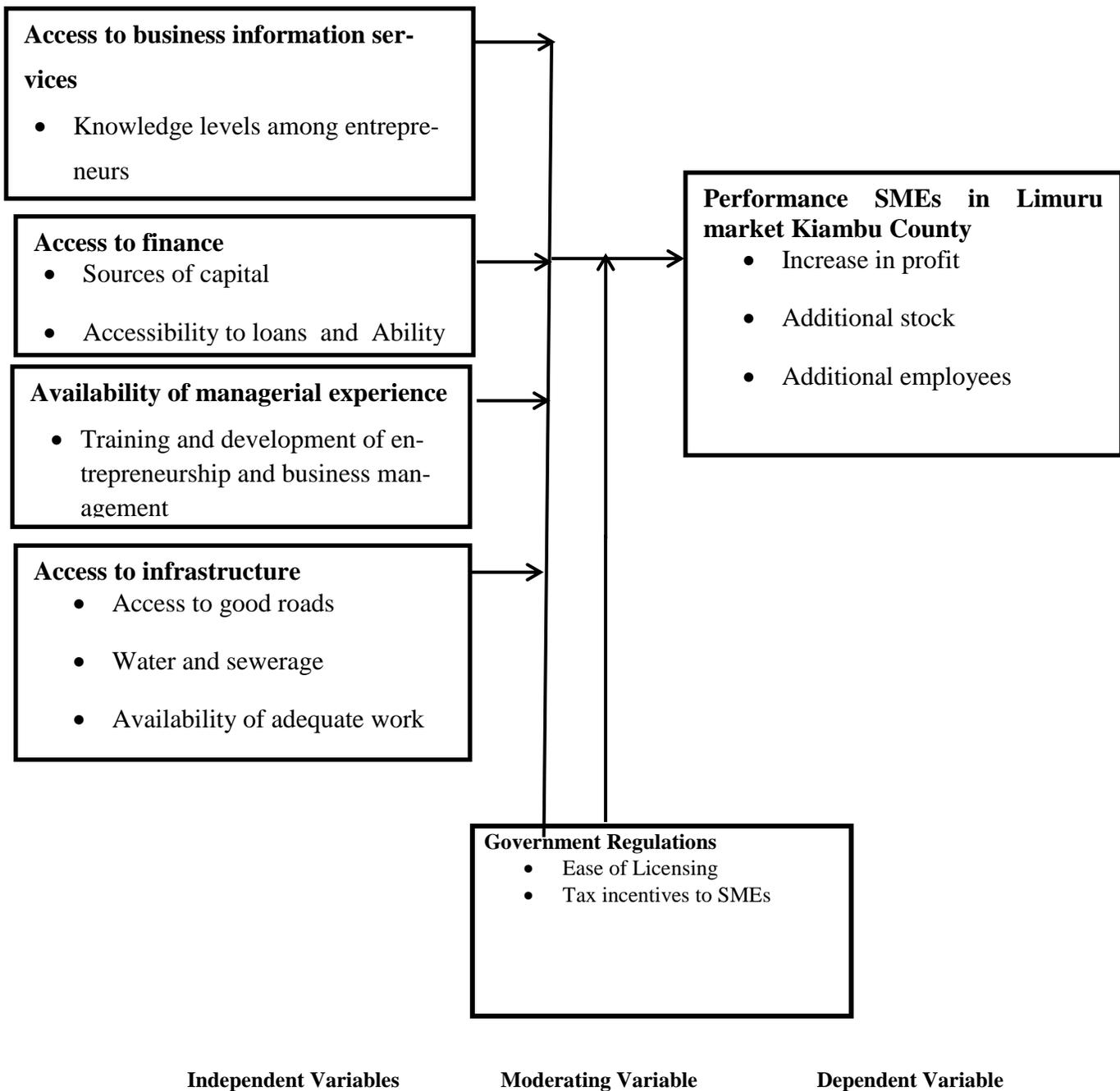
#### 2.2.2 Sociological Theory

The sociological theory of entrepreneurship holds [social cultures](#) as the driving force of entrepreneurship. The entrepreneur becomes a role performer in conformity with the role expectations of the society, and such role expectations base on religious beliefs, taboos, and customs. Weber, (1920) held religion as the major driver of entrepreneurship, and stressed on the spirit of capitalism, which highlights economic freedom and private enterprise. Capitalism thrives under the protestant work ethic that harps on these values. The right combination of discipline and an adventurous free-spirit define the successful entrepreneur.

#### 2.3 Conceptual Framework

Performance of traders in Limuru market depends on certain factors as set out into two categories as dependent and independent variables. Independent variables include: access to business information, access to financial resources, availability of managerial experience in business and access to infrastructure. Government regulations are included as a moderating variable. The relationship of the variables is displayed in the figure 2.1 below:

**Figure 2.1 Conceptual Framework**



**2.3.1 Access to business information services and performance of SMEs**

Access to business information services has been identified as one area that needs attention from governments and business services providers if the SMEs sector in developing countries is to achieve sustainable levels of growth and development. Many firms in Africa operate in an information-poor environment due to lack of adequate business support services and the poor information technological infrastructures (Oshikoya & Hussain, 2007). Access to information has however not been given the same attention as other constraints to growth of SMEs like access to finance, markets, technology or training.

Accessing business information services has over the years been greatly enhanced with the emergence of various information and communication technologies. In developed countries, because of well-developed information and communication technologies (ICTs) infrastructure and easy access to computer hardware and software, SMEs enjoy easy access to business information services. In developing economies there are many challenges regarding ICTs infrastructure and the cost of IT hardware and software. This in itself has created many problems in the area of business information services for the SMEs sector. As governments and business

service providers try to address the many challenges facing the SME sector, it is also important that the present use of ICTs in accessing business information services be identified in order to provide more development support in this area (Levy, 2000).

### 2.3.2 Access to finance on performance of SMEs

Lack of access to credit/ finance is almost universally indicated as a key problem for SMEs. Credit constraints operate in variety of ways in Kenya where undeveloped capital market forces entrepreneurs to rely on self-financing or borrowing from friends or relatives which is not enough to enable SMEs undertake their business activities optimally. Lack of access to long-term

credit for small enterprises forces them to rely on high cost short term finance. There are various financial challenges that face small enterprises. They include the high cost of credit, high bank charges and fees. The scenario witnessed in Kenya particularly during the climaxing period of the year 2008 testifies the need for credit among the common and low earning entrepreneurs. Numerous money lenders in the name of Pyramid schemes came up, promising hope among the 'little investors,' which they can make it to the financial freedom through soft borrowing. The rationale behind turning to these schemes among a good number of entrepreneurs is mainly to seek alternatives and soft credit with low interest rates while making profits. Financial constraint remains a major challenge facing SMEs in Kenya (Wanjohi and Mugure, 2008).

Finding start-up finance for the business is the biggest hurdle that many entrepreneurs go through. Even after getting started, getting sufficient finance to sustain business growth is another problem. Research findings by McCormick et al (1996), Daniels et al (2003) Kinyanjui (2006) show how SMEs are constrained by finance. Studies undertaken by Kiiru, Mirero and Masaviru (1988) for Kenya Rural Enterprise Programme (K-Rep) confirm that a major constraint within the small business enterprise sector is financing. In the study carried in Nairobi among small manufacturing enterprises, Nyambura (1992) established that finance was rated among the biggest problem. In South Africa Eeden (2004) found finance as cited as one of the most prominent constraints. The problem related to finance includes lack of information on where to source for finance, restrictive lending offered by commercial banks, lack of access to finance, insufficient financing, lack of track record required by the banks, limited access to collateral, and the fact that financial institutions lack appropriate structure for dealing with SMEs.

Insufficient financing is as much a problem as lack of finance and as a result of scarcity of finance, small enterprises are unable to expand, modernize or meet urgent orders from customers. The profit Margins are usually little to support growth. Harper (1984) notes that businesses like grain millers and tailors are unable to compete with large manufactures of ready-made goods because they have to wait until a customer provides them with raw material or money to buy it. Some may be unable to get started until a customer pays the deposit, which will be used to buy the raw material.

Access to finance is essential for improving SME competitiveness, as SMEs have to invest in new technologies, skills and innovation. Access to finance issues cannot be resolved by implementing financing schemes or programs in a vacuum. There

are institutional issues covering a spectrum from the macro level to the micro level, which are accompanied by capacity deficiencies (Basil, 2005). A wide spectrum such as this may only be tackled by mainstreaming SME development in national frameworks. It is also noteworthy to add that effort to resolve access to finance issues is not solely the responsibility of governments. SMEs need to take a better initiative than pointing it out as their number one obstacle: they need to mobilize joint advocacy and recommendations, based on sound analyses, through their membership organizations. Most significantly, SMEs must implement sound business practices and continuously invest in good internal management systems: in accounting, planning, financial, operations and human resource management.

SMEs identify financing, especially medium to long-term finance, as their topmost obstacle to growth and investment. These obstacles come at two levels. In least developed economies, and in some transition and developing economies deficiencies in both the macroeconomic and microeconomic environments pose challenges: high budget deficits and unstable exchange rates and legal, regulatory and administrative environment poses major obstacles to access of SMEs to financing. In some economies, capital may just not be available, property rights regimes may not allow ownership of land, markets for transfer of immovable assets may be very underdeveloped, credit and collateral legislation may not allow certain assets that SMEs commonly have access to, to be used as collateral, absence of registries for mortgages and pledges may increase risks to lenders, contract enforcement and asset liquidation may be hampered due to weaknesses in legislation and in the judiciary (Kinyanjui, 2006).

The obstacles may be due to organizational capacity weaknesses: For example, in least developed economies, business services markets in accounting, auditing, financial management and legal counsel may be so underdeveloped that SMEs may not be able to access or afford such services: essential services they would need when they approach banks and other types of lenders. In more advanced developing countries, where there is reasonable progress in the fundamental institutions, SMEs may still face challenges in accessing formal finance in the form of bank loans, guarantees, venture capital and leasing. For instance, although SMEs are by far the largest group of customers of commercial banks in any economy, loans extended to SMEs are often limited to very short periods, thereby ruling out financing of any sizable investments. Moreover, due to high-perceived risks in SME loans, access to competitive interest rates may also limit.

In many developing economies, banks prefer to lend to governments, which offer less risk and higher returns, crowding out most of the private sector from the financial system. The problem related to finance includes lack of information on where to source for finance, restrictive lending offered by commercial banks, lack of access to finance, insufficient financing, lack of track record required by the banks, limited access to collateral, and the fact that financial institutions lack appropriate structure for dealing with SMEs. As a result of scarcity of finance, small enterprises are unable to expand, modernize or meet urgent orders from customers. Capital is therefore necessary for the long-term survival and growth of small enterprises. It should also be noted that more money than required can be much of a problem

as less money. More money means high cost for money in terms of interest and may also lead to un-worthwhile investments.

Most studies (Ngobo, 1995; Kibera and Kiberam, 1997; Chijoriga and Cassiman, 1997), point to finance as one of the key constraints to small enterprise growth. This is worsened by the absence of financial markets in the developing countries. Small enterprise owners cannot easily access finance to expand business and they are usually faced with problems of collateral, feasibility studies and the unexplained bank charges. This means that they cannot access finance to enable them to grow. Ngobo (1995), makes a detailed analysis of finance as a constraining factor and includes collateral, interest rates, extra bank charges, inability to evaluate financial proposals and lack of financial management skills as hindrances to small enterprise growth. Under developed financial markets impose additional constraints. There are no financial instruments and no independent financial sources that are market driven.

Lack of access to credit/ finance affects technology choice by limiting the number of alternatives that can be considered. Many SMEs may use inappropriate technology because it is the only one they can afford. In some cases, even where credit is available, the entrepreneur may lack freedom of choice because the lending conditions may force the purchase of heavy, immovable equipment that can serve as collateral for the loan. Credit constraints operate in variety of ways in Kenya where undeveloped capital market forces entrepreneurs to rely on self-financing or borrowing from friends or relatives. Lack of access to long-term credit for small enterprises forces them to rely on high cost short term finance.

### **2.3.3 Availability of Managerial experience on performance of SMEs**

Many SMEs owners or managers lack managerial training and experience. The typical owner or managers of small businesses develop their own approach to management, through a process of trial and error. As a result, their management style is likely to be more intuitive than analytical, more concerned with day-to-day operations than long-term issues, and more opportunistic than strategic in its concept (Hill, 1987). Although this attitude is the key strength at the start-up stage of the enterprise because it provides the creativity needed, it may present problems when complex decisions have to be made. A consequence of poor managerial ability is that SMEs owners are ill prepared to face changes in the business environment and to plan appropriate changes in technology.

Majority of those who run SMEs are ordinary lot whose educational background is lacking. Hence they may not well be equipped to carry out managerial routines for their enterprises (King & McGrath, 2002). Management skills relate to the owner/manager and the enterprise. Bennet (1997) defines management as concerned with the deployment of material, human and finance resources with the design of organization structure. Haimann (1977) looks at management as a process of getting tasks accomplished with and through people by guiding and motivating their efforts.

Cant and Lightelm (2003) in a survey of small business failure maintain that entrepreneurs often have good ideas and are competent but they do not have a clue on how to run a business and have no underlying appreciation of business fundamentals. Pro-

fessional experience has been cited as an important factor affecting many aspects of entrepreneurial firms. Experience takes many guises and breadth of experience is shown to be an important factor driving the performance of firms, with the number of previous jobs positively related to new firm performance (Lumpkin & Marvel 2007). Thapa (2007) found a positive association between education and small business success. The likelihood of failure was also found to be associated with the owner/manager's work experience prior to business launch and education. Human capital is the most critical agent of SME performance. The recruitment of academically qualified employees is a necessary start for sustainable human capital development in all organizations. Human capacity has become a critical index of competition in the world of business to the extent that the development of such capacities through training has become top priority in designing the strategic plan of business organizations (Tim & Brinkerhoff, 2008).

Education and skills are needed to run micro and small enterprises. Research shows that majority of the lot carrying out micro and small enterprises in Kenya are not quite well equipped in terms of education and skills. Studies suggest that those with more education and training are more likely to be successful in the SME sector (King & McGrath, 2002). As such, for small businesses to do well in Kenya, people need to be well informed in terms of skills and management. SMEs in ICT appear to be doing well with the sprouting of many commercial colleges offering various computer applications. Further, studies show that most of those running SMEs in this sector have at least attained college level education (Wanjohi & Mugure, 2008).

Management is therefore necessary to enable group or business goals to be accomplished through the functions of planning, staffing, directing, controlling activities, coordination and directing. Personal characteristics of the owner/manager were interpreted by Larson and Clute (1979) as lack of experience among small business managers who happen to be the owners leading to poor performance and consequently to business failure. Bamback and Lawyer (1979) also identified poor management as the root cause of many failings and poor performance of small business. Nzioka (1995) in the role of education in business performance notes that one of the things that hold back the development of small – business is the need for better management.

Good management means need for proper planning, control, organizing skills and proper staffing with qualified and competent employees.

Harper (1984) observes that the poor growth of many enterprises of all sizes, suggest that the scarcity of competent managers is a more serious constraint on economic development. As the enterprise becomes larger, the more need for managers to plan, coordinate and control the activities of the enterprise. The owner who is likely to be the manager of the small enterprise may not have the training, skills and experience to steer the operations of the business successfully hence affecting business performance. He/she may operate in a very rigid environment sometimes not dictated by sound business and management decision but by social and cultural norms. The inability to keep proper records, to separate business operations from personal, manage cash flow and growth is likely to affect business performance.

The informal sector has proved that it can be a factor that can boost economic growth in Kenya. In this sector, practical

skills are being developed at low cost and with financial support, various types of small scale technology could be developed for labour-intensive enterprises that could absorb hundreds of young job seekers. However, those who run the businesses in this sector lack adequate business skills mainly attributed to low levels of education. It is not sufficient to know how to produce a high quality product. The producer must also know how to sell it effectively and how to control the financial side of the business and in doing that the entrepreneur must be skilled in business (Wanjohi, 2009).

#### **2.3.4 Access to infrastructure**

The inadequacy of the physical infrastructure is a principle cause of low levels of investment and unsatisfactory performance of small and micro enterprises. The economic recovery strategy paper, 2003 has identified poor infrastructure as a critical factor that constrain profitable business in Kenya. The infrastructure problem includes poor state of roads, inaccessibility to land, work space, electricity and utility. Lack of allocation of suitable land to SMEs in most urban and rural areas is a major impediment to growth and development. Inaccessibility to land and lack of property rights hamper access to infrastructure and utilities by line SMEs (Nteere, 2012).

Ombura (1997) points out that infrastructure networks are useful instruments within network economies. Infrastructure and related services help to make things happen, it feeds and it is fed by trade, it fuels foreign direct investment, it backs up the creation and sustainability of industrial clusters, it cuts costs and raises competitiveness. A spatial planning approach ensures the most efficient use of land by balancing competing demands within the context of sustainable development (Rozee, 2003). It becomes an ongoing, enduring process of managing change by a range of actors, in the interests of sustainable development (Tewdwr, 2004). This makes efforts to promote industrial development extremely urgent and rural focused (Kinyua, 2012).

#### **2.3.5 Government regulations on performance of SMEs**

The current constitutional framework and the new Micro and Small Enterprise Act 2012 (MSE Act 2012) provide a window of opportunity through which the evolution of SMEs can be realized through the devolution framework. However, the impact of devolution of SMEs development depends on the architecture of the regulatory and institutional framework inclined to support SMEs in an economy (Kigguddu, 2000). Research by Harper (2004) observes that governments that are not concerned with the promotion of small enterprises should examine the impact of its policies and programmes on the small businesses. Mann et al (1984) makes a similar observation that government regulation about wages, taxation, licensing and others are among the important reasons why the informal sector business develops. Without careful attention, government policies could crush the small business sector in any economy.

Government policies should aim to encourage and promote the development of local technologies. Emphasis should be on the promotion of the local tool industry to reduce reliance on imports. SMEs are said to face a "liability of smallness." Because of their size and resource limitations, they are unable to develop new technologies or to make vital changes in existing ones. Still, there is evidence that SMEs have the potential to initiate minor technological innovations to suit their circumstances. However, for SMEs to fully develop and use this potential, they need spe-

cific policy measures to ensure that technology services and infrastructure are provided. (Wanjohi, 2009). Policy initiatives in revitalizing the SME sub-sector should not be only government engineered, but all the stakeholders in development arena should take frontline.

#### **2.3.6 Performance of SMEs**

Earlier studies have shown that several factors affect performance in SMEs. The major factor has been shown as lack of capital and financial resources. However, Dia (1996) found that additional capital and finance can be overcome through innovation and creativity. Kallon (1990) also found out that access to commercial credit did not contribute to entrepreneurial success in any significant way. Some researchers argue that small businesses are undercapitalized. Business owners in Africa tend to depend upon their own family savings and access to capital remains a challenge. Most of them cannot meet the requirements for commercial loans, and those who do find such loans expensive.

Administrative problems have been cited as a major cause of business failure. Kazooba (2006) found that poor record keeping and lack of basic business management experience and skills were major contributors. Other factors identified are inexperience in the field of business particularly lack of technical knowledge, lack of managerial skills, inadequate planning and failure to do market research (Lusier, 1996, Mahadea & Murphy 1996).

Ntakobajira (2013) exploring performance of SMEs concludes that access to business information services affected the performance of business to a great extent and that access to finance affected performance of SMEs because it limited the entrepreneurs' ability to take advantage of opportunity as and when they arose. The study further concludes that technology affected the businesses to a very great extent by facilitating communication with both the supplier and customers, by easing the transportation of goods and by easing the marketing of the products.

#### **2.4 Empirical Review**

A study by Mwanja, (2011) on the effect of Biashara Boresha Loan (BBL) on Performance of Micro and Small enterprises owned by Kenya Commercial Bank (KCB) Ruiru branch customers with objectives to review the lending procedures of biashara boresha loan, to assess the effect of BBL on MSEs performance and to find out the challenges faced in lending to SMEs, found out that besides BBL, there are other factors believed to have an effect on business performance. It also found no conclusive results on the relationship between entrepreneurs' level of education and business performance. Of the 51% respondents who received training in their areas of business, 49.5% reported that their businesses were doing well, concluding that relevant training can produce positive results in the running of businesses. Mwanja concluded that infant businesses need support in their early years when their motivation is high and innovation is low and that collateral requirements at KCB Ruiru should be made a bit flexible and repayment period should be increased to at least a year because SMEs only manage to access a small amount of loan due to short repayment periods. 53% of BBL customers interviewed felt the process was cumbersome. Some felt that after availing all the required documentation, the turnaround time was not acceptable. 52% of the entrepreneurs utilized the loan advanced 100% for working capital and their revenue increased from previous thus boosting the business performance. 11.9% diverted the amounts advanced and they con-

fessed as having difficulties in meeting their repayments on time. They also saw their sales turnover decrease from the previous due to the increase in operating costs brought about by the interest rates on the loans advanced.

The study also found a positive correlation between BBL and entrepreneurs business performance and concluded that young businesses require more support financially to supplement their working capital. The study recommended that Kenya Commercial bank had a few issues to address such as lending procedures, collateral requirements and repayment period to ensure better customer satisfaction and that further research should be done on entrepreneur's competencies, competition, government regulations etc.

Another study by Gathitu (2007) on Factors affecting performance of entrepreneurs in privately run secondary schools in Thika had objectives, to find out factors that entrepreneurs consider important when locating a business, to identify the resources and facilities entrepreneurs consider important for a secondary school, to determine the performance of private secondary school owned by professional teachers, to investigate whether those schools owned by professional teachers are more successful than the rest, to investigate the marketing strategies used by entrepreneurs in private schools, to investigate the problems faced by entrepreneurs in secondary schools and what entrepreneurs thought could solve these problems. The study found out that many entrepreneurs do not assess the need when locating a school, but are mainly attracted to their location by personal convenience. It also found out that marketing strategies used were wanting and that most entrepreneurs appear to have more charity like objectives than business, which explains why their enterprises are not doing well. The study recommended that the government should have a policy change to encourage more entrepreneurs to start private schools. The study notes that the government is the main beneficiary of private schools as their presence would go a long way in reducing its fiscal burden in education. The entrepreneurs should also be more aggressive in marketing their schools. Many location decisions are based on personal preferences that could mean that a business owner will locate a business within proximity. It is important though for an entrepreneur to eliminate personal preferences that are emotional other than rational (Gichira & Dickson, 1991). It is very important for a business to be near market areas in order to serve the customers. A business owner must study the market and find out who is interested in buying your service or product. Since almost all businesses need to have extra hands apart from the owner, it therefore needs to be located close to workers you need. Some areas especially the remote areas do not attract workers. Some communities will seek development and will welcome new business ventures while others will be hostile. Where the community is hostile, the location should be avoided as it affects the business negatively (Gichira & Dickson, 1991).

Kinyua (2014), researching on factors affecting the performance of small and medium enterprises in the Jua Kali Sector in Nakuru town, Kenya with objectives to investigate the role of finance, management skills, macro-environment factors and infrastructure on performance of small and medium-sized enterprises in the Jua Kali sector in Nakuru town. The findings indicated that; that access to finance had the potential to positively affect performance of SMEs; management skills were found to

positively and significantly affect performance of SMEs; macro environment factors were found to significantly affect performance and Infrastructure did not significantly affect performance of SMEs in the study area. The study results also indicated that as number of years in operations increased the performance in SMEs increased. The study recommended that banks should improve access to finance through offering better lending terms and conditions and collateral requirements; focus on acquiring appropriate management skills such as financial, marketing and entrepreneurial skills and effectively strengthen the macro environment in order to increase SMEs performance.

A study by Mugo (2012) to investigate factors affecting women entrepreneurs' performance in Central Business District (CBD) of the city of Nairobi, had the objectives, to assess the financial accessibility, assess the effect of record keeping challenges, to establish effect of budgeting on financial factors affecting women entrepreneurs' performance, and to establish the effect of working capital management on the women entrepreneurs' performance. The study also identifies other factors affecting performance of women entrepreneurs as, lack of entrepreneurial training and education, outdated technology on women, poor access to markets, mismanagement of resources by women, lack of management skills and fraud. The study identifies finance as the major impediment affecting performance of women entrepreneurs. It recommends that banks should develop a product for women entrepreneurs that is special to allow them access loans. It further recommends that government should offer business training to women and that it should have good policies in support of women entrepreneurs. The study advocates for women education through seminars to help them keep proper records which shows proper business operation, and help them assess the business margins and mark-up to weigh the rate of business returns on their own.

## 2.5 Critique of Existing Literature Relevant to the Study

The study agrees with Mwanja, (2011); Mugo (2012) and Kinyua, (2014) that finance affects performance of SMEs. Finance aspect is key in any business and most of the reviewed studies do talk about it. But it is notable that finance alone cannot make entrepreneurs successful. It must be in uniformity with the person's will to succeed in business and the training in the field in which the enterprise is set. The above studies ignore the aspect of government as a regulator of the business environment and the fact that enterprises do not gain their full potential when they do not comply with set laws and regulations. This makes them target to harassment and exploitation by law enforcers which in the long term is expensive, disrupts business and affects its performance.

SMEs continue to be hailed as a huge employer in the Kenyan economy. However, the entrepreneurs still continue to languish in poverty since most of them do the businesses for their survival. Many SMEs though operational stagnate at one stage for many years, performing dismally and employing only the owner. This means that such SMEs die when the owners die. No legacy and perpetuity is expected when performance in these SMEs is negligible.

## 2.6 Research Gap

A lot of research has been carried out locally and internationally reviewing small and micro enterprises. Most of these research concentrate on businesses in the cities and urban cen-

tres. They also concentrate on their study areas based on their own objectives. There is scarcity of literature touching on the rural traders. Therefore, the proposed study will build on the local literature on factors that affect performance of rural market traders. Similar studies have focused on the challenges faced by SME traders but this study will concentrate on what affects their performance. The impact of access to business information, access to finance and availability of managerial experience are yet to be researched as a single intervention in a rural setting. This study will concentrate mainly on the factors that affect performance of vendors in Limuru market of Kiambu County, Kenya. The scarce availability of reliable and valid data continues to be one of the key obstacles in understanding small and micro entrepreneurs in the rural Kenya. This study will help to build on the locally scarce available data.

**2.7 Summary**

The study is on the factors affecting performance of small and micro enterprises in Limuru town market of Kiambu County. The theories used to explain the study are the balanced score card theory and the sociological theory. The studies quoted are Mwanja, (2011) on the effect of Biashara Boresha Loan (BBL) on Performance of Micro and Small enterprises owned by Kenya Commercial Bank (KCB) Ruiru branch customers; Gathitu (2007) on Factors affecting performance of entrepreneurs in privately run secondary schools in Thika; Kinyua, (2014) on factors affecting the performance of small and medium enterprises in the Jua Kali Sector in Nakuru town, Kenya and a study by Mugo (2012), to investigate factors affecting women entrepreneurs' performance in Central Business District (CBD) of the city of Nairobi.

III. METHODOLOGY

**3.1 Introduction**

This chapter presents the research methodology adopted in conducting the study in order to achieve the study's objective which is to find out the factors that affect the performance of small and micro enterprises in Limuru town market of Kiambu County. The chapter is thus structured into research design, target population and sample, data collection and data analysis.

**3.2 Research Design**

Research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure (Kothari, 2004). The study adopted a descriptive design because the study seeks to answer the why, how and when of the problem under study. There are a number of advantages of descriptive research, however the two main benefits of this research method is being able to use various forms of data as well as incorporating human experience. It gives researchers the ability to look at whatever they are studying in so many various aspects and can provide a bigger overview as opposed to other forms of research.

Descriptive research involves field survey where the researcher goes to the population of interest to ask certain issues about the problem under the study. Mugenda and Mugenda (2003) describe descriptive research design as a systematic, empirical inquiring into which the researcher does not have a direct control of independent variable as their manifestation has already occurred or because they inherently cannot be manipulated. In-

ferences about relationships between variables are made from concomitant variables.

The research design was a survey conducted on a sample of small and medium sized enterprises (SMEs) within the Limuru market, Kiambu County. According to Owens (2002), survey research design has the advantage of uniqueness since information gathered is not available from other sources, having unbiased representation of population of interest and standardization of measurement as same information is collected from every respondent.

**3.3 Target Population**

The target population consisted of all the SMEs operating within the Limuru Market in Kiambu County. From the records of Limuru Sub-county of Kiambu County, there are 965 registered business operators in Limuru town Market. The businesses in operation are mainly in cereals, fruits, beverages, vegetables and poultry. This is as shown in table 3.1 below:

**Table 3.1 Target Population**

| Category     | Frequency  |
|--------------|------------|
| Cereals      | 300        |
| Fruits       | 280        |
| Tubers       | 104        |
| Vegetables   | 229        |
| Poultry      | 52         |
| <b>Total</b> | <b>965</b> |

**3.4 Sample size and sampling technique**

The section discusses the sampling technique and how the sample size is arrived at. The sampling design refers to the sampling method used to arrive at the sample size.

**3.4.1 Sample size**

According to Mugenda and Mugenda (2003), a sample of 10-30% is good enough if well chosen and the elements in the sample are more than 30. Mugenda and Mugenda (2003) further explains a simplified formula for calculating sample size of a population that is less than 10,000 as below:

$$n = \frac{1 + n/N}{1 + 384/965} = 274$$

Where:  $n_f$  = the desired sample size when the population is less than 10,000  
 $n$  = the desired sample when the population is more than 10,000  
 $N$  = the estimate of the population size

This gives a sample size of 274 respondents as indicated in the table 3.2 below. The sampling frame included: cereals, fruits, tubers, vegetables and poultry.

**Table 3.2 Sample size**

| Category | Frequency | Sample portion | Sample size |
|----------|-----------|----------------|-------------|
|----------|-----------|----------------|-------------|

|              |            |            |            |
|--------------|------------|------------|------------|
| Cereals      | 300        | 28%        | 84         |
| Fruits       | 280        | 28%        | 79         |
| Tubers       | 104        | 28%        | 29         |
| Vegetables   | 229        | 28%        | 67         |
| Poultry      | 52         | 28%        | 15         |
| <b>Total</b> | <b>965</b> | <b>28%</b> | <b>274</b> |

**3.4.2 Sampling technique**

The study applied stratified sampling technique where 28% of the population in each sampling frame was selected to participate in the study. For the exact individuals to participate in the study, the researcher used simple random sampling technique as it offers every member of the population an equal chance of being included in the sample.

**3.5 Research instrument**

The study employed the use of questionnaires to collect primary data. Gall and Borg (1996) points out that, questionnaires are appropriate for studies since they collect information that is not directly observable as they inquire about feelings, motivations, attitudes, accomplishments as well as experiences of individuals. They further observe that questionnaires have the added advantage of being less costly and using less time as instruments of data collection. The questionnaire, which was semi-structured, was administered through drop and pick-later method to the sampled population.

**3.6 Data collection procedure**

The researcher administered the questionnaires to the relevant respondents in an effort to achieve the necessary information. Research assistants were used to assist the researcher in gathering the information. The assistants were trained and understood the research study and what was expected of them. The research assistants were trained on the aspects of the questionnaire and on how to handle the respondents to ensure that ethical considerations were observed. Self-administered questionnaires allow the participants to respond to the questions by themselves and at their own pace. They ease the respondents' burden by giving them the time to think through their responses (Monsen & Horn, 2008).

**3.7 Data Analysis and Presentation**

**3.7.1 Data Analysis**

The questionnaire was checked for completion. Mugenda & Mugenda (2003) assert that data obtained from the field in raw form is difficult to interpret unless it is cleaned, coded and analyzed. Qualitative analysis consisted of examining, categorizing, tabulating and recombining evidences to address the research questions. Qualitative data was grouped into meaningful patterns and themes that are observed to help in the summarizing and organization of the data. Quantitative analysis was analyzed through the use of statistical techniques such as frequency counts, percentages, arithmetic means, modes, pie charts and tabulation to show differences in frequencies. Qualitative data was analyzed descriptively. Bar charts were used to display nominal or ordinal data. Statistical Package for Social Sciences (SPSS) versions 21.0 were used to aid in coding, entry and analysis of quantitative data obtained from the closed ended questions.

The study used multivariate regression analysis to establish relationship between the independent variables and the dependent variable by use of the following regression:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \epsilon$$

Where;

Y = Business performance (Dependent Variable)

X<sub>1</sub> – X<sub>4</sub> – Independent Variables

X<sub>5</sub> – Moderating Variable

X<sub>1</sub> = Business Information Services

X<sub>2</sub> = Access to Finance

X<sub>3</sub> = Availability of Management Experience

X<sub>4</sub> = Access to Infrastructure

X<sub>5</sub> = Government Policy and Regulations (Moderating Variable)

β<sub>0</sub> = Co-efficient of the model

β<sub>1</sub> – β<sub>5</sub> = Beta Co-efficients of Determination

ε = Stochastic Error Term

**3.7.2 Data Presentation**

Quantitative data was presented through the use of statistical techniques such as bar charts, pie charts, percentages and frequency counts. Qualitative data was presented descriptively.

**IV. FINDINGS AND DISCUSSION**

**4.1 Introduction**

This chapter presents the analysis, presentation, discussion and interpretation of the data collected from the administered questionnaires. The collected data was edited and cleaned for completeness in preparation for coding. Descriptive statistics such as mean and standard deviation were used to analyze the data. Regression analysis was used to test the relationship between the variables under study in relation to the objectives of the study. Analysis of variance (anova) was used to confirm the findings of regression.

**4.2 Results of the Pilot study**

**4.2.1 Data Reliability**

To test the reliability of the Likert scale used in this study, reliability analysis was done using Cronbach's Alpha as the measure. A reliability co-efficient of α ≥ 0.7 was considered adequate. In this case, a reliability co-efficient of 0.805 was registered indicating a high level of internal consistency for the Likert scale used as shown in table 4.2 below.

**Table 4.1 Cronbach's Alpha**

| Reliability Statistics |  |            |
|------------------------|--|------------|
| Cronbach's Alpha       | Cronbach's Alpha Based on Standardized Items | N of Items |

| Reliability Statistics |  |            |
|------------------------|--|------------|
| Cronbach's Alpha       | Cronbach's Alpha Based on Standardized Items | N of Items |
| 0.805                  | 0.767  | 24         |

### 4.3 Demographic Information

#### 4.3.1 Response rate

A total of 274 questionnaires were administered and the study managed to obtain 161 completed questionnaires representing 58.76% response rate. The questionnaires contained questions that addressed the objectives of the study. The objectives of the study were: To establish the influence of access to business information on performance of small and micro enterprises in Limuru town market of Kiambu County; To examine the effect of access to finance on performance of small and micro enterprises in Limuru town market of Kiambu County; To determine the effect of availability of managerial experience on performance of small and micro enterprises in Limuru town market of Kiambu County and To determine the effect of access to infrastructure on performance of small and micro enterprises in Limuru town market of Kiambu County. The response rate is as shown in Table 4.1.

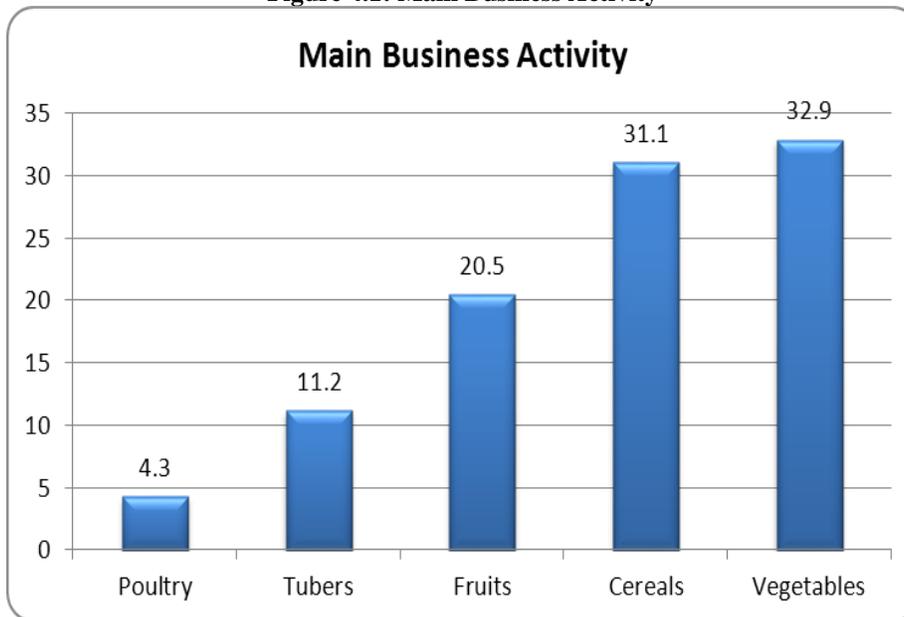
| Response rate | Frequency | Percentage |
|---------------|-----------|------------|
| Completed     | 161       | 58.76%     |
| Incomplete    | 113       | 41.24%     |
| Total         | 274       | 100        |

#### 4.3.2 Main Business Activity

The study sought to know the business activities the respondents' of Limuru town market were involved in. The study established that most (32.9%) of the respondents' were vegetable dealers followed by 31.1% of the respondents who dealt in cereals and then 20.5% of the respondents who sold fruits. Only 4.3% of the respondents' were poultry dealers. This indicates that the study sought answers from respondents' who engaged in different business activities. The findings are as shown in Figure 4.1;

Table 4.2: Response Rate

Figure 4.1: Main Business Activity



#### 4.3.3 Years of Existence

The study sought to know the number of years the businesses had been in existence. The study established that most (42.2%) of the businesses had been in existence for more than 10 years followed by those in existence for 8-10 years at 20.5% and then those with 5-7 years of existence at 15.5%. Only 8.7% had been in existence for 2-4 years. This indicates that the businesses

have been around long enough to understand the issues sought by the researcher. The findings are as shown in Table 4.3

Table 4.3 Years of Existence

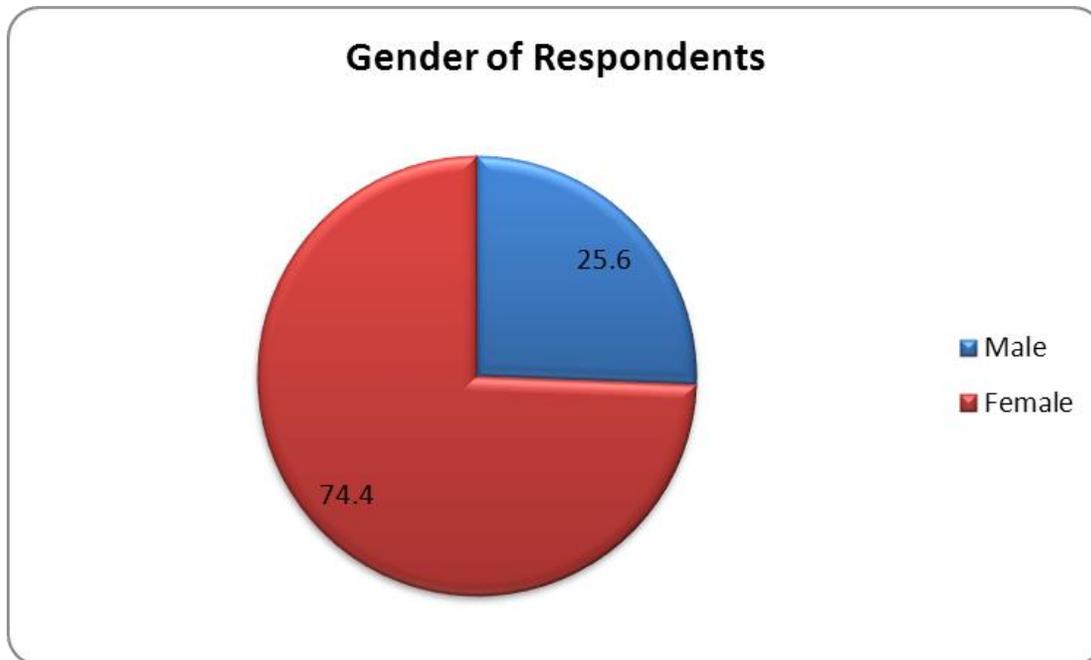
| Frequency | Percent |
|-----------|---------|
|-----------|---------|

|                    |            |              |
|--------------------|------------|--------------|
| More than 10 years | 68         | 42.2         |
| 8-10 years         | 33         | 20.5         |
| 5-7 years          | 25         | 15.5         |
| Less than 2 years  | 21         | 13.1         |
| 2-4 years          | 14         | 8.7          |
| <b>Total</b>       | <b>161</b> | <b>100.0</b> |

The researcher sought and obtained the gender details of respondents who participated in the research. Majority (74.4%) of the respondents were female while 25.6% were male. This is an indication that the researcher observed gender balance in the administration of questionnaires. It also implies that most of the respondents' in Limuru Town market are female. The study findings are as shown in Figure 4.2

**4.3.4 Gender of the Respondents**

**Figure 4.2 Gender of the Respondents**

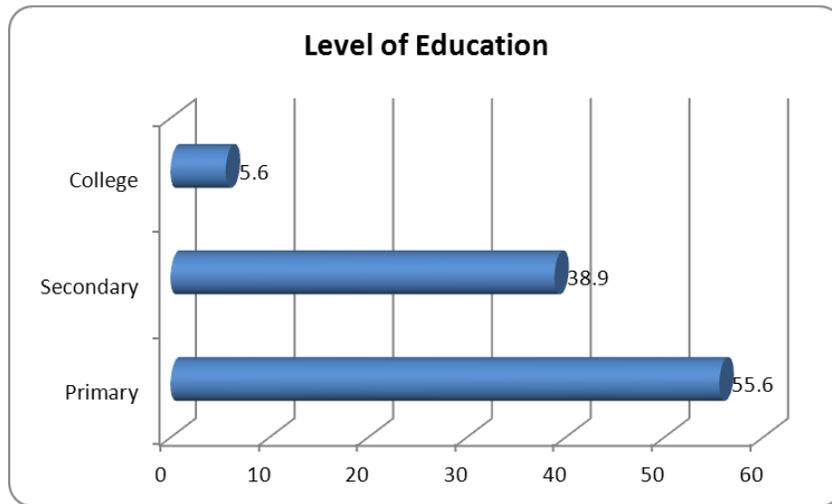


**4.3.5 Level of Education**

The respondents were further requested to indicate their highest level of education. It is important to consider the level of education of the respondents because it has an impact on the way the respondents interpret the questions. The study found out that

majority (55.6%) of the respondents were primary school leavers while 38.9% were secondary school leavers. Those who had a college level of education were the least at 5.6%. The study findings are shown in figure 4.3 below.

**Figure 4.3: Level of Education**



**4.3.6 Number of Employees**

The study further sought to know the size of the businesses at Limuru Town market by virtue of the number of employees each had. The study established that 97% of the businesses had 0-5 employees followed by those who had 6-10 employees at 1.8% and those with 11-15 employees at 1.2%. This indicates that most of the businesses in Limuru Town market are micro businesses of less than 5 employees. The results are shown by Table 4.4 below.

**Table 4.4: Number of Employees**

|              | Frequency  | Percent    |
|--------------|------------|------------|
| 0-5          | 156        | 97.0       |
| 6-10         | 3          | 1.8        |
| 11-15        | 2          | 1.2        |
| <b>Total</b> | <b>161</b> | <b>100</b> |

**4.3.7 Source of Initial Capital**

The study further requested the respondents' to indicate where they obtained their initial capital from. The study established that majority (75.2%) of the businesses obtained their initial capital from personal savings followed by 11.8% of the respondents who obtained their initial capital from family members. Only 1.9% obtained their capital from bank loans. This implies that most respondents obtain their initial capital from sources that attract little or no interest rates. The study findings are as shown in Table 4.5 below.

**Table 4.5: Source of Initial Capital**

|                  | Frequency  | Percent    |
|------------------|------------|------------|
| Personal savings | 121        | 75.2       |
| Family           | 19         | 11.8       |
| Relatives        | 16         | 9.9        |
| Bank loans       | 3          | 1.9        |
| Others           | 2          | 1.2        |
| <b>Total</b>     | <b>161</b> | <b>100</b> |

**4.4. Business Information Services**

In this section, the researcher sought to know the extent to which Business Information Services affected the performance of Micro and Small Enterprises in Limuru Town Market. The extent was measured on a Likert Scale of 1-5 where 5- To a very great extent, 4- To a Great Extent, 3- To a Moderate Extent, 2- Small Extent, and 1- No extent. Interpretation was done as follows: 1-1.5: No extent; 1.6-2.5: Small Extent; 2.6-3.5: Moderate Extent; 3.6-4.5: Great Extent and 4.6 - 5.0: Very Great Extent. The results of the study are as shown in Table 4.5 below;

**Table 4.5: Effect of Business Information Services**

|   | Mean        | Std. Deviation |
|---|-------------|----------------|
| Access to business information affects performance of my business               | 2.95        | 1.85           |
| Business information is readily available in this market                        | 1.51        | 1.06           |
| The information available is relevant to our business                           | 1.42        | 0.91           |
| The information available informs us of the changes in the business environment | 1.39        | 0.90           |
| The information necessary for the business is availed on time                   | 1.31        | 0.86           |
| <b>Overall Mean</b>   | <b>1.72</b> | <b>1.12</b>    |

The study established that access to business information affects performance of businesses at Limuru Town Market to a moderate extent ( $M= 2.95, SD= 1.85$ ). Business information was only readily available at the Limuru Town Market only to no extent at all ( $M=1.51, SD= 1.06$ ) and the available information was not relevant ( $M= 1.42, SD= 0.91$ ). Further, the information available does not inform the respondents of the changes in the business environment ( $M= 1.39, SD= 0.90$ ) nor does it get availed on time ( $M= 1.31, SD= 0.86$ ). The standard deviations recorded indicate the extent to which the respondents' opinions about the statements on business information varied. The re-

spondents' differed more on the statement in regard to whether access to business information affects performance of businesses ( $SD= 1.85$ ) while they differed less on the statement that the information necessary for the business is availed on time ( $SD= 0.86$ ). Overall, the business information services at Limuru Town Market affected the performance of businesses only to a small extent ( $M= 1.72, SD= 1.12$ ).

#### 4.5 Access to Finance

The researcher further sought to know the extent to which access to finance affected the performance of Micro and Small Enterprises in Limuru Town Market. The extent was measured on a Likert Scale of 1-5 where 5- To a very great extent, 4- To a Great Extent, 3- To a Moderate Extent, 2- Small Extent, and 1- No extent. Interpretation was done as follows: 1-1.5: No extent; 1.6-2.5: Small Extent; 2.6-3.5: Moderate Extent; 3.6-4.5: Great Extent and 4.6 - 5.0: Very Great Extent. The results of the study are as shown in Table 4.6 below;

**Table 4.6: Effect of Access to Finance**

|  | Mean        | Std. Deviation |
|--|-------------|----------------|
| Accessibility to capital exposes my business to better opportunities | 4.43        | 1.38           |
| Accessibility to capital has led to improved business performance    | 4.37        | 1.16           |
| Accessibility to capital for my business is very challenging         | 4.18        | 1.29           |
| <b>Overall Mean</b>  | <b>4.33</b> | <b>1.08</b>    |

The study established that access to capital exposes businesses in Limuru Town Market to better opportunities to a great extent ( $M= 4.43, SD= 1.38$ ) while it also leads to improved business performance to a great extent ( $M= 4.37, SD= 1.16$ ). The study also found out that access to capital for businesses is very challenging to a great extent ( $M= 4.18, SD= 0.69$ ). Overall, access to finance affected the performance of business at Limuru Town Market to a great extent ( $M= 4.33, SD= 1.08$ ). The standard deviation indicated that the responses were not necessarily clustered around the mean but were dispersed.

#### 4.6 Availability of Managerial Experience

In this section, the researcher sought to know the extent to which Availability of Managerial Experience affected the performance of Micro and Small Enterprises in Limuru Town Market. The extent was measured on a Likert Scale of 1-5 where 5- To a very great extent, 4- To a Great Extent, 3- To a Moderate Extent, 2- Small Extent, and 1- No extent. Interpretation was done as follows: 1-1.5: No extent; 1.6-2.5: Small Extent; 2.6-3.5: Moderate Extent; 3.6-4.5: Great Extent and 4.6 - 5.0: Very Great Extent. The results of the study are as shown in Table 4.7 below;

**Table 4.7 Effect Availability of Managerial Experience**

|  | Mean        | Std. Deviation |
|--|-------------|----------------|
| Availability of managerial skills and experience affects my business | 3.89        | 1.35           |
| Training on managerial skills are required in my business            | 3.62        | 1.54           |
| I get training on business management skills frequently.             | 2.37        | 1.49           |
| <b>Overall Mean</b>  | <b>3.30</b> | <b>1.45</b>    |

The study established that availability of managerial skills and experience affects businesses at Limuru Town Market to a great extent ( $M= 3.89, SD=1.35$ ) while training on managerial skills are required in the businesses to a great extent ( $M= 3.62, SD=1.54$ ). Further, the respondents reported that they do not get trainings on business management skills frequently ( $M= 2.37, SD= 1.49$ ). Overall, availability of managerial experience affected business performance only to a moderate extent ( $M= 3.30, SD= 1.45$ ). However, there were variations in the responses as evidenced by the standard deviations shown along side.

#### 4.7 Access to Infrastructure

In this section, the researcher sought to know the extent to which Access to infrastructure affected the performance of Micro and Small Enterprises in Limuru Town Market. The extent was measured on a Likert Scale of 1-5 where 5- To a very great extent, 4- To a Great Extent, 3- To a Moderate Extent, 2- Small Extent, and 1- No extent. Interpretation was done as follows: 1-1.5: No extent; 1.6-2.5: Small Extent; 2.6-3.5: Moderate Extent; 3.6-4.5: Great Extent and 4.6 - 5.0: Very Great Extent. The results of the study are as shown in Table 4.8;

**Table 4.8 Effect of Access to Infrastructure**

|   | Mean        | Std. Deviation |
|---|-------------|----------------|
| Good road network is available to us around Limuru market and its easy to bring our stock to the market | 4.16        | 1.09           |
| Infrastructure affects performance in our business  | 4.05        | 1.20           |
| The working space allocated is accessible   | 3.65        | 1.27           |
| The working space allocated is sufficient for our business  | 3.45        | 1.29           |
| There is sufficient light in the allocated working space  | 3.13        | 1.67           |
| Foot paths in the market are in good condition  | 3.06        | 1.51           |
| Toilets are available and are accessible in the market  | 2.81        | 1.41           |
| <b>Overall Mean</b>   | <b>3.47</b> | <b>1.35</b>    |

The study established that good road network is available to the business people around Limuru market and it's easy for them

to bring stock to the market to a great extent ( $M= 4.16, SD= 1.09$ ). The study also found out that infrastructure affects performance of businesses to a great extent ( $M= 4.05, SD= 1.20$ ). The respondents' also reported that the working space allocated to them is accessible to a great extent ( $M= 3.65, SD= 1.27$ ) and sufficient only to a moderate extent ( $M= 3.45, SD= 1.29$ ). Foot paths in the market are in good condition only to a moderate extent ( $M= 3.06, SD= 1.51$ ) while toilets are available and are accessible also only to a moderate extent ( $M= 2.81, SD= 1.41$ ). Overall, infrastructure affected performance only to a moderate extent though varying opinions were given by the respondents' as evidenced by the significant standard deviations.

#### 4.8 Government Policy and Regulations

In this section, the researcher sought to know the extent to which Government Policy and Regulations affected the performance of Micro and Small Enterprises in Limuru Town Market. The extent was measured on a Likert Scale of 1-5 where 5- To a very great extent, 4- To a Great Extent, 3- To a Moderate Extent, 2- Small Extent, and 1- No extent. Interpretation was done as follows: 1-1.5: No extent; 1.6-2.5: Small Extent; 2.6-3.5: Moderate Extent; 3.6-4.5: Great Extent and 4.6 - 5.0: Very Great Extent. The results of the study are as shown in Table 4.9;

**Table 4.9: Effect of Access to Infrastructure**

|   | Mean        | Std. Deviation |
|---|-------------|----------------|
| Government policy and regulations affects our business in Limuru market | 4.16        | 1.09           |
| <b>Overall Mean</b>   | <b>4.16</b> | <b>1.09</b>    |

The study established that government policy and regulations affects businesses in Limuru Town market to a great extent as evidenced by ( $M= 4.16, SD= 1.09$ ). However, the respondents' had varying opinions on the extent to which policy and regulations have on the businesses as evidenced by the significant value of more than one standard deviation.

#### 4.9 Business Performance

##### 4.9.1 Business Performance Measurement

The study sought to know how the respondents' measured the performance of their businesses. The study found out that majority (88.2%) of the respondents' measured the performance of their businesses using sales while 11.8% measured the performance of their businesses using number of customers as shown in Table 4.10. Further, 59.6% of the respondents' felt their method of measurement to be effective while 40.4% felt their method was very effective.

**Table 4.10: Business Performance Measurement**

|                           | Frequency | Percent |
|---------------------------|-----------|---------|
| Using sales               | 142       | 88.2    |
| Using number of customers | 19        | 11.8    |
| Total                     | 161       | 100.0   |

##### 4.9.2 Extent of Business Performance

The researcher sought to know the extent to which the Micro and Small Enterprises in Limuru Town Market were performing in relation to various performance parameters. The extent was measured on a Likert Scale of 1-5 where 5- To a very great extent, 4- To a Great Extent, 3- To a Moderate Extent, 2- Small Extent, and 1- No extent. Interpretation was done as follows: 1- 1.5: No extent; 1.6-2.5: Small Extent; 2.6-3.5: Moderate Extent; 3.6-4.5: Great Extent and 4.6 - 5.0: Very Great Extent. The results of the study are as shown in Table 4.11;

**Table 4.11: Extent of Business Performance**

|                     | Mean        | Std. Deviation |
|---------------------|-------------|----------------|
| Increase in sales   | 4.60        | 0.55           |
| Business expansion  | 4.41        | 0.89           |
| Customer retention  | 3.68        | 0.98           |
| Increase in stock   | 3.45        | 1.13           |
| Waste reduction     | 1.76        | 0.74           |
| Cost reduction      | 1.61        | 0.71           |
| <b>Overall Mean</b> | <b>3.25</b> | <b>0.83</b>    |

In relation to increase in sales, the respondents' rated their businesses to be doing well to a very great extent ( $M= 4.60, SD= 0.55$ ) while business expansion was rated to a great extent ( $M= 4.41, SD= 0.89$ ). The ratings on customer retention ( $M= 3.68, SD= 0.98$ ) and increase in stock ( $M= 3.45, SD= 1.13$ ) also indicated that the performance on those aspects was to a great extent and moderate extent respectively. Waste reduction ( $M= 1.76, SD= 0.74$ ) and Cost reduction ( $M= 1.61, SD= 0.71$ ) were the least rated performance parameters indicating they were rated to a small extent. Overall, the businesses in Limuru Town market were rated to be doing well to a moderate extent ( $M= 3.25, SD= 0.83$ ).

##### 4.9.3 Ways of Improving Business Performance

Lastly, the study sought to know the various ways through which the respondents can improve the performance of their businesses. Majority (70.2%) of the respondents' suggested access to finance as the greatest way of improving performance while 14.9% suggested management training and practice. Only 3.1% suggested improved access to information as a way of improving the businesses at Limuru Town Market. The results of the study are as show in Table 4.12;

**Table 4.12: Ways of Improving Business Performance**

|                                  | Frequency | Percent |
|----------------------------------|-----------|---------|
| Access to finance                | 113       | 70.2    |
| Management training and practice | 24        | 14.9    |
| Access to infrastructure         | 19        | 11.8    |

|                                |            |              |
|--------------------------------|------------|--------------|
| Access to business information | 5          | 3.1          |
| <b>Total</b>                   | <b>161</b> | <b>100.0</b> |

**4.10 Regression Analysis**

The researcher conducted a moderated regression analysis to explain the effect of various factors on the performance of businesses at Limuru Town Market. The scores to be regressed were computed through factor analysis (data reduction) and then saved as variables. Regression analysis was conducted using Statistical Package for Social Sciences (SPSS).

**4.10.1 Model Summary**

The model summary is shown in table 4.13 below.

**Table 4.13: Model Summary**

| Model Summary     |                   |                   |                            |                 |          |       |       |
|-------------------|-------------------|-------------------|----------------------------|-----------------|----------|-------|-------|
| Change Statistics |                   |                   |                            |                 |          |       |       |
| Model             | R                 | Adjusted R Square | Std. Error of the Estimate | R Square Change | F Change | df1   | df2   |
| 1                 | .582 <sup>a</sup> | .339              | .322                       | .99401841       | .339     | 6.278 | 4 126 |
| 2                 | .667 <sup>b</sup> | .445              | .431                       | .99498911       | .106     | 7.476 | 1 125 |

a. Predictors: (Constant), Access to Infrastructure, Access to Finance, Availability of Management Experience, Business Information Services

b. Predictors: (Constant), Access to Infrastructure, Access to Finance, Availability of Management Experience, Business Information Services, Government Policy and Regulations

In a model summary, the “R” value is used to indicate the strength and direction of the relationship between the variables. The closer the value gets to 1, the stronger the relationship. In this case as shown in model 1 in Table 4.13, R= 0.582. This means there was an overall strong and positive relationship between the variables. The R-Square in the study was found to be 0.339. This value indicates that the independent variables (Access to Infrastructure, Access to Finance, Availability of Management Experience and Business Information Services) can explain 33.9% of the variance in the performance of businesses at Limuru Town Market.

The “R” for the moderated model summary is 0.667 indicating a stronger relationship between variables as a result of introducing the government policy and regulation variable. In this case, the independent variables now account for 44.5% of the performance of micro and small enterprises in Limuru town market. When Government Policy and Regulations was added as a moderating variable, a 0.106 change in R square was reported as shown in Table 4.13 Model 2. This 10.6% increase in the variation can be explained by the addition of moderating variable (Government Policy and Regulations). This increase is statistically significant ( $p \leq 0.0072$ ).

**4.10.2 Coefficients of Determination**

The Unstandardized Coefficients of determination under the B column in Table 4.14 (model 2) were used to substitute the

unknown beta values of the regression model. The beta values indicated the direction of the relationship. A positive or negative sign indicates the nature of the relationship. The significant values (p-value) under sig. column indicate the statistical significance of the relationship or the probability of the model giving a wrong prediction. A p-value of less than 0.05 is recommended as it signifies a high degree of confidence.

**Table 4.14: Co-efficients of Determination**

| Model                                 | Unstandardized Coefficients | Standardized Coefficients | t     | (P-value) Sig. |      |
|---------------------------------------|-----------------------------|---------------------------|-------|----------------|------|
|                                       |                             |                           |       |                | B    |
| 1 (Constant)                          | .017                        |                           | 5.197 | .000           |      |
| Business Information Services         | .108                        | .086                      | .112  | 2.260          | .026 |
| Access to Finance                     | .023                        | .088                      | .023  | 3.263          | .001 |
| Availability of Management Experience | .150                        | .091                      | .147  | 2.655          | .009 |
| Access to Infrastructure              | .011                        | .086                      | .011  | 1.130          | .261 |
| 2 (Constant)                          | .019                        |                           | 5.215 | .000           |      |
| Business Information Services         | .112                        | .086                      | .117  | 2.308          | .022 |
| Access to Finance                     | .239                        | .090                      | .039  | 3.430          | .001 |
| Availability of Management Experience | .173                        | .095                      | .169  | 2.832          | .006 |
| Access to Infrastructure              | .013                        | .086                      | .014  | 1.155          | .250 |
| Government Policy and Regulations     | .080                        | .093                      | .081  | 2.868          | .005 |

a. Dependent Variable: Business Performance

In this case, all the predictor variables except Access to Infrastructure ( $p = 0.250$ ) produced statistically significant results  $p < 0.05$  (Access to Finance ( $p = 0.001$ ), Availability of Management Experience ( $p = 0.006$ ), Business Information Services ( $p = 0.022$ ) and Government Policy and Regulations ( $p = 0.005$ )).

The equation for the regression model is expressed as:  
 $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + e$   
 $Y = 0.19 + 0.112 X_1 + 0.239 X_2 + 0.173 X_3 + 0.13 X_4 + 0.80 X_5$   
 Where;  
 Y = SMEs performance (Dependent Variable)  
 $X_1 - X_4$  – Independent Variables  
 $X_5$  – Moderating Variable

- $X_1$  = Business Information Services
- $X_2$  = Access to Finance
- $X_3$  = Availability of Management Experience
- $X_4$  = Access to Infrastructure
- $X_5$  = Government Policy and Regulations
- $\beta_0$  = Co-efficient of the model
- $\beta_1 - \beta_5$  = Beta Co-efficients of Determination
- $\epsilon$  = Stochastic Error Term

The results of the regression equation show that if all the predictor variables were rated zero, business performance of the businesses in Limuru town Market would be 0.19. However, all the predictors had a positive relationship with the dependent variable. A unit increase in Business Information Services would lead to improved business performance by 0.112 while a unit increase in Access to Finance would improve business performance by 0.239. A unit increase in the Availability of Management Experience would improve business performance by 0.173. A unit increase in Access to Infrastructure would lead to 0.13 improvement in business performance while a unit increase in Government Policy and Regulations would lead to improved business performance by 0.80. The Stochastic Error Term was assumed to be zero.

**4.10.3 Analysis of Variance (ANOVA)**

Analysis of variance was also done to establish the significance of the regression model.

**Table 4.15 Analysis of Variance**

| ANOVA <sup>c</sup> |            |                |     |             |        |                    |
|--------------------|------------|----------------|-----|-------------|--------|--------------------|
| Model              |            | Sum of Squares | df  | Mean Square | F      | Sig.               |
| 1                  | Regression | 5.049          | 4   | 1.262       | 6.278  | .0001 <sup>a</sup> |
|                    | Residual   | 124.497        | 126 | .988        |        |                    |
|                    | Total      | 129.547        | 130 |             |        |                    |
| 2                  | Regression | 5.796          | 5   | 1.159       | 13.754 | .0001 <sup>b</sup> |
|                    | Residual   | 123.750        | 125 | .990        |        |                    |
|                    | Total      | 129.547        | 130 |             |        |                    |

a. Predictors: (Constant), Access to Infrastructure, Access to Finance , Availability of Management Experience, Business Information Services

b. Predictors: (Constant), Access to Infrastructure, Access to Finance , Availability of Management Experience, Business Information Services, Government Policy and Regulations

c. Dependent Variable: Business Performance

At 95% confidence interval, a significant value (p-value) of 0.0001 and F-value of 13.754 was registered as shown in Table 4.15 (Model 2). This shows that the regression model has a probability of less than 0.0001 of giving the wrong prediction. Hence, the regression model used above is a suitable prediction model for explaining the factors influencing the performance of businesses in Limuru Town Market.

**V. SUMMARY, CONCLUSIONS, RECOMMENDATIONS**

**5.1 Introduction**

This chapter provides a summary of the study, discussions and conclusions drawn thereof. The researchers then present the major limitations of the study and the recommendations for both the research and for the policy change and practice.

**5.2 Summary of Major Findings**

The study sought to establish the factors affecting the performance of micro and small enterprises in Limuru Town Market of Kiambu County. A total of 274 questionnaires were administered and the study managed to obtain 161 completed questionnaires representing 58.76% response rate. The questionnaires contained questions that addressed the objectives of the study.

**5.2.1 Access to business information services**

The study established that access to business information affects performance of businesses at Limuru Town Market to a moderate extent and this information was not readily available at the Market. Even the available information was not deemed to be relevant nor does it inform the respondents of the changes in the business environment on time. Overall, the business information services at Limuru Town Market affect the performance of businesses at Limuru Town Market only to a small extent.

**5.2.2 Access to Finance**

Further, the study established that access to finance exposes businesses in Limuru Town Market to better opportunities to a great extent while it also leads to improved business performance to a great extent. The study also found out that access to capital for businesses is very challenging to a great extent. Overall, access to finance affects the performance of business at Limuru Town Market to a great extent.

**5.2.3 Availability of Managerial Experience**

The study further found out that availability of managerial skills and experience affects businesses at Limuru Town Market to a great extent while the respondents felt that training on managerial skills are required in the businesses to a great extent. Further, the respondents reported that they do not get trainings on business management skills frequently. Overall, availability of managerial experience affected business performance only to a moderate extent.

**5.2.4 Access to Infrastructure**

On infrastructure, the study established that good road network is available to the business people around Limuru market and it's easy for them to bring stock to the market to a great extent. The respondents' reported that the working space allocated to them is accessible to a great extent but is sufficient only to a moderate extent. Foot paths in the market are in good condition only to a moderate extent while toilets are available and are accessible also only to study also found out that infrastructure affects performance of businesses to a great extent.

**5.2.5 Government Policy and Regulations**

Government policy and regulations affects businesses in Limuru Town market to a great extent. On previous studies, Kinuya (2014), researching on factors affecting the performance of small and medium enterprises in the Jua Kali Sector in Nakuru town in Kenya found out that access to finance had the potential to positively affect performance of SMEs; management skills were found to positively and significantly affect performance of SMEs; macro environment factors were found to significantly

affect performance and Infrastructure did not significantly affect performance of SMEs in the study area. The study results also indicated that as number of years in operations increased the performance in SMEs increased. Therefore, the finding of this study supports existing literature.

### 5.3 Conclusion

The objective of the study was to establish the factors affecting the performance of micro and small enterprises in Limuru Town Market of Kiambu County. The study concludes that access to finance and availability of management experience are the key socio-economic factors affecting the performance of businesses in Limuru Town Market. These two have the potential of leading to improved business performance.

The other key factors that were found to affect performance of micro and small enterprises in Limuru Town Market positively are: access to business information, government policy and regulations and access to infrastructure.

### 5.4 Recommendations

#### 5.4.1 Access to business information

There is scarcity of business information in Limuru town market. The County government of Kiambu in collaboration with the Central government should organize seminars and business drills for these SMEs. Other development partners like banks and Saving and credit organizations should also educate these SMEs so that they may perform better.

#### 5.4.2 Access to Finance

The study found out that most SMEs prefer to use personal savings and contributions from relatives because they find it very difficult to access financing from commercial banks due to strict requirements such as collateral security and high repayment costs. The study therefore recommends that banks and other credit giving financial institutions should come up with creative policies that make it easy for the SMEs to access financing.

#### 5.4.3 Availability of Managerial Experience

The government should start offering basic business and financial management skills as this will enable the Limuru market SMEs to make informed investment decisions. This will enhance their entrepreneurial skills that will enable them to recognize and exploit the available business opportunities.

#### 5.4.3 Access to Infrastructure

Access to infrastructure affects performance of Limuru town market SMEs only to a moderate extent. However, the study recommends permanent roofing in the market to prevent the traders and their wares from being subject to weather changes. Also, the county government should consider re-carpeting the market and putting up adequate toilets for the traders.

#### 5.4.4 Government Policy and Regulations

The study found out that the government policy and regulations has a moderating effect on the performance of SMEs at Limuru Town Market. The study therefore recommends that the government should move in quickly to create policies that favour the growth and expansion of SMEs. This will save the businesses from the challenges they face when trying to access financing from mainstream commercial banks.

### 5.6 Areas for Further Research

Arising from this study, the following directions for future research should be carried out. This research only covered micro and small enterprises Limuru Town Market. However, there are other enterprises that are medium and large firms in the same

town. Researchers are encouraged to research on them. In future, other SMEs in other towns should be involved to enable the researcher to make adequate conclusions.

This research didn't concern itself with the challenges and possible solutions hindering SMEs from accessing financing by credit giving institutions. In future, a research should be instituted to establish the challenges and the possible solutions.

In future, a comparison should be done between the financial performance of SMEs that have received microcredit and the ones that have not received the financing. This will help in shedding light on whether accessing microcredit helps the SMEs to perform better than other businesses.

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# A case of acromegaly with diabetic ketoacidosis as initial presentation

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**Abstract-** Diabetes mellitus can present in 25% of patients with acromegaly, which is usually neither severe nor symptomatic, and can often be controlled with oral hypoglycemic agents. A subgroup of patients with acromegaly exhibit severe hyperglycemia and require insulin. Diabetic ketoacidosis (DKA) is rare.

**Index Terms-** Acromegaly,diabetes mellitus,diabetic ketoacidosis , pituitary adenoma.

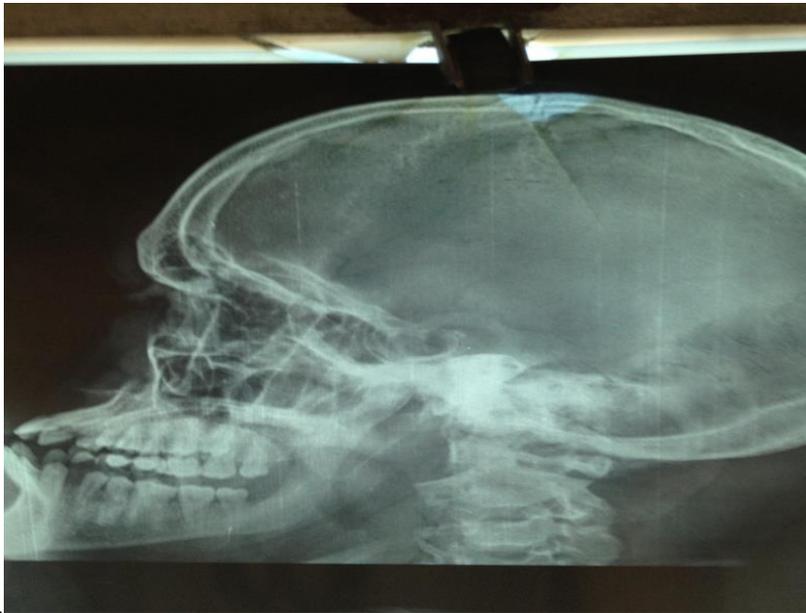
## Case Report

- We present here the case of a young man admitted to osmania general hospital with DKA, as his initial presenting feature of acromegaly.
- This case illustrates the importance of considering an underlying cause, other than type 1 diabetes, as the precipitant of DKA, particularly in individuals with severe insulin resistance requiring large amounts of insulin.
- A 23 year old male patient presented to our emergency department with complaints of polyuria, headache and seizures of generalised tonic clonic type.
- There is no previous history of diabetes mellitus, convulsions, hospitalisation and no family history of diabetes.
- There is no history of trauma and no history of blurring of vision, fever, ear discharge
- No significant medication history.
- On examination patient has coarse facial features wide nasal bridge and thick palms and soles



- 
- Patient was in a state of post-ictal confusion and tachycardic with 106 per minute pulse rate. Bp was 100/60 mm of hg
- His GRBS came as high and urine for ketones were positive and ABG was suggestive of metabolic acidosis
- A provisional diagnosis of new-onset diabetes with moderate DKA was made.

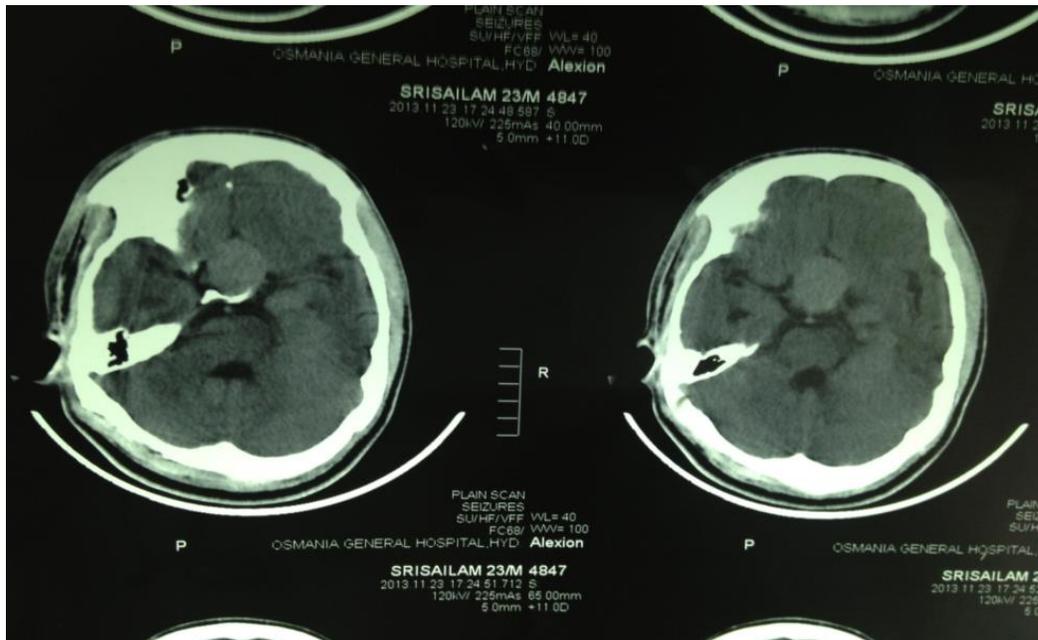
- He was admitted to the intensive care unit. Normal saline rehydration and insulin infusion were started as per our institution's DKA protocol.
- His acidosis resolved within 48 hours, and the insulin was changed to a subcutaneous basal-bolus regimen
- His insulin requirements remained unusually high
- His high insulin requirements prompted the addition of metformin and a more extensive evaluation for a cause of his insulin resistance. Physical examination revealed disproportionately large hands and feet with thickening of the soft tissue
- Suspicion of acromegaly was confirmed on the basis of biochemical and imaging findings. Growth hormone (GH), at  $>40\text{ng/ml}$  (reference range 0-3), and insulin-like growth factor 1 (IGF-1), at  $928\text{ng/ml}$ (reference range 116-358), were markedly elevated. Serum TSH, FSH,LH,cortisol are nor-



mal.

- Roentgenogram of skull suggestive of widened sella and prognathism
- Magnetic resonance imaging (MRI) brain revealed  $3.2 \times 2.5$  cm of pituitary macro adenoma. His visual acuity was counting fingers at 3mts and visual field contracted on B/L temporal side and his fundus showing bilateral papilledema.

#### MRI Brain



- His blood glucose levels normalized postoperatively with complete resolution of diabetes, and insulin was ceased. Hydrocortisone was discontinued before discharge because of normal early morning cortisol levels.

## Discussion

- Insulin resistance, glucose intolerance, and diabetes are commonly seen in patients with acromegaly.
- An analysis of the risk factors promoting glucose intolerance in acromegaly revealed that higher GH levels, older age, and longer duration of disease predicted a tendency to develop symptomatic diabetes
- Evidence suggests that both GH and IGF-1 excess can induce insulin resistance directly in the liver, adipose tissue, and muscle, leading to increased endogenous glucose production, decreased muscle glucose uptake, and rising blood glucose levels.
- Elevated levels of these hormones in the presence of relative insulin deficiency are thought to lead to DKA. DKA therefore develops in the presence of an absolute or relative deficiency of insulin together with increased levels of counterregulatory hormones (cortisol, catecholamines, glucagon, or GH).
- high GH levels may inhibit fatty acid metabolism, increasing lipolysis and leading to ketosis. Glucagon has also been considered as a possible contributing factor to DKA and may be increased in acromegaly.
- Excessive glucagon reduces hepatic fructose 2,6 biphosphate, a metabolite that inhibits gluconeogenesis in the liver and also induces hepatic ketogenesis. Together with insulin deficiency, glucagon may therefore play a role in the pathogenesis of DKA in acromegaly. Increased levels of GH and glucagon, even in the presence of insulin, may be enough to shift the balance towards ketogenesis and ultimately DKA.

- When acromegaly is treated, diabetes will often resolve with normalization of the patient's OGTT. Patients with a shorter duration of acromegaly and lower GH levels before surgery are more likely to show a reversal of their impaired glucose tolerance.

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# Designing of All Terrain Vehicle (ATV)

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**Abstract-** Designing purpose of this Quad bike is to manufacture an off road vehicle that could help in transportation in hilly areas, farming field and as a reliable experience for a weekend enthusiast. In order to accomplish this task, different design aspects of a Quad Bike. vehicle were analyzed, and certain elements of the bike were chosen for specific focus. There are many facets to an off-road vehicle, such as the chassis, suspension, steering, drive-train, and braking, all of which require thorough design concentration. The points of the car I decided to specifically focus on were the chassis, drive-train, and suspension. The most time and effort went into designing and implementing these components of the vehicle because it was felt that they most dramatically effect the off-road driving experience. During the entire design process, consumer interest through innovative, inexpensive, and effective methods was always the primary goal.

## I. INTRODUCTION

### **Frame Design - OBJECTIVE -**

The chassis is the component in charge of supporting all other vehicle's subsystems with the plus of taking care of the driver safety at all time. The chassis design need to be prepared for impacts created in any certain crash or rollover. It must be strong and durable taking always in account the weight distribution for a better performance.

| MATERIAL          | 1018 STEEL             | 4130 STEEL             | 4130 STEEL             |
|-------------------|------------------------|------------------------|------------------------|
| OUTSIDE DIAMETER  | 2.540 cm               | 2.540 cm               | 3.175 cm               |
| WALL THICKNESS    | 0.304 cm               | 0.304 cm               | 0.165 cm               |
| BENDING STIFFNESS | 3791.1 Nm <sup>2</sup> | 3791.1 Nm <sup>2</sup> | 3635.1 Nm <sup>2</sup> |
| BENDING STRENGTH  | 391.3 Nm               | 467.4 Nm               | 487 Nm                 |
| WEIGHT PER METER  | 1.686 kg               | 1.686 kg               | 1.229 kg               |

4130 Chrome Moly Steel is the best suitable material so following it we selected it over 1018 Steel because 4130 Steel has a greater strength to weight ratio. Along with material selection, tube diameter was also taken into consideration. Different sizes of tube were considered for the frame. It was decided to create the Roll Cage using 1 inch OD and 3mm wall thickness, 4130 Steel tubing as it was thought to be more structurally sound than a larger diameter tube.

### Frame Design Considerations:

| CON-SIDE RA-TIONS | PRIORITY  | REASON   |
|-------------------|-----------|--|
| Light-Weight      | Essential | A light race car is a fast race car              |
| Durable           | Essential | Must not deform during rugged Driving            |
| Meet Requirements | Essential | Must meet requirements to Compete                |
| Simple Frame      | High      | Majority of frame fabrication done in House      |
| Attractive Design | Desired   | Easier to sell an aesthetically pleasing vehicle |
| Cost              | Low       | Car needs to be within budget                    |

In the roll cage fabrication also we have not deviated from the initially proposed design according to CAD MODEL.



**ROLL CAGE 3D CADMODEL ( CATIAV5R20 )**



**ROLL CAGE ( FABRICATED )**

**ROLL CAGE DESIGN SPECIFICATIONS:**

| Type                  | Space Frame                                 |
|-----------------------|---|
| Material              | Normalized AISI 4130 Chrome-Moly. Steel     |
| Mass of Roll cage     | 21.61 kg                                    |
| Length of Roll cage   | 64.14 inches                                |
| Width of Roll cage    | 10.5 inches                                 |
| Height of Roll cage   | 22.29 inches                                |
| Total length of pipes | 13.04 m                                     |
| Weld joints           | 42  |
| No. of Bends          | 15  |
| Cross section         | Outer Diameter - 25.4 mm<br>Thickness - 3mm |

**Finite Element Analysis (FEA) :**

Finite element is a method for the approximate solution of partial differential equations that model physical problems such as: Solution of elasticity problems , Determine displacement, stress and strain fields. Static, transient dynamic, steady state dynamic, i.e. subject to sinusoidal loading, modes and frequencies of vibration, modes and loads of buckling. Roll cage analyzed at much higher forces than in real case scenario.

**Loading Analysis –**

To properly approximate the loading that the vehicle will see an analysis of the impact loading seen in various types of accident was required. To properly model the impact forces, the deceleration of the after impact needs to be found. To approximate the worst case scenario that the vehicle will see, research into the forces the human body can endure was completed. It was found that human body will pass out at loads much higher than 7g. And the Crash pulse scenario standard set by industries is 0.15 to 0.3sec. We considered this to be around 2.5 sec. It is assumed that worst case collision will be seen when the vehicle runs into stationary object.

**FEA of Roll cage-** A geometric model of the roll cage was constructed in CATIA and was imported into ANSYS Mechanical in IGES format. ANSYS was used to create a finite element formulation of the problem for both static structural analysis & Dynamic analysis. The Elastic Straight PIPE 16 element was used for creating frames and automatic fine meshing is done for the entire roll cage, with real constant as the thickness & diameter of the pipes.

**For AISI 4130 alloy steel-**

Young’s modulus-205 GPa

Poisson’s ratio- 0.27-0.29 (say0.28)

For all the analysis the weight of the vehicle is taken to be 272 kgs.

**Objectives of FEA of Roll Cage-**

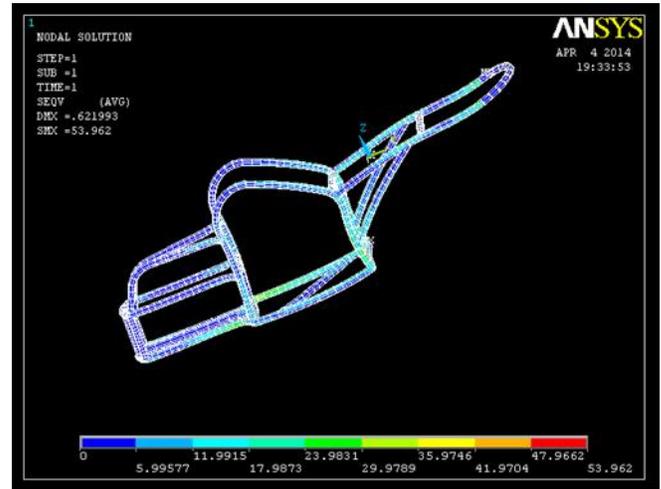
- 1) To have adequate factor of safety even in worst case scenarios to ensure driver safety.
- 2) To have greater torsional stiffness to ensure lesser deflection under dynamic loading and enhanced performance.
- 3) To ensure that the natural frequency of the roll cages doesnot matches. with the engine working range frequency to avoid resonance.

**Static Analysis:-**

- 1)Frontal Impact
- 2) Rear Impact
- 3)Side Impact
- 4)Roll over test
- 5)One wheel bump test
- 6)Torsional Rigidity analysis
- 7)Heave analysis

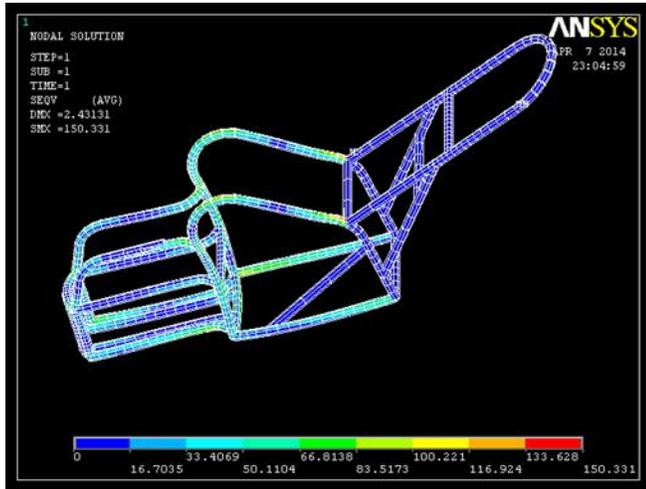
**Frontal Impact Analysis –** The mass of the vehicle is 272kg. The impact test or crash test is performed assuming the vehicle hits the static rigid wall at top speed of 60 Kmph. The collision is assumed to be perfectly plastic i.e, vehicle comes to rest after collision.

|                  |                               |
|------------------|-------------------------------|
| Frontal Impact   | 6G ( 15303.6 N )              |
| Max. Deformation | 2.43 mm                       |
| Max. Stress      | 150.331 Mpa                   |
| Factor of Safety | 3.05<br>( > 2 Design is Safe) |



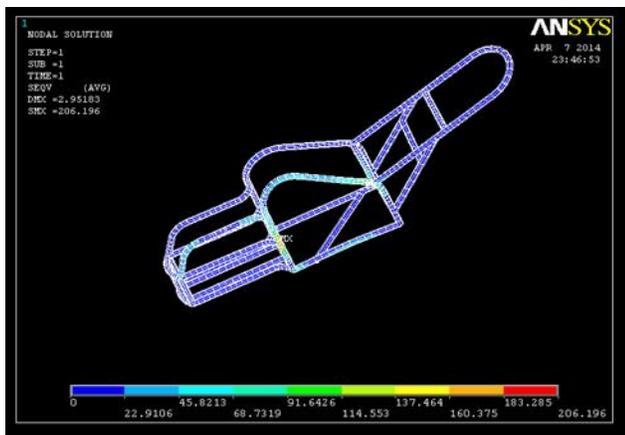
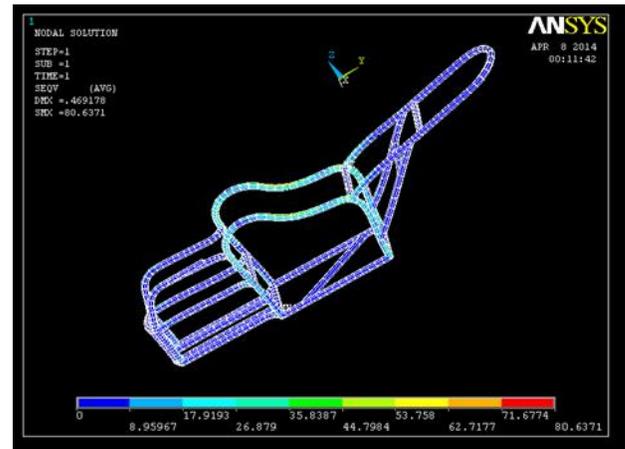
**Roll Over Impact Analysis –**

|                  |                           |
|------------------|---------------------------|
| Roll over Impact | 3.5G ( 8927.1 N)          |
| Max. Deformation | 0.46 mm                   |
| Max. stress      | 80.63 Mpa                 |
| Factor of safety | 5.70 ( > Design is Safe ) |



**Side Impact Analysis -**

|                  |                            |
|------------------|----------------------------|
| Side Impact      | 3G ( 7651.8 N )            |
| Max. Deformation | 2.95 mm                    |
| Max. Stress      | 206.196 Mpa                |
| Factor of Safety | 2.23 ( >2 Design is Safe ) |



**Rear Impact Analysis –**

|                  |                            |
|------------------|----------------------------|
| Rear Impact      | 3G ( 7651.8 N )            |
| Max. Deformation | 0.62 mm                    |
| Max . Stress     | 53.962 Mpa                 |
| Factor of Safety | 8.52 ( >2 Design is Safe ) |

**Details Of Subsystem :**

➤ **Suspension Design -**

**OBJECTIVE -**

1. Designing a suspension which will influence significantly on comfort, safety and maneuverability.
2. Contributing to vehicles road holding/handling and braking for good active safety and driving pleasure.
3. Protect the vehicle from damage and wear from force of impact with obstacles (including landing after jumping)
4. Maintaining correct wheel alignment.

**DESIGN METHODOLOGY -**

The overall purpose of a suspension system is to absorb impacts from coarse irregularities such as bumps and distribute that

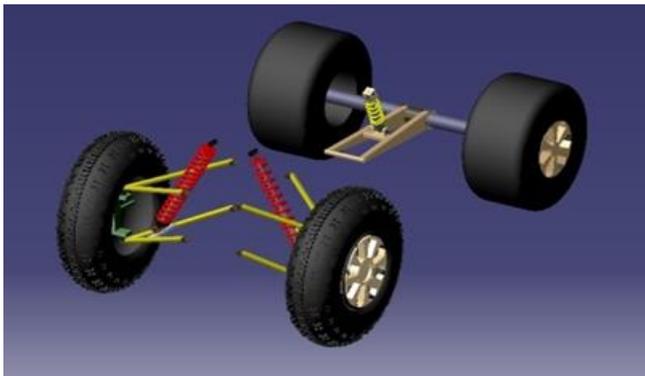
force with least amount of discomfort to the driver. We completed this objective by doing extensive research on the front and rear suspension arm's geometry to help reduce as much body roll as possible. Proper camber and caster angles were provided to the front wheels. The shocks will be set to provide the proper dampening and spring coefficients to provide a smooth and well performing ride.

**WHEEL GEOMETRY**

|              |             |
|--------------|-------------|
| Camber Angle | 2°          |
| Caster Angle | 4°          |
| Toe-in       | 3 mm        |
| KPI          | 7°          |
| Ride Height  | 6.75 inches |
| Scrub radius | 128 mm      |

**DESIGN CONSIDERATIONS**

|                                 |        |
|---------------------------------|--------|
| Unsprung mass of vehicle        | 52.1kg |
| Static Stability Factor (Front) | 1.10   |
| Static Stability Factor (Rear)  | 1.03   |



**FRONT SUSPENSION CAD MODEL ( CATIAV5R20)**



**FRONT SUSPENSION VIEW**

**FRONT SUSPENSION :**

1. For our front suspension we chose one with a Double arm wishbone type suspension. It provided spacious mounting position, load bearing capacity besides better camber recovery.

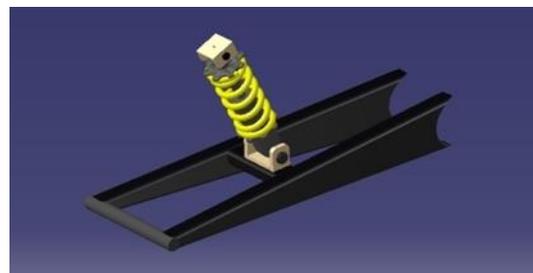
- [1]. Front Unequal Non Parallel double wishbone suspension .
- [2]. The tire need to gain negative camber in a rolling situation, keeping the tire flat on the ground .

**REAR SUSPENSION :**



**SWING ARM CAD MODEL ( CATIAV5R20 )**

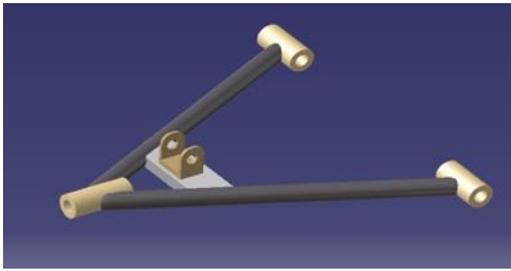
**FABRICATED SWING ARM**



**MONOSHOCK MOUNTING ON SWING ARM**

For our Rear suspension we chose Swinging Arm with Monoshock type suspension. Using monoshock over dual shocks is advantageous due to ease of adjustment as there is only single damping unit and smaller unsprung mass.

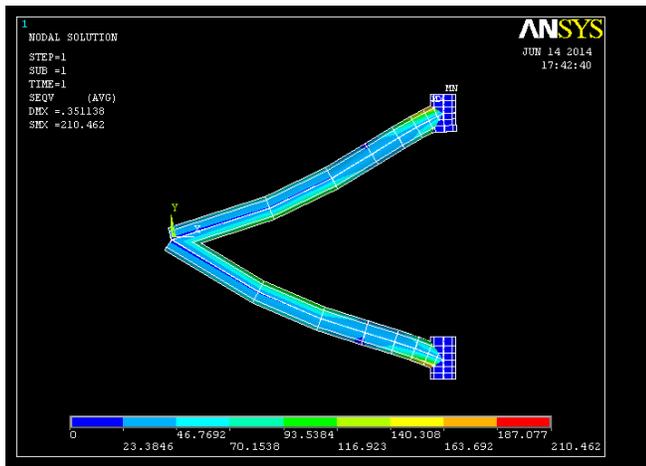
**WISHBONE ARMS :**



Design for optimal geometry of the control arms is done to both support the race-weight of the vehicle as well as to provide optimal performance. Design of the control arms also includes maximum adjustability in order to tune the suspension for a given task at hand. The front A-arms are constructed of 3mm wall thickness, 1 inch diameter 4130 round Chrome moly tube. FEA was also performed on the front arms, and proved them to be capable of handling the stresses exerted on them in extreme situations. Also kinematic analysis on the control arms was done as shown in the figure below to determine the dimensions of cross-section of control arms.

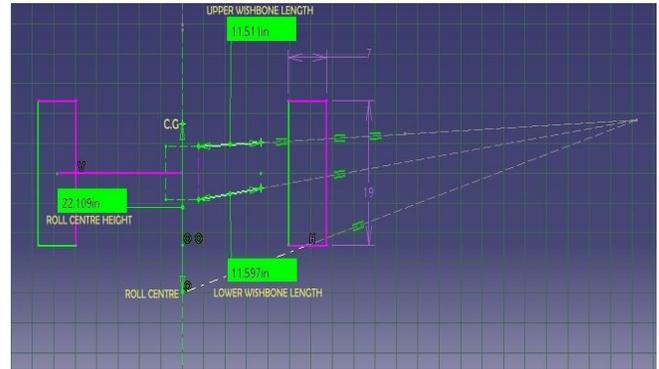
**FEM OF WISHBONE ARM (A-ARM) :**

Finite element analysis has also been conducted on the front arms. The stresses created in the part can be seen in Figure. The biggest reason for choosing this design is that it only requires one piece, using a simple jig, to be fabricated. It has been determined that the tubing used for the suspension arms will be ASTM 106a steel. It will be 1” diameter with 3” wall thickness. This was determined after comparing the weight and material properties for several sizes of tubings.



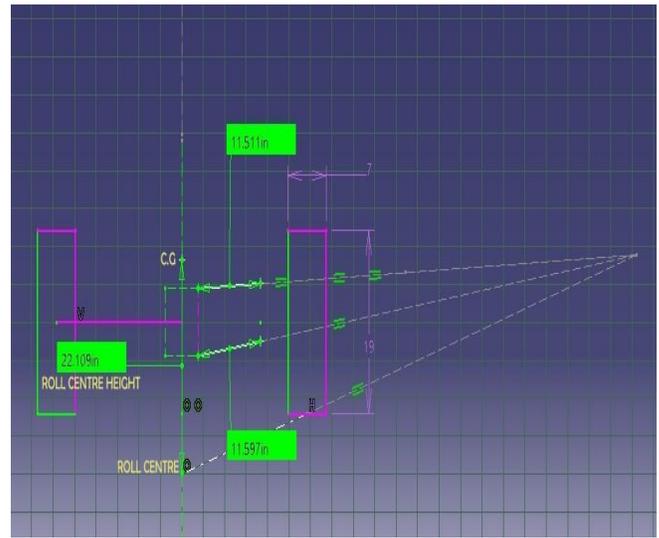
**Determination of length of wishbone arms:-**

The length of the wishbone is found virtually in CATIA V5R20. As we know the pivot points of wishbones as well as the ball joint points on the knuckle.



**Roll Centre Height:-**

The roll centre height was found in CATIA V5R20 by extending the wishbone arm axis to its instantaneous centre and then from the instantaneous centre a line is drawn through the tire centre on the ground which intersect the vehicle centre line, this point is called roll centre and distance of this point from the C.G is the roll centre height.



**SHOCK ABSORBERS :**

The front suspension is equipped with Piaggio shock absorbers which allows the automatic preload adjustment in order to keep the optimal vehicle trim. The Piaggio shock absorbers is completely self-adopting so no HMI is needed. The Rear suspension is equipped with Honda Unicorn MONOSHOCK OEM Shock absorber as it provide the the necessary stiffness needed by the swinging arm to maintain the ground contact as well as it is simpler in design, less unsprung weight which helps to reduce the overall weight of the quad bike and thus provide faster acceleration.

**Calculations –**

**Initial data for Shock Absorber:**

| FAC-TORS | SPRI NG IN-DEX | WIRE DIAME-TER (mm) | SPRIN G OD (mm) | NO. OF TUR NS | FREE LENG TH OF SPRIN G (mm) |
|----------|----------------|---------------------|-----------------|---------------|------------------------------|
|          |                |                     |                 |               |                              |

|       |       |      |      |    |       |
|-------|-------|------|------|----|-------|
| FRONT | 7.0   | 12.7 | 88.9 | 15 | 330.8 |
| REAR  | 4.512 | 15.8 | 71.3 | 10 | 254.6 |

Stiffness of the spring (K) =  $G \times d^4 / 8 D^3 n$

Where,

G = Modulus of rigidity = 70 Gpa

d = Wire diameter in mm

D = Spring outer Diameter in mm

n = No. of Turns

Spring Force (Fs) = K x X

Where, X = Spring Travel

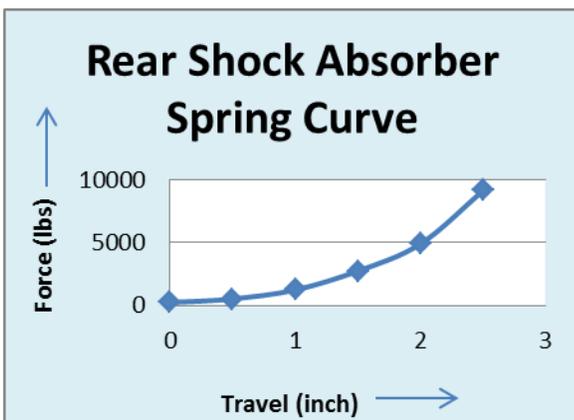
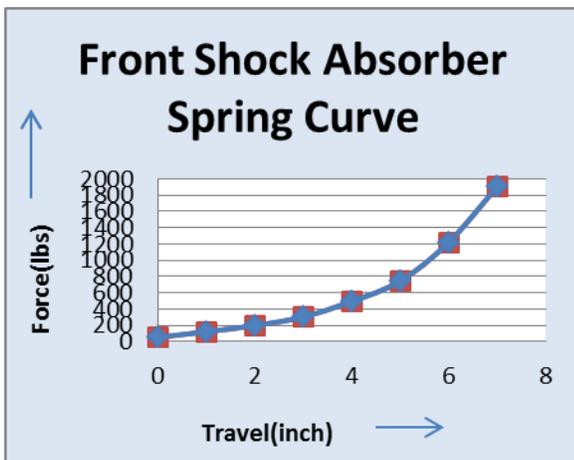
Spring Index (C) = D/d

Motion Ratio (MR) = Spring Travel / Wheel Travel

Static Stability Factor = Wheel Track / 2 x Hcg

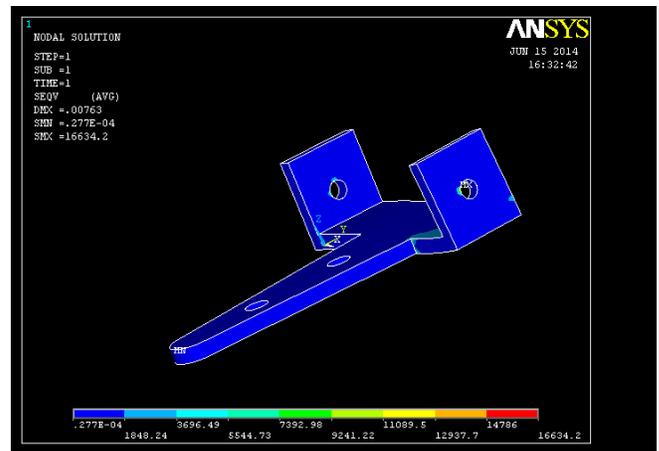
Final Result:

| FACTORS | SPRING RATE (kg/cm) | ROLL CENTER HEIGHT (INCH) [FROM DATUM] | MOTION RATIO | INCLINATION |
|---------|---------------------|--|--------------|-------------|
| FRONT   | 22.01               | 22.109 inch                            | 0.73         | 66.9°       |
| REAR    | 383.38              | 0                                      | 0.25         | 62°         |



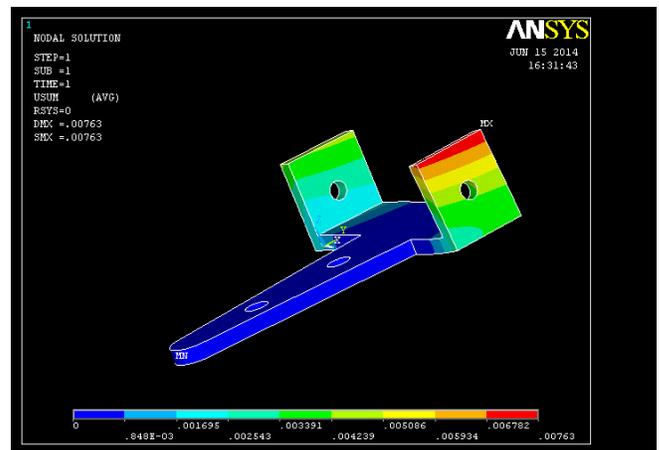
**KNUCKLE ( CUSTOMISED ) FEM :**

The knuckle was evaluated using the ANSYS 14.0 finite element program. The total weight of the system was estimated to be around 2746 N ( 280 kg \* 9.81 m/s\*s ). In a previous study, it was determined that the maximum acceleration a off-road vehicle is likely to endure during competition is 3g's. With this knowledge, 8240.4 N forces were distributed on each component in various directions in order to simulate the stresses encountered during landing from a jump, lateral acceleration due to turning, and frontal impact. The knuckle was tested in order to identify any concentrated stresses in the design. Fixed geometry constraints were added to the ball joint holes at the top and bottom of the knuckle in order to prevent the part from moving when forces are applied. The knuckle was first loaded with a simple vertical force through the spindle similar to the vehicle landing from a jump. The resulting **Von-mises stress** plot is shown in Figure below:



|                                 |  |
|---------------------------------|--|
| Max. Stress                     | 166.34 N/mm2                                     |
| Ultimate strength of mild steel | 450 N/mm2  |
| Factor of safety                | 450/166.342 = 2.705<br>Hence the design is SAFE. |

**FEM FOR MAX. DEFORMATION:**



**MAX. DEFORMATION - 0.763 mm**  
Hence, it is very less so the design is SAFE.

➤ **Steering Design-**

**Objective –**

The objective of steering system is to provide max directional control of the vehicle and provide easy maneuverability of the vehicle in all type of terrains with appreciable safety and minimum effort. Typical target for a quad vehicle designer is to try and achieve the least turning radius so that the given feature aids while maneuvering in narrow tracks, also important for such a vehicle for driver's effort is minimum. This is achieved by selecting a proper steering system (Centrepoint Steering 1:1). The next factor to take into consideration deals with the response from the road. The response from the road must be optimum such that the driver gets a suitable feel of the road but at the same time

the handling is not affected due to bumps. Lastly the effect of steering system parameters on other system like the suspension system should not be adverse.

**Design –**

We researched and compared multiple steering systems. We need a steering system that would be easy to maintain, provide easy operation, excellent feedback, cost efficient and compatible to drivers ergonomics.

Thus we have selected 4 bar linkage centralised point steering system for our Quad bike.

We have increased our front and rear track width to improve the lateral stability according to offroad conditions. Rear track width is kept slightly less than front track width to create a slight over steer in tight cornering situation which allows easier maneuverability at high speed.

$$Lateral\ Weight\ Transfer\ (LWT) = \frac{Lateral\ Acceleration \times Weight \times Hcg}{g \times Track\ width}$$

**OLD:-**

$$Lateral\ Weight\ Transfer\ (LWT) = \frac{7.41 \times 260 \times 0.406}{9.81 \times 0.838}$$

**OLD LWT= 95.14 Kg**

**NEW:-**

$$Lateral\ Weight\ Transfer\ (LWT) = \frac{7.41 \times 280 \times 0.406}{9.81 \times 1.2192}$$

**NEW LWT= 70.34 Kg**

$$\% \text{ reduction in lateral weight transfer} = \frac{95.14 - 70.34}{95.14} \times 100$$

**% reduction in LWT =26 %**

**Calculations -**

We have done following calculations on our steering system:

**Initial Data –**

|                              |            |
|------------------------------|------------|
| Wheelbase(L)                 | 47"=1.193m |
| Front Wheel Track            | 46"=1.168m |
| Rear Track Width             | 44"=1.117m |
| Weight Distribution          | 45:55      |
| Total Weight                 | 280 kg     |
| Turning Radius               | 2.5m       |
| Static Weight on Front Wheel | 126 kg     |
| Static Weight on Rear Wheel  | 154 kg     |

$$\% \text{ Ackermann Geometry} = \frac{\text{Angle of Inside Wheel} - \text{Angle of Outside Wheel}}{\text{Angle of Outside Wheel for 200\% Ackermann}} = 82.56 \%$$

Slip Angle:  $\tan \theta = \frac{F}{S}$   
 For front Wheels,  $\theta = 17.65^\circ$   
 For Rear Wheels,  $\theta = 23.5^\circ$

Acceleration of vehicle:

$$\alpha = \frac{v^2}{g \times R} = 11.705 \text{ m/s}^2$$

**Cornering Stiffness:**

$$C.S = \frac{\text{Lateral force on each wheel}}{\text{Slip Angle}}$$

For front, C.S=35.23 N/degree

For Rear, C.S=29.96 N/degree

Under Steer Gradient(K):

$$K = \frac{\text{Weight on front tyre}}{C.S(\text{front})} - \frac{\text{Weight on Rear tyre}}{C.S(\text{Rear})}$$

K= - 0.79 (-ve sign indicates the tendency to over steer)

Critical Speed( $V_c$ )=29.13 m/s = 104.86 kmph

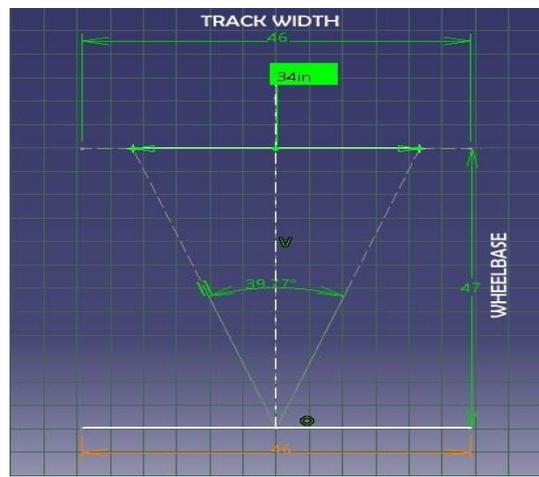
| Description                 | Manually Assisted (Centralized)                       |
|-----------------------------|---|
| Steering Box                | Centralized Steering System (4 Bar linkage mechanism) |
| Lock to Lock Turns          | 0.30 Turns  |
| Outside Wheel Turning Angle | 22.45°  |
| Inside Wheel Turning Angle  | 30.90°  |
| Steering Ratio              | 1:1   |
| % Ackermann Geometry        | 82.56%  |
| Turning radius              | 2.5m  |
| Ackermann Angle             | 10.21°  |
| Under Steer Gradient        | -0.79   |

**Steering Mechanism –**

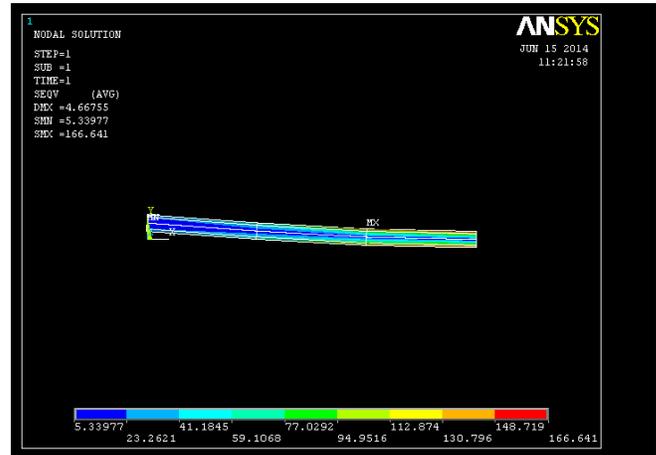
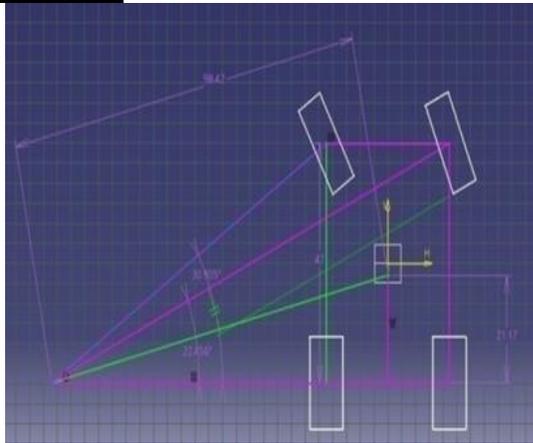
To achieve the correct steering, two types of mechanisms are used. They are the Davis & Ackermann mechanism, Ackermann Mechanism is used generally for application are low. This type of geometry is apt for all-terrain vehicle like Our Quad where the speed seldom exceeds 60 kmph because of the terrain. This geometry ensures that all the wheels roll freely without the slip angles as the wheels are steered to track a common turn centre

**Steering Arm Angle:-**

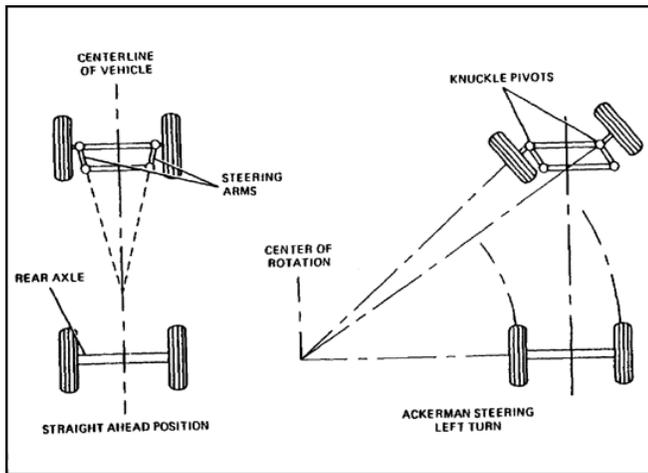
The angle which the steering arm makes with the centre line can be found out geometrically by drawing the given diagram in CATIA or by practical measurement.



**Turning Radius –**

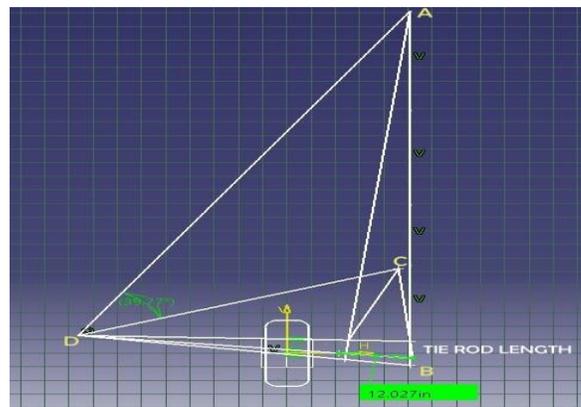


**FEM OF TIE ROD FOR TIE ROD FOR MAX. STRESS**



**TIE ROD DETERMINATION :-**

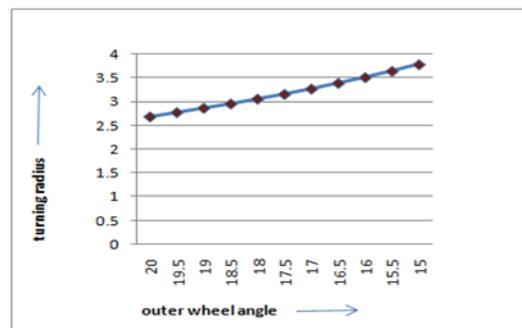
Tie rod length was found virtually in CATIA VSR20 by assuming the position of tie rod to be fixed on knuckle and extending wishbone axis to meet at the instantaneous centres and with the help of steering angle, geometrically we found tie rod length.



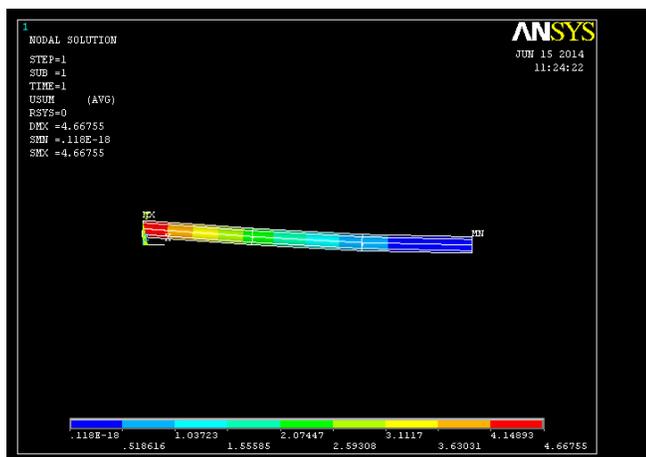
**ANALYSIS OF TIE ROD :**

As that of theoretical study of tie rod is done. The overall purpose if tie – rod is to transmit the motion from steering arm to steering knuckle and sustain the forced vibrations caused by bumps from tires due to uneven road surfaces the main task is to find the deformation and stresses induced in the tie rod and optimising it for various material combinations. The 3-D model is prepared for Tie-Rod of AISI 1020 material is assigned and analysis is carried out using ANSYS14.0.

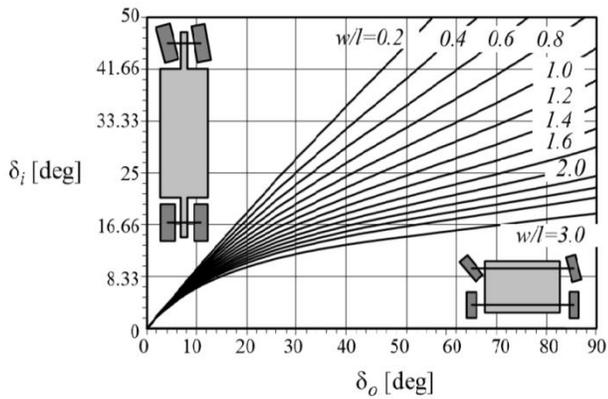
**Graph :**



**Effect of the w/l on the Ackermann condition for the front-wheel steering vehicles:-**



**FEM OF TIE ROD FOR MAX. DEFORMATION**



**Bump and roll steer**

Steer with ride travel is very common in all terrain scenarios. Steer with ride travel is undesirable because if the wheel steers when it runs over a bump or when the car rolls in a turn the car will travel on a path that a driver did not select intentionally.

Ride/Bump and roll steer are a function of the steering geometry. If the tie rod is not aimed at the instant axis of the motion of the suspension system then the steer will occur with ride because the steering and suspension are moving about different centres. If the tie rod is not of the correct length for its location then it will not continue to point at the instant axis when the suspension travelled in ride. Thus the choice of the tie rod location and length is important. If the tie rod height and angle are adjustable it is usually possible to tune most of the ride steer out of a suspension.

Curved ride/bump steer as shown in figure are to be avoided because they result in a net change in toe with ride and the steer effect changes from under steer to over steer depending on the wheel ride position. If ride steer plot is curved then a possible solution is to raise both the ends of the tie rod to move it closer to the shorter, upper A arm with the tie rod angle also be adjusted.

**Braking system**

**Objective –**

The purpose of the braking system is to increase the safety and maneuverability of the vehicle. In order to achieve maximum performance from the braking system, the brakes have been designed to lock up all four wheels at the same time. It is desired from a quad bike that it should have effective braking capability to negotiate rigid terrains.

**Design –**

The braking system is composed of both internal expanding drum brakes and disc brakes. The drum brakes are installed at the two front wheels and a single rotor is mounted on the rear axle to satisfy the braking requirements of our quad bike such as terrain of the track, speedlimits, driver ergonomics and other rulebook constraints.

The front drum brakes are mounted on each wheel of internal radius 2.5 inches having a brake lining width of 3 mm. The distance between the pivot point of both the brake shoes and the cam is 3.93 inches.

At the rear axle we are using disc brake due to fact that we require a effective braking at the rear. It is also to our advantage that even if the front brakes fail in the worst case scenario, brak-

ing power is still available to the driver. The Rear brake is composed of 5 inch diameter disc and dual piston 1.5 inch diameter calliper.

**FEM OF BRAKE DISK ( CUSTOMISED ) :**

The role of FEA analysis in disk brake helps us to ascertain the importance of holes in the design of disks.

**TYPE of Element used : PLANE 55**

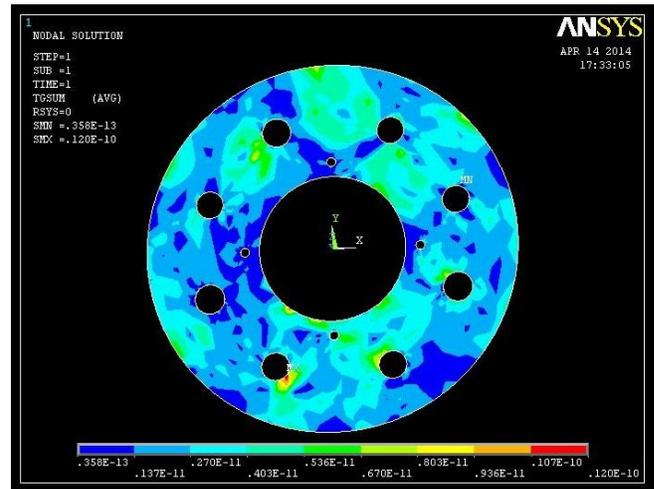
Since the thickness of disk is very small (4mm) when it is compared to its diameter, hence the analysis in 2-D. for this reason, the plane element is chosen in place of solid element in case of 3-D analysis.

**BOUNDARY CONDITION :**

The boundary condition is that the temperature of outer edge is 40C and of the inner edge also 40C.

**THERMAL LOAD :**

The temperature of the contact patch is assumed to be 700C. It is assumed to be annular region.



**ANALYSIS OF RESULT :**

By using 8 holes of 10mm diameter in the disk the temperature of the disk is reduced and more area is under reduced temperature. Hence by using holed disk the life of the disk can be improved from thermal degradation.

**Calculations–**

The total weight of the vehicle along with a average weight of driver ( 70 kg ) was estimated to be 260 kg. The weight distribution for the quad bike was estimated to be approximately 45:55 from the front to the rear. The static weight distribution of the vehicle is 117 kg at the front and 143 kg at the rear.

$$\text{Stopping Distance (SD)} = (V_{max})^2 / 2\mu g$$

$$= (16.66^2 / 2 \times 0.75 \times 9.81) = 18.72 \text{ m}$$

$$\text{Deceleration rate (D}_x) = (V_{max})^2 / 2 SD$$

$$= 16.66^2 / 2 \times 18.72 = 7.36 \text{ m/sec}^2$$

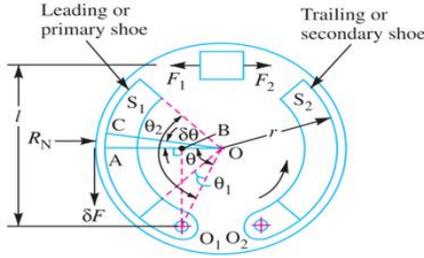
$$\text{Dynamic weight transfer (}\Delta W) = D_x \times W \times H_{c.g.} / g \times l$$

$$= 7.36 \times 280 \times 0.406 / (9.81 \times 1.193) = 71.49 \text{ kg}$$

Total Torque to drive the wheel =

$$T_F + T_R = 1656.3 \times 0.2413 + 403.18 \times 0.2286 = 491.83 \text{ Nm}$$

**For Front Drum brake-**



Forces on an internal expanding brake.

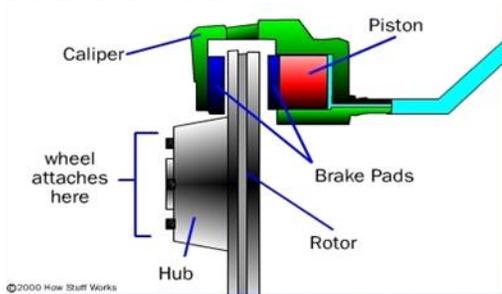
**Initial Data-**

|                                 |             |
|---------------------------------|-------------|
| Driver effort                   | 25 lbs      |
| Lever Ratio                     | 6.3:1       |
| Coefficient of friction (μ)     | 0.5         |
| Internal Radius of Drum (r)     | 2.5 inches  |
| Width of Brake Lining (b)       | 3 mm        |
| Pivot point to cam distance (l) | 3.93 inches |
| θ <sub>1</sub>                  | 30°         |
| θ <sub>2</sub>                  | 150°        |

$$\begin{aligned} \text{Braking Torque } (T_b) &= \mu p_1 b r^2 (\cos \theta_1 - \cos \theta_2) \\ &= 0.5 \times 16.427 \times 10^6 \times 0.003 \times (0.63)^2 \\ &= 169.386 \text{ N-m} \end{aligned}$$

$$\begin{aligned} \text{Braking Torque for both the wheels } (T_{BF}) &= 2 \times T_b \\ &= 2 \times 169.386 = 338.772 \text{ N-m} \end{aligned}$$

**For Rear disc brake –**



**Initial data –**

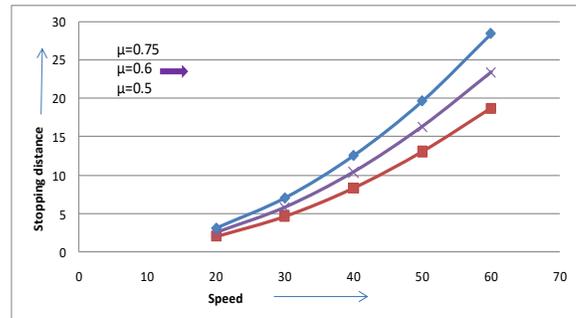
|  |           |
|--|-----------|
| Drive Effort (D <sub>E</sub> )             | 80 lbs    |
| Pedal Ratio (R <sub>p</sub> )              | 4.66:1    |
| I.D of Master Cylinder (ID <sub>mc</sub> ) | 14.043 mm |
| I.D of Calliper (ID <sub>c</sub> )         | 38.23 mm  |
| μ between Disc Pad & Rotor                 | 0.4       |
| Diameter of Rotor                          | 5 inches  |

$$\begin{aligned} \text{Pressure developed at master cylinder } (P_{mc}) &= D_E \times R_p / \pi/4 \times (ID_{mc})^2 \\ &= 10.09 \times 10^6 \text{ N/m} \\ \text{Force of friction generated by brake pad } (F_{fri}) &= 2 \times F_{cal} \times \mu \\ &= 9154.56 \text{ N} \\ \text{Torque at Rotor } (T_r) &= F_{fri} \times R_{eff} \end{aligned}$$

$$\begin{aligned} &= 9154.56 \times 0.0508 \\ &= 465 \text{ N-m} \\ \text{Torque at Rear wheels } (T_{BR}) &= T_r \\ &= 465 \text{ N-m} \end{aligned}$$

**Final Result-**

|                       |                       |
|-----------------------|-----------------------|
| Deceleration Rate     | 7.36 ms <sup>-2</sup> |
| Stopping Distance     | 18.72 m               |
| Stopping Time         | 2.25 sec              |
| Braking Force         | 3437 N                |
| Dynamic mass Transfer | 71.49 kg              |
| Braking Efficiency    | 75%                   |



**DRIVE TRAIN-DESIGN**

**Objective-**

The drive train includes the engine, transmission and the axles for transmitting the power to the wheels. The drivetrain of a motor vehicle is the group of components that deliver power to the driving wheels. This excludes the engine or motor that generates the power. In contrast, the powertrain is considered as including both the engine or motor, and the drivetrain.

**SHIFTER TRANSMISSION (MANUAL GEARBOX) –**

The shifter transmission has high output and power transfer. The power is more easily controlled on with the gear shifter and desired gear can be chosen at any time. The main advantage of the shifter transmission is that it is tried and tested in many previous vehicles besides it has a high output also. Therefore we have decided to use the shifter transmission. We have studied the transmissions of various 2-wheelers and other small vehicles but none of them meets our requirements as much as the Honda CBR 250 transmission does. Therefore we have decided to use the HONDA CBR 250 transmission. Since we have to manage maximum speed at 60 kmph so we have restricted our vehicle up to 3rd gear only.

**Engine Specification -**

|                   |                               |
|-------------------|-------------------------------|
| Engine            | Honda CBR 250                 |
| Displacement      | 249.4 cc                      |
| Bore x stroke     | 76 mm x 55 mm                 |
| Compression Ratio | 10.7:1                        |
| Power             | 26.2 bhp (18.7 Kw) @ 8500 rpm |
| Torque            | 22.9 N-m @ 7000 rpm           |
| Idle Speed        | 1400 rpm +/- 100 rpm          |

|             |  |
|-------------|--|
| Ignition    | Computer controlled digital transistorized with electric advance |
| Fuel        | Petrol   |
| Cooling     | Liquid cooled  |
| Lubrication | Forced and wet Sump  |
| Lube Oil    | 10W30 MB Oil   |

**Calculations –**

**Formulae used:**

$R_w$  = Radius of wheel,

$R$  = overall gear ratio,

$N$  = Redline rpm (8500 rpm),

$\eta_t$  = Transmission efficiency (85%)

$f_r$  = Rolling resistance constant,

$T_E$  = Engine torque (22.9 N-m)

Vehicle speed ( $V$ ) =  $(2\pi \times R_w \times N \times 3600 / R \times 1000) \times 0.85$

(Assuming 85% efficiency ,due to transmission losses as we have used old parts)

Tractive Effort ( $F$ ) =  $R \times \eta_t \times T_E / R_w$

Torque on wheel ( $T_w$ ) =  $R \times \eta_t \times T_E$

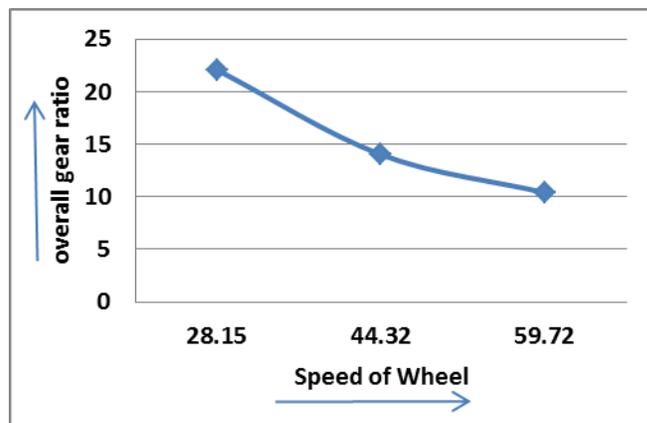
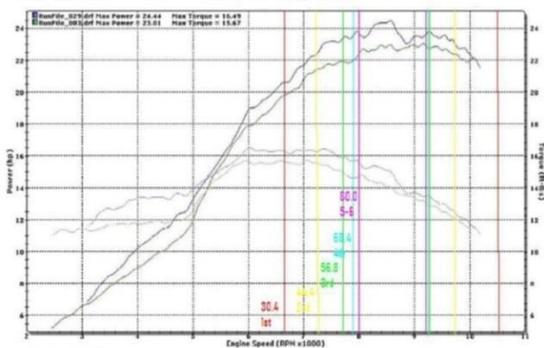
Grade ability =  $(\frac{F}{W} - F_r) \times 100$

**Individual and overall gear ratio –**

| Gear              | Gear ratio | Over all ratio | Speed of wheel(kmph) | Torque on wheel (N-m) |
|-------------------|------------|----------------|----------------------|-----------------------|
| Final drive ratio | 6.619      | -              | -                    | -                     |
| First             | 3.333      | 22.061         | 28.15                | 429.417               |
| Second            | 2.117      | 14.012         | 44.32                | 272.743               |
| Third             | 1.571      | 10.398         | 59.725               | 202.397               |

**Engine –Torque Curve**

2011 HONDA CBR250R



**TYRES AND RIMS -**

**Objective -**

Traction is one of the most important aspects of both steering and getting the power to the ground. The ideal tire has low weight and low internal forces. In addition, it must have strong traction on various surfaces and be capable of providing power while in puddles.

**Functions-**

- Supports weight
- Transmit vehicles propulsion-
- Soften impacts from roads



**TYRES-**

Keeping in mind all the above mentioned aspects we studied about the various types of tires available in market and decided to use 2-Ply Duro rating tyres, tubeless tires and that have got specific tread pattern so as to provide a very strong and firm grip on all kinds of surfaces as well as sturdy enough to absorb various bumps and depressions on track. After going through the engine, transmission and some basic torque and angular velocity calculations we have finalized the diameter of front tires to 19 inches and the diameter of rear tires to 18 inches which would help us to transmit maximum power. This calculation is also in accord with the requirements of Acceleration, Hill climb, Manueverability and Endurance events. The dimension of Front tires is finalized as 19x7 inches and Rear tires 18x9.5 where diameter is 19 inches and 18 inches and width is 7 inches and 9.5 inches respectively.

**RIMS -**

The Rims shall be made up of Aluminum to minimize unprung weight. By reducing the width of the rim the inertia will

be directly decreased and subsequently this will also reduce the overall weight. The diameter of all four rims will be 8 inches. To make our Design cost effective we have customised our own rims.

We selected two identical scooter rims from the scrap yard and fastened them with four 3 inch bolts which are fixed together by welding collar joint of the bolts.



Considering driver's safety and ergonomics, we have used two tubes in a tyre for worst case so that even if one tube get burst, another tube will handle the situation upto 100kms.

**WHEEL END -**

The wheel end is made up of the following parts - Rim, Hub, Disc/Drum, Milled bearing, and knuckle in sequence .Their compatibility with each other is a major design issue as these parts have been taken from different sources.

**Wheel Specifications:**

| Wheel | Dimensions |
|-------|------------|
| Front | 19x07-08   |
| Rear  | 18x9.5-08  |

➤ **Electrical System :**

**Objective -**

The electronic system for the car Quad Bike was designed to fulfil two key purposes. First, the electronics system supports. The mandatory safety equipment, specifically the brake light and the kill switch circuit.

**COMPONENTS OF ELECTRICAL SYSTEM**

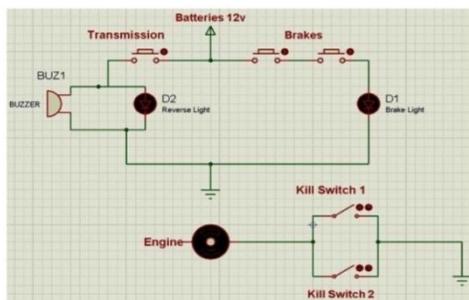
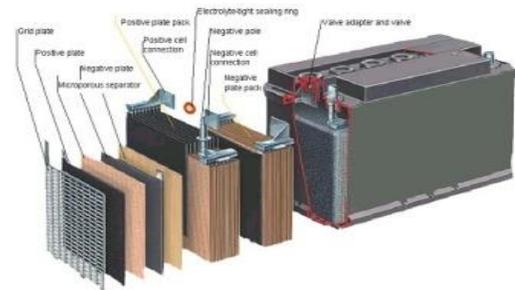


Figure 14. Electric System Diagram

**1. BATTERY -**

A maintenance free lead-acid storage battery is an electro-chemical device that produces voltage and delivers electric current. The electrochemical reaction changes chemical energy into electrical energy and is basis of all automotive vehicle.

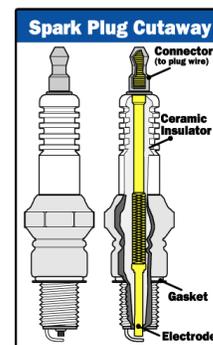
- SPECIFACTONS:-9V 6Ah.
- PURPOSE:- Electricity from battery is used operate lighting ,for ignition and other electrical system.



**2. Spark Plug-**

It is used to ignite the fuel inside the cylinder of petrol engine.

- SPECIFICATION:- SIMR8A9(NGK)



**3. Reverse Light and Alarm -**

Our vehicle (introducing reverse gear) is equipped with a reverse light (White colour, visible at a minimum distance of 10 meters from vehicle). Reverse alarm is installed for safety reason which shall operate when the reverse gear is engaged.

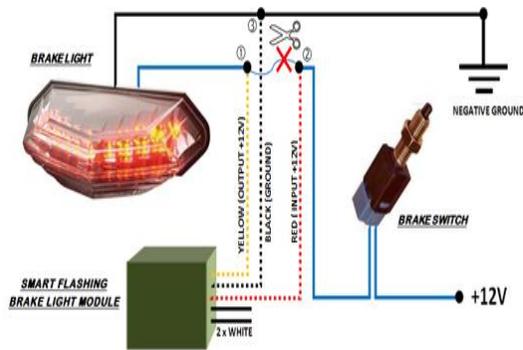
**4. Kill Switch -**

These kill switches are able to cut off all the electrical connections including ignition system and are rigidly mounted near the steering handle where the driver can easily control it. Second kill switch is placed on left side of vehicle near driver seat.

**5. Brake Light –**

The brake light is installed at the back of our vehicle red in colour which is clearly visible from the rear, and is visible in very bright sunlight, and is mounted between the wheel center-line to serve the purpose of indicating that the driver has applied brake and the vehicle tends to stop.

SPECIFICATIONS - 32 led brake light with brake housing.



## 6. Electric Start –

The modern starter motor is either a permanent-magnet or a series- or series-parallel wound direct current electric motor with a solenoid switch (similar to a relay) mounted on it. When current from the starting battery is applied to the solenoid, usually through a key-operated switch, it pushes out the drive pinion on the starter driveshaft and meshes the pinion with the ring gear on the flywheel of the engine.

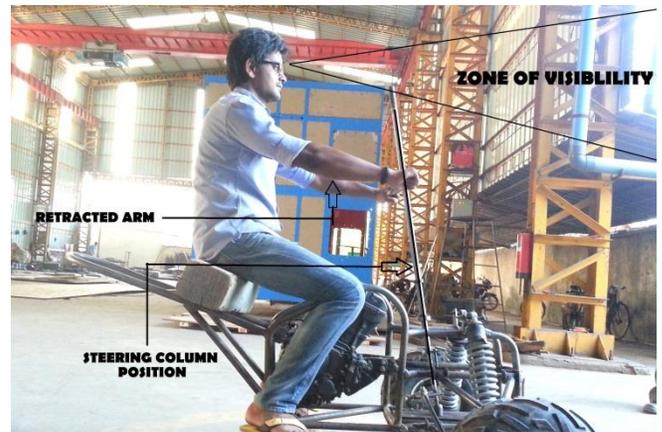
### ➤ DRIVER'S SAFETY & ERGONOMICS-

Driver's safety is the most important concern for our ATV. For better perspective we have made a 1:1 PVC model of the roll cage and further improvised our design in CATIA according to driver's ergonomics. For the comfort and well-being of the driver, the use of standard helmet, goggle, driver suit, gloves, neck brace, shoes & fire safety equipment will be used to ensure driver safety. For the rugged, up and down track the vehicle will be provided with a hitch point bumper with spring support installed in the front of the vehicle to absorb energy from collision. Two Fire extinguisher and two kill switches specified in the rulebook will also be used for the case of emergency.

Ergonomics include the foam padding of the front, rear and side body panels, gear shifting indicator, turn light indicators, standard rear view mirrors and such other things. ISI grade brake lights will be installed in the ATV with proper insulations in the vehicle which allows us to successfully compete in the Quad Torc competition.

### DRIVER'S VISIBILITY TEST:-

Driver's visibility governs the safety of the vehicle. The visibility not only refers to driver's ability of neglecting a distant placed object in front of the vehicle but also the ability to distinguish obstacles and respond to controls spontaneously.



**PICTURE SHOWING DRIVER ARM POSITION AND VISIBILITY ZONE ( DRIVER ERGONOMICS )**

### Anthropometry:-

Effective motorcycle and personal protective equipment design depends heavily upon understanding the geometric relationship between the motorcycle and the motorcycle rider. Basic human factors issues such as forward vision, riding comfort, control location and operation all require knowledge of riding posture while operating a motorcycle. This study reports on the results of a study to determine the three dimensional location and orientation of body segments for six different postures. Each subject was asked to assume a most comfortable riding position followed by a maximum forward and maximum rearward riding position on a conventional, sport and cruiser motorcycle. Many trials were conducted and these results were compared to a series of tests collected on the same motorcycles for testing. The data from this study provide unique three dimensional anthropometric data that could be used for future human factors motorcycle research.

The subjects were informed that photographs were going to be taken of them in various riding positions. The subjects were instructed that the first position represented their most natural or most comfortable riding posture for that particular motorcycle. The second trial represented the forward most riding posture that they would assume while the third trial represented the most rearward posture that they would assume for that motorcycle. Following these three trials, the subjects were asked to assume intermediate postures between these two extreme postures. In general, a minimum of five trials were collected for each subject. For all trials, subjects were asked to assume that they were operating the motorcycle and looking straight ahead. A target was placed on the curtain directly in front of the rider at some height. Riders were instructed to look forward to that they could see the target, but not necessarily to fix their gaze upon the target. It was felt that this approach ensured that the rider's head would remain upright throughout the entire range of seating positions.

**TABLE- List of body dimensions selected for measurement including age and weight:-**

| Dimension Number | Dimension                             | Description  |
|------------------|---------------------------------------|--|
| 1                | Age (year)                            |  |
| 2                | Weight (kg)                           | Total mass (weight) of the body  |
| 3                | Stature                               | Vertical distance from the floor to the highest point of the head (vertex).  |
| 4                | Shoulder (biacromial) breadth         | Distance along a straight line from acromion to acromion   |
| 5                | Hip Breadth, sitting                  | Breadth of the body measured across the widest portion of the hips   |
| 6                | Shoulder height, sitting              | Vertical distance from a horizontal sitting surface to the acromion  |
| 7                | Elbow height, sitting                 | Vertical distance from a horizontal sitting surface to the lowest bony point of the elbow when it is bent at a right angle with the forearm horizontal |
| 8                | Buttock-popliteal length (seat depth) | Horizontal distance from the hollow of the knee to the rearmost point of the buttock   |
| 9                | Lower leg length (popliteal height)   | Vertical distance from the footrest surface to the lower surface of the thigh immediately behind the knee, bent at right angles                        |
| 10               | Upper hip bone height, sitting        | Distance from floor to the uppermost point of the left hipbone. The hipbone is traced by palpating [11, 16].   |
| 11               | Lowest rib bone height, sitting       | Distance from floor to the bottom of the lowest left rib. The lowest left rib is traced by palpating [11, 16].   |

**Illustrations of anthropometric dimensions corresponding to Table:-**



## II. CONCLUSION

The objective of designing a single-passenger off-road race vehicle with high safety and low production costs seems to be accomplished. The design is first conceptualized based on personal experiences and intuition. Engineering principles and design processes are then used to verify and create a vehicle with optimal performance, safety, manufacturability, and ergonomics. The design process included using Solid Works, CATIA and ANSYS software packages to model, simulate, and assist in the analysis of the completed vehicle. After initial testing it will be seen that our design should improve the design and durability of all the systems on the car and make any necessary changes up until the leaves for the competition.

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R.P.M Bhopal (M.P)  
RPM, near Ratibad Town,  
Bhadbhada Road,  
Bhopal, Madhya Pradesh – 462023  
Polaris Indore (M.P)
- [4] MyCar Polaris, Pipliya Kumar Mangal      Compound Near Mttal Toll  
Kanta Indore, India – 452010

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# The Manager and User's Role in IT Use as a KM Tool.

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**Abstract-** As a matter of fact the knowledge aspects either if it was theoretical knowledge or practical knowledge is infinitely intertwined and has become ubiquitous in terms of technology use. Knowledge Management is imperatively related to the information technology in a large number of these aspects in order to create effective and professionalized techniques to go hand in hand with the users and managers to achieve the highest level of success in the face of the accelerated challenges. Hence, the study will be focused on to show the importance of the user and manager's roles in terms of the use of IT in Knowledge Management as a tool to elaborate and illustrate the roles of the Management and users in that capacity.

**Index Terms-**(KM) knowledge Management, (IT) Information Technology, Manager and user's roles.

## I. INTRODUCTION

Technology assures information availability, immediacy and transparency and all together make just-in-time solutions possible. But, the first generation of knowledge management (KM) practitioners were not excited about technology role in KM (Mohamed, 2008). It is undoubted that the use of technology becomes one of the imperative factors to obtain the competitive advantages and core competences in business or whatever aspect. Presenting the key technological indices can help managers of knowledge Management department in implementation of knowledge management processes among members of the supply chain (Nikabadi, 2014). Information is required to explain how the managers working under conditions are able to carry out their duties (Bergin, 2009). Managers need to understand the maturity of structuring and operating knowledge in their organization before they pursue learning projects. Our theory strongly suggests that different types of interventions and projects are necessary to shape the evolution of technological knowledge when technological knowledge is mature (Skilton and Dooley, 2002). Instead of seeking knowledge proactively, people receive information directly through push technology (Wachter, 1999). Both technological and organizational initiatives are needed, if aligned and integrated; they can provide a comprehensive infrastructure to support knowledge management processes productivity (Lang, 2001). Technology is not restricted to the field of technological function. Technology management is targeting a much broader view .it deals with stakeholders who so far has not employed and are even scared of technological variables such as accountants and financial experts (Chanaron and Jolly, 1999). Technological Management is not only a high-tech business fashion but it also concerns low-tech business where the diffusion of new technologies might have a significant impact. When adopting such a

transversal approach to technological management, we are stating that managers as well as practitioners and academia should be educated and trained in such a way that they should be able to identify, analyze, understand and evaluate the co-evolution of technology and management. They should also be able to fully integrate technological change in their decision making process at both strategic and operational levels (Chanaron and Jolly, 1999). The knowledge that was shared within the communities enabled the technologists to implement process improvements and to adopt new procedures and new products (Meeuwesen and Berends, 2007). Many efforts continue to focus on new applications of IT to support the digital capture, storage and retrieval and distribution of explicitly documented knowledge in a firm (Lang, 2001).

## II. LITERATURE REVIEW

### A. *Tacit and Explicit Knowledge:*

Wachter (1999) has explained "Tacit knowledge is personal and context specific, which is often developed over a long period of time through direct experience, whereas Explicit knowledge is knowledge that is transmittable in formal, systematic language" Styhre (2003) has explained that the "knowledge is thus a practice/ concept assemblage enabling for a seeing and doing as well as a saying and writing". It is beyond of concepts which should be applied in the real work field.

### B. *Knowledge Network:*

Pena (2002) has defined the knowledge network which is "an inter-organizational agreement to share knowledge among network members for the exploration (creation and development) or exploitation (product transformation and commercialization) of new technologies. An integrated knowledge management framework must comprehend both internal and external elements to create, develop and exploit knowledge can be managed inside the organization, but also can be shared with other organizations." Skilton & Dooley (2002) has described that there is a direct connection between technological knowledge and organizational learning where managers have to understand the nature of structuring and operating knowledge which would be suggested the possible future research on technological knowledge and easy to find the answer.

### C. *Managerial and user's Role:*

Burstrom and Wilson (2014) has described the managerial role which is "that requirement manager's role fulfillment is performed through five major activities described as developing, anchoring, re-organizing, routinizing, and positioning. These activities are essential in order to manage the change from working with small incremental project into working with a large flagship project. The demand on process precision in work with re-

quirement specifications is higher in flagship projects than in smaller projects with less degree of complexity.” Lang (2001) has reasoned that the knowledge management and corporate strategy might have insufficient linkage which is harmful for organization. The most important managerial context for investing in and promoting the use of knowledge management is the firm's strategy. That is, knowledge management efforts must not be divorced from strategy planning and execution. In other words, a firm's knowledge management strategy must be driven by a clear sense of what its competitive strategy is.” Bergin (2009) has given the manager's responsibility. “As middle managers, they had to satisfy many different needs, and thus they described innumerable clashes that occurred. They all spoke of how a politically governed organization creates conflicts for those who are in charge of the care making it necessary to deal with new financial conditions, prioritizations, leadership, and organization” Mohamed (2008) has supported the importance of knowledge management to support technology. “Knowledge Management Technology (KMT) is relatively powerful in regard to the domain of structured data (statistical, discovering patterns and modeling capabilities), but fairly weak in the area of unstructured data inference, self-learning, and tacit knowledge elicitation. As integration and interoperability have guided business software such as ERP, collaborative systems, and distributed database to succeed.” Nikabadi (2014) has also emphasized on the technology based factors which can accelerate the supply chain management and also the manager's role. The technology based factors for knowledge management in the supply chains for car industry between Iran Khodro and Saipa companies which known as biggest car manufacturers in Iran which can show the proof of knowledge management validity. We can find that “the integration of information systems with the development of IT tools in the internal and external processes in the supply chain are interrelated.” Nikabadi (2014) has claimed and also showed some challenges about those factors which should be improved. “Lack of e-business and e-commerce policies (business to business and business to client) among the members of the supply chain is among the other factors. This fact can challenge the companies on their outer organizational and inner organizational integration process and make the execution of enterprise resource planning system impossible. That is why the data integration has less importance than networks and information banks integration.” Petrovic et al. (1998) has recommended that we should improve our teaching to achieve the learning goals and also better to use of IT and non IT based methods and also to plan methods of education and training. For using the technologies in education we should change the perception of the teachers. We can take into account to make more globalization and decentralization which can be possible through IT. The technological management is not for allocating resources where the traditional management can arrange the specific resources. Technological management has a broader sense which can contribute to the stakeholder and also finance experts. For solving technical issues it is not necessary to have research and development department (Chanaron and Jolly, 1999). Technology can change the human resource management which can be a “logical and structured manner” and also the management should have necessary people whose have to understand “why change is occurring”. Another reason is the management should have to “ensure that

staff are aware of developments and receptive to change” (Farrow, 1997). Kagaari, Munene and Ntayi (2010) have found that the young universities performance is better than the older ones where is the main factor is the knowledge contribution which is done by “the theories agency and goal setting converge into performance management practices to explain and provide information on how to attain managed performance (quality services, service delivery and cost reduction).” Also the problems are found that the “committed and motivated workforce” are needed by using “human resource and quality initiatives”. It is confirmed that the importance of IT and quality of information are complementary to each other because manual filtering might disappear. Although automated information processing prevents manual mistakes, it also makes the process less transparent and therefore, wrong information or information of low value might be generated if the information input is already of bad quality and not properly checked. (Maharana et al., 2011).

### III. DISCUSSION

The tools of Knowledge management were considered as the pillars of Knowledge Management designing at any organization; one of these tools is the IT. Moreover, KM strategy, Organizational processes, management leadership, and politics are going hand in hand with the IT pillars in order to create an innovative KM. Thus, the use of IT by the Managers and even users requires being familiar in IT use and knowledge manage where the manager will be the responsible on to sustain and generate the knowledge at the organization. Hence, the outright understanding of these roles would support the managers and users to work out with the company mission and strategic objectives, cooperate the task among the strategic objectives to IT operation character, identify and assign all operations support tasks at organization, create a set of cost effective resources, staffing plans, and continuous improvement plans to sustain the competitive advantage if there. Both the manager and user have to use the systems and technologies which are excessively imperative to understand the nature and the environment of to work at any organization in order to meet the requirements of the organization at the time of the invasion technologies. Thus, the Importance of IT in KM shown by realizing the clearest common aim which is the sharing of Knowledge either if it was tacit or explicit knowledge. It is imperative to know and to understand the relationship among the manager and user in terms of IT use, and IT needs. Nevertheless, the correct usage of KM implementations will strengthen this relationship under its umbrella to create a sustainable value, improve, develop and refine the firm's competences and knowledge assets to meet the organizational goals and objectives. Subsequently, implementing KM perfectly and highly proficiency within the use of IT.

### IV. CONCLUSION

In short, it is found that the use of technology is irreplaceable and indispensable in terms of fulfilling the obligations of managers and users toward their organization. This requires a proper use of IT with managing it strategically to enable the organizations to manage its assets, managerial functions, minimiz-

ing operational costs and maximizing profits. Thereby, it is imperative for managers and users to work extensively to obtain the greatest possible out of the IT use in order to use KM perfectly and to have an integrated methods to outreach the staff which contributes to the competency of an organization.

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# Preliminary phytochemical analysis of different solvent extracts of *Scoparia dulcis* L.

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**Abstract-** Medicinal plants contain bioactive compounds which are used for treatment of various human diseases. Phytochemicals have two categories i.e., primary and secondary constituents. Secondary metabolites are responsible for medicinal activity of plants. The phytochemical analysis of total extracts in water, ethanol, methanol, chloroform, hexane and ether extracts of *Scoparia dulcis* L. were investigated. The phytochemical analysis revealed the presence of flavonoids, steroids, quinone, starch, cellulose, terpenoids, phenols, carbohydrates, fixed oil and fat, and saponins in varying solvents. This research seeks to investigate the presence phytochemical constituents as the possible agent responsible for the medicinal activities of the plant *Scoparia dulcis* L.. This plant belongs to family Scrophulariaceae. The present study provides evidence that different solvents can extract different phytochemical constituents of *Scoparia dulcis* L. The diversity of phytochemicals found suggests that *Scoparia dulcis* L. could serve as a natural source of traditional medicine for treatment of various diseases.

**Index Terms-** *Scoparia dulcis* L., phytochemical analysis, solvents, medicinal plant

## I. INTRODUCTION

The medicinal plants are useful for healing as well as curing of human diseases because of the presence of phytochemical constituents [1]. These include compounds that are utilized as food by man and other animals and also other com-pounds that exert physiological effects on them. This second group of chemical substances often referred to as secondary metabolites, give plants their therapeutic properties [2].

*Scoparia dulcis* L. is a widely distributed tropical and subtropical plant. It is a medicinal plant used to treat various human disorders. The fresh or dried plant has traditionally been used as one of remedies for stomach troubles, hypertension, diabetes, inflammation, bronchitis, hemorrhoids and hepatosis and as an analgesic and antipyretic [3].

Successful determination of biologically active compounds from plant material is largely dependent on the type of solvent used in the extraction procedure [4]. The main objective of our research work is to analyze the presence of secondary metabolites as the promising agent responsible for the medicinal and pharmaceutical activities of the plant *Scoparia dulcis* L. by carrying out the phytochemical screening of the plant in different solvents.

## II. MATERIAL AND METHODS

### 1) Collection of plant materials

The plant species were collected wildly from the of Long Thanh district, Dong Nai province, Viet Nam in August 2014 with the help of local people. The plant material was identified at the field using standard keys and descriptions.

### 2) Preparation of plant extracts

The selected plants were washed under running tap water to remove dust. The plant samples were then dried for 48hrs in a hot air oven at 60°C and then were ground using an electric blender to obtain a fine powder and stored in polythene bags until needed for analysis. 50g portions of powdered plant materials were each separately dispersed in 500ml of each water, ethanol, methanol, chloroform, hexane and ether. The solutions were vigorously shaken at room temperature for 48hrs and were filtered with Whatman No.1 filter paper. The filtrate was used for the phytochemical analysis.

### 3) Phytochemical analysis

Chemical tests for the screening and identification of bioactive chemical constituents in the medicinal plants under study were carried out in extracts as well as powder specimens using the standard procedures as described by [5, 6, and 7].

## III. RESULT AND DISCUSSION

Table 1: Phytochemical analysis of *Scoparia dulcis* L.

| Constituent       | Aqueous extract | Ethanol extract | Methanol extract | Chloroform extract | Hexane extract | Ether extract |
|-------------------|-----------------|-----------------|------------------|--------------------|----------------|---------------|
| Flavonoids        | +               | +               | +                | +                  | -              | -             |
| Steroids          | -               | -               | -                | -                  | +              | +             |
| Quinone           | +               | +               | -                | -                  | -              | -             |
| Starch            | +               | +               | -                | -                  | +              | +             |
| Anthocyanin       | -               | -               | -                | -                  | -              | -             |
| Cellulose         | -               | -               | -                | +                  | +              | -             |
| Terpenoids        | +               | +               | -                | -                  | +              | -             |
| Phenols           | +               | +               | +                | -                  | -              | -             |
| Carbohydrates     | +               | +               | +                | -                  | -              | -             |
| Fixed oil and Fat | +               | -               | -                | +                  | -              | -             |
| Saponins          | +               | -               | +                | -                  | -              | +             |

The study has revealed the presence of phytochemicals considered as active medicinal chemical constituents. Of the eleven phytochemicals screened for, ten were found present in various solvent extracts. They are of flavonoids, steroids, quinone, starch, cellulose, terpenoids, phenols, carbohydrates, fixed oil and fat, and Saponins. Anthocyanin was not detected in six different solvents.

The extraction of phytochemicals is dependent on the dissolution of each compound in the plant material matrix and their diffusion into the external solvent [8], therefore the choice of extraction solvent is one of the most important matters to consider for solid-liquid extraction. The factors that need to be considered when choosing the solvent or solvent system for extraction of phytochemicals are safety of the solvent and potential for formation or extraction of undesirable compounds and finally solubility of the target compound [9, 10].

The result indicates that *Scoparia dulcis* L. is a promising herbal of pharmaceutically important phytochemicals. Terpenoids can have medicinal properties such as anticarcinogenic (e.g. perilla alcohol), antimalarial (e.g. artemisinin), anti-ulcer, hepaticidal, antimicrobial or diuretic (e.g. glycyrrhizin) activity and the sesquiterpenoid antimalarial drug artemisinin and the diterpenoid anticancer drug taxol [11, 12]. Flavonoids have been stated to possess many useful properties, containing anti-inflammatory activity, enzyme inhibition, antimicrobial activity, oestrogenic activity, anti-allergic activity, antioxidant activity, vascular activity and cytotoxic antitumor activity [13].

#### IV. CONCLUSION

Those phytochemicals were revealed differently in different solvents. The study concluded that the choosing of solvent could have produced diversely number of secondary metabolites which are responsible for many medicinal and pharmaceutical properties. The plant *Scoparia dulcis* L. should be investigated under more researches to utilize its potential activities. Furthermore, isolation, purification, and characterization of the phytochemicals found present should also be considered for future investigation.

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# Potential of some fungicides on the growth and development of *Sclerotium rolfsii* Sacc. *in vitro*

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**Abstract-** *Sclerotium rolfsii* Sacc. is known to be a serious pathogen on many crops of economic importance. This pathogen is the major constraint in successful cultivation of most of the cash crops in Barak Valley. The present investigation was carried out to evaluate the potential of six systemic fungicides (i.e. Propiconazole 25% EC, Hexaconazole 5% EC, Myclobutanil 10% WP, Thiophanate Methyl 70% WP, Tebuconazole 25.9 m/m EC & Carbendazim 50% WP); three non-systemic fungicides (i.e. Captan, Mancozeb 75% WP & Copper oxychloride) and three combo fungicides (i.e. Metalaxyl 8% + Mancozeb 64%, Carbendazim 12% + Mancozeb 63% & Carboxin 37.5% + Thiram 37.5%). These fungicides were evaluated at different concentrations (i.e. 1, 10, 50 and 100 ppm), except copper-oxychloride (contact) at 0.1%, 0.25%, 0.5% and 1.00% on the growth of *Sclerotium rolfsii* in Potato dextrose agar (PDA) medium using poisoned food technique, *in vitro*. The result shows that the effect of hexaconazole (systemic) has been highly effective in suppressing radial expansion as well as percent inhibition of the fungus at all the concentrations used followed by Carboxin 37.5% + Thiram 37.5% (combo Fungicide) and tebuconazole (systemic). The results suggest that some of these fungicides may be tried against *S. rolfsii* in susceptible crop plants (i.e. brinjal) under field condition.

**Index Terms-** Fungicides, inhibitory, *in vitro*, radial growth, *Sclerotium rolfsii*

## I. INTRODUCTION

*Sclerotium rolfsii* Sacc. is a devastating soil-borne fungus and infects more than 500 plant species in tropical and subtropical countries of the world (Aycock, 1966; Punja 1985). It can infect seeds, seedlings, mature plants in the field, cause diseases to fresh vegetables and rhizomes, while in storage and transit (Dasgupta and Mandal 1989).

The Barak Valley situated at Southern part of Assam is one of the important regions for both agricultural and horticultural point of view. The economy of the poor families living in this region is always depending on agriculture. The prevailing uncertain climatic condition leads to various plant diseases resulting economic loss of agricultural productivity.

Keeping the above in view the present work was taken up to evaluate some systemic, contact and combo (combination) fungicides against the pathogen *S. rolfsii* *in vitro*.

## II. MATERIALS AND METHODS

### Isolation of the target Fungus

Affected brinjal plants showing the typical symptoms of foot rot disease were collected from the farmers' field for isolation of the fungus through standard isolation technique. Affected tissue bits were surface sterilized with 1:1000 mercuric chloride solutions for one minute and then aseptically transferred to Petri plates having potato dextrose agar medium. These plates were then incubated at 25± 2°C for 72 hours. The fungal growth, which arose through the infected tissues were aseptically transferred to the PDA slants.

### *In vitro* evaluation of fungicides against *S. rolfsii*:

The efficacy of six systemic fungicides (Propiconazole 25% EC, Hexaconazole 5% EC, Myclobutanil 10% WP, Thiophanate Methyl 70% WP, Tebuconazole 25.9 m/m EC & Carbendazim 50% WP); three non-systemic fungicides (Captan 50% WP, Mancozeb 75% WP & Copper oxychloride) and three combo fungicides (Metalaxyl 8% + Mancozeb 64%, Carbendazim 12% + Mancozeb 63% & Carboxin 37.5% + Thiram 37.5%) was evaluated *in vitro* at different concentrations of 1, 10, 50 and 100 ppm, except copper-oxychloride (contact) at 0.1%, 0.25%, 0.5% and 1.00% on the growth of *Sclerotium rolfsii* on Potato dextrose agar (PDA) medium using poisoned food technique (Nene and Thapliyal, 1982). Three replications were maintained for each treatment. Potato dextrose agar medium without any of the fungicide served as control. The plates were incubated at 25± 2°C for recording radial growth of the target fungus *in vitro*.

### Growth parameter and analysis of data:

The mean colony diameter in each treatment was recorded by taking diameter of the colony in two directions at 48 hrs after inoculation and subsequent data were recorded at 24 hrs interval. The percent inhibition of the growth over control was calculated at 120 hrs after inoculation by using the formula given by Vincent (1947):

$$I = \frac{C-T}{C} \times 100$$

Where,

I=percent inhibition

C=growth in control

T=growth in treatment

The recorded data were analysed by using Microsoft office Excell-2007, SPSS- 19.2

III. RESULTS AND DISCUSSION

From the results, it can be seen that the lowest radial mycelial growth of *Sclerotium rolfisii* was observed at all the concentrations of Hexaconazole followed by Tebuconazole and highest growth was recorded with Thiophanate Methyl followed by Carbendazim 50WP (Table 1).

All the tested systemic fungicides showed initial inhibitory effect at all the concentrations used as compared to control, except Thiophanate Methyl at 1 ppm. However, Hexaconazole and Tebuconazole exhibited 100% inhibition upto 144 hrs at both 50 and 100 ppm concentration followed by Mycobutanil upto 96 hrs at 100 ppm concentration. Moreover, Hexaconazole at very low concentration had shown satisfactory suppression on the radial growth of *S. rolfisii* i.e. 75.22 % at 1 ppm and 91.33% at 10 ppm as recorded after 120 hrs of incubation following inoculation. Thiophenate methyl had shown less inhibitory effect at all the concentrations tested (Table 1& 4).

Out of the non-systemic fungicides, all the three tested fungicides have shown slight initial inhibitory effect on the test fungus at all the concentration of treatment as compared to control. However, Mancozeb and Captan showed higher inhibitory effect as compared to Copper oxychloride (Table 2, 4).

Among the three combo fungicides, all of them have exhibited initial inhibitory effect on test fungus at all the concentrations used as compared to control. However, Carboxin 37.5% + Thiram 37.5% showed 100% inhibition upto 144 hrs at both 50 and 100 ppm concentration and upto 72 hrs at 10 ppm concentration (Table 3,4).

Hexaconazole (systemic) is found to be the most effective fungicide followed by Carboxin 37.5% + Thiram 37.5% (combo Fungicide) and Tebuconazole (Table 4).

**Table 1: Effect of selected systemic fungicide on the radial expansion of *Sclerotium rolfisii*, in vitro**

| Name of fungicides        | Treatment | Radial expansion of the test fungus (mm) |            |            |            |            |
|---------------------------|-----------|--|------------|------------|------------|------------|
|                           |           | 48 hrs                                   | 72 hrs     | 96 hrs     | 120 hrs    | 144 hrs    |
|                           | Control   | 29.0±1.11                                | 50.0±1.51  | 73.0± 2.48 | 90.0± 0.00 | 90.0± 0.00 |
| Propiconazole 25% EC      | 1 ppm     | 10.5±0.28                                | 27.16±0.92 | 54.7±1.92  | 65.5±2.52  | 83.7±1.85  |
|                           | 10 ppm    | 7.5±0.50                                 | 16.83±0.16 | 28.3±0.66  | 40±0.58    | 49.0±0.76  |
|                           | 50 ppm    | 0.0±0.00                                 | 13.83±0.33 | 19±0.76    | 19.7±0.33  | 20.0±0.28  |
|                           | 100 ppm   | 0.0±0.00                                 | 8.3±0.88   | 10.3±1.09  | 10.8±1.36  | 11.0±1.32  |
| Hexaconazole 5% EC        | 1 ppm     | 0.00                                     | 14.7±0.72  | 17.5±0.76  | 22.3±0.33  | 28.0±0.57  |
|                           | 10 ppm    | 0.00                                     | 7.7±0.33   | 8.5±0.57   | 7.8±0.17   | 7.8±0.16   |
|                           | 50 ppm    | 0.00                                     | 0.00       | 0.00       | 0.00       | 0.00       |
|                           | 100 ppm   | 0.00                                     | 0.00       | 0.00       | 0.00       | 0.00       |
| Mycobutanil 10% WP        | 1 ppm     | 10.0±1.04                                | 18.6 ±0.53 | 41.6± 0.90 | 86.0 ±1.8  | 90.0 ±0.00 |
|                           | 10 ppm    | 09.0±0.29                                | 16.6± 0.12 | 34.4 ±0.12 | 80.0 ±0.50 | 90.0± 0.00 |
|                           | 50 ppm    | 0.0± 0.00                                | 0.0± 0.00  | 19.0 ±0.15 | 56.3 ±0.36 | 74.0± 0.40 |
|                           | 100 ppm   | 0.0 ±0.00                                | 0.0± 0.00  | 0.0± 0.00  | 34.3 ±0.30 | 62.0± 0.87 |
| Thiophanate Methyl 70% WP | 1 ppm     | 29.0±0.92                                | 49.0± 0.98 | 72.0± 0.83 | 90.0 ±0.00 | 90.0± 0.00 |
|                           | 10 ppm    | 25.3±0.26                                | 48.0 ±1.30 | 69.8± 1.47 | 90.0 ±0.00 | 90.0±0.00  |
|                           | 50 ppm    | 24.0±0.42                                | 47.8± 0.72 | 66.7± 0.97 | 90.0 ±0.00 | 90.0± 0.00 |
|                           | 100 ppm   | 18.3±0.69                                | 25.6 ±0.53 | 41.4± 0.92 | 72.5 ±2.08 | 89.0 ±1.06 |
| Tebuconazole 25.9 m/m EC  | 1 ppm     | 7.5±0.28                                 | 19.2±0.44  | 36.0±1.75  | 43.5±0.76  | 63.3±1.33  |
|                           | 10 ppm    | 00.00                                    | 11±0.29    | 21.17±2.24 | 24.7±2.03  | 28.83±2.58 |
|                           | 50 ppm    | 0.00                                     | 0.00       | 0.00       | 0.00       | 0.00       |
|                           | 100 ppm   | 0.00                                     | 0.00       | 0.00       | 0.00       | 0.00       |
| Carbendazim 50% WP        | 1 ppm     | 12.2±1.06                                | 48.7±2.06  | 61.2±1.63  | 90.0±0.00  | 90.0±0.00  |
|                           | 10 ppm    | 10.6±0.40                                | 44.6±2.40  | 59.2±0.64  | 88.8±0.40  | 90.0±0.00  |
|                           | 50 ppm    | 10.2±0.30                                | 43.2±0.70  | 58.4±0.61  | 88.4±0.42  | 90.0±0.00  |
|                           | 100 ppm   | 10.2±0.50                                | 34.2±1.02  | 51.3±2.02  | 78.2±1.22  | 88.0±0.61  |
|                           | F-test    | 38.12                                    | 22.80      | 14.50      | 18.90      | 14.64      |

Values are mean ± SE of three replication

**Table 2: Effect of selected non systemic(contact) fungicide on the radial expansion of *Sclerotium rolfisii*, in vitro**

| Name of fungicides | Treatment | Radial expansion of the test fungus (mm) |           |           |            |            |
|--------------------|-----------|--|-----------|-----------|------------|------------|
|                    |           | 48 hrs                                   | 72 hrs    | 96 hrs    | 120 hrs    | 144 hrs    |
|                    | Control   | 35.3±0.66                                | 63.5±1.35 | 80±1.90   | 90±0.00    | 90.0± 0.00 |
| Captan 50% WP      | 1 ppm     | 28.9±0.92                                | 48.6±1.40 | 61.0±0.72 | 82.0±1.17  | 90.0±0.00  |
|                    | 10 ppm    | 26.0±0.61                                | 44.0±0.83 | 60.6±0.94 | 81.3± 0.87 | 90.0± 0.00 |

|                    |         |            |            |            |            |            |
|--------------------|---------|------------|------------|------------|------------|------------|
|                    | 50 ppm  | 24.8±0.41  | 42.0±0.81  | 57.7± 0.70 | 80.0± 1.25 | 84.0± 1.33 |
|                    | 100 ppm | 21.3±1.04  | 39.8±0.81  | 53.3± 1.42 | 75.6±1.27  | 80.2±0.64  |
| Mancozeb 75% WP    | 1 ppm   | 28.2±0.92  | 44.0± 2.02 | 64.3 ±1.43 | 86.0± 2.43 | 90.0± 0.00 |
|                    | 10 ppm  | 27.0±0.41  | 43.7 ±0.68 | 57.5 ±2.07 | 82.6± 0.99 | 90.0± 0.00 |
|                    | 50 ppm  | 24.9±0.93  | 41.0 ±0.72 | 54.0 ±1.17 | 78.3 ±0.47 | 90.0 ±0.00 |
|                    | 100 ppm | 20.8±0.30  | 38.4± 1.11 | 48.0 ±0.53 | 72.0 ±0.99 | 87.0± 2.10 |
|                    | F-test: | 15.45      | 51.31      | 18.66      | 4.05       | 2.23       |
| Copper oxychloride | 0.10%   | 27.80±0.92 | 48.60±0.50 | 67.80±0.20 | 90.00±0.00 | 90.0±0.00  |
|                    | 0.25%   | 27.60±0.49 | 46.40±0.83 | 64.20±1.35 | 88.50±0.38 | 90.0±0.00  |
|                    | 0.50%   | 24.90±0.74 | 44.00±0.61 | 58.40±0.30 | 87.80±0.50 | 90.0±0.00  |
|                    | 1.00%   | 24.00±1.39 | 42.60±0.40 | 53.60±0.50 | 83.20±1.06 | 90.0±0.00  |
|                    | F-test: | 15.45      | 51.31      | 18.66      | 4.05       | 2.23       |

Values are mean ± SE of three replication

**Table 3: Effect of selected combo fungicide on the radial expansion (growth) of *Sclerotium rolfsii*, in vitro**

| Name of fungicides             | Treatment | Radial expansion of the test fungus (mm) |            |            |            |            |
|--------------------------------|-----------|--|------------|------------|------------|------------|
|                                |           | 48 hrs                                   | 72 hrs     | 96 hrs     | 120 hrs    | 144 hrs    |
|                                | Control   | 35.3±0.66                                | 63.5±2.25  | 80±1.73    | 90±0.00    | 90.0± 0.00 |
| Metalaxyl 8% +Mancozeb 64%     | 1 ppm     | 26.4±1.13                                | 39.8 ±1.58 | 54.0 ±1.44 | 84.0 ±2.03 | 90.0± 0.00 |
|                                | 10 ppm    | 24.0±1.47                                | 32.5 ±0.68 | 48.6 ±0.95 | 83.3 ±0.64 | 90.0± 0.00 |
|                                | 50 ppm    | 21.0±1.01                                | 30.0± 1.11 | 43.6 ±1.33 | 73.3± 2.07 | 83.3± 0.44 |
|                                | 100 ppm   | 17.6±0.72                                | 26.0± 2.03 | 31.0± 0.72 | 57.5 ±1.78 | 72.0 ±1.06 |
| Carbendazim 12% + Mancozeb 63% | 1 ppm     | 28.4±0.70                                | 41.4±0.94  | 58.2±1.06  | 88.2±1.04  | 90.0±0.00  |
|                                | 10 ppm    | 24.8±0.72                                | 34.6±0.87  | 49.8±0.35  | 86.0±0.47  | 90.0±0.00  |
|                                | 50 ppm    | 21.4±0.83                                | 31.0±1.01  | 44.6±0.99  | 77.0±0.50  | 90.0±0.00  |
|                                | 100 ppm   | 18.6±0.42                                | 28.2±0.61  | 34.0±0.53  | 58.4±0.31  | 74.4±0.92  |
| Carboxin 37.5% + Thiram 37.5%  | 1 ppm     | 14.0±0.61                                | 26.8±0.92  | 44.0±0.70  | 54.2±1.06  | 74.2±0.95  |
|                                | 10 ppm    | 0.0                                      | 0.0        | 8.4±0.31   | 12.2±0.60  | 26.6±0.42  |
|                                | 50 ppm    | 0.0                                      | 0.0        | 0.0        | 0.0        | 0.0        |
|                                | 100 ppm   | 0.0                                      | 0.0        | 0.0        | 0.0        | 0.0        |
|                                | F-test:   | 5.94                                     | 41.66      | 18.50      | 17.16      | 11.20      |

Values are mean ± SE of three replication

**Table 4: Effect of systemic, non systemic (contact) and combo fungicide on the percent inhibition of radial growth of *S. rolfsii* at different concentrations**

| Name of fungicides        | Percent inhibition on radial growth of <i>S. rolfsii</i> in different concentrations of test fungicides observed at 120 hrs after inoculation |        |        |         |
|---------------------------|---|--------|--------|---------|
|                           | 1 ppm   | 10 ppm | 50 ppm | 100 ppm |
| Propiconazole 25% EC      | 27.22   | 55.55  | 78.11  | 87.66   |
| Hexaconazole 5% EC        | 75.22   | 91.33  | 100.00 | 100.00  |
| Mycobutanil 10% WP        | 4.44  | 11.11  | 37.45  | 61.89   |
| Thiophanate Methyl 70% WP | 0.00  | 0.00   | 0.00   | 19.44   |
| Tebuconazole 25.9 m/m EC  | 51.66   | 72.55  | 100.00 | 100.00  |
| Carbewndazim 50% WP       | 0.00  | 8.66   | 8.22   | 3.11    |
| Captan 50% WP             | 8.89  | 9.67   | 11.11  | 16.00   |

|                               |       |       |        |        |
|-------------------------------|-------|-------|--------|--------|
| Mancozeb 75% WP               | 4.44  | 8.22  | 13.00  | 20.00  |
| Copper oxychloride*           | 0.00  | 1.67  | 2.44   | 7.55   |
| Metalaxyl 8% +Mancozeb 64%    | 6.67  | 7.44  | 18.56  | 36.11  |
| Carbendazim12%+Mancozeb 63%   | 2.00  | 4.44  | 14.44  | 35.11  |
| Carboxin 37.5% + Thiram 37.5% | 39.78 | 86.44 | 100.00 | 100.00 |

*Sclerotium rolfsii* is known to be a serious pathogen on many of the crop plants of economic importance (Aycok, 1966). This pathogen is the major constraint in successful cultivation of most of the cash crops in Barak Valley. The extensive field survey through this entire geographic region reveals that the foot rot disease caused by *S. rolfsii* is widely distributed and causes severe damage to many cash crops during all the season(i.e. Kharif and Rabi season).

In the present investigation, six systemic fungicides; three non- systemic and three combo fungicides were evaluated for their potential of inhibition to the growth of the pathogen (*S. rolfsii*) *in vitro*. This was done with poisoned food techniques (Nene and Thapliyal, 1982).

The two fungicides viz Hexaconazole & Tebuconazole among the systemic fungicides, were found to be highly effective at all the concentrations used followed by propiconazole and mycobutnil. Least inhibition was observed with Thiophanate methyl and Bavistin. The result conform with the established findings of earlier workers viz. Prabhu( 2003), Choudhury et al. (1998). Manu et. al.(2012) reported that hexaconazole, Tebuconazole & propiconazole were found to be having strong inhibitory effect on the growth of *S. rolfsii* isolated from finger millet at lower concentration.

Out of the three combo fungicides, Carboxin 37.5% + Thiram 37.5% is found to be highly inhibitory on the growth of *S. rolfsii* and it is in accordance with the works of many workers viz. Vyas and Joshi (1977) , Sujatha (1991), Manu et.al.(2012), reported Carboxin was highly effective against *S. rolfsii*.

Systemic fungicides (i.e. benomyl, thiophenate methyl, bavistin) have reported to have given excellent control to the wilt disease of tomato caused by *Verticillium albo-atrum* R. & B (Dutta 1980). Deb and Dutta (1989) reported that nitrofurans caused complete inhibition of *Sclerotium rolfsii* at 1000 µg/ml *in vitro*. The furans have also reduced disease severity to the *S. rolfsii* infected soybean plants under field condition.

Dutta *et al.*(1992) has also reported that some systemic and contact fungicides (i.e. Tridemorph, Hexaconazole, Propiconazole, Cyproconazole, Carbendazim, Carboxin and Copper) applied *in vitro* and as foliar spray gave excellent control of Blister blight disease of tea causing organism *Exobasidium vexans*. It has further reported by Dutta (1994) that some systemic and contact fungicides could control some of the economically important tea diseases caused by *Exobasidium vexans*, *Corticium theae*, *Cephaleuros parasitic* and *Tunstallia acculata* under the agroclimatic condition of Darjeeling district of West Bengal and Barak Valley of Southern Assam respectively.

Based on the result presented above it can be suggested that the fungicides (i.e. Hexaconazole, Carboxin + Thiram (vitavex power), Tebuconazole and Propiconazole) can be recommended to control *S. rolfsii* under field condition for the susceptible crop plants i.e. Brinjal. The experiment under field condition is in progress, the results of the same will be communicated in due course of time.

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# Predictors of overweight and obesity among medical students

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**Abstract Background:** India has been experiencing a nutritional transition in food choices from typical Indian diet into the fast- food pattern. Obesity in combination with unhealthy lifestyle such as smoking and physical inactivity may increase the risk of chronic diseases. We have focused on finding out the predictors of obesity among medical students using a questionnaire and the prevalence of obesity by BMI (Body-Mass Index) which is a weight to height ratio and is a sensitive indicator for finding out the prevalence of obesity

**Aim:** This study was designed to find the prevalence of overweight and obesity and to identify the predictors of overweight and obesity among the medical students.

**Results:** out of 375 participants, 22.9% were found to be in the pre-obese category and 6.9% in the obese category. 70.1% did not have a regular exercise pattern or no habit of exercising. 5.3% of the non-exercising participants were found to be obese with a p value of 0.0201 and odds ratio = 1.45. 4% of participants who had the habit of consuming snacks between meals were obese with a p value of 0.020 and odds ratio = 2.44. 0.8% of participants who had the habit of having snacks at midnight were found to be obese with a p value of 0.0015 and odds ratio = 2.4.

**Conclusion:** To conclude,

Among the pre obese and obese category predictors like regular exercise, mid meal snacking and midnight snacking were found to have significant association .

**Index Terms-** obesity, overweight, predictors

## I. INTRODUCTION

Obesity may be defined as an abnormal growth of the adipose tissue due to an enlargement of fat cell size or an increase in fat cell number or both.[1] Obesity is one of the major risk factors for development of many chronic non communicable diseases such as NIDDM, CVD and cancer and is also associated with various psychosocial problems. The health consequences of obesity are many and varied ranging from premature death to severe non fatal but debilitating complaints. [2] India has been experiencing a nutritional transition in food choices from typical Indian diet into the fast- food pattern. Obesity in combination with unhealthy lifestyle such as smoking and physical inactivity may increase the risk of chronic diseases.[2] Worldwide, at least

2.8 million people die each year as a result of being overweight or obese, and an estimated 35.8 million (2.3%) of global DALYs are caused by overweight or obesity.[3]

Overweight and obesity lead to adverse metabolic effects on blood pressure, cholesterol, triglycerides and insulin resistance. Risks of coronary heart disease, ischemic stroke and type 2 diabetes mellitus increase steadily with increasing body mass index (BMI), a measure of weight relative to height. [3] The nutritional status of medical students is commonly overlooked and are not examined in depth. This study focuses on finding out the prevalence of obesity in medical students using BMI (Body-Mass Index) which is a weight to height ratio and is a sensitive indicator for finding out the prevalence of obesity.

## II. OBJECTIVES

This study was a cross sectional study conducted on medical college undergraduates in Saveetha Medical College, Thandalam from September 2013-december 2013. The sample size was calculated with the help of n-Master software as 375 based on a study conducted by a group of doctors in Karachi on post graduate students.

- To assess the prevalence of obesity in medical students in a private medical college.
- To identify the factors associated with the development of obesity in the study group.
- Identification of persons in the pre-obese category.

## III. MATERIALS AND METHODOLOGY

The height and weight of the students were measured and BMI has been calculated. The lifestyle and eating habits of each student had been collected with the help of a questionnaire.

### A. Calculation of Body Mass Index

$$\text{BODY MASS INDEX (BMI)} = \frac{\text{Weight in kilograms}}{\text{Height in metre}^2}$$

| CLASSIFICATION  | BMI         |
|-----------------|-------------|
| UNDERWEIGHT     | <18.50      |
| NORMAL RANGE    | 18.50-24.99 |
| OVERWEIGHT      |             |
| PRE-OBESE       | 25.00-29.99 |
| OBESE CLASS I   | 30.00-34.99 |
| OBESE CLASS II  | 35.00-39.99 |
| OBESE CLASS III | ≥40.00      |

TABLE 1: Classification according to BMI

*B. Analytical strategy:*

Prevalence was expressed in percentage and Chi-square test was used to establish an association of factors. Proposal development took 1 month .After approval by ethical committee the data was collected from college students in 2 months Data collected was entered in an excel sheet with coding and analysed. Analysis of data and manuscript drafting was completed in 1 month

III. OBSERVATIONS

A. Gender distribution of the participants

Out of the 375 participants, the male participants were found to be 47.3% (164) and the female population was 56.3% (211)

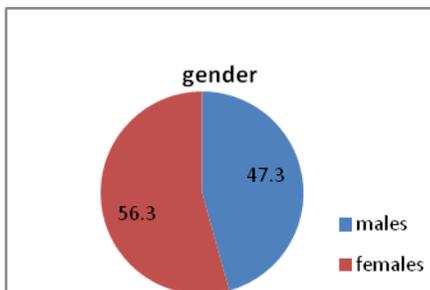


FIGURE 1: Gender distribution of the participants.

B. Body mass index of participants

Of the 375 participants, 20 were obese,269 were in the pre-obese category,138 had normal BMI and 36 were in the underweight category.

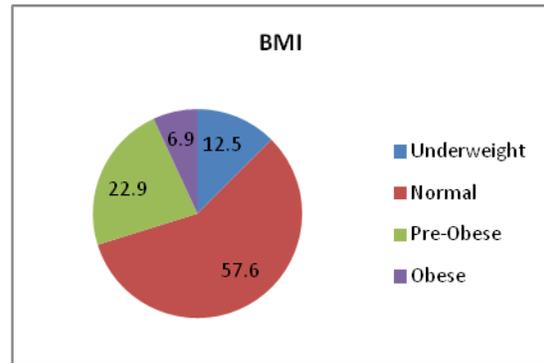


Figure 2: Body mass index (BMI) classification of the participants

C. Exercise patterns of the participants

Out of the 375 participants 263 were on a regular exercise regimen and 112 were not on any exercise regimen.

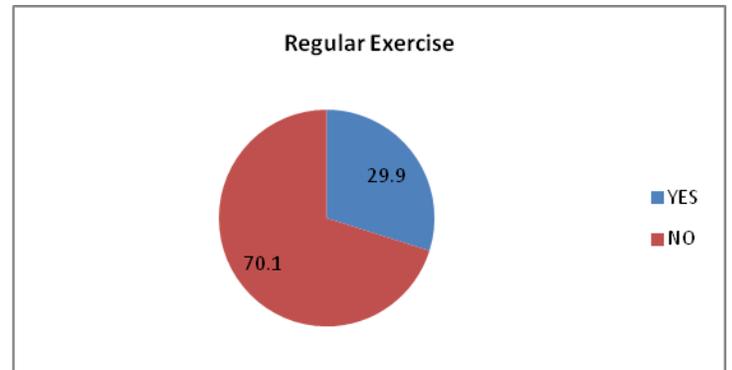
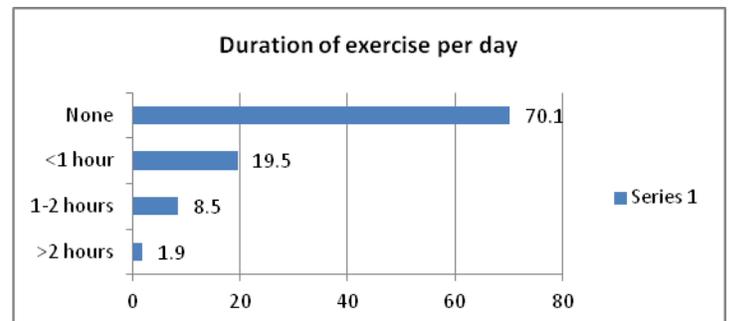


Figure 3: Exercise patterns of participants.

D. Duration of exercise





- or Post Graduate  
school diploma
- B) Graduate  
C) Intermediate or post high school certificate  
D) High school certificate  
E) Middle school certificate  
F) Illiterate
- 9) Total Income of the family \_\_\_\_\_
- 10) Number of members in the family \_\_\_\_\_
- 11) Do you consume alcohol? YES NO
- 12) How often do you consume alcohol?  
A) Daily B) Weekly C) Occasionally D) Rarely
- 13) Do you smoke? YES NO
- 14) How often do you smoke?  
A) Daily B) Weekly C) Occasionally D) Rarely
- 15) If daily, how many cigarettes do you smoke per day?  
A) 10 cigarettes or less  
B) 11-20  
C) 21-30  
D) More than 30
- 16) Which is your heaviest meal of the day?  
1) Breakfast  
2) Lunch  
3) Dinner
- 17) How many meals do you have per day?  
\_\_\_\_\_
- 18) Do you skip Breakfast? 1) YES 2) NO
- 19) If yes, how often do you skip breakfast in a week?  
1) 1-2 times  
2) 3-4 times  
3) Everyday
- 20) Do you have the habit of eating/snacking between meals? 1) YES 2) NO
- 21) What is your preferred snack?

- 1) Fruits and vegetables  
2) Junk food-chips, cookies etc.  
3) sweets
- 22) Which beverage do you prefer to drink?  
1) Water  
2) Juice  
3) Carbonated drinks
- 23) How frequently do you eat out?  
1) Once a month  
2) Couple of times a month  
3) Once a week  
4) Couple of times a week  
5) Every day
- 24) Do you have the habit of eating midnight snacks?  
1) YES 2) NO
- 25) If yes, how many times in a week do you do so?  
1) 1-2 times  
2) 2-3 times  
3) 3-5 times  
4) Everyday

#### Appendix B : CONSENT FORM

I \_\_\_\_\_ agree to take part in the research study, conducted by \_\_\_\_\_, Medical students of Department Of Community Medicine in Saveetha Medical College and Hospital, entitled “: PREVALENCE OF OBESITY AMONG MEDICAL STUDENTS IN A PRIVATE MEDICAL COLLEGE”.

I acknowledge that the research study has been explained to me and I understand that agreeing to participate in the research means that I am willing to:

- Provide information which is only the truth and to the best of my knowledge.
- Allow the researcher to have access to the medical records, pertaining to the purpose of the study.
- Allow to participate in the analysis program.

I have been informed about the purpose of my queries towards the research. I provide consent to the researcher to use the information given by me for educational purposes only. I understand that my participation is voluntary and can withdraw at any stage of research.

#### ACKNOWLEDGMENT

We express our acknowledgement to the Department of Community Medicine, Saveetha Medical College for the guidance.

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# The Free Energy Generator

Mayank Grover, B. Lohith Kumar, Isaac Ramalla

**Abstract-** More than 90% world's power is being generated using electromagnets based on the faraday's law of electro-magnetic induction. Many new technologies were discovered with time which led a drastic change in the perception of electric energy. But at the same time there is misconception of FREE ENERGY. Energy becomes free only at a point after which we don't have to pay for power generation after commissioning the unit. By using the magnetic force of magnets continuous motion (Energy) is generated.

We used Neodymium magnets are placed on the fins of the fan which has a capacity of 1-1.4 T[1]. Disc shaped magnets are placed in such a way that all the north poles or south poles are facing one direction. This magnet also produces a magnetic field, so both the magnetic fields repel each other (like poles repel), which causes the fins to move. The free Energy Generator was fitted onto the 2 wheelers in-front. The power extracted was used to charge a mobile battery. Few positive results are motivating us to create a better model to store the energy and use for different necessary applications by using this free energy. In this research paper, the usage of free energy was noticed by using a magnet and few satisfactory results are motivating us to review few research ground work of magnets to create a perfect strong prototype for better applications.

**Index Terms-** Electromagnetic Induction, free energy, neodymium magnets, MOC

## I. INTRODUCTION

There is no such thing as Free Energy. Any electric power from Solar cells, Wind, Tidal, Geothermal, Hydro-electric is only free, after we starting up these methods for generating electric power by providing some capital cost. Energy becomes free only after some point since we do not have to pay charges for electric power generated through these non-conventional methods for generating electric power.

Hence the concept of using magnets in generation of electricity has been around us from a long time.

For many years simple magnets have been used for their magnetic field to produce electric power. They are placed in the inside core of motors & generators. The basic principle of power generation lies under the magnetic effect. It states that "When a conductor is rotated in a magnetic field, a voltage is induced in the conductor". So here we will be dealing with such conductors [2]

Magnet Engine free energy generator is an easy device to generate electrical energy. It works on the principle of Neodymium Magnets. In a simple motor, magnetic field is created by the electric coils generally Cu, Al coils. These motors continuously need electrical supply to produce magnetic field. There are huge amount of energy losses. But the Magnet Motor Consists of no such coils. Hence there will be minimal losses [5]. It uses the permanent magnetic field of the magnets to generate the required

force to move the motor. This concept of generating magnetic field from the permanent magnets became practical only after introducing Neodymium magnets which are much power full than the previous Ferrite magnets. The main advantage is that it does not require continuous electric supply.

## II. EXPERIMENTS AND DISCUSSION

### A. Construction:

The basic model (prototype) of the free energy generator consists of the following components:

- 1) Set of Nd magnets (Neodymium magnets)
- 2) Small Electric motor (Example: A DC FAN)

Fig 1,



A simple dc motor/generator consists of a rotor & a stator. The stator of the machine does not move & normally is the outer frame of the machine; the rotor is free to move & normally is the inner part of the machine. Both of them are usually made up of ferromagnetic materials. Slots are cut on the inner periphery of the stator & the outer periphery of the rotor. Conductors are placed in these slots of the stator or rotor. These are interconnected to form round windings. The winding in which voltage is induced is called armature windings & which current is passed field winding. Permanent magnets are used in some machines to provide the main flux of the machine.

Fig 2, shows the internal windings of the dc fan which is behaving as a generator (here). The windings are coiled around a cavity in which the shaft is inserted & rotated to produce the electric power.

Fig 2,



Now we need to rotate the shaft of the generator to produce power, for that we are using Neodymium magnets which are placed on the fins of the fan as shown. These disc shaped magnets are placed in such a way that all the north poles or south poles are facing one direction i.e., inwards or outwards. These magnets facing upward produce a magnetic field. After this a larger sized magnet is faced these disc magnets [3]. This magnet also produces a magnetic field, so both the magnetic fields repel each other (like poles repel), which causes the fins to move & finally rotate the shaft of the fan (generator).

Now as the shaft rotates in between the windings, it cuts the flux created by the windings & a small amount of voltage is produced in the conductor (shaft) which is collected by the 2 wires coming out of the fan.



Fig 3,

### B. Installation:

The free Energy Generator was fitted onto the 2 wheelers in-front of their outer body like on the mudguard where the air turbulence is higher with proper seals. The setup was connected to a multi-meter to find the practical readings of voltage & current. The power extracted was used to charge a mobile battery (the battery was charged 43% when driven with the speed of 40kmph for 35 minutes)

### C. Applications:

The free energy generator finds a no. of applications in the real world. Many such applications are listed below:

1. Using with magnets (as shown)
2. With 2 wheeler (bike, cycles)

The free energy generator can be fitted on the sides of a 2 wheeler in such a way that as the vehicle moves the fan start rotating and produces free energy.

### 3. With 4 wheeler (car)

In the same manner the fan can also be fitted on the 4 wheeler and produce free energy.

### 4. Fitted at the ends of chimneys

The free energy generator can be fitted at the end of chimneys of house or small industries in such a way the exhaust gases rotate the shaft of the fan & produces small amounts of free energy.

### 5. For Charging Small Batteries

This free Energy can be used to charge small Li-Ion batteries of high voltage & low current, which are used for other applications.

### 6. For Small wattage bulbs

The Free energy generator can be used to power up small led's & bulbs on vehicles.

There are many applications of the free energy generator which are yet to discover...

## III. EXPERIMENTAL RESULTS

The following results were tabulated while performing the experiments for free energy generator with magnets & 2wheeler  
The following results were tabulated while performing the experiments for free energy generator with magnets & 2wheeler

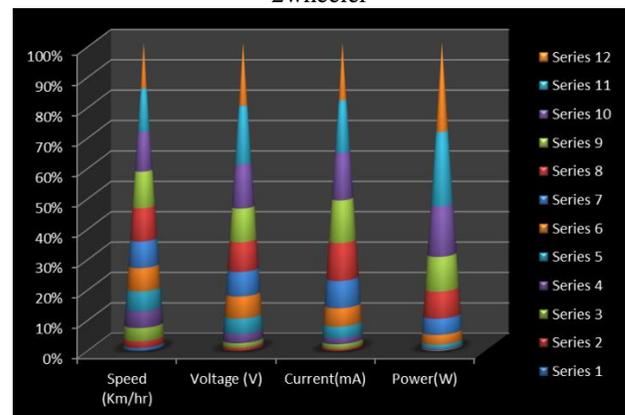
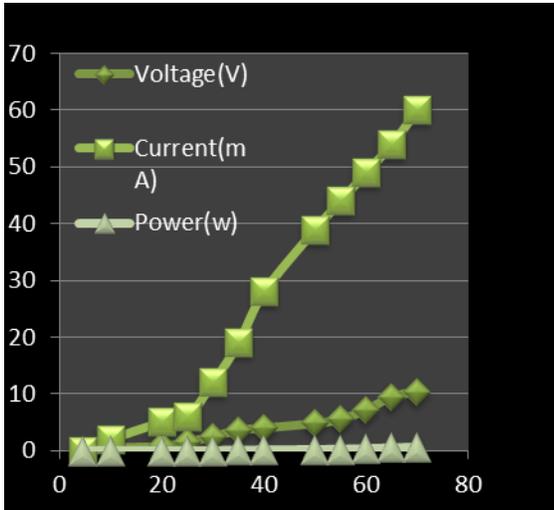


Fig 4,

The fig4, shows a pictorial description of the variation of speed with voltage

Fig 5,



The graph increases almost linearly initially but as the speed increases a rapid curve is seen with an increase in the voltage output of the free energy generator.

**Voltage Booster:**

As we can see that, the voltage produced out of this generator is free but of a very small value which is not of much use. So we need to add a voltage booster & a current booster with the generator which increases the voltage of the output to a usable value [4].

| S.No. | Speed (Km/hr.) | Initial Voltage (V) | Boost Voltage (V) | Current (A) | Power (W) |
|-------|----------------|---------------------|-------------------|-------------|-----------|
| 1.    | 4-5            | 0                   | 0                 | 0           | 0         |
| 2.    | 10             | 0.5                 | 0.5               | 0.002       | 0.001     |
| 3.    | 20             | 0.75                | 0.75              | 0.005       | 0.003     |
| 4.    | 25             | 1.5                 | 12                | 0.006       | 0.072     |
| 5.    | 30             | 2.5                 | 15                | 0.012       | 0.18      |
| 6.    | 35             | 3.6                 | 15                | 0.019       | 0.285     |
| 7.    | 40             | 4.0                 | 15                | 0.028       | 0.42      |
| 8.    | 50             | 4.8                 | 15                | 0.039       | 0.585     |
| 9.    | 55             | 5.5                 | 15                | 0.044       | 0.66      |
| 10.   | 60             | 7.2                 | 15                | 0.049       | 0.735     |
| 11.   | 65             | 9.5                 | 15                | 0.054       | 0.81      |
| 12.   | 70             | 10.4                | 15                | 0.060       | 0.9       |

Fig 6,

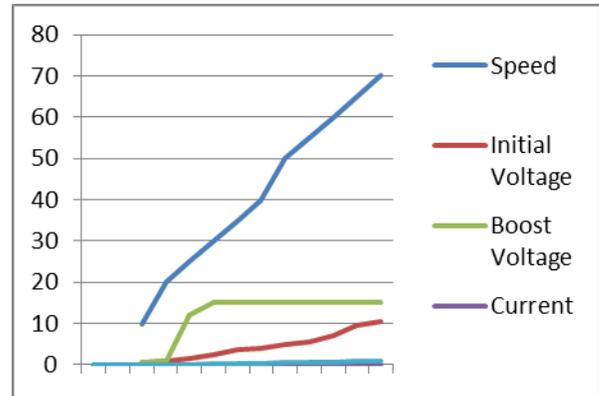


Fig 7, shows the circuit of voltage booster used in the experiment

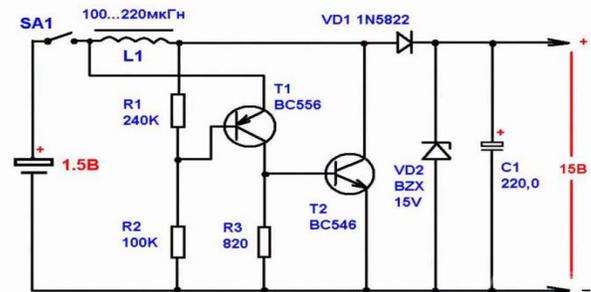


Fig 7,

**Dimensions of the setup:**

1. Side = 7.8cm\*7.8cm
2. Width = 2.5cm
3. Radii of the center = 1.6cm
4. Size of fin from center = 2.2cm
5. Windings = 4
6. Fan input = 12V/0.25A

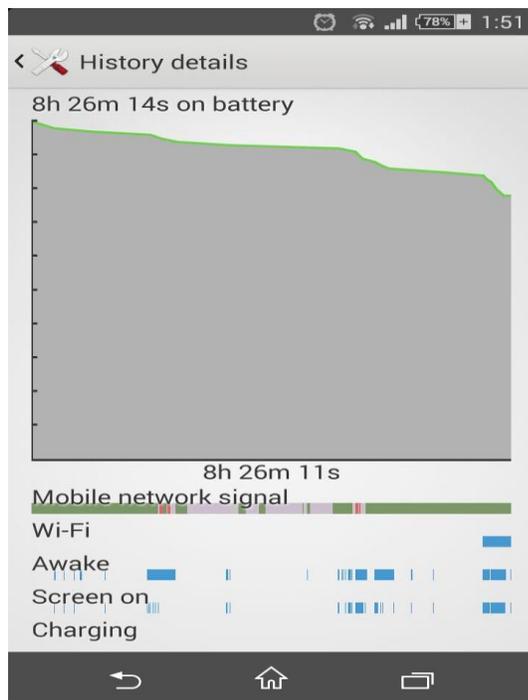


Fig 8,

The fig 8, depicts the battery discharging of a smart phone charged with the free energy generator.

#### Future work and Conclusions:

In this paper, by integrating the basics of a generator and a motor, we successfully have a newer concept of free energy generator which runs on almost no input & gives a valuable amount of electric runs which can be used to for many purposes. The paper revolves around the construction, working & applications of free energy generator & its future enhancements. This design may prove to be a pioneer in the field of research of free energy. Now it is possible to get free electricity from stuffs from our home. This concept of free energy is can be made using magnets & simple motors. This knowhow using magnets has been with us ever since we started generating electricity using conventional sources of energy.

#### ACKNOWLEDGEMENTS

We take this opportunity to express my profound gratitude and deep regards to my University (University of Petroleum & Energy Studies) for the exemplary guidance, monitoring and constant encouragement throughout the course of this thesis. The blessing, help and guidance given by the university time to time shall carry me a long way in the journey of life on which I am about to embark.

We are obliged to lab assistants, for the valuable information provided by them in their respective fields. I am grateful for their cooperation during the period of my assignment.

Lastly, we thank almighty, my parents, brother, sisters and friends for their constant encouragement without which this assignment would not be possible.

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# An uncommon presentation of enteric fever: Cholestatic Hepatitis

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**Abstract-** Enteric fever (EF or typhoid) is a common infectious disease. It is a common cause of morbidity and hospital admission in developing countries like India. We report a case of Cholestatic Hepatitis secondary to enteric fever in a 42-year-old male who was admitted to our medical emergency unit with chief complaints of fever for 9 days followed by anorexia, abdominal discomfort and jaundice. He recovered completely to prompt administration of appropriate antibiotic therapy with supportive management.

**Index Terms-** Enteric Fever, *salmonella*, Cholestatic jaundice, Icterus, *salmonella* hepatitis

## I. INTRODUCTION

Enteric Fever is a systemic disease characterized by fever, abdominal pain and caused by dissemination of *S. typhi* or *S. paratyphi* which is pathologically as a unique illness because of its association with enlarged Peyer's patches and mesenteric lymph nodes.<sup>[1]</sup> The Gastrointestinal complications of EF are intestinal haemorrhage and perforation, acute pancreatitis, hepatic abscess, acute cholecystitis, splenic rupture and hepatitis.<sup>[2]</sup> Liver tests suggesting cholestatic disorder may be due to intra- or extrahepatic cholestasis. EF is known to cause a wide range of hepatic complications.<sup>[3]</sup> However, only few cases of cholestatic hepatitis secondary to EF are reported in literature.<sup>[4,5]</sup>

## II. CASE REPORT

A 45 years old male, office worker, resident of lucknow was presented in our emergency department with chief complaints of anorexia, and high grade fever for 12 days followed by a vague right hypochondrial discomfort, vomiting and yellowish discoloration of eyes for 4 days. On enquiry he told that he had also constipation associated with dark urine. He denied complaint of pruritus. He had no history of jaundice, alcoholism, contact history with muddy water and blood transfusions, promiscuity or intravenous drug abuse and significant past medical history.

On general examination patient was conscious and well oriented. He had icterus. He had no pallor or lymphadenopathy. He was febrile (103°F) and his pulse rate was 90/ min and regular, B.P-110/80mmHg and respiratory rate was-19/min. Systemic examination revealed tender firm mild hepatomegaly and gall bladder was not palpable. Rest of the systemic examinations were within normal limit. Investigations of patient during hospi-

talisation are summarised in table 1. Computerized tomography (CT) of abdomen showed mild hepatomegaly (15.8cm) with normal margins and normal CT attenuation value. No evidence of any intrahepatic biliary radical dilatation (IHBRD) noted. Gall bladder is noted to be distended with normal in CT attenuation value with normal wall thickening.[Figure1] Liver biopsy showed hepatic cholestasis [Figure2]. Enzyme-linked immunosorbent assay for human immunodeficiency virus, Australia antigen for Hepatitis B and antibody against Hepatitis C virus were negative. Serology (IgM antibody) for dengue infection and smear examination for malarial parasite were negative. Electrocardiography and chest X-ray were within normal limit. His blood culture was sterile and serology (IgM antibody) for *Salmonella typhi* was positive. Our case was already on oral antibiotic at the time of admission which could be a reason for sterile blood culture. The diagnosis of cholestatic hepatitis due to enteric fever was made on the basis of clinical and laboratory parameters with positive serology (IgM antibody) for *Salmonella typhi*. So ceftriaxone 3gm per day intravenous was started for 10 days. Patient was started improving day by day and got discharged on 12<sup>th</sup> day of admission. Liver function test showed near normalization on follow up after 2 weeks of admission.

## III. DISCUSSION

Enteric fever remains a serious health threat in developing countries including India.<sup>[6]</sup> Most commonly, food-borne or waterborne transmission results from fecal contamination by ill or asymptomatic chronic carriers. Up to 10% of untreated patients with typhoid fever excrete *S. typhi* in the feces for up to 3 months, and 1–4% develop chronic asymptomatic carriage, shedding *S. typhi* in either urine or stool for >1 year which increases its prevalence and incidence. Enteric fever can manifest a variety of systemic complications ranging from mild to life-threatening such as gastrointestinal bleeding and intestinal perforation which most commonly occur in the third and fourth weeks of illness.<sup>[1]</sup> Rare complications whose incidences are reduced by prompt antibiotic treatment include disseminated intravascular coagulation, hemophagocytic syndrome, pancreatitis, hepatic and splenic abscesses and granulomas, endocarditis, pericarditis, myocarditis, orchitis, hepatitis, glomerulonephritis, pyelonephritis and hemolytic uremic syndrome, severe pneumonia, arthritis, osteomyelitis, and parotitis.<sup>[7,8]</sup> The first case of hepatic involvement in typhoid fever was reported by William Osler in 1899.<sup>[9]</sup> Pramoolsinsap *et al.* in their comprehensive review of Salmonel-

la hepatitis suggested that typhoid fever is often associated with abnormal liver biochemical tests, but severe hepatic involvement with clinical features of acute hepatitis is a rare complication.<sup>[10]</sup> Liver involvement in enteric hepatitis may be in the form of hepatomegaly alone, jaundice, biochemical alterations and histopathological changes.<sup>[3]</sup> The possible associated factors for development of salmonella hepatitis are virulence of the organisms, delayed treatment and poor general health of the patients.

The exact pathogenesis of severe hepatic involvement in salmonella infection is not fully known and needs further studies. Though endotoxin, local inflammatory and/or host immune reactions may be responsible for development of hepatitis in salmonella infection.<sup>[11]</sup> Our case had isolated hyperamylasemia and hyperlipasemia without evidence of pancreatic involvement. This may be possible as result of a reduced excretion due to either impaired renal or liver function which is common in Salmonella infections.<sup>[12]</sup>

The common causes of intra- hepatic cholestasis are Viral hepatitis (Hepatitis A, B and C, Epstein-Barr virus, cytomegalovirus), Alcoholic hepatitis, Drug toxicity (anabolic and contraceptive steroids, chlorpromazine, erythromycin estolate, prochlorperazine), Primary biliary cirrhosis, Primary sclerosing

cholangitis, Chronic rejection of liver transplants, Sarcoidosis, Inherited, Cholestasis of pregnancy, Total parenteral nutrition, Nonhepatobiliary sepsis, Benign postoperative cholestasis, Paraneoplastic syndrome, Venooclusive disease, Graft-versus-host disease, Infiltrative diseases like TB, Lymphoma, Amyloid and infections like Malaria, Leptospirosis.<sup>[13]</sup> All the causes of cholestasis were ruled out with the help of clinical examination and investigations. We are reporting this case because the patient recovered completely after starting of Enteric Fever therapy which also supports our final diagnosis of cholestatic hepatitis secondary to enteric fever.

#### IV. CONCLUSION

With the above description it is clear that enteric fever can causes a variety of systemic manifestations in endemic countries. Cholestatic hepatitis should be kept in mind as a differential diagnosis in patients of enteric fever complaining of jaundice at peak of fever. Early diagnosis and management with prompt supportive care improves prognosis in these cases.

**Table 1; Patient's laboratory parameters**

| Laboratory parameters | Normal range     | Duration from admission |                     |                     |                      |                      |                      |
|-----------------------|------------------|-------------------------|---------------------|---------------------|----------------------|----------------------|----------------------|
|                       |                  | 1 <sup>st</sup> day     | 4 <sup>th</sup> day | 8 <sup>th</sup> day | 2 <sup>nd</sup> week | 4 <sup>th</sup> week | 6 <sup>th</sup> week |
| Hb(g/dl)              | 13-17            | 12.2                    | 11.2                | 10.8                | -                    | -                    | -                    |
| TLC (103/ $\mu$ L)    | 4-11             | 9.2                     | 12.6                | 8.0                 | -                    | -                    | -                    |
| DLC (%)               | N40-80<br>L20-40 | N78L09                  | N80L15              | N67L22              | -                    | -                    | -                    |
| PC (103/ $\mu$ L)     | 140-440          | 188                     | 165                 | 200                 | -                    | -                    | -                    |
| S.Na+(mmol/L)         | 135-155          | 134                     | 137                 | 138                 | -                    | -                    | -                    |
| S.k+(mmol/L)          | 3.5-5.5          | 3.5                     | 3.8                 | 3.4                 | -                    | -                    | -                    |
| S.Urea(mgdl)          | 20-40            | 49.4                    | 29.5                | -                   | -                    | -                    | -                    |
| S.Creat (mgdl)        | 0.5-1.2          | 0.95                    | 0.7                 | -                   | -                    | -                    | -                    |
| RBS(mg/dl)            | 70-              | 112                     | 112                 | -                   | -                    | -                    | -                    |
| PT(seconds)           | 10.4-12.6        | -                       | 13.9                | -                   | -                    | -                    | -                    |
| INR (seconds)         | 0.8-1.2          | -                       | 1.21                | -                   | -                    | -                    | -                    |
| S.Bilirubin-Direct    | 0.0-1.1          | 12                      | 13                  | 10                  | 6                    | 3                    | 0.8                  |
| S.Bilirubin-Indirect  | 0.0-0.3          | 1.5                     | 2                   | 2                   | 1                    | 0.8                  | 0.2                  |
| ALT (IU/L)            | 21-72            | 300                     | 375                 | 199.6               | 150                  | 70                   | 66                   |
| AST (IU/L)            | 17-59            | 200                     | 225                 | 72.6                | 70                   | 42                   | 42                   |
| S.ALP                 | 38-126           | 2100                    | 2000                | 1400                | 800                  | 302                  | 120                  |
| S.Protein(g/dl)       | 6.3-8.2          | 7.4                     | 7.2                 | 8.0                 | -                    | 7.4                  | -                    |
| S.Albumin(g/dl)       | 3.5-5.5          | 3.4                     | 3.5                 | 4.6                 | -                    | 4.0                  | -                    |
| S. Amylase(U/L)       | 22-80            | 412                     | -                   | 116                 | -                    | -                    | -                    |
| S.Lipase(U/L)         | Upto 60          | 302                     | -                   | 100                 | -                    | -                    | -                    |

ALT, alanine transaminase; ANA, antinuclear antibody; AST, aspartate transaminase, S.ALP, serum alkaline phosphatase; RBS, random blood sugar; PT, prothrombin time; INR, international normalised ratio.

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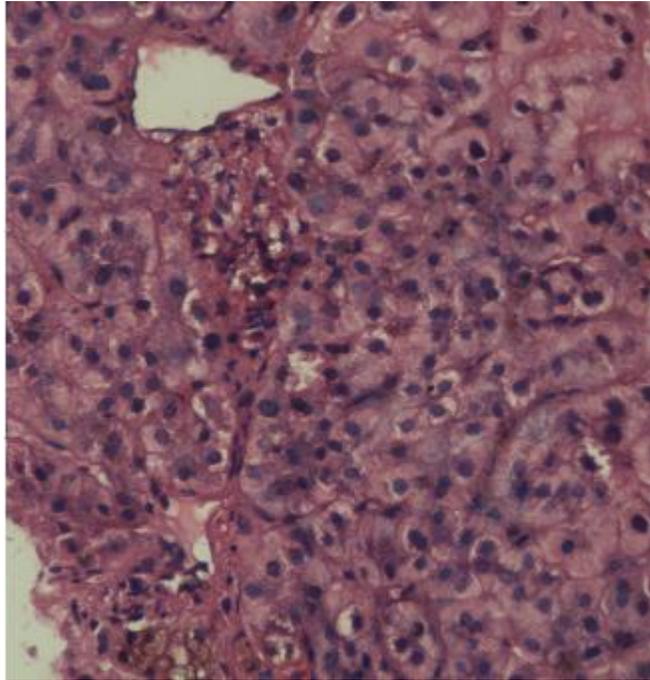


Figure 2: Liver biopsy showing hepatic cholestasis without inflammation.

# Ileal perforation and peritonitis due to taenia a rare case

Sanjeev Kumar, Suresh Kumar, Manish Kumar, Shefali Gautam , Kanishk Shidhartha

**Abstract-** Tapeworm infection is major threat in many developing countries. Despite asymptomatic patients some develop serious conditions like intestinal obstruction. due to entanglement of the worms which may leads to perforation which is a rare cause of acute abdomen. Taenia solium infection is caused by ingestion of undercooked pork meat containing cysticercus cellulose. Ileal perforation by taenia solium is very rarely reported condition in literature.

## I. INTRODUCTION

Tapeworm is also known as taenia and two common species are taenia solium and taenia saginata. Man is defensive host of both while intermediate host is pig for taenia solium and cattle is for taenia saginata(1). In literature few cases caused of perforation by taenia are reported. Other common parasites are ascaris, trichuris trichura, enterobius vermicularis(2). In this report a large tapeworm causes perforation in distal ileum.

## II. CASE REPORT

A 35years old male presented to surgical emergency with sudden onset of pain following distension of abdomen. Pain was initially I lower abdomen but later become diffuse through whole abdomen. There was history of low grade fever, nausea and vomiting for 10 days duration. Patient was labourer and nonvegetarian. On examination patient was febrile (temp 101<sup>0</sup>F) tachycardia (pulse 110/minute), blood pressure 100/70 mm of Hg. Abdomen was distended, tenderness, and guarding was present, bowel sound was absent. On routine laboratory test Hb 9gm% total count 14300/ccmm differential count shows relative neutropenia. X-Ray abdomen shows gas under right dome of diaphragm. So diagnosis of perforation peritonitis made and emergency laparotomy was performed which revealed a single large perforation in terminal ileum (figure 1) through which a large tape worm is coming out which was taken out (figure 2) peritoneal cavity was thoroughly lavaged. Perforation site was closed after freshing of margins parasite was send for histopathology. Patient was allowed to take oral liquids and semisolid when he tolerated for it.

## III. OUTCOME AND FOLLOW UP.

Patient was discharged with oral praziquantel 600mg and in our follow up and doing well.

## IV. DISCUSSION

Taeniasis is common in tropical areas. It is ubiquitous disease occurs where existence of pigs and humans are associated. Cysticercosis was first described by Aristophanes and Aristotle in the 3rd century B.C. Later it was noticed in humans by Parunoli in

1550. It was also described in ancient Indian Medical book, the Charak Sanhita(3). The parasite has long since been eradicated from the most developed countries, but it still remains common in central and south America, South Asia and China, with patchy distribution in Africa. The disease is known to be caused by ingestion of undercooked pork in areas lacking basic sanitary facilities and by ingestion of vegetables contaminated by sewage product. Muslim population does not eat pork due to religious reason this is the reason why, it is very rare in Islamic countries.

The studies regarding Taeniasis are limited. This is an important disease as most of the patients end up with surgical complications with high morbidity and mortality(4). A small bowel perforation caused by T. solium is very rare and indistinguished from other acute abdomen conditions(5). Typhoid fever with intestinal ulceration is most common cause of intestinal perforation worldwide. The mortality rate in small intestinal perforation due to infestation is high(6) T. solium is a ribbon like, segmented flat worm residing in the small bowel of man. It has a scolex (head); neck and numerous proglottids which have the independent reproductive capacity. The terminal half of the parasite consists of mature gravid segments. Adult worm resides in the upper jejunum and may live for decades. The T. solium – scolex shows four suckers and numerous hooks, whereas T. saginata shows only suckers. T. solium gravid segment shows 7- 12 lateral uterine branches on each side; T. saginata shows 15-20 uterine branches on each side(7). Presence of tapeworms in the bowel lumen contributes considerably to the bowel perforation where no obvious etiology of perforation is found as in our case. Management of the condition is same as other surgical abdominal emergency conditions which is emergency laparotomy after primary resuscitation of patient and the patient is observed for a minimum of six months to one year, as a small piece of viable neck or scolex can regenerate into a new worm. The treatment of choice is a single dose of Praziquantel 10-20 mg per kg body weight or Niclosamide 2 grams as a single dose(8).

## V. CONCLUSION

Infection by taenia is rare cause of intestinal perforation so Cases presenting with pain abdomen, guarding in endemic areas should be evaluated for Taenia and meticulous search must be done to trace the parasite if any. The awareness regarding the disease and complications of the disease is to be enlightened to the society. The safe sanitary practices and hygienic food habits are to be encouraged, especially in people of low socioeconomic status.

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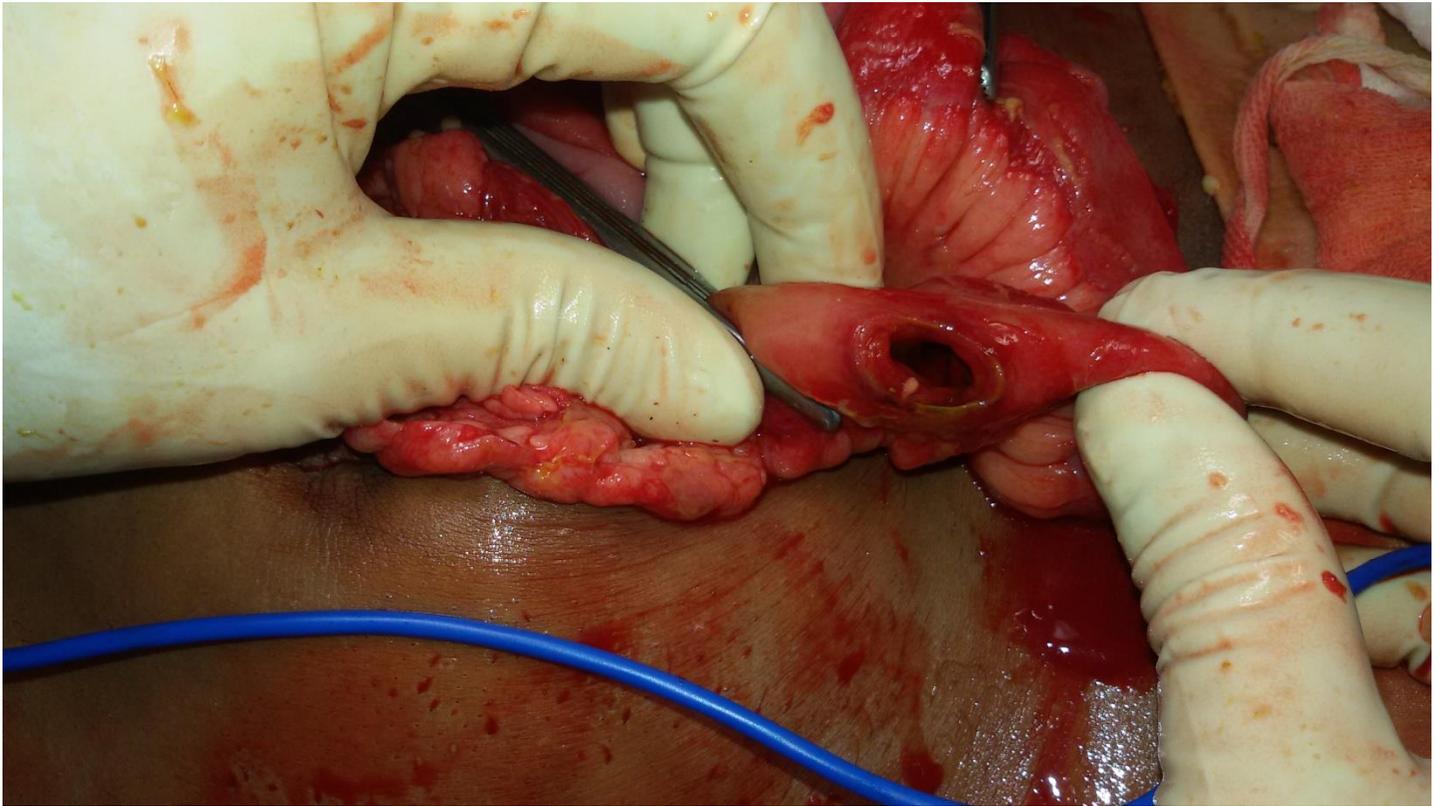
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**Figure 1. Single large perforation in terminal ileum**



**Figure 2. Single large parasite Taenia after removal from perforated site of ileum**



# FPGA-Based Quad Transmit/ Receive Module (QTRM) Controller Design

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**Abstract-** Ultra- small size transmit/ receive module is reported with regard to active phased arrays by the application of GaAs MMIC technique. This makes possible the production of Quad TRMs, while satisfying the basic requirements for transmit/ receive modules- wide band, high output power, low noise figure, small size and weight and low cost and sufficient gain in both transmit and receive. This paper focuses on the control of one such X-band QTRM using FPGA.

**Index Terms-** Active Electronically Scanned Array (AESA); GaAs MMIC; Quad Transmit Receive Module (QTRM); Field Programmable Gate Array (FPGA)

## I. INTRODUCTION

The active transmit/ receive (T/R) modules are essential elements for the construction of active phased array antennas with a broad range of applications for radars, communications and electronic warfare systems. The control circuit has following functions<sup>[1]</sup>:

- Receives control data from external beam steering unit
- Controls six-bit phase shifter and attenuator
- Controls pulse operation of the T/R amplifier
- Controls the T/R switching
- Controls the timing sequences for the above operations

Earlier, control circuits consisted of dedicated gate array LSI IC for interface. As technology evolved, various methods have been employed for the purpose. The QTRM discussed in this paper operates in the X- band and uses ACTEL FPGA Fusion device AFS600 256 FPGA as controller. It operates at a clock frequency of 160 MHz, serial data transfer rate of 20 Mbps. Figure 1 shows the basic TR module block diagram.

## II. PROJECT IMPLEMENTATION

### A. Current Problem

A variety of technical problems face one looking to equip an airplane with X radars. Modern radars systems are often implemented as active electronically scanned arrays (AESA) with hundreds of transmit/receive modules aligned in an array. One advantage of an active electronically scanned array is that it can perform radar scans without physically turning the radar array. This is accomplished by altering the phase of the transmitted radars. By synchronizing<sup>[2],[3]</sup> the phases of each of the transmit/receive modules, the beam transmitted points in a different direction. However, in order to change the direction of the radar beam (i.e., the main lobe) the transmitted radars must be packed close enough together to work in unison.

X band radar<sup>[4],[5],[6]</sup>, is transmitted at approximately 10-12 GHz. Because such high frequencies are being used, the transmit/receive modules must be packed very tightly. In an active electronically scanned array, the lattice spacing must be approximately half of the wavelength of the highest frequency used. Thus, the demanded space requirements are too small for the current size of transmit/receive modules.

In addition to the size of the modules, a designer must also contend with the size of the connections to and from modules. Prior art designs require bulky connectors connecting a module to a radiating element. Prior art designs also require a connector from the module to a manifold interconnect.

Thus we are now into the generation of integrating TR modules so as to have common control and interface units for them. One such stage is that of the QTRM. For the four TR modules bound together, the control code now has to be optimized and the health of the board has to be monitored for power and temperature.

### B. Functional Flow of TR Module

Figure 2 depicts the handling of data by the control logic. Data from the Plank Controller arrives at the SPI slave block @ 20 Mbps through SPI communication protocol. This data consists of a header, phase and attenuation information for each TRM of the QTRM, mode and parity check byte (total 19 bytes). The SPI\_SLAVE block checks for header error and passes the data to PARITY\_CHECK block if no error, else data is discarded. Similarly, the PARITY\_CHECK block checks for errors in the data received by bitwise- XORing of the bytes, and discards the received data if error is detected. An indication of the error and location of the error is also recorded in the status information. Otherwise the data moves into the PARSER section.

The PARSER section extracts phase and attenuation information for each TRM from the received data, and the mode and latches on to this data when the Start of Burst (SOB) signal goes HIGH. Now the mode is analyzed for generating the control signals for the different components on board. The mode, along with the Pulse Repetition Time (PRT) signal determines the control of the on-board limiter (Lim), low-noise amplifier (LNA), power amplifier (PA), Tx/Rx switch (Sw), core-chip power amplifier (Core\_PA) and core-chip low-noise amplifier (Core\_LNA).

At the same time, the status bytes are prepared to be sent back. This is done by the STATUS\_COLLECTOR block. It receives

error indications from PARITY\_CHECK block and PRT block, and analog data recorded from board. Analog data includes temperatures from two on-board temperature sensors, and voltages converted to digital data by the on-board ADC.

Other blocks include the RC\_OSC which is the on-board clock generator that supplies clock to the different blocks. PRT block makes sure that the incoming PRT signal has ON-time and duty cycle as per specified requirements only; else it modifies PRT and reports it through the status information.

8 modes of operation have been implemented in the project:

- Normal: The received phase and attenuation data are routed to the respective TRMs
- PPFA (Pulse-to-pulse Frequency Agility): This mode is used to battle clutter interference.
- Receive Calibration: One TRM, specified in the information received, would receive its phase and attenuation data for receive mode while the other TRMs would have all set to 0.
- Transmit Calibration: One TRM, specified in the information received, would receive its phase and attenuation data for transmit mode while the other TRMs would have all set to 0.
- Receive Isolation: All TRMs in OFF condition.
- Transmit Isolation: All TRMs in OFF condition.
- Link status: This mode is used to verify the data flow. Dummy values are sent into the QTRM and if all goes well, a pre-decided status format is sent back.
- Reset: This mode resets the QTRM board.

The control operation can be reset-ed either by an on-board reset or by specifying RESET mode in the external command coming in.

FIFO structures have been used for the PPFA mode so as to store phase and attenuation values for 4 TRMS for 32 PRT pulses; at each pulse a fresh value would be loaded. This would cause rapid changes in phase and attenuation values loaded into the antenna elements and lessen probability of external agents interfering with this data.

**C. Implementation Details**

The programming was done in VHDL language using ACTEL board AFS600. Simulation was done on ModelSim and results were verified using ChipScope and Oscilloscope.

Figure 3 shows the hardware set-up and figure 4 shows the final results achieved. Resource utilization was reported to be 37% (Core cell usage was found to be 5176.) I/O cells used were 88 and 20 out of 24 Block RAMS were used. The maximum clock frequency is 100 MHz and serial communication rate is 20 Mbps. The static power consumption was found to be 46.74 mW and dynamic power consumption is 165.444 mW.

**D. Limitations**

A possible improvement to the logic for the upcoming designs could be a more efficient means of parity checking rather than

bitwise-XORing. A number of efficient and secure algorithms are today available in the market that can be used.

**E. Figures**

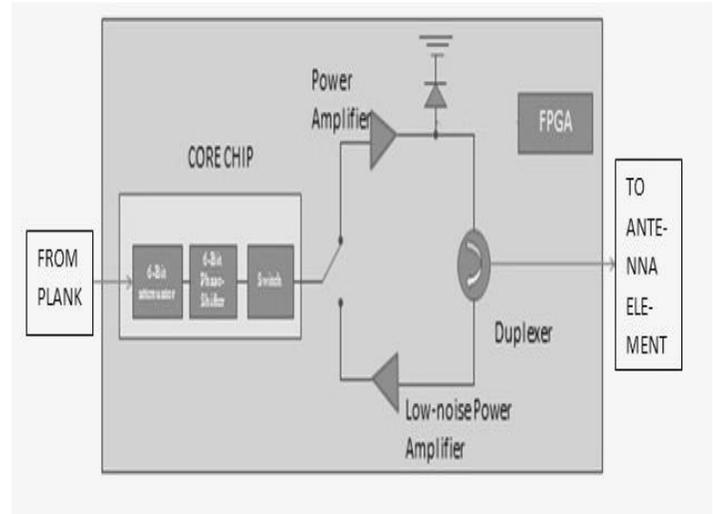


Figure 1: Basic TR Module block diagram

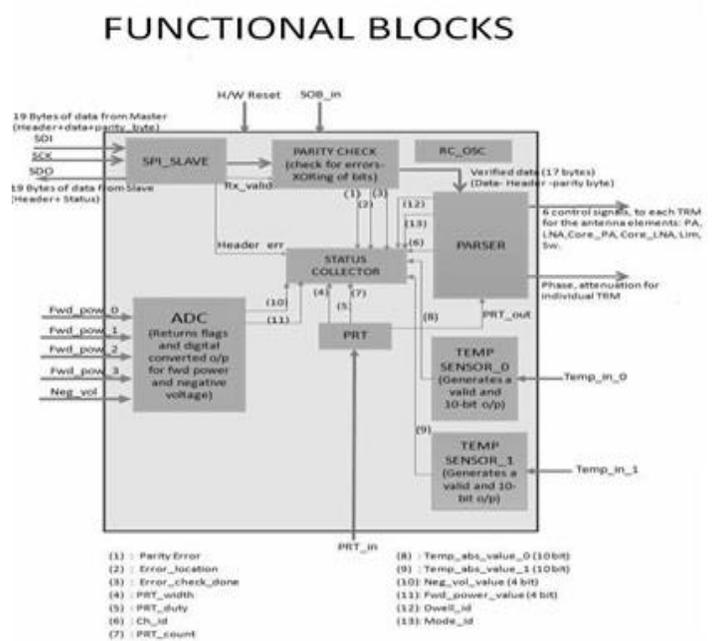


Figure 2: Functional Flow



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# The negative effects of the consume of economic environment resources on a sustainable development

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**Abstract-** The resources of economic environment is the available natural resources in the environmental ocean, which are in different forms and kinds, whether life or non life, renewable or non-renewable of the necessities of sustaining life and to achieve the natural stability according to a balanced perspective to contents of the ecosystem. The effective tools, mechanical of rational interaction with ecosystem is the human who has the scientific capacity and a mechanism a live dealing with life ocean in which they live, the environment and their protection are old, environment protection emerged and created in the eighties of the last century, more researches had focused on the relationship between the environment and economic development, then evolved into the concept of sustainable development, economic growth accompanied by mass production and urban development in the world which moves in fast form accompanied by depletion of natural resources and accompanied damage inflicting to global environmental ocean. This highlights the deterioration and depletion of some natural resources, loss of balance of life, increase the phenomenon of environmental pollution as a result of technology of natural resources and industries manufacturing, both at the production or post-consumption. For all these problems negative effects on the sustainability of life in all levels. The programs of economic theories designed to achieve economic efficiency, increase growth rates, mass production and to maximize the output, so must to development programs achieve environmental protection, the preservation of its economic resources side by side the efficiency and economic stability by linking development programs economically and socially with environment for the purpose achieving effective balance between the above three factors in order to lay the foundations of stability of life and sustainable development. The solutions that have been were not sufficient to confrontation environmental decomposition which were of the global warming, the decomposition of the ozone layer, the warming of the planet and drought the world, increasing desertification, melting of ice at the poles, gases emissions, waste increases and residues of projects and factories. Therefore requires global rules and the fundamentals through the global, regional, and local organizations and interaction with the scientific centers to find strategy solutions to sustainable development. Present study aims to find methods to maintain environmental sustainability on the level of governments and peoples to ensure a natural balance of economics, society and environment, which is the fundamental factors for sustainable development.

**Index Terms-** sustainable development, environment resources, negative effects, consume.

## I. INTRODUCTION

The relationship of man with the environment was from old times, where coexistence the man with his environment by positive interaction and recognized the importance of natural resources in his life, this confirmed by ancient civilizations and called by the all religions through the scriptures and the prophets and messengers calls good and peaceful co-existence of human beings, the control of human was weak and not compact on the nature, but the nature had a psychological and life impact to the man. These transformation of coexistence, interaction and alignment with the environment to the a negative coexistence not equivalent and balanced since the beginning of the industrial revolution, where reflected the developed industrial activities negatively on the resources of nature and they causes of damages and decline(1). From this perspective the concern to be mentioned this research in environment and contents of natural resources in all forms and types and methods of their protection and conservation from depletion and pollution and its relations with economic development. Where the suffering of human society in all countries whether developed or not developing of the variables is not balanced between the environment and economic activities, do not forget the role of population growth and urbanization in urban areas besides economic activities in this negative impact on the environment and sustainable development (2). We can say that after globalization and opening up the global economic and the emergence of global markets, common and trade organizations of global, regional became our planet a laboratory for the achievements of scientific, technological and economic, and associated patterns of development, growth and progress in the countries all at the expense of the economic environment without gesture to the sustainability of resources and methods of protection and the reduction of environmental pollution, emerged the complex environmental problems by the result of non the proper dealing with the resources of the planet, such as excessive increasing in consumption and depletion of natural resources. The types of environmental pollution, high rates of population growth increased, analyze the natural environment and the high degree of warming, analyze the ozone layer and global warming a result of emission of various gases of the projects, factories. We see that the economic policy in place to reduce these negative phenomenon and their treatment focused only on the style of taxes (3). The research aims to shed light on today's environment and diagnose the problem existing between the economy, environment and society, the study of the global environment and their effects on sustainable development and theoretical, methodological and applied for the science environment economics as a premise the scientific basic fundamental

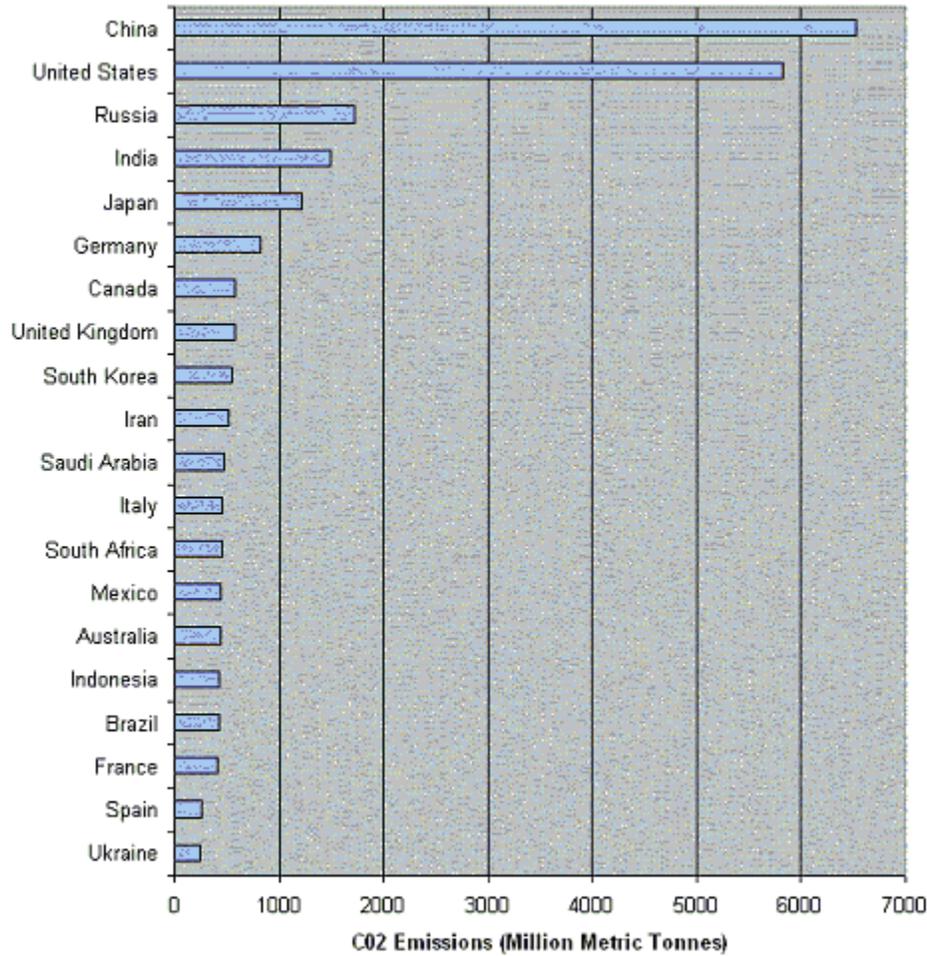
and steady rule for achievement economic development in the case of balanced with the environment to reach the goals and requirements of sustainable development to achieve stability and sustainability of life in the vicinity of an environmental ocean , balanced economy and prosperous society. The research dealing the following topics:

## II. RESEARCH MATERIALS

### **Natural resources and Economic:**

Natural resources are the assets of the environment, which contributes effectiveness for the perpetuation of human life and other living organisms , it is without not lived human on life, one of the necessary requirements that contribute to the economic and social activities . Researchers and scholars classified natural resources to two main sections, life natural resources ( living),such as a human, animals , plants , microorganisms, and non life natural resources (non-living) is the air, water, soil ,minerals , all kinds of energies and the contents of the inner earth, all of which contribute in economic development both in the case of their existence as a crude or after the manufacturing technology and turn it to easy form of acquisition and human using, most raw materials for industry, so note its effectiveness presence in the building materials (gravel, sand, cement ,glass , iron and wood), vehicles, trains, aircraft and military equipment, food, medicine, clothing ... etc.. economy found fertile ground for the establishment of the foundations of his success on these resources taking advantage of scientific and technological progress to achieve the production rates and to maximize the output depending on the natural capital (natural resources), which do not enter in the cost of production, where the economic activities successful by productivity process, achieve the public of special profit by exploitation of natural capital and turn it into a currency cash deposited in banks in favor of economy the government or the individual, it is known that natural resources have other divisions , such as renewable resources and non-renewable, alternative and non-alternative , ending and non-ending, there are other classifications and divisions ( 1 ) . Requires dealing with natural resources at perfectly rational by give and take manner , focus on renewable , alternative resources , and recycled materials because the most of natural resources heading towards depletion, also the ownership of all the generations it is

in the public ownership unconsciously, so must be preserved used standardized manner with out extravagance , to achieve the benefit for the environment and the economy ( 2 ) .The environmental ocean is a human basket to all the requirements and morally requires a dish which you eat from it must be cleaning without deposit it on dirtiness, In other word, when the manufacture and transfer of nature resources to manufacturer materials during the production gets pollution of environment by wastes and the gases, requires purification projects along technological factories to transfer dust, gases and other emissions by purification factories to their sources with out the deposit of the rope at liberty and allowed to these wastes to pollute air , water and soil. Any dealing of man with his environment and resources require a positive interaction when production and through consumption with not to damage the ocean ecosystem. The environment of typical is the relationship of mutual constructive between organisms and the environmental ocean, to maintain optimal use of natural resources must develop policies ,administrations, laws , foundations and ministries involved in environment and means to rationalize the investment their resources in an economic standardized and balanced to reach and achieve a situation of sustainable development for the benefit of the economic , environment and society, must protect these resources from pollution, comes mainly form air factor, air must be protected from emissions of gases such as carbon dioxide , sulfur gases, methane , greenhouse gases , substances that deplete the ozone layer , the preservation of biodiversity from extinction , ecosystem management , protected areas in order to ensure the conservation of biological diversity , genetic resources and maintain on marine and coastal areas to fish stocks . Follow the methods of progress scientific management and treatment of water resources, reusing waste water and achieve a situation of balance of groundwater, follow the technological methods for the management , waste recycling, processing ,conservation the case of land desertification and degradation of productivity , reducing the use of chemical compounds (fertilizers and pesticides) in agricultural operations, resorting to the use of environment-friendly organic compounds, which is not damaging to the environment to sustain the environmental effectiveness of soil productivity (3).The figure (1) clear the emission of carbon dioxide gas in 20 countries in (Million metric tones) which causing the global warming, .



**FIGURE (1) POLLUTION ABOUT 20 COUNTRIES OF TOTAL CARBON DIOXIDE EMISSION**

### **Economic development and the environment**

Economic development is the process of socio-economic comprehensive, covering production and their excess , services, health, education, income distribution and environmental protection. Economic development expressing the economy of society or state as independent entity , communities that have a high income level have the advanced development process , while the communities which their incomes were low have slow development process , development is a comprehensive process, have complement all aspects of socio - economic activity, the development is based on fundamental rules distinguished by scientific and rationality to ensure positive results for the welfare of the community. and seek economic development to build the basis of rapid economic in all aspects of life whether materialistic, such as productivity projects, transportation or non-materialistic such as the implications of human development , that cause of burden in growing countries in economic terms in the preparation of strategies for the development of their countries as it is prevalent in developed countries, which relied on two main pillars were, Economy and the society , the first axis deals achieving economic efficiency and to maximize the output , the second axis to justice achievement according to the distribution of income to min-

imize the phenomenon of poverty. Forcing growing countries to over-exploitation of natural resources and encouraged the developed countries to achieve the goals of the advanced economies whether in the field of the increasing rate of accumulation or expansion of production , this led to the expansion of consumption of goods, causing an increase in exploitation of natural resources, as well as that of developed countries helped growing countries by providing loans were fell in the trap of debt. How can growing countries allocated part of its revenues from resource consumption through government spending in order to create social and political stability, this led to the improvement of a relative in the rate of welfare of these countries, which led to a rapid increase in population of the growing world, especially the urban population. As a result, it is expected double the demand for food in the coming years . It is noted that developed countries may sensed of the environmental problem early to suffer from pollution in all its forms, but it continues to encourage growing countries to exhaustion their resources through its support for multinational corporations and the exploitation of crises experienced by growing countries ( 4 ), although knowledge of natural resource depletion, but that human is the victim innovations and captive his inventions and sought human

permanent in achieving economic growth and economic development to protect and secure the future to meet the requirements of his feat by becoming threatening to exacerbate the consumption of natural resources and the appearance of a large environmental problems, exposure his presence to the grave danger, the risk of his future life on the planet, this can be summarized with the following problems.

1 - A phenomenon of continual pollution in soil, water and air also acid rainfall.

2 - Global warming rate of the earth  $3,5\text{ }^{\circ}\text{C}$  in this century.

3 - Decomposition of the ozone layer by 7,5% due to ozone-depleting gases, which has negative effects for humans, animals and plants.

4 - The extinction of biodiversity up to 1500 species.

5 - Continuous burning and cutting of forests, which is the lungs of the planet.

6 - Expansion of the desertification phenomenon at high degree about 40% of area world land.

7 - The world's population growing rate of 250,000 people daily.

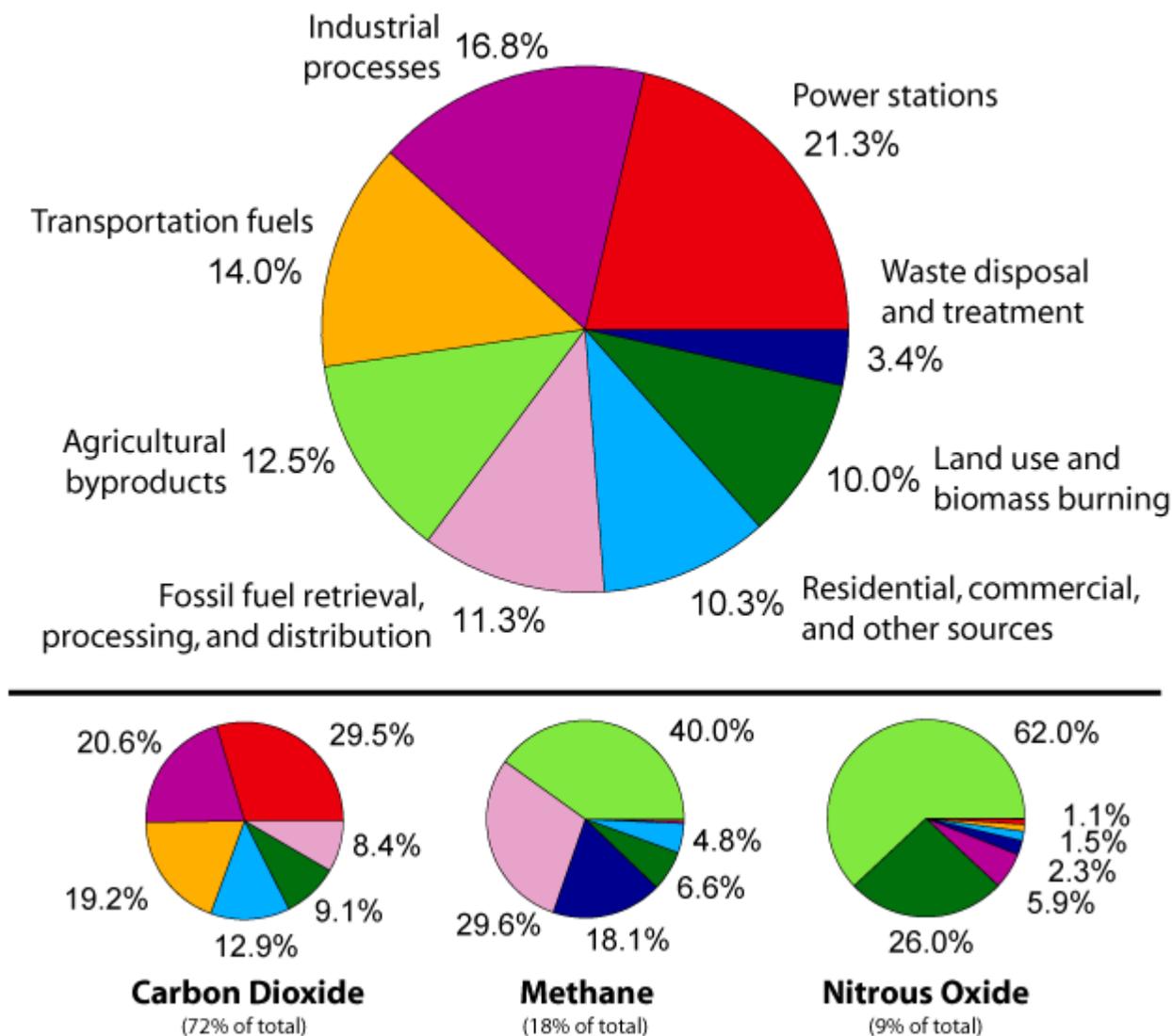
8 - Increase the waste and trash of factories, lack treating to the ends of pipes which breath throwing the atmosphere by various gases, dust and fumes.

9 - Increase the use of chemicals in agricultural operations, which cause environmental damage to the human, land and agricultural crops.

10 - An increase of water pollution by hydrocarbon oil which has a negative impact to the environment of aquatic, life and coastal.

After identifying these secretions negative result of economic development, prompting economic researcher to the preparation of studies and researches to find new methods to treatment the economic system and make its development to become sustainable, this requires serious study, scientific and real understanding of the environmental natural resources, determine the damage, economic and social burdens caused by the economy in order to find mechanisms and the means and policies of environment to management of natural, human resources and clarify ways of implementation, to lay necessary strategies to their comprise for achieve sustainable development (4,5). The figure (2) clear the annual greenhouse gas emission by sector.

# Annual Greenhouse Gas Emissions by Sector



FIGURE(2) ABOUT ANNUAL GAS EMISSION BY SECTOR

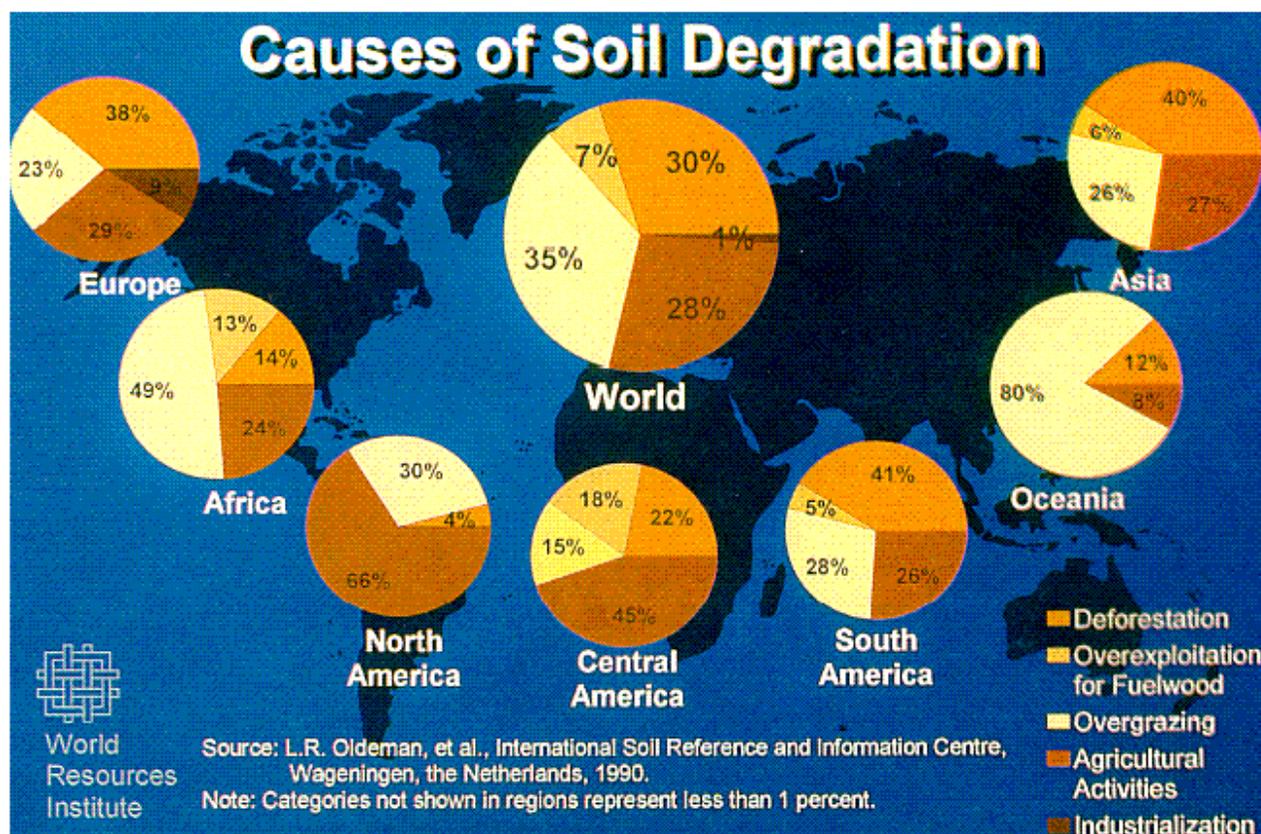
## Sustainable development and the environmental economics :

Emerged the heed in sustainable development recently and after the UN Conference on Environment and Development which took place in 1992. In Rio de Janeiro, which gave this term extreme importance, where interested in this, the world countries and their developmental foundation by result of intellectual awareness to the sustainability of economic growth, which was the other face for economic development in order to achieve economic and social welfare to human, define the conference the term sustainable development (it should be done right to development which achieved on an even keel balance the developmental and environmental needs for present and future generations). The conference acknowledged that in order to realize sustainable development should be environmental protection as apart economic as apart non partitioned of the process of economic development and prosperity can not thinking of welfare-being in isolation from it (5,6), that this approach led to the interaction between the economics and the environment. The concept

of sustainability not owns according to the used one definition, appear of many interpretations of the term of which (is the status that meet the minimum qualifications of the ecosystem through time) or (that the administration of resources may be in a way that ensures and maintains an continuous tender the services of these resources) or (is that the status in which the benefits are not see decline over time) or ( resource management to be in a form ensure and preserve and perpetuate the production opportunities in the future) or (is that the status which not see stocks of natural capital - water, forests, land and air ... etc,decline and degradation over time. Environmental scientists confirms the sustainability of ecosystem through the sustainability of natural capital, whether renewable or non-renewable and is managed so as to ensure sustainable tender for resources services as is in the biological resources to the stock of renewable resource such as forests and fisheries, the sustainable tender is the one who gives a stable status where conservation stock of capital a steady level and gives a continuous flow of this resource, for example, for-

ests representing the stock of the resource and this resource is sustainable when it is re-planting trees rather than removed, so the forest is given of continuous production be sustained over time and the preservation of an ecosystem (6), that the behavior of ecologists about what is happening from high in temperature and resulting significant change in the ecosystem, which reflected negatively on the environment , This makes environmentalists look for a firm stand and take an appropriate decision about this change on the basis of stability of human life and which will be subject to threat as a result change in the ecosystem. Therefore, we must take the concept of sustainable development wide heed because it is linked to human life and their future, astute as this problem persists means convert the planet to store the waste and emissions, which cause the difficulty of life in a natural form, whether through the damage human health and its safety, or through what affects biosphere from the decomposition and degradation due to pollution. Where it is necessary to be most of the environmental impacts by a balanced relationship with the economic environment, could not be economic growth and economic development by the destructive effects on the vocabulary of

environmental elements, so it must be the task of caring for the environment and sustainable development of the State responsibility through its institutions competent to draw the effective policies to guarantee growth and sustainable development, as well as the realized financial resources from the exploitation of natural resources employs a part of it to preserve the environment and their maintenance . That keep up the globalization phenomenon and the reception of foreign investment, that must take into account the care and heed for the environment through the selection of economic activities for which not damage to the environment and the system of their balance. Should also focus on the recycling of waste and environmental conservation as a strategic objective of each country to reduce the exploitation of economic activities to the depleted natural resources , as well as the need for research to develop ways and means to replace renewable resources in place of non-renewable resources (7 ,8). The figure (3) clear the several means of soil degradation in world .



FIGURE(3)SEVRAL MEANS OF SOIL DEGRADATION IN WORLD

### III. SECURE AND ENSURE ENVIRONMENTAL SUSTAINABILITY

One of the main objectives of sustainable development to achieve welfare for present and future generations in sustainable environmental ocean and properly somewhat, to meet the needs of human life according to constructive environmental economic development , so as to ensure the issue of ensuring environmental sustainability by diagnosis the potentials , the achievement of

goals and positive connection between the vocabulary of economic development , environmental development and the evolution of society. From this point we have to be the existence of initiatives effectively oversees the general policy of the environment that holds the attention to main dimensions of sustainable development, as well as the immediate concern for the management of natural capital which its owned wont to present and future generation, that this policy must be strengthened with de-

tails of methods and techniques used to lead the environment , society and the economy together. That according to the context of this combination must be a decision-making process from a central point to ensure environmental sustainability, due to fundamental role in the embodiment of it to the states and governments, or how to develop the structure of this and their details are a relative due to the nature of the sustainable development of the state, but It is important to meet these foundations or ministries to get all the variables which get here and there to treating the environmental problems of concern all humanity. Where these administrations are responsible for achieving sustainable development and the deepening interdependence between the three dimensions of sustainable development which represented by dimension of economic, social, environment, can imagine some contexts in the formulation of public policy within the framework of sustainable development were a global , regional and national to facing the challenges of sustainable development. Within the context of the global dimension into global climate change , global warming , analyze the ozone layer. Within the context or dimension of the regional ,coastal waters , the phenomenon of desertification , joint border resources . This requires the formation of regional , environmental organizations for protection resources and maintenance of the environmental ocean of the region which is characterized common(share) relation environmental, climatic and geographical. At the national level where the state and its policy to achieve an security of environmental sustainability and its shape are determined by the interactions of economic, social and environmental to ensure sustainable development. Economic dimension require growth a quantitatively and qualitatively either the social dimension requires institutions perform their functions efficiently and social stability and equality. The environmental dimension requires the stability of regimes eco-biological natural and an environmental health of the population, that link these three dimensions together provides and ensures the field of cooperation within the state, which can be developed and exploited for international cooperation. And here highlights the role of state institutions in the preparation of plans, scientific , regulatory studies and researches in order to achieve stability and sustainability of life for the guarantee and insurance to ensure environmental sustainability through the practical programs , which is prepare for this purpose (9,10) . Above concepts are consider a guide to makers public policy decision .Therefore, must highlight the role of efficient following and continual environmental monitoring to projects of productivity and diagnosis environmental breaches namely that contribute to protection the public environmental policy that through the use of economic instruments such as commercially widespread rights and payment mechanisms for existing pollution in environmental policy as well as to try to reach renewable resources by creating a specific ownership rights in properly manner required in addition to working to raise government subsidies harmful to the environment with the imposition of taxes and fees , or even prosecution for everyone who works events damage the environmental ocean , that to configure the best balance status in framework of achieving sustainable development(11 , 12 ) .

#### IV. RECOMMENDATIONS AND CONCLUSIONS

The natural resources were common own but unconsciously must be protected with in the environmental ocean to secure the guarantee of environmental sustainability and all countries of the world to provide support for environmental protection, with the need to strive for the development of the international organization to cooperative with local policies on the conservation the global environment by minimization and reduce the various pollution factors, that the concept of sustainable development worthwhile to preserve the ground planet from pollution and protection their natural resources, the most important recommendations and conclusions reached through this research are:

1- The Adoption of a world environment day which is the fifth of June of the year as a world environment day, must be in this day stop all projects and factories mercy of the environment and employment of all audio-visual means to serve the global environment and sustainable development.

2-originating centralized global study by the name environment and pollution concerned with the practical and scientific concept to the environment, the preparation of academic vocabulary by format to ensure the provision of environmental education and the applied methods to environmental protection on the educational levels.

3- Doing update global environment system called environment globalization equal trade globalization to achieve the goal of sustainable development.

4-Applied clean alternative energy and renewable natural resources which not polluted the environment.

5-Require development water resources and rationing of their consumption ,recycling waste water, take-off from the use chemical compounds in water purification and sterilization of water but applying ozone and solar energy ozone, reduce the consumption of water in agricultural sector, which consume 60-80%, by using new scientific means in irrigation techniques.

6-Requires from the international community to follow a policy of international based on harmony and agreement so the prohibition of wars which have a negative impact on economic and environmental development which generate the situation of instability in prices of products and coins , also causes the wars the great attrition for the types of energy and natural resources, the emission of toxic gases also heat and radiation that are emitted to the atmosphere by explosion, which have a negative impact on the environment.

7-To maintain environmentally human health , considered human supreme value generosity of God, require to breathe clean air free from pollution and clean eats free from chemical compounds by following organic farming, seek treatment with clean drugs through natural products (therapy) and herbs, friendly of environment with out a side effects.

8-Innovation and technological techniques to use clean non-polluting and another dolly for the purification of waste into the production process.

9-Awareness and education to reduce the phenomenon of smoking as nearly50% of the community to exercise smoking which have negative impact on the environment.

10-Activate the regulations and laws issued from the environmental Committee of the United Nations and the World

Health Organization and Local , Regional Organizations to achieve sustainable development

11- Preparation of studies and researches to identify the risks of nuclear energy to the environment so living organisms and their spread, to ensure the protection from radiations and their wastes .

12- Exclusion the material economic foreseeable by sustainable economic development, because the first is aimed at the accumulation of capital and profits, where dominated on the lives of human life materially look, while seen as natural resources moral and legal look, it's the main pillar of growth and economic development, but as commons raw material their durability achieve sustainable development.

13-Achieve a situation of balance between the public and special benefits ,first to aim the situation of balance between the environment and the economics for the benefit of society , the second is designed to accumulate capital and to maximize output and profits. Where when get a bug in the production process was soon treated by the presence of spare parts to the factory because it is within the special benefits, either detect obtain in the environmental ocean from the same factory be not treat because it is within the public own, also that requires treatment, such as the first case to secure sustainable development.

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# Cytogenetic Profile of Variant Philadelphia Translocations in Chronic Myeloid Leukemia

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**Abstract-** Chronic myeloid leukemia (CML) is a myeloproliferative neoplasm characterised by the presence of the Philadelphia (Ph) chromosome which is due to the reciprocal translocation, t(9;22)(q34;q11.2). The translocation results in the *BCR-ABL1* fusion gene, encoding a constitutively active tyrosine kinase protein which causes the genesis of CML. About 5-10% of newly diagnosed Ph-positive CML patients have a variant translocation involving chromosomes 9 and 22, and one or more than one other chromosomes. The objectives of this study are to identify the chromosomes involved, breakpoints and additional chromosomal aberrations in variant Ph translocation. Conventional cytogenetic analysis is performed as a routine diagnostic test for all patients with hematological malignancies in our Cytogenetic Laboratory. Based on cytogenetic findings, 42 newly diagnosed CML patients with variant Ph translocation were selected for this study. Thirty nine patients (93%) had simple variant translocation and three patients (7%), complex variant translocation. Besides chromosomes 9 and 22, a total of 16 different chromosomes were involved in variant Ph translocation. The most frequently involved chromosomes were chromosomes 1 and 11. A total of 34 breakpoints were identified. Additional chromosomal abnormalities such as trisomies, translocations, and deletions were also observed. This shows that variant Ph translocations are very heterogeneous at the genetics level, with the involvement of different chromosomes and a diversity of breakpoints.

**Index Terms-** Chronic myeloid leukemia (CML), variant Philadelphia (Ph) translocations

## I. INTRODUCTION

Chronic myeloid leukemia (CML) is a myeloproliferative neoplasm. It is characterized by the presence of the Philadelphia (Ph) chromosome (derivative chromosome 22) which is due to the reciprocal translocation t(9;22)(q34;q11.2) [1]. The translocation results in the fusion of the 3' portion of the Abelson gene (*ABL1*) at chromosome 9q34 and the 5' portion of the breakpoint cluster region gene (*BCR*) at chromosome 22q11.2. The *BCR-ABL1* fusion gene generated encodes an oncogenic protein tyrosine kinase which causes the genesis of CML by activating multiple signalling pathways that are involved in the cell cycle, adhesion and apoptosis (2). The translocation t(9;22) can be detected by routine karyotyping. About 5-10% of newly diagnosed CML patients have a variant translocation involving chromosomes 9 and 22, and one other chromosome (simple variant translocation), or more than one other chromosomes (complex variant translocation) [3]. Sometimes, the chromosome changes are submicroscopic, so the translocation can be masked and de-

tected by fluorescence in situ hybridization (FISH) or molecular studies.

Variant Ph breakpoints usually occur in the G-light bands, within the cytosine (C) and guanine (G) richest regions of the genome. CG content is related to chromatin condensation and transcription activity. Open chromatin is transcriptionally active and likely to undergo breakage and repair, and hence resulting in illegitimate recombination and translocation (4). The objectives of this study are to identify the chromosomes involved, breakpoints, and additional chromosomal aberrations in newly diagnosed CML patients in chronic phase (CP) with variant Ph translocation.

## II. MATERIALS AND METHODS

### Patients

Conventional cytogenetic analysis (CCA) is performed by our Cytogenetics Laboratory on all patients with hematological malignancy as a routine diagnostic test. Based on cytogenetic findings (from the year 2004 - 2013), a total of 42 newly diagnosed CML patients in CP with variant Ph translocation were included in this retrospective study. The median age was 51.5 years (range: 12 to 77 years). 31 patients (73.8%) were male and 11 patients (26.2%), female.

### Cytogenetic Analysis

About 1-2 ml of bone marrow aspirate from patients with leukemia were collected in transport media containing RPMI 1640 and sodium heparin. CCA was performed on the bone marrow cells according to standard procedures. The bone marrow cells were cultured overnight without the addition of any mitogen. Chromosomes were G-banded and analysed using the Applied Imaging Cytovision System (Genetix, UK). Karyotype designation was according to the International System for Human Cytogenetic Nomenclature (ISCN 2009) [5] at the time of cytogenetic analysis.

## III. RESULTS

The cytogenetic findings of the 42 newly diagnosed CML patients with variant Ph translocation are shown in Table 1. Out of 42 newly diagnosed CML patients, 39 (93%) patients had simple variant translocation (SVT) and three patients (7%) had complex variant translocation (CVT). In addition to chromosomes 9 and 22, the other chromosomes involved in variant translocations are chromosomes 1, 2, 3, 4, 5, 7, 8,10, 11,12, 14, 16, 17, 21, 22, and Y (Table 1). The chromosomes most frequently involved were chromosome 11 (9 patients, Patient No. 16-24) [21.4%] followed by chromosome 1 (4 patients, Patient

No. 1-4) [9.5%]. Although the Ph chromosome was present, it was not possible to identify the third chromosome involved in the translocation in two patients (Patient No. 38 and 39). In these two patients the segment 22q11.2 was apparently deleted. Fig. 1 shows the karyotype of a patient with SVT involving three chromosomes. Three patients (Patient No. 40, 41, and 42) had CVT. Patient No. 40 had CVT involving four chromosomes, t(9;22;3;10). Patient No. 41 and No. 42 had CVT involving five chromosomes, t(9;22;7;3;16) and t(2;9;22;16;5) [Fig.2] respectively.

A total of 34 breakpoints involved in variant Ph translocation were identified (Table 2). Recurring breakpoints were most frequently observed at 11q13 (4 patients; Patient No. 19, 20, 23, and 24) followed by 1q21 (3 patients; Patient No. 1-3). Recurring breakpoints were also found at 8q22, 11p15, 12q13, 14q32, and 21q22 (2 patients, each breakpoint). Besides the variant translocation, four patients (Patient No. 15, 17, 33 and 34) had additional chromosomal aberrations. Patient No. 17 had trisomies of chromosomes 8 and 12. Patient No. 15 and 33 had an additional translocation, t(1;17) and t(6;11) respectively. Patient No. 34 had additional chromosomal material on 19q.

#### IV. DISCUSSION

Variant Ph translocations are observed in about 5-10% of CML patients at diagnosis, and their occurrence is not associated with disease evolution. A majority of our newly diagnosed CML patients (93%) showed a 3-way translocation involving three different chromosomes (SVT). Three patients had CVT (7%) involving four or five chromosomes. In addition to chromosomes 9 and 22, a total of 16 different chromosomes were involved in variant Ph translocation. The two most frequently involved chromosomes in our study were chromosome 11 (21.4%) and 1 (9.5%). Marzocchi *et al.*, (2011) [6] and Chauffaille *et al.*, (2014) [7] reported that the most frequently involved chromosome was 17. Other studies have reported the involvement of chromosomes 6, 13, 15, 18, 19, 20 and X, in variant Ph translocation (6, 8), although this was not observed in our study. This could be due to the small sample size in our study. A total of 34 breakpoints were identified. The recurring breakpoints observed in our CML patients were 1q21; 8q22, 11p15, 11q13; 12q13, 14q32, and 21q22. Reid *et al.*, (2003) [9] listed nine recurring breakpoints in variant Ph translocation (3p21, 3q21, 6p21, 11q13, 12p13, 17p13, 17q21, 17q25, and 22q13), and most of these breakpoints occur in regions of known oncogenes, fragile sites, or typical secondary breakpoints in other cancers.

Besides the variant Ph translocation, additional chromosomal abnormalities such as trisomies, translocations and deletions were also observed in our patients. Deletions of the derivative chromosome 9 are found at a higher frequency in variant translocation compared to t(9;22) standard translocation, probably due to genomic instability [3]. Marzocchi *et al.*, (2011) [6] reported that the clinical characteristics and outcome of CML patients with variant Ph translocation are similar to those with standard Ph translocation when treated with imatinib mesylate as frontline therapy. Their data showed that variant translocations had no impact on cytogenetic and molecular response, regardless of the involvement of different mechanisms and chromosomes, or the presence of deletions in the imatinib era. The European Leuke-

miaNet Recommendations for the management of CML (2013) [10] stated that variant translocations and chromosome 9 deletions have no prognostic value when tyrosine kinase inhibitors are used as frontline therapy (11, 12), whereas the Ph chromosome with any clonal cytogenetic abnormalities such as trisomy 8, an additional Ph chromosome, isochromosome 17q, and trisomy 19 confer an adverse prognostic value (12, 13).

#### V. CONCLUSION

In our retrospective study of 42 newly diagnosed CML patients with variant Ph translocation, 93% had SVT and 7% had CVT. In addition to chromosomes 9 and 22, a total of 16 different chromosomes were involved in variant translocation. A total of 34 different breakpoints were also identified. Recurring breakpoints were most frequently observed at 1q21 and 11q13. Additional chromosomal aberrations were also present in some patients. This shows that variant Ph translocations are very heterogeneous genetically with the involvement of different chromosomes and a diversity of breakpoints. However, studies have reported that variant Ph translocations are of no prognostic value compared to standard Ph translocation in CML patients in the imatinib era.

#### CONFLICT OF INTERESTS

The authors declare no conflict of interest

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**Table 1: Cytogenetics Findings in variant Philadelphia translocation in chronic myeloid Leukemia**

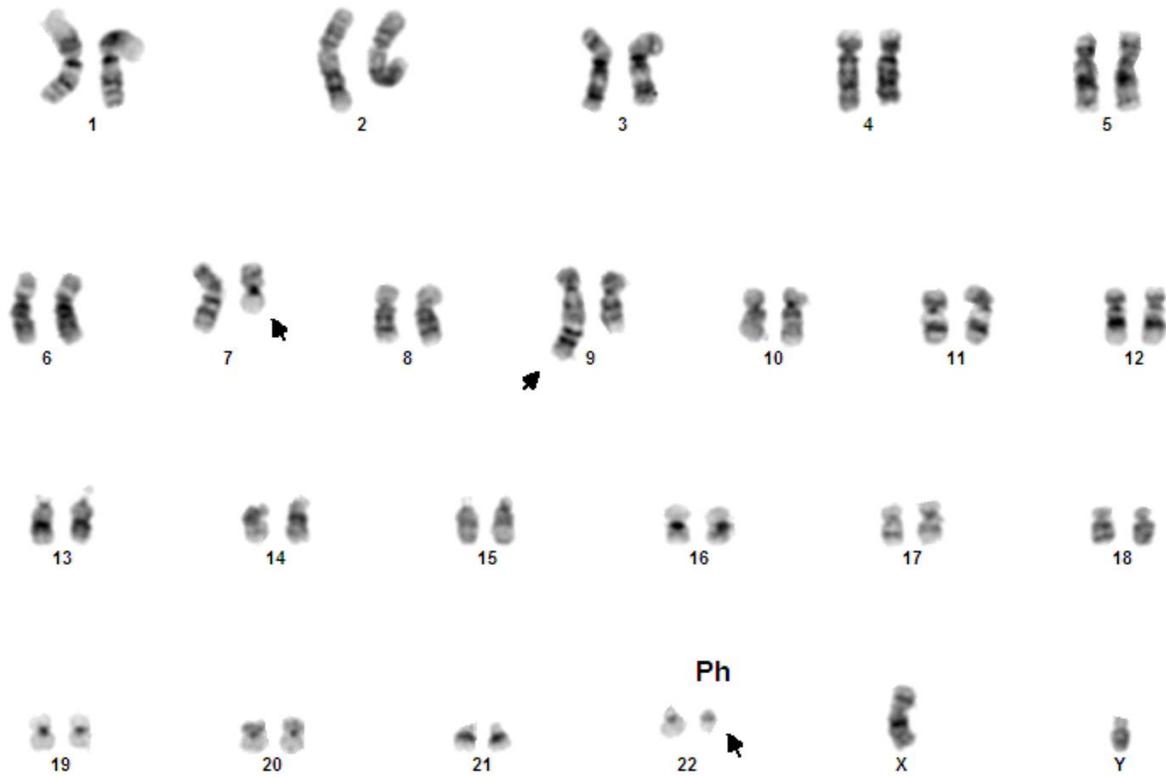
| Patient No. | Age | Sex | Karyotype  |
|-------------|-----|-----|--|
| 1           | 38  | M   | 46,XY,t(1;9;22)(q21;q34;q11.2)[6]/46,XY[2]   |
| 2           | 28  | F   | 46,XX,t(1;9;22)(q21;q34;q11.2)[20]   |
| 3           | 48  | M   | 46,XY,t(1;9;22)(q21;q34;q11.2)[3]/46,XY[9]   |
| 4           | 59  | F   | 46,XX,t(1;9;22)(p13;q34;q11.2)[20]   |
| 5           | 33  | F   | 46,XX,t(3;9;22)(q29;q34;q11.2)[20]   |
| 6           | 51  | M   | 46,XY,t(4;9;22)(p16;q34;q11.2)[20]   |
| 7           | 59  | M   | 46,XY,t(5;9;22)(q13;q34;q11.2)[20]   |
| 8           | 62  | M   | 46,XY,t(5;9;22)(q35;q34;q11.2)[20]   |
| 9           | 77  | M   | 46,XY,t(7;9;22)(p11.2;q34;q11.2)[12]   |
| 10          | 34  | F   | 46,XX,t(8;9;22)(q22;q34;q11.2)[3]/46,XX[4]   |
| 11          | 28  | M   | 46,XY,t(8;9;22)(q24;q34;q11.2)[20]   |
| 12          | 67  | M   | 46,XY,(8;9;22)(q22;q34;q11.2)[10]  |
| 13          | 66  | F   | 46,XX,t(9;22;10)(q34;q11.2;q22)[5]   |
| 14          | 57  | M   | 46,XY,t(9;22;10)(q34;q11.2;q24)[6]   |
| 15          | 64  | M   | 46,XY,t(1;17)(q35;q25),t(9;22;10)(q34;q11.2;q24)[10]                                     |
| 16          | 26  | M   | 46,XY,t(9;22;11)(q34;q11.2;q24)[14]  |
| 17          | 64  | F   | 48,XX,t(9;22;11)(q34;q11.2;q25),+8,+12[14]/<br>48,XX,t(9;22;11)(q34;q11.2;q25)[10]       |
| 18          | 57  | F   | 46,XX,t(9;22;11)(q34;q11.2;p15)[9]/46,XX[6]  |
| 19          | 58  | M   | 46,XY,(9;22;11)(q34;q11.2;q13)[8]  |
| 20          | 26  | M   | 46,XY,(9;22;11)(q34;q11.2;q13)[10]   |
| 21          | 32  | M   | 46,XY,t(9;22;11)(q34;q11.2;p15)[14]/46,XY[6]   |
| 22          | 25  | M   | 46,XY,t(9;22;11)(q34;q11.2;p11.2)[20]  |
| 23          | 57  | M   | 46,XY,t(9;22;11)(q34;q11.2;q13)[13]  |
| 24          | 36  | M   | 46,XY,t(9;22;11)(q34;q11.2;q13)[20]  |
| 25          | 40  | M   | 45,X,-Y,t(9;22;12)(q34;q11.2;q13)[15]  |
| 26          | 61  | F   | 46,XX,t(9;22;12)(q34;q11.2;q13)[7]/46,XX[8]  |
| 27          | 22  | M   | 46,XY,t(9;22;12)(q34;q11.2;q24.3)[15]  |
| 28          | 61  | M   | 46,XY,t(9;22;14;)(q34;q11.2;q32)[20]   |
| 29          | 58  | M   | 45,X,-Y,t(9;22;14;)(q34;q11.2;q32)[20]   |
| 30          | 64  | M   | 46,XY,t(9;22;14)(q34;q11.2;q24)[3]/46,XY[15]   |
| 31          | 12  | F   | 46,XX,t(9;22;17)(q34;q11.2;p13)[20]  |
| 32          | 40  | M   | 46,XY,t(9;22;17)(q34;q11.2;q24)[20]  |
| 33          | 43  | M   | 46,XY,t(6;11)(q11;q11.1),t(9;22;17)(q34;q11.2;q21)[21]/<br>46,XY[3]                      |
| 34          | 52  | F   | 46,XX,t(9;22;21)(q34;q11.2;q22)[11]/<br>46,XX,t(9;22;21)(q34;q11.2;q22),add(19)(q13)[10] |
| 35          | 59  | M   | 46,XY,t(9;22;21)(q34;q11.2;q22)[20]  |
| 36          | 31  | M   | 46,XY,t(9;22;22)(q34;q11.2;q13)[20]  |
| 37          | 56  | M   | 46,XY,t(Y;9;22)(p11.2;q34;q11.2)[10]   |
| 38          | 65  | M   | 46,XY,t(9;22; ?)(q34;q11.2,?),?del(22)(q11.2)[10]  |
| 39          | 40  | M   | 46,XY,t(9;22; ?)(q34;q11.2,?),add(9)(q34),?del(22)(q11.2)[5]                             |
| 40          | 45  | F   | 46,XX,t(9;22;3;10)(q34;q11.2;p21;p11)[14]  |

|    |    |   |   |
|----|----|---|---|
| 41 | 56 | M | 46,XY,t(9;22;7;3;16)(q34;q11.2;q22;p25;q24)[10]         |
| 42 | 50 | M | 46,XY,t(2;9;22;16;5)(q11;q34;q11.2;p13;q31)[7]/46,XY[3] |

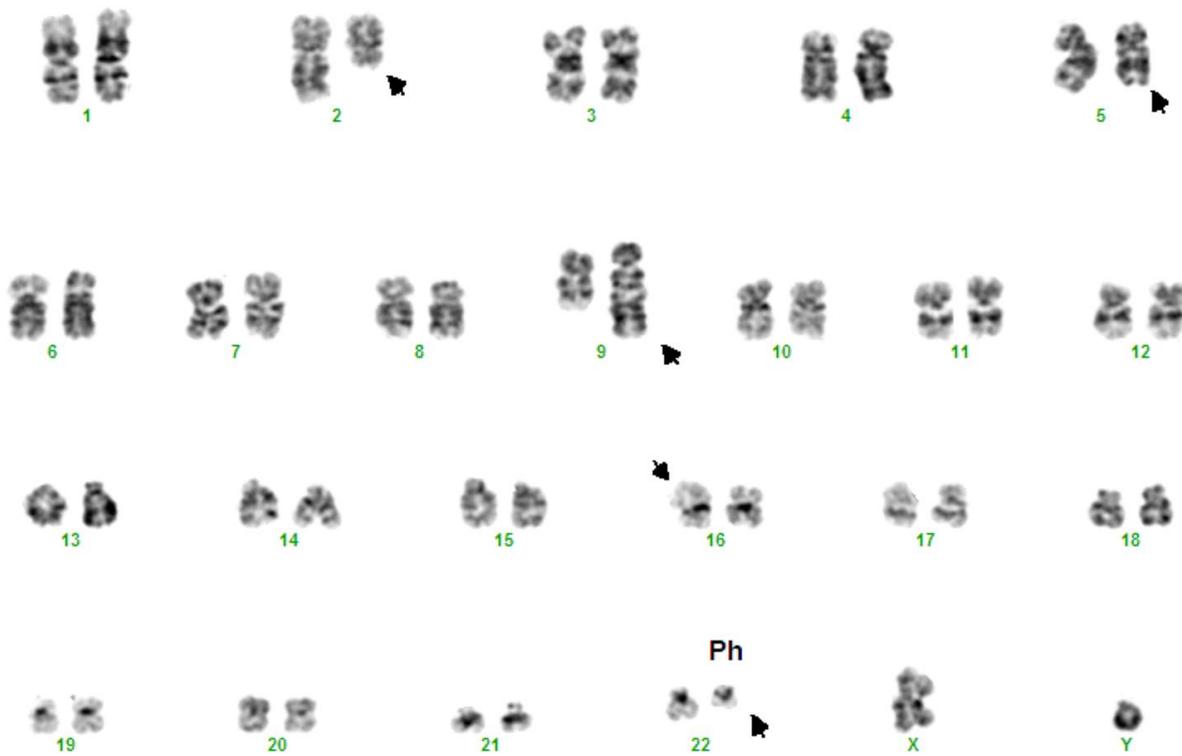
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**Table 2: Breakpoints involved in Variant Philadelphia (Ph) Translocation in Chronic Myeloid Leukemia**

| Breakpoints in Variant Ph Translocation |       |       |       |
|---|-------|-------|-------|
| 1p13                                    | 5q35  | 11q13 | 16q24 |
| 1q21                                    | 7q11  | 11p15 | 17p13 |
| 2q11                                    | 7q22  | 11q24 | 17q21 |
| 3p21                                    | 8q22  | 11q25 | 17q24 |
| 3p25                                    | 8q24  | 12q13 | 21q22 |
| 3q29                                    | 10p11 | 12q24 | 22q13 |
| 4p16                                    | 10q22 | 14q24 | Yp11  |
| 5q13                                    | 10q24 | 14q32 |       |
| 5q31                                    | 11p11 | 16p13 |       |



**Fig. 1 Karyotype of a chronic myeloid leukemia patient with simple variant translocation, 46,XY,t(7;9;22)(q11;q34;q11.2)**



**Fig. 2** Karyotype of a chronic myeloid leukemia patient with complex variant translocation,  $46,XY,t(2;9;22;16;5)(q11;q34;q11.2;p13;q31)$

# Organisational Capability and their strategic impact on firms Market Share

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**Abstract-** The focus of this paper is to theoretically investigate about different organisational capabilities. Understanding about the organisational capability can support organisation to draft strategies and invest directly to the capabilities which has better outcome in terms of business performance. This study focuses on organizational capabilities such as innovation, supply chain management, manufacturing R&D, and marketing and their effect on organizational performance with strategic implications. Organisational capabilities show their presence through organisational processes and are source of competitive advantage. The focus of research is to investigate about marketing capability and associate its relevance in B2B setup. The model of organizational capability and market share as business performance outcome proposed in the paper is one of the useful platform to understand dynamic capability and implementation of capability to solve business bottlenecks. Paper focuses on theoretically conceptualizing and creating platform for research scholars for further extension of this research in the form of empirical study. It would also be useful for managers to benchmark their marketing strategies.

**Index Terms** - Organisational capability, market share, changing environment, strategy

## I. INTRODUCTION

Market based organizational learning has been identified as an important source of sustainable competitive advantage (Vorhies and Morgan 2005). Market driven business units developed higher level of six vital marketing capabilities (in the area of market research, pricing, product development, channels, promotions and market management) than their less market driven rival business units on the four measures of organizational performance viz. growth, profitability, customer satisfaction and adaptability (Vorhies, Harker, and Rao 1999). Companies with high adaptive capability seemingly perform better than low adapters, despite the implication of high cost and inefficiency (Tracey, Lim, and Vonderembse 2005). Short product life cycle in fashion retailing present number of marketing challenges for retail firms. In order to survive in this industry, it is vital for participant to develop and leverage core marketing capabilities (Moore and Fairhurst 2003). The most distinctive features of market-driven organizations are their mastery of the market sensing and customer linking capabilities (Day 1994). In order to understand capabilities, one needs also to understand the processes of interaction and inter organizational learning (Croom and Batchelor 1997). In recent year's management scholars sought to integration of resource based view and dynamic capability approach within the field's epistemological orientation to provide normative framework for practicing managers (Pandža et.al. 2003b). Capabilities of a dynamic nature, aside from being a source of new resources for the company, provide a solid instrument for the organization's strategists. These capabilities allow the activation and redirection of the complex framework of economic and organizational factors. Dynamic capabilities are key factors in optimizing the strategic course of the company's future (López 2005).

As Managers become more responsible for their own strategic decision making, the clear understanding of enterprise's specific capabilities and advantages are required in order to achieve sustained competitive advantage (Benedetto and Song 2003). The core innovation assets (R & D, manufacturing and marketing) alone cannot lead to sustainable export growth. On the contrary, the supplementary innovation assets (learning, research, organizational resource allocation and strategy planning) not only enable the firm's technology assets to permeate into the entire competency integration, but also make it possible for firm to acquire sustainable international competitiveness (Guan and Ma 2003).

## II. ORGANISATIONAL CAPABILITIES AND BUSINESS ENVIRONMENT

Capabilities can be sorted into three categories, depending on the orientation and focus of the defining processes. At one end of the spectrum are those that are deployed from the inside out and activated by market requirements, competitive challenges, and external opportunities. Examples are manufacturing and other transformation activities, logistics, and human resource management, including recruiting, training, and motivating employees.

**Table I: Dynamic business environment and organizational capability**

| Dynamic External variables                               | Firms Action Area                  | Firms Action Plan  | Focused Capability                      | Authors Names  |
|--|------------------------------------|--|---|--|
| Rising Customer Expectations                             | Improved Quality Focus             | Self managing teams, ISO 9001:2000, TQM                  | Manufacturing                           | Day 1994<br>Guan and Ma 2003<br>Forker 1996                  |
| Technology based performance and productivity management | Information Network                | Reengineering  | Supply Chain Management                 | Tracey, Lim, and Vonderembse 2005<br>Tracey 2005             |
| Service  | Software Augmentation              | Learning Organisation                                    | Supply Chain Management, Innovation     | Guan and Ma 2003<br>Weerawardena 2003<br>Pandza et.al. 2003a |
| Erosion of brands  | Innovation                         | Expeditionary effort                                     | R&D                                     | Guan and Ma 2003   |
| Fashionisation   | Speed, Store image differentiation | Breaking hierarchis                                      | Marketing, Supply Chain Management      | Moore and Fairhurst 2003<br>Oktemgil and Greenley1997        |
| New constraints  | Stakeholders                       | Multiple Stakeholder oriented profile, Role of the board | Marketing                               | Greenley, Hooley and Rudd 2004                               |
| Globalisation  | Think Global                       | Transnational organisation                               | Marketing, Supply Chain Management, R&D | Day 1994   |

At the other end of the spectrum are those capabilities whose focal point is almost exclusively outside the organization. The purpose of these outside-in capabilities is to connect the processes that define the other organizational capabilities to the external environment and enable the business to compete by anticipating market requirements ahead of competitors and creating durable relationships with customers, channel members, and suppliers.

Finally, spanning capabilities are needed to integrate the inside-out and outside-in capabilities. Strategy development, new product/service development, price setting, purchasing, and customer order fulfillment are critical activities that must be informed by both external (outside-in) and internal (inside-out) analyses (Day 1994).

Focus on marketing capabilities in times of crisis may be less profitable than possessing the capabilities for strategic flexibility, especially as competitive intensity increases (Combe and Greenley 2004). Some studies found that market research capabilities and marketing management/planning capabilities are crucial to the success of market-driven businesses (Day 1994; Vorhies, Harker, and Rao1999). Competition among firms is rising and to act proactively firm need to focus on their core competency. They need to focus on strategic alliance, marketing, supply chain management, manufacturing and R&D (Day 1994; Guan and Ma 2003; Tracey, Lim, and Vonderembse 2005 and Tracey 2005).

Major organizational capabilities have been categorised into different segments based on strategic aspects and changing environment.

### III. CHANGING ENVIRONMENT AND CAPABILITY

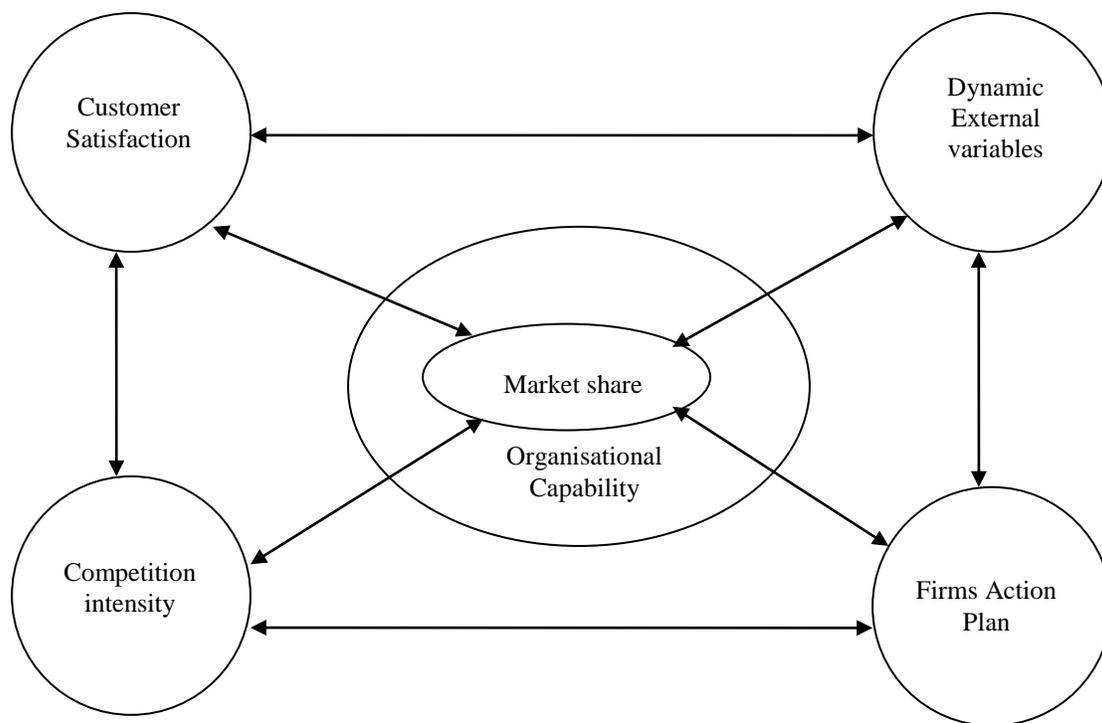
Table 1 shows trends in dynamic external variables in changing environment and different strategy based action plan and capability support which would be helpful for better performance of organization. While creating model dynamic capability view is taken into account. Fig.1 shows model of organizational capability and market share. Environmental changes are input while capability based strategic solution is related to output which is business performance. The model takes into account customer satisfaction as a separate entity.

### IV. PERFORMANCE MEASURE

Companies need to identify and invest on developing different skill-sets which might produce same result which can be achieved by developing single skill-set. Therefore, benchmarking is one of the important aspects of identifying and making use of organisational capabilities. As per Vorhies and Morgan. (2005), *marketing capabilities* associated with superior business performance can be identified and that the *marketing capability* gap between top-performing benchmarks and other firms explains significant variance in business performance. There are two views of organizational capability. Some of the researchers state that organizational capability lies in resource based view of corporate strategy and relates to the use of resources in the attainment of firm's strategic goals and objectives (O'Regan, and Ghobadian 2004).

Resource based view approach does not adequately explain the process via which some firms reach position of competitive advantage in dynamic market or in situation of change. Dynamic Capability View approach evolved from resource approach helps in generation of firm's core competency (López 2005). Significant potential business performance benefits can be available from successfully *benchmarking marketing capabilities*. Market-based learning should include learning from competitors and peers. Market - oriented firms require strong *marketing capabilities* (Day 1994; Vorhies and Morgan 2005).

Market share has become a language for the expression of the market targets by top management. Clark (2000) found this dimension of most importance to managers. Since, by definition, changes in market share represent improving or declining performance relative to competitors, it inherently reflects the attainment or loss of competitive advantage. An operationalisation of the "success of business' products and programs in relation to those of its competitors in the market, measured by such items as sales growth in comparison with that of competitors or changes in market share" represents an effectiveness dimension of performance (Walker and Ruekert, 1987).



**Fig I: Model of organizational capability and Business performance**

## V. IMPLICATIONS FOR MARKETING THEORY

Firms must uphold certain types of capabilities regardless of industry in order to remain competitive (Day 1994, Tracey, Lim, and Vonderembse 2005). At the organizational level, the supply chain management functions of physical distribution and supply chain management spanning processes directly create value for customers and affect a firm's performance (Tracey, Lim, and Vonderembse 2005). Model developed through conceptualization of various aspects of organizational capability and business performance (Fig. 1) can serve as a useful tool for managers in strategic decision making and implementation.

## VI. LIMITATION

In this study concept of organizational capability and its implications to strategy and business performance are discussed, but more in-depth empirical study will be needed for developing better understanding of linkages among organizational capability and market share.

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# Face Recognition Technique: Enhanced Safety Approach for ATM

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**Abstract-** Automated Teller Machine (ATM) has been convenient approach than ever before for accessing bank's account from anywhere anytime. Being an electronic telecommunication device, it helps customer to perform transactions/withdraw cash, make deposits & transfer funds by simply touching few buttons on screen without need for a cashier or bank teller. A survey showed that there is no proper security in withdrawing cash from ATM's. There are no proper authentication methods applied for security during ATM transactions. In this paper, security approaches of ATM have been focused on, and has been improved using biometric based authentication technique i.e., face recognition from 3 angles. One of the main motive is to diminish and tranquillize the effects of attacks to ATM by use of biometrics. The end result is strengthened biometric ATM system that will be a defending approach in coming year and will escalate the confidence of customer's in banking sector.

**Index Terms-** ATM system, Security, Strengthen, Biometric Authentication

## I. INTRODUCTION

In modern world, numerous of people are dependent on computers for keeping major record of data. Data are transferred in a cost-effective manner across wide area. ATM is one of the automatic systems being used since 1967 by many of us. ATM was invented by John Shepphardbaren on June 1967 at United Kingdom [3]. It first came in India in 1968. Today, many people have PIN's and password for operating multiple devices like car, mobile, ATM machines ; herein using PIN's without safety results in a major difficulty faced by customers like usability, memorability and security [3]. Some people used to write their PIN and password on some paper or diary which is not at all secure. As, it can be easily attacked and hacked by someone, resulting the account holder can suffer.

With the growing sector of banking, everyone is using ATM machines as these machines are located in different places and the customer can access his account anytime anywhere. A customer holding a bank account can access the account from ATM systems by getting a PIN or password confidentially from bank. By scratching the ATM card into the machine and entering PIN number, one can easily perform transaction, transfer money, etc. PIN number is a crucial aspect used to secure information of customer's account, thus should not be shared with others.

In this regard, an intuitive approach is to introduce biometric authentication technique in ATM systems, i.e., face recognition technique from 3 different angles using high resolution camera. Although various biometric technique like-

print, eye recognition, retina and iris recognition, etc have been devised as an authentication method for ATM machines, still there is need to enhance the security in ATM systems to overcome various challenges. This paper focuses on security of ATM system i.e., how to augment security of transaction using face recognition from 3 different angles at a time. The study aims to design a module of an ATM simulator based on face recognition from 3 different angles in order to minimize frauds associated with use of ATM systems.

## BIOMETRIC:

The word "biometric" is a Greek word that is derived from 2 words- bio (life) and metric (to measure). Biometric can be stated as measure of behavioural and physical characteristics that are captured and stored in database and further compared with an instance for verification purpose.

Further, this paper is organized as follows- section 2 presents Literature Review in ATM security, section 3 presents analysis and design methodology, working of biometric authentication is explained in section 4 and section 5 presents conclusion.

## II. LITERATURE REVIEW

Security Experts says that Automatic Teller Machine (ATM) in future will have biometric authentication techniques to verify identities of customer during transaction. In South America, there are companies that have introduced fingerprint technology as a embedded part of ATM systems, where citizens have already started using fingerprint in place of PIN or Password for general identification with their ID cards. Gregg Rowley said- "Banks will move to smart cards and biometric will be next step after that "[10]. Bank has already been moved to smart cards and now is the time to implement biometric authentication approach in ATM systems. Nowadays, there are devices to perform biometric identification and authentication of following: fingerprint, hand, retina, iris, face, and voice. Rowley says, "Most insecure is a magnetic stripe with a PIN, more secure is a smart card with a PIN, and even more secure is a smart card with biometrics" [10]. India is still lacking in implementing biometric with smart card as a safety approach. Various ideas are given by researchers for biometric authentication including- fingerprint, iris and retina, voice, etc. Fingerprint approach for identification given by Oko S. and Oruh J. (2012) not proved efficient as when citizen will move to ATM system, fingers may become dirty from natural environment and will not be able to access his account with ATM system, since fingerprints will not match from the one that was traced during identification. Secondly, a iris and retina approach proposed by Bhosale S. and Sawant B.(2012) as a identi-

fication method, but citizens might not want a laser beamed into their eyes for retina scan at every time he wants to access account through ATM. Thus, iris and retina as identification authentication proved inefficient. Vibration detector sensor were also proposed as a security system for ATM machines by Ajaykumar M. And Bharath Kumar N.(2013). Voice was also proposed for security in ATM systems as a biometric with smart card. The cons were there at the same time as two citizens can have same voice and one can easily hack and can fraud with another's account. Thus, this paper came with an idea of face recognition technique with 3 different angles as a biometric authentication that cannot be lost, stolen, harmful, dirty, copied, forgotten and is always available. Thus, biometric device is ultimate attempt in trying to prove who you are.

### III. ANALYSIS & DESIGN METHODOLOGY

Face Recognition is a biometric scan technology. Face Recognition includes face scan system that can range from a high-resolution camera, workstations, software and back-end processors. Face scan technology is used to analyse and capture facial characteristics such as distance between eyes, mouth or nose, and face cut of person. The ATM system will consist of embedded camera in machine that will recognize the face standing about 2 feet far in front of system and perform matches against the facial database. The system will usually come to a decision in less than 5 seconds [6]. It is very important that the face is at proper distance from camera or system, at proper angle and lighting is appropriate, otherwise distance from camera will reduce facial size and thus resolution of image. Facial-scan technology has unique advantage, over all other biometrics in the area of surveilling large groups and the ability to use pre-existing static image [6].

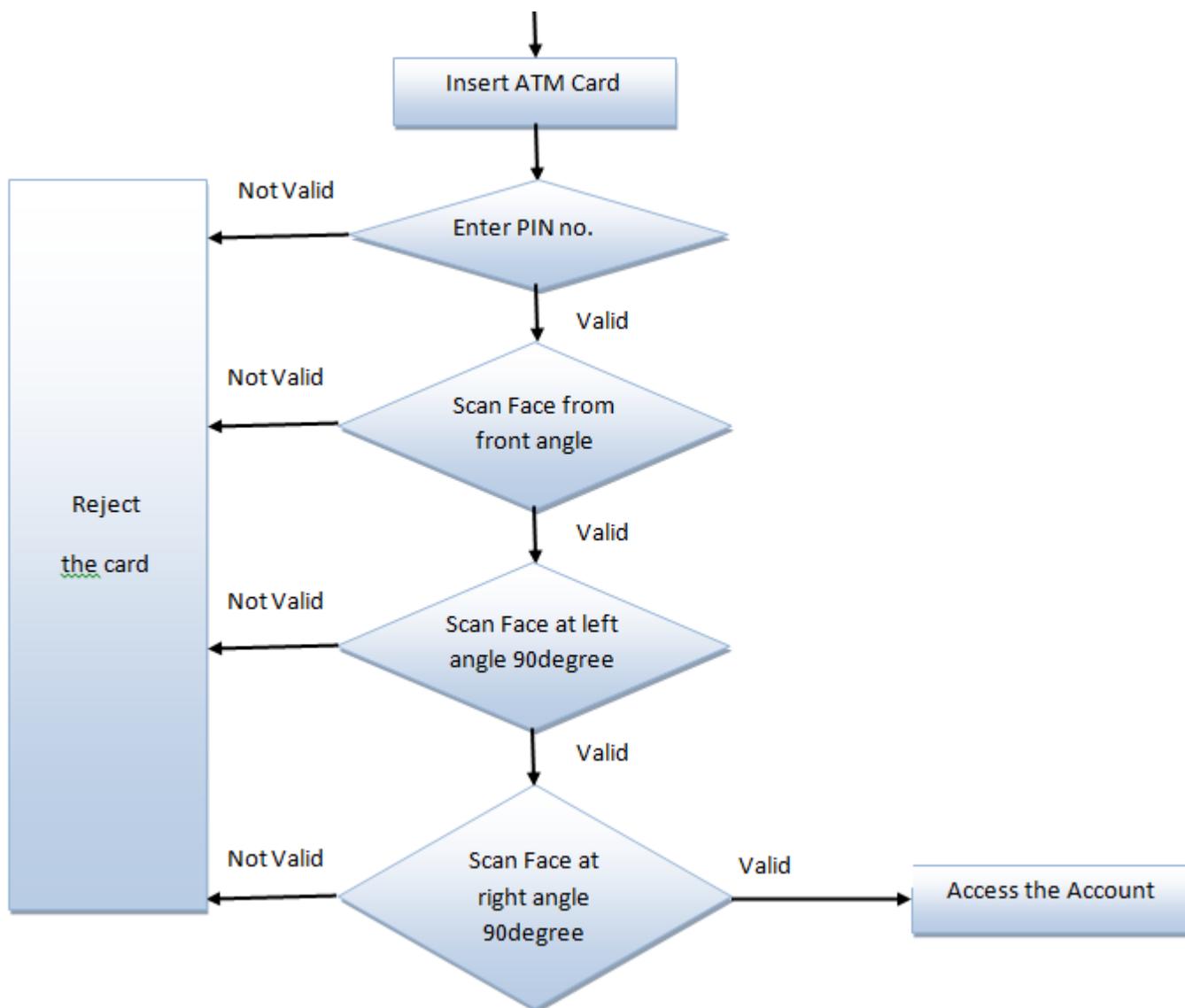
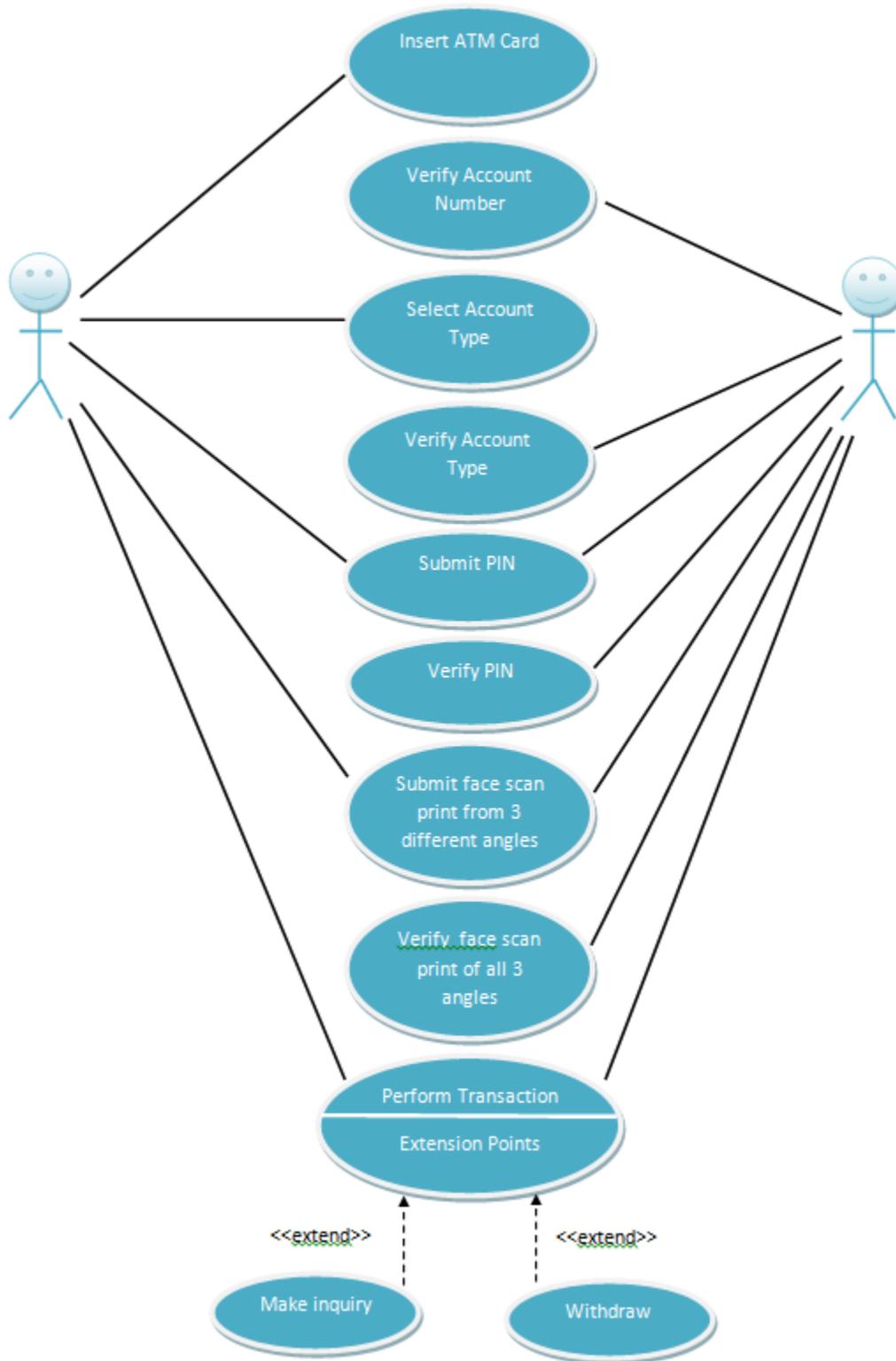
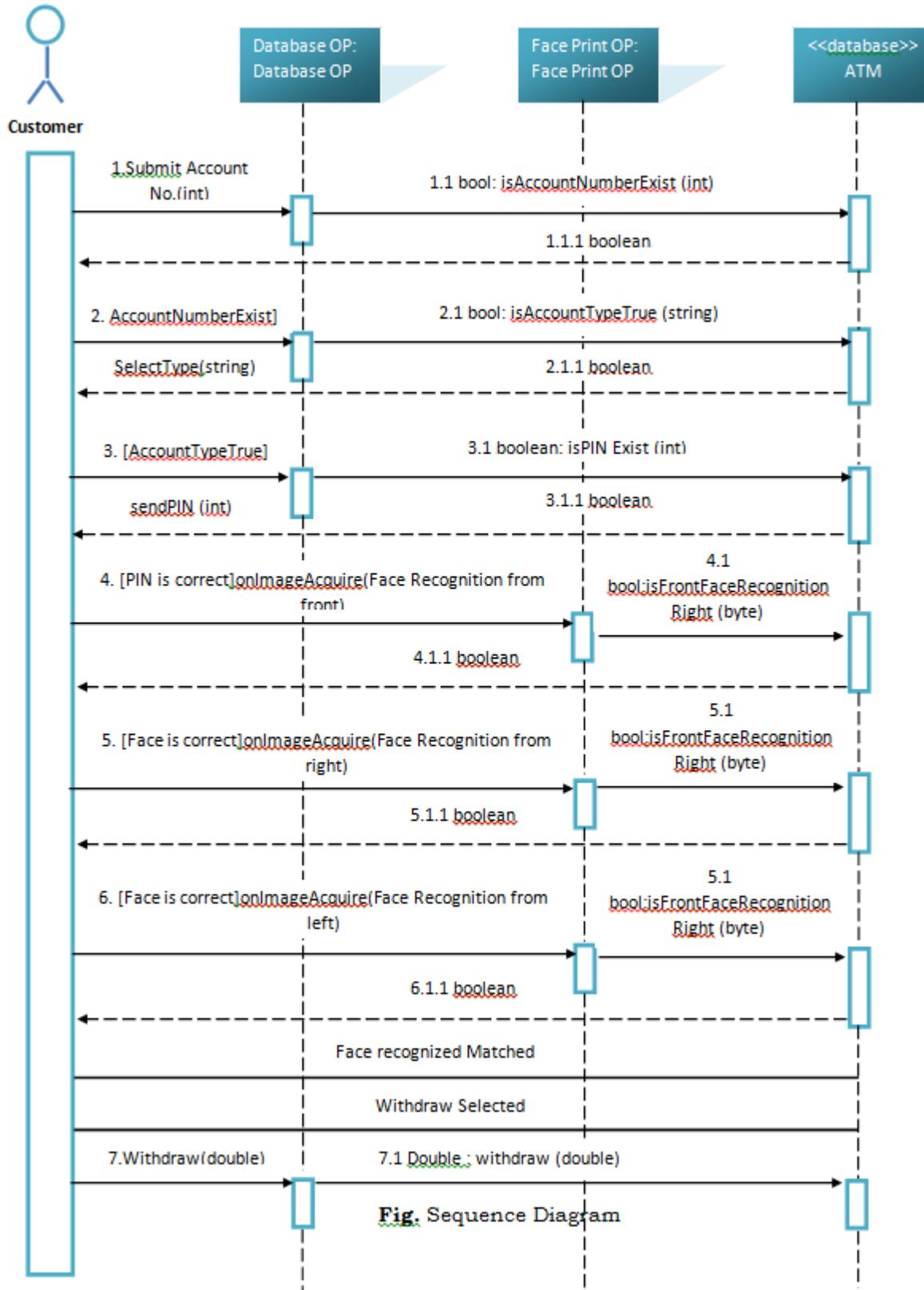


Fig. System Flow Diagram for ATM using Biometric



**Fig. Use Case Diagram for ATM Simulator**

IV. WORKING OF BIOMETRIC AUTHENTICATION

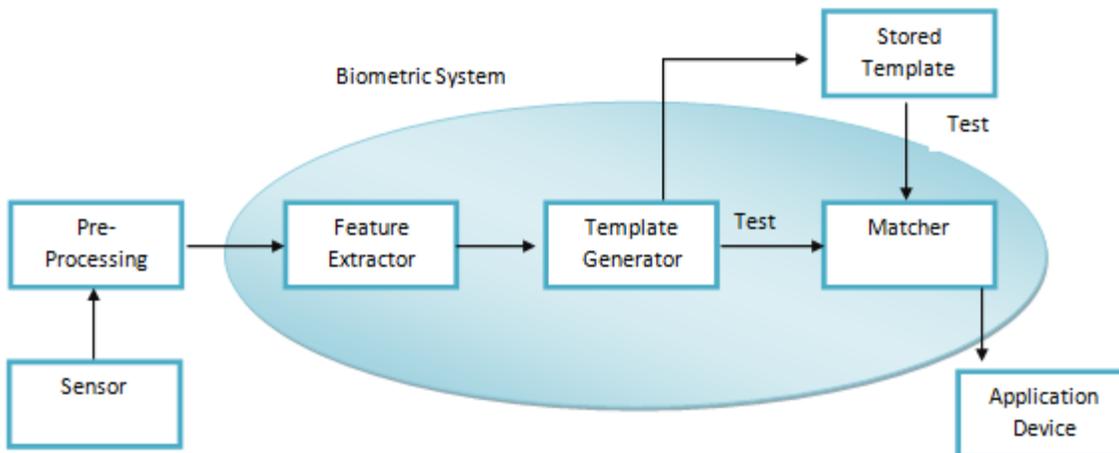


Biometric device works in order to capture human characteristics, such as fingerprint, iris and retina, voice and face. Many devices are there that can be used for biometric authentication

like hand print detectors, voice recognizer, high resolution camera and identification pattern in the retina. In working of Biometric authentication, a database is maintained by banks in which

sample of user's characteristics are stored as identification information. Thus, while using ATM system, during authentication, the user is required to provide another sample of the user's

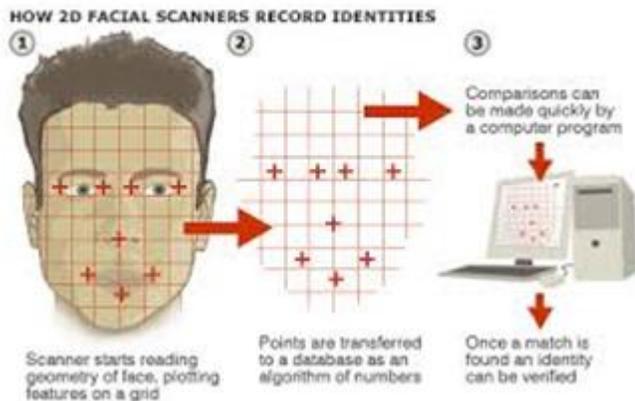
biometric characteristics. Below figure shows working of biometric authentication process [2].



**Fig.** Working of Biometric Authentication

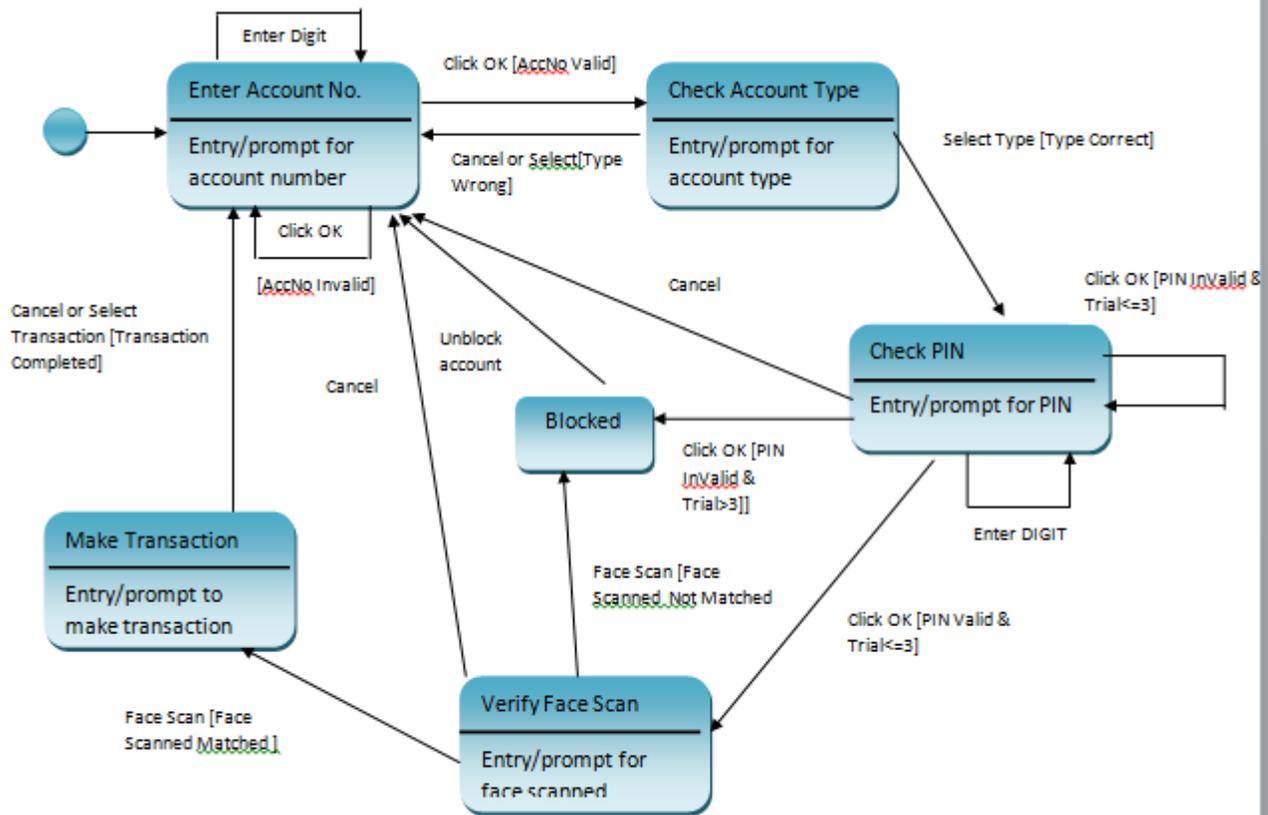
Biometric Authentication process involves: the matching of extracted feature with the sample feature already stored in database. When user provides a sample of same nature i.e., face scan etc. with its PIN in ATM system, then the system sends grid points of user's face to database as algorithm of numbers through a network to server. On server side, the user's current sample is

matched after decryption and compared with the one stored in database. As soon as, the sampled images match the current image, the user is allowed to proceed further as an authenticated user for transaction, deposit, transfer, etc., else user is considered as invalid user and session is terminated.



Working of ATM system with biometric authentication can also be explained using state chart diagram. It shows the state in which an ATM system can be at any point in time. The diagram

depicts the flow from one state to another with conditions denoted with arrows.



**Fig. State Chart Diagram**

**V. CONCLUSION**

From the above proposed conceptual model, it has been concluded that biometric ATM systems is highly secure as it provides authentication with the information of body part i.e., face recognition from 3 different angles. Biometric Authentication with smart cards is a stronger method of authentication and verification as it is uniquely bound to individuals. It is a viable approach, as it is easy to maintain and operate with lower cost. In this paper, a new authentication technique for ATM system is introduced for secure transaction using ATM's. Devising a face grid algorithm and an effective ATM simulator forms the main focus of our further research.

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# Analysis and control of noise in a textile factory

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**Abstract-** Increased noise level with the technological advancement becomes a serious problem in the textile industry and it has become a crucial occupational hazard to its workers. Maximum noise level of some textile machines is as high as 95dB and locating many machines inside a single room causes to increase the cumulative noise level by at least 5dB beyond maximum noise level of a machine. So the noise level inside a textile factory is well above the limits specified by NIOSH and it amounts to be hazardous. This article analyzes the quality of noise and its distribution inside the factory. A mathematical model is developed to predict the noise distribution pattern and the model is validated with the noise data gathered following the standard methods. Economically viable noise control panels are designed and carry out a pilot implementation in order to prove the effectiveness of the noise control method experimentally. Further, authors present the potential applications of the proposed design and evaluate its usefulness.

**Index Terms-** Noise analysis, noise control, noise pattern model, noise measurement

## I. INTRODUCTION

With the advent of Technological development, many high speed machines invade the industry with no exception to the textile industry. The machines and devices used in textile factory are highly diverse in its nature and most of them emit high noise levels due to frequent operation of noise generating components such as pneumatic elements and other fast moving mechanical components. The operational speed of textile machines are highly increased and heralded high productivity as well as efficiency. However, parallel to technological and economical progress, ever increasing occupational noise problem reached to an alarming level with the incident of undesirable consequences and adverse health effects to its workers. The maximum noise level of some textile machines has reached 95 decibels. When a number of machines are placed in a room, cumulative noise level is reached to hazardous level where noise control becomes absolutely essential.

Noise is defined as excessive or unwanted sound which potentially results in annoyance and/or hearing loss and it can be from occupational and/or non-occupational sources [Robert et.al]. In other words, noise is a sound disturbance as well as a nuisance which results in health problems and adverse social consequences. Noise effects on human health can be auditory effects such as permanent or temporal hearing loss and non-auditory effects such as communication, concentration and sleep interference, annoyance, loss of working efficiency [AA Abbasi et.al and WE Pur-

cell et.al], and possible hypertension [Parvizpoor, Lees et.al]. The non-auditory effects entails to social issues such as lack of domestic communication as well as the disruption of job performance [EPA]. It may contribute to industrial and road accidents. However, data are insufficient to deterministic endorsement of such specific damage risk criteria as consequences of non-auditory effects. In order to control ever increasing exposure of human beings to high noise levels World Health Organization set standards for noise level [WHO noise exposure limits] and provided guidelines to control noise [Berglund et.al].

Human ear is not sensitive to all frequencies except the frequencies from 20 Hz to 20 kHz. Even within the audible range of frequencies equally loud sound with same sound pressure level perceived by human ear differently [ISO 389]. When calculation of a value representing noise level, some frequencies become more important than the other frequencies. The combined effect of noise is calculated with due consideration to its relative contribution of frequency components and their different perception levels considering equal-loudness contours, various weighted schemes are in use to represent noise levels. A-weighted and C-weighted noise levels are frequently in use to measure noise levels.

The adverse effect of the noise is characterized by various descriptive parameters of noise exposure such as noise pressure level, time duration in which that noise level persists. The hearing damage risk criteria states the relationship between such parameters and probability of temporary or permanent hearing loss [MIL-STD-1474C]. In 1972, National Institute of Occupational Safety and Health (NIOSH) published "Criteria for a Recommended Standard—Occupational Exposure to Noise" which provided the basis for a recommended standard to reduce the risk of developing permanent hearing loss as a result of occupational noise exposure. NIOSH recommends that workers should not be exposed to noise at a level that amounts to more than 85 decibels for 8 hours.

Significance of noise control become increasingly important in textile industry as global statistics reveals that the seriousness of the hearing problems of workers in textile industry [MK Talukdar, R Bedi]. In the hierarchical approach of noise reduction techniques ranges from noise elimination by physically removing the hazard, substitution by replacing the hazard, engineering control by isolation from the hazard, administrative control by changing the way that people work to personal protective equipment (reference [11]). The elimination in short time is impractical in Textile industry while development of quieter machines to substitute existing noisy machines may be a long term solution with the advent of sustainable and green technology. Engineering

control techniques to use of personal protective equipment are identified feasible short term solution approaches to noise problem. The least effective approach-the use of personal protective wear is still heavily used Textile industry in Sri Lanka and it is the high time to move towards more effective engineering control approach.

In this paper, authors attempt to analyze the quality of noise quantitatively and noise distribution pattern inside a textile factory. Theoretical analysis on noise propagation is briefed and underlying theories are reviewed. A mathematical model is developed for the distribution of the noise and the model is validated with the noise data collected from the factory following the standard procedures to collect data. After critical review of available noise reduction techniques quantitatively, economically viable noise control technique was designed. A pilot implementation was carried out in the factory and the effectiveness of the noise control method verified experimentally.

## II. MODEL TO ESTIMATE NOISE

### A. Noise Propagation

The vibrating elements create pressure differences in the atmosphere and it propagates across the atmosphere as pressure variations transmitted by wave motion [Paul Jenson et.al]. Such pressure variation within audible frequency range heard by the human ear is termed as sound. Sound propagation is characterized by three elements namely sound source which generates sound characterized by sound power level, propagation media which attenuate different frequency components by different levels and the receiver what the sound impinges upon that may be a microphone or a person. Sound pressure level at the receiver ends determines the loudness of the sound or noise. Since noise is undesired and unwanted sound, noise propagation also has three key elements and each element can be separately treated to control noise.

The air borne noise is radiated in the environment and in most cases, noise propagation obeys a hemi-spherical model either due to ground in the case where noise source is in close vicinity to the ground or due to ceiling in case of noise source is too close to the ceiling.

### B. Measurement of noise

Generally noise waveforms are complex in nature or composed of a frequency spectrum in which each frequency component has different magnitudes. Size or magnitude of the pressure change measured in decibels as the pressure variation range of the human ear is as wide as from 20  $\mu$ Pa to 200Pa. So the quality of the noise is characterized by frequency content and it is essential to carry out a frequency analysis in order to determine the relative contribution of frequency components to the total noise so as to design an effective noise control mechanism.

The combined effect of the different frequencies perceived as noise, can be approximated by various frequency weightings to yield single number rating. The A-weighting is widely in use as it used a family of equal-loudness contours (ISO 1987a) that describe the frequency response of the hearing system. So quantify

the hearing sensitivity of human beings the A-weighted decibel or dBA scale is created. The noise level expressed in dBA unit can be directly measured with a sound level meter. The C-weighting network is a nearly flat response except attenuation of extremely high and low frequencies and expressed in the unit of dBC. This weighting scale is used in the selection of hearing protectors. The difference between C-weighted and A-weighted noise levels is an indicative measure of low frequency content when frequency analysis of the noise is not feasible.

With sound level meters, pressure variation in atmosphere can be measured (sound pressure level), but not the power of the source (sound power level). However, the following formula establishes the relationship between sound pressure level (SPL) and sound power level of the source (SWL).

$$SWL = SPL_x + 10\log(2\pi x^2) \quad \text{---(1)}$$

where  $SPL_x$  is the sound pressure level at x meters away from the source and assumed hemi-spherical model in radiation of the noise in the environment. From equation (1), it is possible to deduce that the sound pressure level at a distance of y meters from the source is given by

$$SPL_y = SPL_x - 20 \log (y/x) \quad \text{---(2)}$$

where  $SPL_y$  is the sound pressure level at y meters from the source.

In order to investigate the quality of sound, a noise spectrum is analyzed with special software called "SpectrumView". "SpectrumView" is an audio spectrum analyzer program that allows the display of audio data captured from the PC's sound card or from a WAVE file in either a spectrum graphical format or in a waterfall display. The data will be displayed in the frequency domain; each data point on the graph will represent a frequency point in the audio spectrum.

### C. Noise estimation

The human beings can withstand high noise levels to a shorter duration and with the increase of every five decibel, permissible duration of exposure is halved (5dB exchange rate). The permissible noise exposure limits are defined by OSHA and table 1 depicts the permissible noise exposure.

Table 1: Permissible noise exposures (Source: OSHA 1910.95)

| Duration per day (hrs) | OSHA 1910.95 (US) |
|------------------------|-------------------|
| 8                      | 90                |
| 6                      | 92                |
| 4                      | 95                |
| 3                      | 97                |
| 2                      | 100               |
| 1 ½                    | 102               |
| 1                      | 105               |
| ½                      | 110               |
| < ¼                    | 115               |

Specific permissible duration of exposure to noise, not given in table 1 can be calculated with the following equation:

$$T = \frac{8}{2^{(L-90)/5}} \quad \text{----(3)}$$

where T is the permissible duration in hours and L is the measured noise level in dBA. However, action level for noise is defined as 5dBA below noise level specified in OSHA 1910.95 standards.

The total daily noise exposure is composed of noise exposures from different noise sources with different noise levels which is greater than 80dB over different disjoint time periods. The combined effect of the noise sources termed as total noise dose D is given by

$$D = \sum_{i=1}^N \frac{C_i}{T_i} \quad \text{----(4)}$$

where  $C_i$  is the total duration of exposure at a specified noise level and  $T_i$  is the total time of exposure permitted at that level. Since the workers are not permitted to be exposed to an 8hour time weighted average equal to or greater than 90 dBA, the value of D cannot exceed the unit and failure of that amount to exceed the limit value. The equivalent continuous sound level  $L_{eq}$  can be calculated as [MIL-STD-1474C]

$$L_{eq} = 85 + \frac{40}{3} \log_{10} \left[ D \cdot \frac{8}{T_s} \right] \quad \text{----(5)}$$

where  $T_s$  is the total sample time in hours.

Since the decibels are measured using a logarithmic scale based on the sensitivity of the human ear, it cannot be added arithmetically. The sum of sound pressure levels, sound intensity levels, or sound power levels can be calculated with the following formula.

$$CL = 10 \log_{10} \left[ \sum_{i=1}^n 10^{L_i/10} \right] \quad \text{----(6)}$$

where  $L_i$  is the sound level of  $i^{th}$  source in dB and CL is the combined sound level in dB. Since noise is an undesirable form of sound, these equations can be applicable to noise too.

#### D. Development of model

Pneumatic ejecting valves are identified as major noise sources in the machines of covering plant. Cams and metal bearings are the next dominance sources of noise but compared to the pneumatic ejecting valves, contribution of these sources to the total noise level is assumed to be relatively low to develop a simple model. The pneumatic valve noise without silencers can be estimated by the following equation:

$$L_w = 17 \log(M) + 50 \log(T) - 15 \quad \text{----(7)}$$

where  $L_w$  is the noise power level emitted by the valve in dBA, M is the mass flow rate capacity in t/h, and T is the absolute temperature of the emitting gas. Since the exhaust is equipped with a pneumatic silencer valve with noise reduction capability of 20dBA, the sound power level of pneumatic valve with silencer yields as 96dBA.

The machine bodies act as disturbances to sound propagation, and they can be considered as sound barriers. The insertion loss due to the sound barriers in shadow area are given by

$$IL = \log_{10} \left[ \frac{Q}{\frac{4\pi r^2 + R}{Q} + \frac{4}{4\pi r^2 + R}} \right] \quad \text{----(8)}$$

where IL is the insertion loss, Q is the directivity of the noise source, R is the room constant, r is the shortest distance from the source to distance and  $Q'$  is the effective directivity of the source in the direction of shadow zone which is given by

$$Q' = Q \sum_{i=1}^n \left[ \frac{\lambda}{3\lambda + 20di} \right] \quad \text{----(9)}$$

where  $\lambda$  is the wavelength of the noise in meters, and  $di$  is the path difference in diffracted path and the direct path between the source and receiver.

In order to calculate noise pressure level at different locations, a 3D-Cartesian coordinate system is defined such that origin of the system lies at the top left corner of the plan in Fig.1, x- axis along the widthwise direction of the machine and y axis is parallel to the lengthwise direction. Z coordinate denotes the height from the ground level. At the grid points of 0.1X0.1 m at 1.5m above the ground level, noise pressure levels are calculated considering the noise generated by pneumatic ejectors only and assuming that the machines are of cuboid shape. In calculation of noise pressure level at each grid point, air attenuation, attenuation due to perforation of energy in the environment by equation (1), and the directivity of sound source are considered for every noise source having line of sight and get the cumulative noise effect of multiple noise sources using equation (6). For each noise source in the shadow area, insertion loss is calculated considering the directivity of the source and the central frequency of each octave band so as to calculate the effective insertion loss of the noise. Insertion loss is deducted from the sound pressure level calculated without the barrier for every noise source and gets the cumulative noise effect at each grid point. Then combine the line of sight incident noise level and diffracted/reflected noise level to obtain the final effective noise level at each grid point. From the final effective noise level calculated at each grid point is used to construct the theoretical noise propagation map.

### III. NOISE CONTROL

Noise control can be briefly defined as avoiding unwanted sound reaching the worker's ear drum. Controlling of noise can be broadly categorized into three types of noise treatment, namely source treatment, path treatment and receiver treatment [FA Everest et. al]. Source treatment can be use of exhaust silencers, silencer canopies [Perlikowski]. Path treatment of noise may be either by blocking the air borne sound with barriers which places in between the source and workers' ear drums [MK Talukdar] or by absorbing air borne sound with absorbent surfaces or vibration damping [HS Seddeq]. In case of blocking airborne sound, the object in the sound path must be larger than one wavelength to significantly disturb the sound [DA Beis et.al] and hence this approach is not effective in low frequencies as the panel size needs to be considerably large and it disturbs the very purpose. However, acoustic absorbent approach may be a reasonable solution if the major noise problem lies in the medium frequency range. Vibration isolation techniques such as damping pads to dissipate mechanical vibration and plastic springs to reduce vibration emissions can be used in vibration control [MK Ta-

lukdar]. Receiver treatment for noise can be wearing of hearing protecting devices such as ear plugs, noise muffs (circumaural) or attenuating helmets or headsets and this may be the least effective approach as it disturbs the inter personal communication which eventually extends to social problems.

The approaches of noise control can be divided into three main categories namely active noise control, passive noise control and hybrid noise control – combination of active and passive control cancellation [TM Jonsana et.al, MA Milošević et.al]. Active noise control (ANC) is the use of secondary source which generates a sound field of the inverted version of noise signal to cancel the primary sound field generated by the primary noise source. As the noise is time varying in terms of frequency and amplitude in addition to variable sound speed due to temperature and humidity variation ANC becoming a challenging task of adaptive control. Feedback and feed forward models of active noise control were experimented by Peter Gaikwad et. al with an FPGA board and presented the pros and cons of digital electronics in active noise control. Passive Noise Control is preventing sound waves from reaching the eardrum by disturbing, absorbing & isolating the sound wave. For low frequency level, passive noise control systems are much bulky and implementation of such system perturbs the easy working environment. To cover the full frequency spectrum, best approach may be the hybrid approach.

Feasibility of noise control includes the identification of all the noise sources that contribute to the noise level, all noise paths between the noise source and the location of interest, rank ordering of the source/path combinations in terms of their contribution to the overall noise level, development of noise control measures based on the quality of noise and ability to implement according to the dominance of noise until the required noise levels are achieved at the location of interest.

#### IV. METHODOLOGY

##### A. Experimental setup

A typical covering plant is selected as the experimental setup for noise control. First draft the machine layout of the factory and identified the most suitable places to take noise readings. The plan of the machine layout is given in Fig.1.

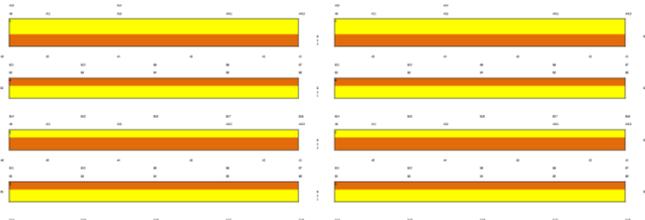


Fig.1: Plan of machine layout

Four number of MULTIPLA P410 machines and four number of SSM, type DP3-C machines are located in the factory. Each MULTIPLA P410 machine has 48 nozzels with 41.5 cm spacing between nozzels at a height of 59cm from the ground level. Each SSM, type DP3-C machine has 40 nozzels with inter nozzle space of 44cm at 79cm height from the ground. Each machine

has a lengthwise separation of 223cm between machines and 1.7m separation in widthwise.

##### B. Data collection

Since the quality of sound is essential for effective noise treatment, the noise spectrum is measured with “SpectrumView” software running on a portable PC with an external capacity type microphone connected to the PC. Since the noise level is below 171dB level, the capacitive type microphones are ideal as it provides a rather flat response. Prior to use that software, the entire data acquisition system was calibrated by using a tuning fork. Further the sound pressure level measured for each octave band with this data acquisition system is summed up with A-weighting compensation to calculate equivalent dBA reading using the equation (6) and cross verified the calculated value with dBA scale reading of a precise sound pressure meter categorized under type 1 according to IEC 1979 standards in slow response mode. The microphones were kept vertically in taking the measurements and a record of sound is stored in wav format with a sampling rate of 160K samples/s. In order to integrate sound pressure level over one decade, signal is filtered with Bessel type filter with 40KHz cut off frequency and roll off rate of 40dB/octave. 10 bit word size A/D conversion was used conversion of analog signal into digital domain.

##### C. Method

Calibrated and verified noise data acquisition system was used to record data and subsequent analysis. Most dominant noise problem exist in 0-2500Hz band and it is identified with online spectrum obtained with the “SpectruView” software. In order to identify the most significant noise band, this band is subdivided into 5 bands each having a bandwidth of 500Hz. The noise level at different location in the factory floor is measured at 5 feet above the ground level as it is the plane where the ear of standing average person. With the experimental data gathered, a noise propagation map is plotted in the plan of the factory floor using Civil3D software to indicate noise level variation inside the covering factory.

High noise (>85dB) generating components of the machine is identified with its location and elevation from the ground level. Using the mathematical model developed the sound level at different locations was estimated and thereby constructed a noise propagation map with a code written in Matlab 7.8 version. Based on the quality of sound, an appropriate design of the noise control method is developed and implemented in the factory. Before and after implementation of the noise control design, noise spectrums of the same location were obtained and evaluated the effectiveness of the implemented noise control technique.

##### C. Design of noise control

Majority of the areas having more than 93dBA or above sound level inside the covering plant and daily shift of workers are 8 hour in duration. Once the daily dose of noise exposure is calculated using equations (3) and (4), the noise dose per day is well above unit value even for 8 hour shift worker and hence the implementation of noise control mechanism is absolutely essential for the occupational health. An analysis of noise exposure reveals that action level of noise exposure level should be 85dBA for 8 hours period which is 5dBA less than the permissible noise exposures specified in OSHA 1910.95 [M Praveen Kumar et.al].

Since the lower frequency is the major component of noise problem, use of acoustic barrier is less effective due to bulkiness. In modern era, bio based materials have been heavily used for sound insulation [Xiaodong Zhu et.al]. So noise control with sound absorbent materials as well as active noise control remains as solutions despite the noise reduction coefficient is higher for high frequencies [CM Harris]. The sound absorbent properties of woven fabrics [Paola Ricciardi et.al] and polyurethane [Tsuayoshi Yamashita et. al] were intensively investigated considering the effect of microscopic internal structures.

In case of control noise in rooms, a reverberant noise control technique was proposed but it has serious limitations especially in high performance control [ACC Warnock]. High performance noise control proposed for museums found in literature with major objective of bringing down the reverberant time to acceptable limits [PO António et.al]. Since the noise in textile industry is of persistent nature with non randomized pattern, such high performance noise control methods have minor role in applicability. Though silencer and acoustic enclosures are potential noise reduction means, it disturbs the easy working environment and full acoustic enclosures are prohibitive in use due to the nature of operation of machines. Use of acoustic ceiling is an ideal solution to control noise inside a textile factory. The acoustic ceiling can be engineered not only to serve as a sound absorber, but also as a resonate type of sound absorber.

Fibre size of material, air flow resistance per unit thickness of material, porosity as well as tortuosity of material, thickness density and compression of material are the factors influencing the factors for sound absorption [HS Seddeq]. For effective sound absorption of a porous absorber, thickness of the material needs to be about one tenth of the wavelength of the incident sound [Michael Coates et.al] and compression of the material could reduce the required effective thickness. Further, denser structure performs better noise absorbent properties for frequencies above than 2000 Hz. Since higher frequencies need to be cut off to reduce the annoyance feeling of the noise, a compressed material becomes a good candidate for the acoustic ceiling material. In the meantime, fire resistance, light weight, impact resistance, and availability in larger blocks easy installation are other important factors under consideration in selection of acoustic material besides noise reduction coefficient. Duraboard could meet all non-acoustic factors with a reasonably higher noise reduction coefficient of 0.31 and with a thickness of 50mm/58mm.

Since the low frequency noise is required to be reduced by greater extent, use of acoustical tile is inevitable. So 3/4" thick textured film faced acoustic tiles of 12"X 24" size was used to cut off lower frequencies and the remaining space is covered with duraboards in the acoustic ceiling designed. The schematic diagram of the acoustic ceiling is given Fig. 2. The available sizes of acoustic tiles of high noise reduction coefficient (0.75 as per manufacturer's specifications), dimension as well as the separation between machines, economical factors and the results of the many experimental trials determines the design of the acoustic ceiling.

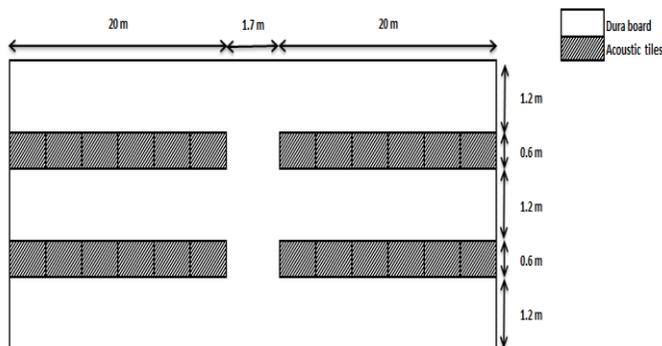


Fig. 2: Schematic diagram of acoustic ceiling

## V. RESULTS

Fig. 3 gives the noise spectrum over 0-20kHz and it is rather flat spectrum except in the lower frequency band below 2500Hz. So the most dominant low noise frequency band is subdivided into frequency spectrums having a bandwidth of 500Hz and rates the frequency bands as shown in Fig. 4.

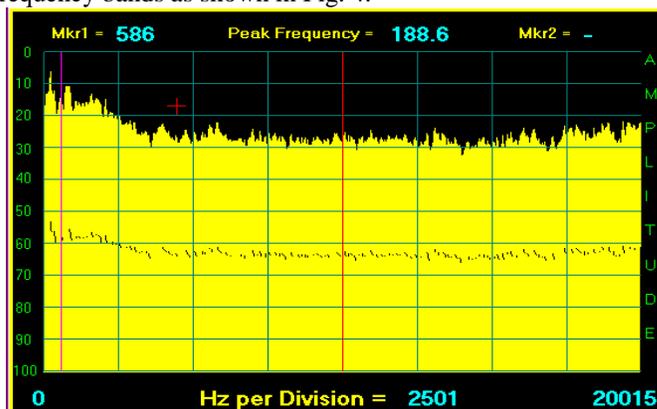


Fig.3: Noise spectrum

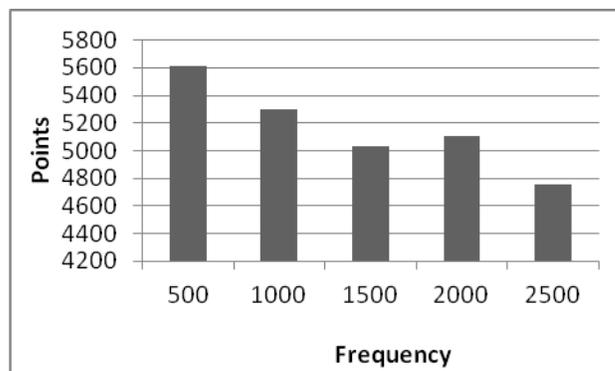


Fig.4: Frequency rating chart below 2500Hz

The noise propagation map in the covering plant is generated with Civil3D software based on the experimental data gathered from sound meter measured in dBA scale and depicted in Fig. 5.

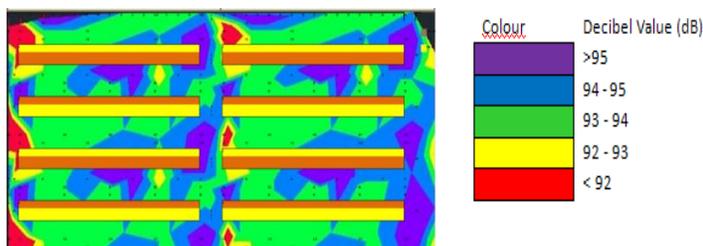


Fig.5: Experimental noise propagation map in covering plant

The theoretical noise propagation map based on the noise estimation model data is given in the Fig. 6 and it has a compatible noise levels with the empirical noise propagation map.

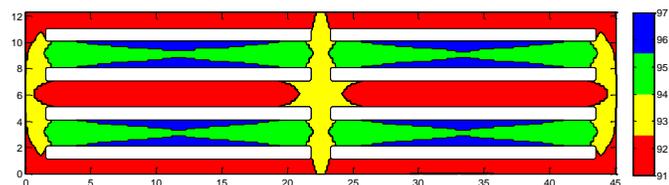
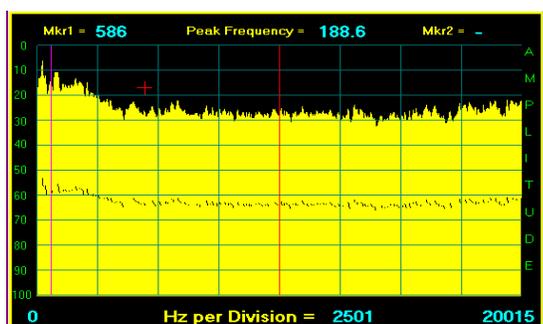
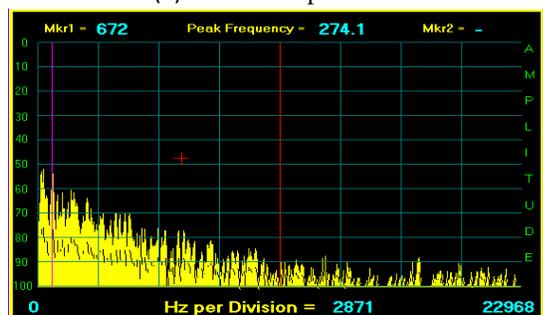


Fig.6: Theoretical noise propagation map

Figure 7 shows the noise spectra inside the covering plant before and after implementation of noise control technique. It is observed that noises over 5kHz are drastically reduced and the noises below 5kHz are not reduced by the same extent due to the implementation of acoustical ceiling as a noise control device. The same phenomenon can be clearly experienced through the frequency sensation of the human ear.



(a) Before implementation



(b) After implementation

Fig.7: Noise spectra before and after implementation of noise control

## V. DISCUSSION

When the quality of the noise in ear plane is analyzed, it is quite a flat response except below 2500Hz frequency. Lower frequency band is further analyzed and the frequency rating chart reveals that most dominant noise problem occurs around 500Hz range. The noise level in the octave band having centre frequency 500Hz exceeds 90dBA noise level.

The experimental noise propagation map in covering plant depicts the special pattern of the actual sound field inside the factory. It was noted that at the end of the machine and at the centre of the face to face machines noise levels reached to its peak level. Symmetrical and proximal incidence of noise generated from the pneumatic ejecting valves at the center of machines causes to reach noise level to a maximum value. The refraction of the noise at the end of the machine and direct incidence of noise sources from other machines without the attenuation of machine body triggers to make the noise level quite high at the ends of the machines. However, noise propagation pattern of the theoretical derivation is quite different from the actual noise pattern due to assumptions made in development of the model. Control box locates at the one end of the machine and at this end noise level becomes rather high in rear side of the machine in the empirical noise map. It reveals that other than pneumatic ejectors, other more dominant noise sources are located in the control box and which was not considered in theoretical model. Further, casing of the control box acts as an acoustic barrier to the proximal noise sources of the same machine and thus makes that end of the machine less noisy in experimental noise map.

The sound power level of the pneumatic ejecting valve is above 120dB in noise power level but with silencer valves it was dropped to 96dB level. In development of the model, still we assumed that the dominant sources of noise are pneumatic ejectors as compared to the noise levels of cams and gears. Calculations are done assuming that machine is of cuboidal shape and pneumatic ejecting valves are on the front surface of the machine. However, in reality, it is slightly deviated from this assumption as control box is protruded out by many centimeters covering one side from its own noise generating valves. So a slight variation could be noted in theoretically generated sound propagation map or technically spectral pattern of sound field.

Noise estimation model was coded by the Matlab as it provides a convenient way of handling matrices in a multi paradigm numerical computing environment. However, due to higher number of noise sources, the run time of the program exceeded half an hour and avoids consideration the actual shape of the machines with control boxes. However, use of CAD software may be a good option in further analysis of sound propagation pattern considering the actual shape of the machine.

The acoustic ceiling is composed of acoustic tiles (NRC 0.75) which can absorb low frequency content much, is responsible of attenuation of low frequency component of noise. The remaining part is covered with duraboard which has a gradually increasing noise absorbent coefficient for higher frequencies, cuts off the higher frequency components with greater intensity. So it could be noticeable in the noise spectra after implementation of the noise control. Since the acoustic tile covers a smaller area, the noise reduction effect on low frequency is not much intense as for high frequencies.

## VI. CONCLUSIONS

The noise level inside a covering plant of a textile factory was experimentally measured and developed a noise propagation pattern. Since the noise level was well above the action level of noise exposure, quality of the noise was analyzed in order to design a noise control system. A mathematical model is developed to predict the noise distribution and the model is validated with the noise data gathered according to the standards. An economically viable acoustic ceiling was designed to control noise and carries out a pilot implementation in order to prove the effectiveness of the recommended noise control method experimentally. Further, a combined use of different sound absorbent material, it was shown that passive noise control approach has greater horizons in noise control without going for hybrid noise control approach.

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# Community Education Needs of Community Based Organization Leaders in Anambra State, Nigeria

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**Abstract-** The central focus of this study was to ascertain the community education needs of community based organizations leaders in Anambra State of Nigeria. To guide this study, five research questions were posed. The study adopted a descriptive survey design. The population of the study comprised 1,701 executive members of the 189 registered community based organizations in the 21 local government areas that make up the three senatorial zones of Anambra State. The sample consisted of 1045 executive members of community based organizations selected through stratified random sampling. The internal consistency reliability coefficient obtained was 0.88. Questionnaire was the instrument used for data collection while mean was used to analyze the data. The criterion mean of 2.50 and above was accepted as indicative of agreement and where it falls below 2.50, it indicated disagreement. Among the major findings of the study were that the respondents agreed that they need basic, social, political, economic, and cultural education to improve or further lead as required. It was recommended that the Agency for Mass Literacy, Adult and Non-formal Education in Anambra State should mount campaign in the rural communities on the need for community education programmes, that community education centres should be established in the rural areas and qualified adult educators employed to facilitate the programmes, policy makers and other administrators in mass literacy, adult and non-formal education should reflect the needs of the community in policy formulation.

**Index Terms-** Community education, Community based organization and Community leaders.

## I. INTRODUCTION

Within the community framework, there is need for people to be educated. It is vital because without it, people may not function effectively. Community education is one form of education that will bring about positive change among the people in the community. Ezumah (2004) sees community education as a process aimed at raising consciousness, spreading understanding, and providing the necessary skills, including the human and material resources for the social, economic, political and cultural development. Finsen (2006) defined community education as an organized learning activity that groups or individuals undertake for the personal, community, cultural or economic development. It touches all other areas of learning but its primary focus is the adult as learner and the community as the context.

Contextually, community education is the education that promotes the integrated involvement of community members in the effort to bring about desirable social change. It is education

for peoples empowerment to take control over their own lives. In other words, it is an educational process whereby people, collectively learn to help themselves and improve their lives. It is the need for improving the quality of life in the in the community that brought about the activities of community education.

According to Anyanwu (2002), community education is not a new phenomenon of human living. For example, in Nigeria traditional communities, people had been practising indigenous community education before the advent of the early missionaries and the colonial administrators. The traditional apprenticeship programmes were plausible forms of community education. Such programmes were run in the areas of health, agriculture, arts and crafts and constituted a recognized way of inducing enlightenment. Anyanwu further stated that with the introduction and general acceptance of the Western system of education and culture, there was a gradual decline in enthusiasm for erstwhile indigenous community education with corollary problems of illiteracy, unemployment, underdevelopment, poverty, armed robbery, kidnapping, and youth restiveness in Nigeria. This indicates the inadequacy of formal school system of Western Education alone to meet the socio-economic and cultural needs of the Nigerian society.

Formal education having been unable to address most community concerns alone, policy makers came up with the idea of non-formal education. Non-formal education according to Ngwu (2003:41) can be defined as:

any planned and consciously organized general education and /or training activity outside the formal school in a particular society for illiterates, school leavers, dropouts or other adults, as individuals or in groups, for the purpose of raising their consciousness of their social situation and their standard of living, improving their individual or collective efficiency in their jobs or preparing them for self-employment, wage employment or further training within the existing education/training system.

Non-formal education is focusing on teaching people to improve their basic level of subsistence, as well as there standards of nutrition and general health, participate in determining the nature and content of programmes of community education, and acquire knowledge and skills which can immediately be put into practice to solve community problems. In these ways, non-formal education becomes an important tool for community education to provide social change for better living in the community. Non-formal education provides the viable educational alternatives that will enable different categories of completers to further their education.

In 2004, the Mass Literacy, Adult and Non-formal Education came up with strong emphasis on all forms of functional education such as community education that was enshrined in the

National Policy on Education (Federal Republic of Nigeria, 2004). In the document, it was clearly stated that efforts shall be made to relate education to overall community needs. To realize this objective locally and globally, the fifth World Conference on Community Education was convened in 1987 in Nairobi, Kenya where the proponents and practitioners of community education from 40 countries in all continents affirmed their commitment to the goal of community education: to raise the consciousness and enhance the initiative of people in solving their problems in the spirit of self-reliance and self determination (Akanke, 2007).

Ezumah (2004) stated that the non-formal nature of community education operational strategies determines its objectives. He went on to state that the primary objective of non-formal community education is to return education to the people in the community. Community Based Organization (CBO) leaders, therefore, need this type of education (community education). This is the type of education that will provide them with certain types of knowledge, skills, understanding, courage, perceptivity, and foresight in community leadership. The National Libraries of Medicine (2007) defined community based organizations as public or private non-profit organizations that are representatives of a community or a significant segment of a community, and are engaged in meeting human, educational, environmental, or public safety community need. Thus, community based organizations refer to all the organizations based in the community and set by the community for the purposes of enhancing the well-being of the community members. Each community based organization has its own leaders and the essence of the leadership is to direct activities and have enormous responsibility to direct what they are doing within CBOs.

Abiona (2009) sees community leaders as volunteers and agents of change that motivate and mobilize their people to improve their communities. They are members of their community who are familiar with the culture, social organization, structure, and values of their community. In other words, community leaders are the leaders of different community based organizations set-up by the community who are often formed to improve the standard of living in their community. Because community leaders occupy this position, they need to be educated within the context of the community. In realization of this, successive Nigerian governments have intensified efforts in initiating national development programmes to promote community education. Such programmes include: Mass Mobilization, Social Justice, and Economic Recovery (MAMSER), Family Support Programme (FSP), Environmental Sanitation, population education, mass literacy campaign, political education, among others. These programmes were initiated to promote the life and meet learning needs of the people, community leaders inclusive. This is in line with the views of Alam (2004) who noted that one of the goals of Dakar Education for All (EFA) framework of action was ensuring equitable access to education to meet the learning needs of all.

Despite the efforts of the government in initiating community education programmes in the country, the findings of the study show that community based organizations leaders in Anambra state have little or no idea of community education programmes to improve their lots. It is not clear if these community education programmes have been contributory in improving their expected roles. This is because, they have not been able to fill their posi-

tion properly and hence, do not perform as desired in their area of jurisdictions. This is evidenced from their poor leadership and accountability, disputes, ignorance of political rights, poor attitude to environmental sanitation, among others. This agrees with the views of Anyanwu (2002) who said that:

Community leaders are more interested in power sharing and the creation of positions than in the solution of community problems. Hence, with the lack of intelligent and imaginative of local leadership, the administration of a disorganized community can be frustrated by low morale, apathy, and outright neglect.

The non-performance of these community leaders of their expected roles could be attributed to some gaps that need to be filled through community education programmes. The gap will be considered as the educational needs of these community based organizations leaders. As a problem-centered activity, community education becomes a tool that will build the capacity of community leaders to satisfy the imbalance or lack of adjustment between the present condition in the life of the community and a new set of condition that will be more desirable.

In identifying those gaps, they could be basic education needs, social education needs, political education needs, economic education needs, and cultural education needs. These are important because, they will equip the individuals, including the community leaders with the desired knowledge and skills that will make them function effectively in their communities, hence the need for this study.

## II. METHOD

The study adopted a survey research design. The population of the study comprised of 1,701 executive members of the 189 registered community based organizations in the 21 local government areas that make up the three senatorial zones in Anambra State. The sample consisted of 1,045 executive members of community based organizations selected through stratified random sampling. A self constructed questionnaire titled "Community education needs of community based organizations leaders" (CENOCBOL). The instrument was subjected to two experts in Adult Education and two other experts in Measurement and Evaluation all from Nnamdi Azikiwe University, Awka, Nigeria. Comments from the experts were incorporated in the modification of the instrument. The reliability coefficient of the instrument was ascertained using Cronbach Alpha and 0.88 was obtained and was adjudged high enough. The data collected was analyzed using Mean and Standard deviation. Decision rule was based on 4 points numerical values assigned: Very Great Extent (VGE)\_4points, Great Extent (GE)\_3points, Low Extent (LE)\_2points and Very Low Extent (VLE)\_1point. Items which had mean rating of 2.50 and above were agreed on.

## III. RESULTS/FINDINGS

The findings of the study were presented according to the research questions in tables 1~5. Out of the 1,071 copies of the questionnaire distributed and returned, 26 copies were badly filled and discarded while the remaining 1,045 copies were presented and analysed in tables using mean and standard deviation.

**Research Questions 1**

To what extent do community based organizations leaders need basic education?

**Table 1: Mean of the basic education needs of the respondents**

N = 1045

| S/N | ITEMS  | $\bar{X}$ | STD. Deviation | DECISION |
|-----|--|-----------|----------------|----------|
| 1.  | Basic literacy skills i.e. ability to read, write, and compute figures | 3.72      | .476           | Agreed   |
| 2.  | Simple hygiene and other health care practices                         | 3.46      | .542           | Agreed   |
| 3.  | Nutritional values of balancing daily diet                             | 3.41      | .553           | Agreed   |
| 4.  | New Methods of farming   | 3.40      | .629           | Agreed   |
| 5.  | Civic education  | 3.47      | .569           | Agreed   |

Table 1 shows that all the items 1-5 were agreed by the respondents. This is because each of these items has mean rating that is greater than the criterion mean of 2.50. This, therefore, implies that the CBO leaders need basic education which includes basic literacy, simple hygiene and health care, family planning, social change, nutritional values, new methods of farming to improve their quality of life.

**Research Question 2**

To what extent do community based organizations leaders need social education?

**Table 2: Mean of the social education needs of the respondents.**

N = 1045

| S/ N | ITEMS   | $\bar{X}$ | STD. DEVIATION | DECISION |
|------|---|-----------|----------------|----------|
| 1.   | Knowledge of establishing good human relationship   | 3.49      | .560           | Agreed   |
| 2.   | Communications skills   | 3.50      | .565           | Agreed   |
| 3.   | Knowledge of restoring peace and harmony, counseling and resolving conflicts in the community | 3.43      | .545           | Agreed   |
| 4.   | Acquisition of leadership training to perform your roles effectively.                         | 3.32      | .624           | Agreed   |
| 5.   | Skills of attracting private sector partnership for community development                     | 3.37      | .545           | Agreed   |
| 6.   | Improved family life con-   | 3.43      | .619           | Agreed   |

|    |   |      |      |        |
|----|---|------|------|--------|
|    | dition.   |      |      |        |
| 7. | Love for others, recognition of personality, and security of life.        | 3.44 | .652 | Agreed |
| 8  | Identifying the needs and problems of the community for self improvement. | 3.34 | .625 | Agreed |

Table 2 revealed that all the items 1-8 were agreed by the respondents because each of the items has mean rating that is greater than the criterion mean of 2.50. This means that the CBO leaders equally need social education which includes among others knowledge of good human relationship, effective communication, peace and harmony, social change, security life.

**Research Question 3**

To what extent do community based organizations leaders need political education?

**Table 3: Mean of the political education needs of the respondents.**

N = 1045

| S/ N | ITEMS   | $\bar{X}$ | STD. DEVIATION | DECISION |
|------|---|-----------|----------------|----------|
| 1.   | Knowledge of your civic   | 3.56      | .581           | Agreed   |
| 2.   | Knowledge of state ideology   | 3.41      | .588           | Agreed   |
| 3.   | Ability to vote and be voted for  | 3.48      | .590           | Agreed   |
| 4.   | Knowledge of and sound criticism of state issues                              | 3.59      | .639           | Agreed   |
| 5.   | Ability to train other people in leadership skills and political development. | 3.38      | .607           | Agreed   |
| 6.   | Ability to conduct free and fair elections in your                            | 3.42      | .613           | Agreed   |
| 7.   | Knowledge of the importance of democratic value in a local environment.       | 3.37      | .591           | Agreed   |
| 8    | Basic office skills to strengthen your leadership structure.                  | 3.42      | .608           | Agreed   |

Table 3 shows that all the items 1-8 were also agreed by the respondents because of the fact that each of the items has mean rating that is greater than the criterion mean of 2.50. This means that the CBO leaders also need political education such as knowledge of their rights and duties, ideology of the state, ability to vote and be voted for, leadership training, to mention but a few.

**Research Question 4**

To what extent do community based organizations leaders need economic education?

**Table 4: Mean of the economic education needs of the respondents.**

N = 1045

| S/N | ITEMS   | $\bar{X}$ | STD. DEVIATION | DECISION |
|-----|---|-----------|----------------|----------|
| 1.  | Skills of identifying available community resources and | 3.54      | .559           | Agreed   |
| 2.  | Mobilizing strategies for self-help effort projects     | 3.51      | .609           | Agreed   |
| 3.  | Improving your agriculture productions.                 | 3.33      | .569           | Agreed   |
| 4.  | Acquisition of vocational/technical skills.             | 3.37      | .642           | Agreed   |
| 5.  | Employment skills to reduce poverty                     | 3.40      | .600           | Agreed   |
| 6.  | Ability to pay your tax regularly.                      | 2.85      | .900           | Agreed   |
| 7.  | Entrepreneurial skills to promote your business.        | 3.17      | .575           | Agreed   |

Table 4 revealed that all the items 1- 7 were as well agreed by the respondents because they have mean ratings that are greater than the criterion mean of 2.50. This implies that the CBO leaders need economic education such as knowledge of identifying and utilizing their available resources judiciously, mobilizing people for self-help effort projects, improved agricultural production, among others.

**Research Question 5**

To what extent do community based organizations leaders need cultural education?

**Table 5: Mean of the cultural education needs of the respondents.**

N = 1045

| S/N | ITEMS   | $\bar{X}$ | STD. DEVIATION | DECISION |
|-----|---|-----------|----------------|----------|
| 1.  | Acquisition of monuments and historical events.   | 3.42      | .650           | Agreed   |
| 2.  | Strategies to abolish harmful cultural practices in the community.                      | 3.33      | .654           | Agreed   |
| 3.  | Knowledge of your culture and other peoples' cultures.                                  | 3.57      | .633           | Agreed   |
| 4.  | Knowledge of other peoples' languages and styles of communication such as storytelling. | 3.39      | .604           | Agreed   |
| 5.  | Ability to impart the tradition, beliefs, values, and behaviour of the community        | 3.39      | .632           | Agreed   |

|    |   |      |      |        |
|----|---|------|------|--------|
|    | into the younger generation.  |      |      |        |
| 6. | Possession of a set of belief and principles regarding the existence of a single being or group of beings who created and govern the world. | 3.77 | .916 | Agreed |

Table 5 shows that all the items 1-6 were also agreed by the respondents owing to the fact that each of the items has mean score that is above the criterion mean of 2.50. This, therefore, implies that the CBO leaders agreed need cultural education such as knowledge of monuments and historical events, harmful cultural practices, other peoples' cultures, languages, to mention but a few.

**IV. DISCUSSION**

From the analysis of data in research question one, it showed that the respondents agreed to the basic education needs that would make them perform better in their communities. This is in agreement with the views of Lynette and Babara (2010) that basic education refers to all those programmes with fundamental education, as well as those programmes with alternative curricular, including areas such as basic health, nutrition, family planning, literacy, agriculture, and other vocational skills. This also corroborates with the notion of Wikipedia (2011) that basic education refers to the whole range of educational activities taking place in various settings that aim to meet the basic learning needs.

Result of research question two showed that social education needs were agreed by the respondents. This means that the respondents need social education to establish good relationship in the community, communicate effectively, restore peace and harmony, improve their family life, among others. This agrees with the view of Davis and Gibson (1997:12) who noted social education as:

Any individual's increased consciousness of himself- of his aptitude and untapped resources and of the relevance of these to others. It enhances the individual's understanding of how to form mutually satisfying relationships, and so involves a search for the adult for ways of helping a young person to discover how to contribute to as well as take from his associations with others.

Social education here, is emphasized as a particular type of process directed at a specific task-the social development of adolescents. Learning can, therefore, be viewed as either an internal change in consciousness or as the process of acquiring knowledge, feelings, and skills.

The findings from research question three revealed that political education needs were agreed by the respondents. The respondents see political education as a way of knowing their rights and duties, state ideology, exercising their franchise, strengthening their leadership, among others. This is in line with the view of Okafor (2004) who stated that political awareness is referred to attitudinal term that connotes one's consciousness as regard to his political duties to nation and that of the nation to the citizens. It is the process of making the citizens of a country to know their political rights which entitle them to participate in the

national political life of the state. Cheng (2001) agreed with the above statement when he said that political education enlightens residents from different perspectives about political points of views and knowledge and values of ideological events.

On economic education needs, it was found that the respondents' opinions were unanimous in all the items. Those items include among others, identifying their available resources, mobilizing people for self-help efforts, improving their agricultural production and vocational skills to gain employment. The findings of the study is in agreement with the view of Steinmann (1994) who affirmed that economic education prepares individuals for their roles in everyday economic situations as consumers, producers, and economic citizens. It aims at the emancipation of individuals to improve their living situations in a responsible way. Hopkins (2003) corroborates with the above statement when he noted that economic education is the education that helps individuals to develop skills to meet their financial and personal objectives, including savings, financial stability, home ownership, high education and retirement.

Result of research question five revealed that cultural education is of necessity leaders. This implies that the respondents need cultural education to acquaint themselves with monuments and historical events, know different cultures, languages and styles of communication, propagate the tradition, values and beliefs, abolish harmful cultural practices, and have belief on a being that created and govern the world. This finding is in line with Campbell [2011] who averred that to be culturally literate is to understand the history and accept what underlie a culture, and to be able to converse fluently in the allusions and informal content of that culture.

## V. CONCLUSION

From the foregoing, it can be concluded that one of the major indices of development in any society is education of its citizenry. Community education becomes a panacea for improving the quality of life in the community. It embraces all range of development activities in any community undertaken by the people, the government or non-governmental organization. Community development, therefore, relies heavily on community leaders who are the real agents and catalysts of social change and improvement of their communities.

For community leaders to perform very well in their expected roles, community education programmes are of utmost necessity. Such programmes of community education include: basic education, social education, political education, economic education, and cultural education. It is assumed that when they acquire these educational programmes, the decline in their roles will be reversed and a desired set of conditions set in.

## VI. RECOMMENDATIONS

Based on the findings, the following recommendations are made:

The Agency for Mass Literacy, Adult and Non-formal Education in Anambra State should mount campaign in the rural communities on the need for community education programmes. This is to sensitize community leaders to ensure their popular

participation in educational programme activities that are designed for them to improve their quality of life.

The government should from time to time organize workshops, seminars, and symposium for community leaders and adult educators. This will go a long way in strengthening the leaders' knowledge and skills in developmental programmes especially when new innovation in education is made.

Community education centres should be established in rural communities and qualified adult educators employed. This will enable the people to integrate into the whole spectrum of development programmes and to meet the demand of both the non-literate and functionally illiterate adults to improve themselves educationally which guarantees a leverage to better livelihood.

The policy makers and other administrators in Mass Literacy, Adult and Non-formal Education should reflect the needs of the community in policy formulation. This will make the people see the educational programmes as their own and this will make them participate in the learning exercise.

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# Fuzzy Stacked Set and Fuzzy Stacked Semigroup

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**Abstract-** To develop the concept of stacked set and fuzzy stacked set in the previous two papers [1] and [2], also generalize the idea of stacked systems to become more comprehensive in addressing similar issues, and the addition of some algebraic relations and algebraic operations, while maintaining the basic shape of the stacked systems.

**Index Terms-** stacked set, fuzzy stacked set, fuzzy set, fuzzy system, stacked

## I. INTRODUCTION

This system that we have developed in previous papers, observant and presence in everything in this universe. Our world is full of overlapping relationships between the elements, and is difficult to determine the specific arrangement of the importance of these elements to each other, and so it must generalize this system to include many issues in science.

It is noted that stacked style building close to the idea of fuzzy set, so you should turn this set related to the ordinal set stacking into obscurity or fuzzy set.

And since the general idea for this study based on the identification of ways to arrange an element within the set, they need to follow this order, to the style of fuzzy set.

Therefore we need to find other operations and relationships make it a more positive idea.

## II. PRELIMINARIES

### 2.1 Definition <sup>[1]</sup>

let  $T_\alpha$  be a finite set, where  $T_\alpha$  be a stacked set if and only if  $a_\alpha \in T_\alpha, \alpha \in N/0$ ,  $\alpha$  is the number of methods stacking elements in the set, and it is called paths  $(P_1, P_2, \dots, P_\alpha)$ .

### 2.2 Definition <sup>[1]</sup>

The system  $(T_\alpha, \tau)$  called stacked - system if and only if  $a_\gamma \tau b_\beta = \min_0(a_\gamma, b_\beta)$ , and the system looking for (zero convergence), and The system  $(T_\alpha, \Upsilon)$  called stacked - system if and only if  $a_\gamma \Upsilon b_\beta = \max_0(a_\gamma, b_\beta)$ , and the system looking for (zero spacing).  $a_\gamma$  and  $b_\beta \in T_\alpha$ .

### 2.3 Definition <sup>[1]</sup>

The system  $(T_\alpha, \tau)$  called stacked - system if and only if  $a_\gamma \tau b_\beta = \min_t(a_\gamma, b_\beta)$ , and the system looking for (convergence of t), and The system  $(T_\alpha, \Upsilon)$  called stacked - system if and only if  $a_\gamma \Upsilon b_\beta = \max_t(a_\gamma, b_\beta)$ , and the system looking for (spacing of t).  $a_\gamma$  and  $b_\beta \in T_\alpha, t \in \mathcal{R}$ .

### 2.4 Definition <sup>[1]</sup>

The order element on stacked system  $T_\alpha$ , where the system looking for zero convergence or zero spacing, is amount contributes to this element in the system, and this estimate is calculated relationship of this element in every path that contains this element, then the element order of  $a_\gamma, (O_0(a_\gamma))$ :

$$O_0(a_\gamma) = [a_\gamma]_0 = \left[ \frac{|a_{\gamma 1}|}{\left| \sum_{i=1}^{\alpha} a_{\gamma i} \right|} + \frac{|a_{\gamma 2}|}{\left| \sum_{i=1}^{\alpha} a_{\gamma i} \right|} + \dots + \frac{|a_{\gamma \alpha}|}{\left| \sum_{i=1}^{\alpha} a_{\gamma i} \right|} \right] / \alpha =$$

$$\left[ \sum_{i=1}^{\alpha} \frac{|a_{\gamma i}|}{\left| \sum_{i=1}^{\alpha} a_{\gamma i} \right|} \right] / \alpha$$

### 2.5 Definition <sup>[1]</sup>

The order element on stacked system  $T_\alpha$ , where the system looking for convergence of t (or spacing of t), is amount contributes to this element in the system, and this estimate is calculated relationship of this element in every path that contains this element, then the element order of  $a_\gamma, (O_t(a_\gamma))$ :

$$O_t(a_\gamma) = [a_\gamma]_t =$$

$$\left[ \frac{|a_{\gamma 1} - t|}{\sum_{i=1}^{\alpha} |a_{\gamma i} - t|} + \frac{|a_{\gamma 2} - t|}{\sum_{i=1}^{\alpha} |a_{\gamma i} - t|} + \dots + \frac{|a_{\gamma \alpha} - t|}{\sum_{i=1}^{\alpha} |a_{\gamma i} - t|} \right] / \alpha =$$

$$\left[ \sum_{i=1}^{\alpha} \frac{|a_{\gamma i} - t|}{\sum_{i=1}^{\alpha} |a_{\gamma i} - t|} \right] / \alpha$$

### 2.6 Definition <sup>[1]</sup>

The order stacked set  $T_\alpha$  in zero convergence system is set  $O_0(T_\alpha) = \{x_1, x_2, \dots, x_n\}$  if  $[x_1]_0 < [x_2]_0 < \dots < [x_n]_0$ . And the

order stacked set  $T_\alpha$  in zero spacing system is set  $O_0[T_\alpha] = \{x_n, x_{n-1}, \dots, x_1\}$  if  $\lfloor x_1 \rfloor_0 > \lfloor x_2 \rfloor_0 > \dots > \lfloor x_n \rfloor_0$ .

The order stacked set  $T_\alpha$ , where the system looking for convergence of  $t$  (or spacing of  $t$ ), is set  $O_0(T_\alpha) = \{x_1, x_2, \dots, x_n\}$  if  $\lfloor x_1 \rfloor_t < \lfloor x_2 \rfloor_t < \dots < \lfloor x_n \rfloor_t$ . And the order stacked set  $T_\alpha$  in zero spacing system is set  $O_0[T_\alpha] = \{x_n, x_{n-1}, \dots, x_1\}$  if  $\lfloor x_1 \rfloor_t > \lfloor x_2 \rfloor_t > \dots > \lfloor x_n \rfloor_t$ .

**2.7 Definition** <sup>[1]</sup>

- If  $(T_\alpha, \tau)$  or  $(T_\alpha, \lceil )$  is stacked – system then  $\forall a_\alpha, b_\beta \in T_\alpha$  :  
 $\text{Max}_t(a_\alpha, b_\beta) = a_\alpha \lceil b_\beta$ , and  $\text{Min}_t(a_\alpha, b_\beta) = a_\alpha \tau b_\beta$
- If  $(T_\alpha, \tau)$  or  $(T_\alpha, \lceil )$  is stacked – system then  $\forall a_\alpha, b_\beta \in T_\alpha$  :

$$\text{max}_t(a_\alpha, b_\beta) = \begin{cases} a_\alpha : \text{if } \lceil a_\alpha \rfloor_t > \lceil b_\beta \rfloor_t \\ b_\beta : \text{if } \lceil b_\beta \rfloor_t > \lceil a_\alpha \rfloor_t \end{cases}$$

$$\text{min}_t(a_\alpha, b_\beta) = \begin{cases} a_\alpha : \text{if } \lceil a_\alpha \rfloor_t < \lceil b_\beta \rfloor_t \\ b_\beta : \text{if } \lceil b_\beta \rfloor_t < \lceil a_\alpha \rfloor_t \end{cases}$$

- If  $a_\alpha = t$ , (in  $\lfloor a_\alpha \rfloor_t$ ) then we suppose that  $|a_\alpha - t| = \Delta t$ , and where  $\sum_i^\alpha |a_i - t|$ ,  $\alpha \in \{1, \dots, i\}$  then, we compensate  $|a_\alpha - t| = 0$ .
- If  $\lfloor a_\alpha \rfloor_t = \lfloor b_\beta \rfloor_t$  (one order element in two different places) so we have many type of this system, and if  $\lfloor a_\alpha \rfloor_t \neq \lfloor b_\beta \rfloor_t$  the system is type-1.

**2.8 Definition** <sup>[1]</sup>

A stacked-semigroup is a stacked-system  $T_\alpha$ , with associative binary operation.

**2.9 Theorem** <sup>[1]</sup>

- (i) If the systems  $(T_\alpha, \tau)$  is a stacked-system (type – 1), then  $(T_\alpha, \tau)$  is a semigroup and called a stacked-semigroup.
- (ii) If the systems  $(T_\alpha, \lceil )$  is a stacked-system (type – 1), then  $(T_\alpha, \lceil )$  is a semigroup and called a stacked-semigroup.

Prove this theorem earlier in paper [1]

**2.10 Definition** <sup>[2]</sup>

Let  $T_\alpha = \{x_{11}, x_{12}, \dots, x_{1n}, x_{21}, \dots, x_{2n}, \dots, x_{nn}\}$  be called a stacked set if the elements in  $T_\alpha$  are stacked in terms of the place (horizontally and vertically).

**2.11 Definition** <sup>[2]</sup>

If  $T_\alpha$  is a stacked system of element denoted generically by  $x$  then a fuzzy stacked system  $T_\mu$  in  $T_\alpha$  is a system of ordered pairs:

$$T_\mu = \{(x, \mu_T(x)) \mid x \in T_\alpha\}$$

$\mu_T(x)$  is called the membership function or grade of membership (also degree of compatibility or degree of truth) of  $x$  in  $T_\mu$  which maps  $T_\alpha$  to the membership space  $M$ . (When  $M$  contains only the two points 0 and 1,  $T_\mu$  is non-fuzzy and  $\mu_T(x)$  is identical to the characteristic function of a nonfuzzy stacked set). The range of the membership function is a subset of the nonnegative real numbers whose supremum is finite. Elements with a zero degree of membership are normally not listed.

$$T_\mu = \{(x, \mu_T(x)) \mid x \in T\}$$

**2.12 Theorem** <sup>[2]</sup>

If  $T_\alpha$  is a stacked system,  $\forall x, a \in T_\alpha$  :

$$\begin{aligned} \mu_{T1}(x) &= (1 + |a - x|)^{-1} \\ \mu_{T2}(x) &= (1 + (a - x)^2)^{-1} \\ \mu_{Tn}(x) &= (1 + (|a - x|)^n)^{-1} \end{aligned}$$

are types of a function such that  $\mu_{Ti}(x) \in [0, 1], i \in \{1, 2, \dots, n\}$ .

**proof** : let  $T_\alpha$  is a stacked system,  $\forall x, a \in T_\alpha$  :

$$\begin{aligned} |a - x| \geq 0 &\Rightarrow (1 + |a - x|) \geq 1 \Rightarrow 0 \leq (1 + |a - x|)^{-1} \leq 1 \\ &\Rightarrow \mu_{T1}(x) = (1 + |a - x|)^{-1} \in [0, 1] \\ (a - x)^2 \geq 0 &\Rightarrow (1 + (a - x)^2) \geq 1 \Rightarrow 0 \leq (1 + (a - x)^2)^{-1} \leq 1 \\ &\Rightarrow \mu_{T2}(x) = (1 + (a - x)^2)^{-1} \in [0, 1], \text{ so } \mu_{Tn}(x) = (1 + (|a - x|)^n)^{-1} \in [0, 1], i \in \{1, 2, \dots, n\} \end{aligned}$$

**2.13 Theorem** <sup>[2]</sup>

If  $T_\alpha$  is a stacked system,  $\forall x \in T_\alpha, \mu_T(a) \geq \mu_T(x)$  then :  $\mu_T(x) = (1 + (a - x)^n)^{-1}, n \in \mathbb{N}/0$ , is convex function.

**Proof** : Let  $x_1 < a < x_2$ , and  $\forall x \in T_\alpha, \mu_T(a) \geq \mu_T(x)$  then :

$$\mu_T(a) \geq \mu_T(x_1), \text{ and } \mu_T(a) \geq \mu_T(x_2)$$

So :  $[\mu_T(a) - \mu_T(x_1)] / [a - x_1] < 0 < [\mu_T(x_2) - \mu_T(a)] / [x_2 - a]$ .

From definition 2.6 :  $[\mu_T(a) - \mu_T(x_1)] / [a - x_1] \geq [\mu_T(x_2) - \mu_T(a)] / [x_2 - a]$ , then  $\mu_T(x) = (1 + (|a - x|)^n)^{-1}$  is convex function.

**2.14 Definition** <sup>[2]</sup>

If  $T_\alpha$  is a stacked system, then the fuzzy stacked system  $T_\mu$  in  $T_\alpha$  is a system of ordered pairs:

$$T_\mu = \{(x, \mu_T(x)) \mid x \in T\}$$

Such that :

$$\mu_T(x) = (1 + (|x - a|)^n)^{-1}, n \in \mathbb{N}/0 \text{ and } x \in T_\alpha$$

**2.15 Definition** [2]

For a finite fuzzy stacked set  $T_\mu$  the column(row) cardinality  $\backslash T_{\mu(C \text{ or } R)} \backslash$  is defined as :

$$\backslash T_{\mu(C \text{ or } R)} \backslash = \sum_{x \in (C \text{ or } R)} \mu_{T(C \text{ or } R)}(x).$$

**2.16 Definition** [2]

Let  $(x) \in T_\mu$ ,  $\gamma$  is a row and  $\beta$  is column then the order fuzzy stacked of  $\mu(x_{\gamma\beta})$  is :

$$O(x) = \|\mu(x_{\gamma\beta})\| = [\mu(x_{\gamma\beta}) / \backslash T_{\mu(\gamma)} \backslash + \mu(x_{\gamma\beta}) / \backslash T_{\mu(\beta)} \backslash] / 2 .$$

**2.17 Theorem** [2]

If  $T$  is a stacked system,  $\forall x, a \in T$  :

$$O(x) = \|\mu(x_{\gamma\beta})\| = [\mu(x_{\gamma\beta}) / \backslash T_{\mu(\gamma)} \backslash + \mu(x_{\gamma\beta}) / \backslash T_{\mu(\beta)} \backslash] / 2$$

is a type of a function such that  $O(x) \in [0, 1]$ ,

**proof** :from definitions (3.5), (3.7), (3.8).

$$0 \leq \mu(x_{\gamma\beta}) \leq \backslash T_{\mu(\gamma)} \backslash \Rightarrow 0 / \backslash T_{\mu(\gamma)} \backslash \leq \mu(x_{\gamma\beta}) / \backslash T_{\mu(\gamma)} \backslash \leq \backslash T_{\mu(\gamma)} \backslash / \backslash T_{\mu(\gamma)} \backslash \Rightarrow 0 \leq \mu(x_{\gamma\beta}) / \backslash T_{\mu(\gamma)} \backslash \leq 1 \text{ (A)}. \text{ And so } 0 \leq \mu(x_{\gamma\beta}) \leq \backslash T_{\mu(\beta)} \backslash \Rightarrow 0 / \backslash T_{\mu(\beta)} \backslash \leq \mu(x_{\gamma\beta}) / \backslash T_{\mu(\beta)} \backslash \leq \backslash T_{\mu(\beta)} \backslash / \backslash T_{\mu(\beta)} \backslash \Rightarrow 0 \leq \mu(x_{\gamma\beta}) / \backslash T_{\mu(\beta)} \backslash \leq 1 \text{ (B)}.$$

$$\text{Then (A) + (B) } \Rightarrow 0+0 = 0 \leq \mu(x_{\gamma\beta}) / \backslash T_{\mu(\gamma)} \backslash + \mu(x_{\gamma\beta}) / \backslash T_{\mu(\beta)} \backslash \leq 1 + 1 = 2 \Rightarrow 0 \leq [\mu(x_{\gamma\beta}) / \backslash T_{\mu(\gamma)} \backslash + \mu(x_{\gamma\beta}) / \backslash T_{\mu(\beta)} \backslash] / 2 \leq 1 \Rightarrow O(x) \in [0, 1]$$

**2.18 Definition** [2]

If  $T_\alpha$  is a stacked system, then the fuzzy level stacked system  $l(T_\mu)$  in  $T_\alpha$  is a system :

$$l(T_\mu) = \{ (x, \mu_T(x), O(x)) \mid x \in T_\alpha \} .$$

**2.19 Definition** [2]

Let  $l(T_\mu)$  in  $T_\alpha$  is a fuzzy level stacked system  $l(T_\mu) = \{(x, \mu_T(x), O(x)) \mid x \in T_\alpha\}$ , then :

$$\max_{i1} l[O(T)] = \{x_1, x_2, \dots, x_n\} . \text{ That's where :}$$

$$\max[O(T)] = x_1, \max[O(T) / \{R_{x_1}, C_{x_1}\}] = x_2, \dots, \max[O(T) / \{R_{x_1}, C_{x_1}, R_{x_2}, C_{x_2}, \dots, R_{x_{n-1}}, C_{x_{n-1}}\}] = x_n,$$

$C$  mean column and  $R$  mean row, and if  $x_\beta \in \max_{i1}(O(T))$ , then  $R_\beta \cap \max_{i1}(O(T)) = \{x_\beta\}$ , and  $C_\beta \cap \max_{i1}(O(T)) = \{x_\beta\}$ ,  $|C_i| = |R_i| = |\text{Max}_{i1}(O(T))| = n$ .

**2.20 Definition** [3]

If  $\tilde{A}$  is a collection of objects denoted generically by  $x$  then a fuzzy set  $A$  in  $\tilde{A}$  is a set of ordered pairs:

$$\tilde{A} = \{ (x, \mu_{\tilde{A}}(x)) \mid x \in T \} .$$

$\mu_{\tilde{A}}(x)$  is called the membership function or grade of membership (also degree of compatibility or degree of truth) of  $x$  in  $A$  which maps  $X$  to the membership space  $M$ . (When  $M$  contains only the two points 0 and 1,  $\tilde{A}$  is nonfuzzy and  $\mu_{\tilde{A}}(x)$  is identical to the characteristic function of a nonfuzzy set.) The range of the membership function is a subset of the nonnegative real numbers whose supremum is finite. Elements with a zero degree of membership are normally not listed.

**2.21 Definition** [3]

The support of a fuzzy set  $\tilde{A}$ ,  $S(\tilde{A})$ , is the crisp set of all  $x \in X$  such that :

$$\mu_{\tilde{A}}(x) > 0 .$$

**2.22 Definition** [3]

The (crisp) set of elements that belong to the fuzzy set  $A$  at least to the degree  $a$  is called the  $\alpha$ -level set :

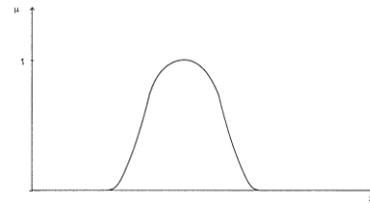
$$A_\alpha = \{x \in X \mid \mu_{\tilde{A}}(x) \geq \alpha\}$$

$\tilde{A}_\alpha = \{x \in X \mid \mu_{\tilde{A}}(x) > \alpha\}$  is called "strong  $\alpha$ -level set" or "strong  $\alpha$ -cut."

**2.23 Definition** [3]

A fuzzy set  $\tilde{A}$  is convex if :

$$\mu_{\tilde{A}}(\lambda x_1 + (1 - \lambda)x_2) \geq \min(\mu_{\tilde{A}}(x_1), \mu_{\tilde{A}}(x_2)), x_1, x_2 \in X, \lambda \in [0, 1]$$



Figures 1  
Convex fuzzy set

**2.24 Definition** [4]

By groupoid  $(S, *)$  we shall mean a non-empty set  $S$  on which a binary operation  $*$  is defined. That is to say, we have a mapping  $*$ :  $S \times S \rightarrow S$ .

We shall say that  $(S, *)$  is a semigroup if  $*$  is associative, i.e. if  $(\forall x, y, z \in S), ((x, y)*, z)* = (x, (y, z)*)*$

**2.25 Definition** [4]

$S$  is a finite semigroup if it has only a finitely many elements.

**2.26 Definition** <sup>[4]</sup>

A commutative semigroup is a semigroup S with property :

$$(\forall x, y \in S) \quad (xy = yx).$$

**2.27 Definition** <sup>[4]</sup>

If there exists an element 1 of S such that  $(\forall x \in S) \quad x1 = 1x = x$ . We say that 1 is an identity (element) of S and that S is a semigroup with identity.

**2.28 Definition** <sup>[5]</sup>

Let S be a set and  $\sigma : S \times S \rightarrow S$  a binary operation that maps each ordered pair (x, y) of S to an element  $\sigma(x, y)$  of S. The pair (S,  $\sigma$ ) (or just S, if there is no fear of confusion) is called a groupoid.

**2.29 Definition** <sup>[6]</sup>

We denote by L[a] (R[a], J[a], I[a], Q[a], B[a]) the principal left (right, two-sided, interior, quasi-, bi-) ideal of a semigroup S generated by the element  $a \in S$ , that is,

$$\begin{aligned} L[a] &= \{a\} \cup Sa, \\ R[a] &= \{a\} \cup aS, \\ J[a] &= \{a\} \cup Sa \cup aS \cup SaS, \\ I[a] &= \{a\} \cup \{a^2\} \cup SaS, \\ Q[a] &= \{a\} \cup (aS \cap Sa), \\ B[a] &= \{a\} \cup \{a^2\} \cup aSa. \end{aligned} \quad [10]$$

**2.30 Definition** <sup>[7]</sup>

A real function f defined on a real interval I is convex on I iff:

$$\forall x_1, x_2, x_3 \in I: x_1 < x_2 < x_3 : [f(x_2) - f(x_1)] / [x_2 - x_1] \leq [f(x_3) - f(x_2)] / [x_3 - x_2].$$

or:

$$\forall x_1, x_2, x_3 \in I: x_1 < x_2 < x_3 : [f(x_2) - f(x_1)] / [x_2 - x_1] \leq [f(x_3) - f(x_1)] / [x_3 - x_1].$$

The function f is strictly convex on I if, in the above inequalities, equality cannot hold.

**2.31 Definition** <sup>[8]</sup>

For a set A, we define a membership function  $\mu_A$  such as

$$\mu_A(x) = \begin{cases} 1 & \text{iff } x \in A \\ 0 & \text{iff } x \notin A \end{cases}$$

(“ iff ” is short for “if and only if”).

X be a classical set of objects, called the universe, whose generic elements are denoted x. Membership in a classical subset A of X is often viewed as a characteristic function,  $\mu_A$  from X to {0,1} such that :

$$\mu_A : X \rightarrow \{0, 1\}.$$

**2.32 Axioms for Union Function** <sup>[8]</sup>

In general sense, union of A and B is specified by a function of the form.

$$\mu_{A \cup B}(x) = [0, 1] \times [0, 1] \rightarrow [0, 1]$$

This union function calculates the membership degree of union AU B from those of A and B.

$$\mu_{A \cup B}(x) = U[\mu_A(x), \mu_B(x)].$$

this union function should obey next axioms.

**(Axiom U1)**

$$U(0,0) = 0, U(0,1) = 1, U(1,0) = 1, U(1,1) = 1$$

so this union function follows properties of union operation of crisp sets (boundary condition).

**(Axiom U2)**

$$U(a, b) = U(b, a) \text{ Commutativity holds.}$$

**(Axiom U3)**

If  $a \leq a'$  and  $b \leq b'$ ,  $U(a, b) \leq U(a', b')$  Function U is a monotonic function.

**(Axiom U4)**

$$U(U(a, b), c) = U(a, U(b, c)) \text{ Associativity holds.}$$

The above four statements are called as “axiomatic skeleton”. It is often to restrict the class of fuzzy unions by adding the following axioms.

**(Axiom U5)**

Function U is continuous.

**(Axiom U6)**

$$U(a, a) = a \text{ (idempotency).}$$

**2.35 Some Algebraic Operations** <sup>[8]</sup>

(1) Probabilistic sum  $A \overset{\wedge}{+} B$  (Algebraic sum)

Fuzzy union  $A \overset{\wedge}{+} B$  is defined as,

$$\forall x \in X, \mu_{A \overset{\wedge}{+} B}(x) = \mu_A(x) + \mu_B(x) - \mu_A(x) \mu_B(x)$$

It follows commutativity, associativity, identity, and De Morgan’s law.

This operator holds also the following :

$$A \overset{\wedge}{+} X = X$$

(2) Bounded sum  $A \oplus B$  (Bold union)

$$\forall x \in X, \mu_{A \oplus B}(x) = \text{Min}[1, \mu_A(x) + \mu_B(x)]$$

This operator is identical to Yager function at  $w = 1$ . Commutativity, associativity, identity, and De Morgan’s Law are perfect-ed, and it has relations,

$$A \oplus X = X$$

$$A \oplus A = X$$

but it does not idempotency and distributivity at absorption.

(3) Drastic sum  $A \cup B$

Drastic sum is defined as follows:

$$\forall x \in X, \mu_{A \cup B}(x) = \begin{cases} \mu_A(x), & \text{when } \mu_B(x) = 0 \\ \mu_B(x), & \text{when } \mu_A(x) = 0 \\ 1, & \text{for others} \end{cases}$$

(4) Hamacher's sum A U B

$$\forall x \in X, \mu_{A \cup B}(x) = \frac{\mu_A(x) + \mu_B(x) - (2-\gamma)\mu_A(x)\mu_B(x)}{1 - (1-\gamma)\mu_A(x)\mu_B(x)}, \gamma \geq 0$$

(5) Algebraic product A • B (probabilistic product)

$$\forall x \in X, \mu_{A \bullet B}(x) = \mu_A(x) \bullet \mu_B(x).$$

Operator • is obedient to rules of commutativity, associativity, identity, and De Morgan's law.

(6) Bounded product A ⊙ B (Bold intersection)

This operator is defined as,

$$\forall x \in X, \mu_{A \odot B}(x) = \text{Max}[0, \mu_A(x) + \mu_B(x) - 1]$$

and is identical to Yager intersection function with w = 1,

$$I_1(a, b) = 1 - \text{Min}[1, 2 - a - b]$$

commutativity, associativity, identity, and De Morgan's law hold in this

operator. The following relations

$$A \odot \emptyset = \emptyset$$

$$A \odot \bar{A} = \emptyset$$

are also satisfied, but not idempotency, distributability, and absorption.

**2.36 Definition** [9]

The mathematical systems is a set of interacting or interdependent components forming an integrated whole or a set of elements (often called 'components') and relationships which are different from relationships of the set or its elements to other elements or sets.

**Example:** (R, +) is a system, R is a set of all the real numbers, and (+) the relation between the elements.

**2.37 Definition** [7]

A binary operation on a set S is a mapping of the Cartesian product S × S into S.

**2.38 Definition** [10]

Let X be a space of points (objects), with a generic element of X denoted by x. Thus, X = {x}. A fuzzy set (class) A in X is characterized by a membership (characteristic) function f\_A(x) which associates with each point in X a real number in the interval [0, 1], with the value of f\_A(x) at x representing the "grade of membership" of : x in A. Thus, the nearer the value of f\_A(x) to unity, the higher the grade of membership of 0 in A. When A is a set in the ordinary sense of the term, its membership function can take on only two values 0 and 1, with f\_A(x) = 1 or 0 according as x does or does not belong to A. Thus, in this case f\_A(x) reduces to the familiar characteristic function of a set A. (When there is a need to differentiate between such sets and fuzzy sets, the sets with two-valued characteristic functions will be referred to as ordinary sets or simply sets).

**III. BASIC CONCEPTS IN THE STACKED FUZZY SET**

**3.1 Theorem**

If T\_α be a stacked set then the set of ordered pairs :

$$T_{\mu(t)} = \{(x_\gamma, \mu_t(x_\gamma)) \mid x_\gamma \in T_\alpha, \mu_t(x_\gamma) = [x_\gamma]_t\}$$

is a fuzzy stacked set.

**Proof :**

We only need to prove that μ\_t(x\_γ) ∈ [0, 1], and that's enough to prove T\_{μ(t)} is a fuzzy stacked set.

From the definition of the stacked set, x\_γ ∈ T,

$$0 \leq |x_\gamma - t| \leq \sum_{i=1}^{\alpha} |x_{\gamma i} - t| \Rightarrow$$

$$0 \leq \frac{|x_\gamma - t|}{\sum_{i=1}^{\alpha} |x_{\gamma i} - t|} \leq 1 \Rightarrow$$

$$0 \leq \frac{|x_{\gamma 1} - t|}{\sum_{i=1}^{\alpha} |x_{\gamma i} - t|} + \frac{|x_{\gamma 2} - t|}{\sum_{i=1}^{\alpha} |x_{\gamma i} - t|} + \dots + \frac{|x_{\gamma \alpha} - t|}{\sum_{i=1}^{\alpha} |x_{\gamma i} - t|} \leq 1 + 1 +$$

$$\dots \text{ (to } \alpha \text{ times)} = \alpha \Rightarrow$$

$$0 \leq \left[ \sum_{i=1}^{\alpha} \frac{|x_{\gamma i} - t|}{\sum_{i=1}^{\alpha} |x_{\gamma i} - t|} \right] / \alpha \leq 1 \Rightarrow$$

$$0 \leq [x_\gamma]_t \leq 1$$

Then [x\_γ]\_t = μ\_t(x\_γ) ∈ [0, 1].

**3.2 Example**

If there are three distribution centers, consumer products of the type (A, B, C), where they are transported to sales centers (X, Y, Z) at a cost, as in the following table:

|        |        |        |        |
|--------|--------|--------|--------|
| [1]    | [2] X  | [3] Y  | [4] Z  |
| [5] A  | [6] 1  | [7] 3  | [8] 2  |
| [9] B  | [10] 4 | [11] 5 | [12] 1 |
| [13] C | [14] 7 | [15] 3 | [16] 1 |

Table 1

So there is a process of transferring between (A, B, C) and (X, Y, Z).

Transportation between A and X cost 1, so

$$\text{cost} (A, X) = 1 \equiv 1_{11}$$

$$\text{cost} (A, Y) = 3 \equiv 3_{12}$$

$$\text{cost} (A, Z) = 2 \equiv 2_{13}$$

$$\begin{aligned} \text{cost ( B,X)} &= 4 \equiv 4_{21} \\ \text{cost ( B,Y)} &= 5 \equiv 5_{22} \\ \text{cost ( B,Z)} &= 1 \equiv 1_{23} \\ \text{cost ( C,X)} &= 7 \equiv 7_{31} \\ \text{cost ( C,Y)} &= 3 \equiv 3_{32} \\ \text{cost ( C,Z)} &= 1 \equiv 1_{33} . \end{aligned}$$

And  $T_{2,3}$  ( Non-Order ) = {  $1_{11}, 3_{12}, 2_{13}, 4_{21}, 5_{22}, 1_{23}, 7_{31}, 3_{32}, 1_{33}$  } .

In this example, if required the transfer of consumer products at the lowest cost, so that the transfer of a single product from each single distribution center to the single center of the sale, we go directly to :

$$\text{Min}_0\{\text{cost}[(A,B,C),(X,Y,Z)]\} = \{ 1_{11}, 1_{23}, 3_{32} \}$$

But when the average transfer request are limited to a specific value, we identify through :

$$T_{(0)} = \{ (x, \mu_i(x)) \mid x \in T_\alpha \} .$$

Now suppose that the average transportation intended for distribution 3 units of products, from each distribution center to each center sale .

Then :

$$\mu_i(x_{\gamma}) = [ a_{\gamma} ]_3 = \left[ \frac{\sum_{i=1}^3 |x_{\gamma i} - 3|}{\sum_{i=1}^3 |x_{\gamma i} - 3|} \right] / \alpha$$

If  $x_a = t$ , then we suppose that  $|x_a - t| = \Delta t$ , and where

$$\sum_i^{\alpha} |x_i - t|, a \in \{1, \dots, i\} \text{ then, we compensate } |x_a - t| = 0 .$$

1-  $T_{3,2} =$

|   |   |   |
|---|---|---|
| 1 | 3 | 2 |
| 4 | 5 | 1 |
| 7 | 3 | 1 |

Table 2

2-  $T_{3,2} [ |x_{\gamma i} - 3| ] =$

|   |            |   |
|---|------------|---|
| 2 | $\Delta t$ | 1 |
| 1 | 2          | 2 |
| 4 | $\Delta t$ | 2 |

Table 3

3-  $T_{3,2} [ \mu_T(x_{\gamma}) ] = T_{3,2} [ [ a_{\gamma} ]_3 ] =$

$$T_{3,2} \left[ \frac{\sum_{i=1}^3 |x_{\gamma i} - 3|}{\sum_{i=1}^3 |x_{\gamma i} - 3|} \right] / \alpha =$$

|     |     |     |
|-----|-----|-----|
| 0.2 | 1   | 0.5 |
| 0.5 | 0.2 | 0.2 |
| 0   | 1   | 0.2 |

Table 4

when  $O_3(T_{3,2}) = \{ 3_{32}, 3_{12}, 4_{21}, 2_{13}, 1_{33}, 1_{23}, 1_{11}, 7_{31}, 5_{22} \}$  .  
so

$$T_{\mu(3)} = \{ (3_{32}, 0.333), (3_{12}, 0.417), (4_{21}, 0.171), (2_{13}, 0.267), (1_{33}, 0.367), (1_{23}, 0.400), (1_{11}, 0.476), (7_{31}, 0.619), (5_{22}, 0.700) \} .$$

Then if we have identified average transportation extent 3 units , most suitable conduct for transport are:

$$\text{Min}_3\{\text{cost}[(A,B,C),(X,Y,Z)]\} = \{ (3_{32}, 0.333), (4_{21}, 0.171), (2_{13}, 0.267) \}$$

### 3.3 Example

In example 3.2 , if required the transfer of consumer products at the lowest cost, so that the transfer of a single product from each single distribution center to the single center of the sale, we go directly to :

$$\text{Min}_0\{\text{cost}[(A,B,C),(X,Y,Z)]\} = \{ 1_{11}, 1_{23}, 3_{32} \}$$

But when the average transfer request is limited to a specific value, we identify through:

$$T_{\mu} = \{ (x, \mu_T(x)) \mid x \in T \} .$$

Now suppose that the average transportation intended for distribution 3 units of products, from each distribution center to each center sale. And that does not exceed 6 units for transportation products

So:

$$\mu_T(x) = \begin{cases} 0 & : x > 6 \\ (1 + (x - 3)^2)^{-1} & : 0 \leq x \leq 6 \end{cases}$$

Then

$$\mu_T(1_{11}) = (1 + (1 - 3)^2)^{-1} = 0.2, \mu_T(3_{12}) = 1, \dots, \mu_T(7_{31}) = 0, \dots$$

when  $T_{3,2} = \{ 1_{11}, 3_{12}, 2_{13}, 4_{21}, 5_{22}, 1_{23}, 7_{31}, 3_{32}, 1_{32} \}$  (non-order) .

So:

$$T_{\mu} = \{ (1_{11}, 0.2), (3_{12}, 1), (2_{13}, 0.5), (4_{21}, 0.5), (5_{22}, 0.2), (1_{23}, 0.2), (7_{31}, 0), (3_{32}, 1), (1_{32}, 0.2) \} .$$

Or

$$T_{\mu} =$$

|       |                  |       |
|-------|------------------|-------|
| 0.476 | 0.417 $\Delta t$ | 0.267 |
| 0.171 | 0.700            | 0.400 |
| 0.619 | 0.333 $\Delta t$ | 0.367 |

Table 5

Then if we have identified average transportation extent 3 units, most suitable conduct for transport are:

$$\text{Max}_3\{\text{cost}[(A,B,C),(X,Y,Z)]\} = \{(3_{32}, 1), (4_{21}, 0.5), (2_{13}, 0.5)\}$$

It has already been mentioned that the membership function is not limited to values between 0 and 1. If  $\sup_x \mu_T(x) = 1$  the fuzzy stacked set  $T_\mu$  is called normal. A nonempty fuzzy stacked set  $T_\mu$  can always be normalized by dividing  $\mu_T(x)$  by  $\sup_x \mu_T(x)$ : As a matter of convenience we will generally assume that fuzzy stacked sets are normalized. For the representation of fuzzy stacked sets we will use the notation illustrated in example above respectively. A fuzzy stacked set is obviously a generalization of a classical set and the membership function a generalization of the characteristic function. Since we are generally referring to a universal (crisp) set  $T$  some elements of a fuzzy set may have the degree of membership zero. Often it is appropriate to consider that element of the universe which has a nonzero degree of membership in fuzzy stacked set.

### 3.4 Definition

The support of a fuzzy stacked set  $T_{\mu(\cdot)}$ ,  $S(T_{\mu(\cdot)})$ , is the crisp set of all  $x \in T$  such that  $\mu_t(x) > 0$ .

### 3.5 Example

In example above  $S(T_\mu) = \{1_{11}, 3_{12}, 2_{13}, 4_{21}, 5_{22}, 1_{23}, 3_{32}, 1_{32}\}$ . The element  $\{7_{31}\}$  is not part of the support of  $T_\mu$

### 3.6 Definition

The (crisp) set of elements that belong to the fuzzy stacked set  $T_\mu$  at least to the degree  $\alpha$  – level stacked set:

$$T_\alpha = \{x \in T \mid \mu_T(x) \geq \alpha\}$$

$T_\alpha = \{x \in T \mid \mu_T(x) > \alpha\}$  is called (strong  $\alpha$  – level stacked set or strong  $\alpha$ – cut).

### 3.7 Example:

The list possible  $\alpha$  – level stacked set in the above example:

$$T_{0.2} = \{1_{11}, 3_{12}, 2_{13}, 4_{21}, 5_{22}, 1_{23}, 3_{32}, 1_{32}\},$$

$$T_{0.5} = \{3_{12}, 2_{13}, 4_{21}, 1_{23}, 3_{32}\},$$

$$T_{1.0} = \{3_{12}, 3_{32}\}.$$

The strong  $\alpha$  – level stacked set for  $\alpha = 0.5$  is  $T_{0.5} = \{3_{12}, 3_{32}\}$ .

Convexity also plays a role in fuzzy set theory. By contrast to classical set theory, however, convexity conditions are defined with reference to then membership function rather than the support of a fuzzy set.

### 3.8 Example

Suppose that the average transportation intended for distribution 3 units of products, from each distribution center to each center sale. And that does not exceed 6 units for transportation products

So:

$$\mu_T(x) = \begin{cases} 0 & : x > 6 \\ (1 + (x - 3)^2)^{-1} & : 0 \leq x \leq 6 \end{cases}$$

when  $T_{3,2} = \{1_{11}, 3_{12}, 2_{13}, 4_{21}, 5_{22}, 1_{23}, 7_{31}, 3_{32}, 1_{32}\}$ .

So:

$$T_\mu = \{(1_{11}, 0.2), (3_{12}, 1), (2_{13}, 0.5), (4_{21}, 0.5), (5_{22}, 0.2), (1_{23}, 0.2), (7_{31}, 0), (3_{32}, 1), (1_{32}, 0.2)\}.$$

The cardinality is:

$$\|T_\mu\| = \sum_{x \in X} \mu_T(x) = 0.2 + 1 + 0.5 + 0.5 + 0.2 + 0.2 + 0 + 1 + 0.2 = 3.8$$

Its relative cardinality is:

$$\|T_\mu\| = \frac{3.8}{9} = 0.422$$

## IV. THEORETIC OPERATIONS FOR FUZZY STACKED SETS

The membership function is obviously the crucial component of a fuzzy set. It is therefore not surprising that operations with fuzzy sets are defined via their membership functions.

### 4.1 Definition

The membership function  $\mu_{CT}(x)$  of the intersection  $C_T = A_T \cap B_T$  is point wise defined by:

$$\mu_{CT}(x) = \min_t\{\mu_{AT}(x), \mu_{BT}(x)\}$$

Such that: if  $a_\alpha \in \mu_{AT}(x)$  and  $b_\beta \in \mu_{BT}(x)$

$$\text{Min}_t(a_\alpha, b_\beta) = \begin{cases} a_\alpha : \text{if } \lfloor a_\alpha \rfloor_t < \lfloor b_\beta \rfloor_t. \\ b_\beta : \text{if } \lfloor b_\beta \rfloor_t < \lfloor a_\alpha \rfloor_t. \end{cases}$$

If  $\lfloor a_\alpha \rfloor_t = \lfloor b_\beta \rfloor_t$  (one order element in two different places)so we have many type of this system, and if  $\lfloor a_\alpha \rfloor_t \neq \lfloor b_\beta \rfloor_t$  the system is type-1.

### 4.2 Example

Suppose that the average transportation intended for distribution 3 units of products, from each distribution center to each center sale. And that does not exceed 6 units for transportation products:

$$\mu_{T1}(x) = \begin{cases} 0 & : x > 6 \\ (1 + (x - 3)^2)^{-1} & : 0 \leq x \leq 6 \end{cases}$$

when  $T_{3,2} = \{1_{11}, 3_{12}, 2_{13}, 4_{21}, 5_{22}, 1_{23}, 7_{31}, 3_{32}, 1_{32}\}$ .  
 so

$$T_{\mu 1} = \{(1_{11}, 0.2), (3_{12}, 1), (2_{13}, 0.5), (4_{21}, 0.5), (5_{22}, 0.2), (1_{23}, 0.2), (7_{31}, 0), (3_{32}, 1), (1_{32}, 0.2)\}.$$

Or:

$$T_{\mu_1} = \begin{matrix} \begin{matrix} 0.2 & 1 & 0.5 \\ 0.5 & 0.2 & 0.2 \\ 0 & 1 & 0.2 \end{matrix} \end{matrix}$$

Table 6

In the same set  $T_{3,2} = \{ 1_{11}, 3_{12}, 2_{13}, 4_{21}, 5_{22}, 1_{23}, 7_{31}, 3_{32}, 1_{32} \}$ .

Assume that the distribution of products from all distribution centers, to points of sale at the largest cost and taking into account that the biggest cost for distribution is 7 units

So:

$$\mu_{T_2}(x) = (1 + (x - 7)^2)^{-1} : 0 \leq x \leq 7$$

$T_{\mu_2} = \{ (1_{11}, 0.027), (3_{12}, 0.0588), (2_{13}, 0.03846), (4_{21}, 0.1), (5_{22}, 0.2), (1_{23}, 0.027), (7_{31}, 1), (3_{32}, 0.0588), (1_{32}, 0.027) \}$ .

Or:

$$T_{\mu_2} = \begin{matrix} \begin{matrix} 0.201 & 0.521 & 0.425 \\ 0.6349 & 0.1566 & 0.222 \\ 0 & 0.644 & 0.194 \end{matrix} \end{matrix}$$

Table 7

the order element on stacked system  $T_{\mu}$ , where the system looking for zero convergence or zero spacing, is amount contributes to this element in the system, and this estimate is calculated relationship of this element in every path that contains this element, then the element order of  $a_{\gamma}$ , ( $O(a_{\gamma})$ ):

$$[a_{\gamma}]_0 = \left[ \frac{\sum_{i=1}^{\alpha} a_i}{\sum_{i=1}^{\alpha} a_{\gamma i}} \right] / \alpha$$

Then:

$$[(0.027_{11})]_0 = [(0.027 / (0.027 + 0.1 + 1)) + (0.027 / (0.027 + 0.0588 + 0.03846))] = 0.241243744 / 2 \approx 0.12$$

And so:

$$T_{\gamma_2} [[a_{\gamma}]_0] = \begin{matrix} \begin{matrix} 0.121 & 0.329 & 0.3627 \\ 0.197 & 0.62 & 0.082 \\ 0.904 & 0.1196 & 0.158 \end{matrix} \end{matrix}$$

Table 8

And

$$T_{\gamma_1} [[a_{\gamma}]_0] = \begin{matrix} \begin{matrix} 0.201 & 0.521 & 0.425 \\ 0.6349 & 0.1566 & 0.222 \\ 0 & 0.644 & 0.194 \end{matrix} \end{matrix}$$

Table 9

Then :

$$\mu_{T_1}(x) \cap \mu_{T_2}(x) = \min_t \{ \mu_{T_1}(x), \mu_{T_2}(x) \}$$

$$= \{ (1_{11}, 0.121), (3_{12}, 0.329), (2_{13}, 0.3627), (4_{21}, 0.197), (5_{22}, 0.1566), (1_{23}, 0.082), (7_{31}, 0), (3_{32}, 0.1966), (1_{32}, 0.158) \}$$

### 4.3 Definition

The membership function  $\mu_{DT}(x)$  of the union  $D_T = A_T \cup B_T$  is point wise defined by

$$\mu_{DT}(x) = \max_t \{ \mu_{AT}(x), \mu_{BT}(x) \}$$

Such that: if  $a_{\alpha} \in \mu_{AT}(x)$  and  $b_{\beta} \in \mu_{BT}(x)$

$$\text{Max}_t (a_{\alpha}, b_{\beta}) = \begin{cases} a_{\alpha} : \text{if } [a_{\alpha}]_t > [b_{\beta}]_t \\ b_{\beta} : \text{if } [b_{\beta}]_t > [a_{\alpha}]_t \end{cases}$$

if  $[a_{\alpha}]_t = [b_{\beta}]_t$  (one order element in two different places) so we have many type of this system, and if  $[a_{\alpha}]_t \neq [b_{\beta}]_t$  the system is type-1.

### 4.4 Example

From example above

$$T_{\mu_1(3,2)} [[a_{\gamma}]_0] = \begin{matrix} \begin{matrix} 0.027 & 0.0588 & 0.03846 \\ 0.1 & 0.2 & 0.027 \\ 1 & 0.0588 & 0.027 \end{matrix} \end{matrix}$$

Table 10

$$T_{\mu_2(3,2)} [[a_{\gamma}]_0] = \begin{matrix} \begin{matrix} 0.121 & 0.329 & 0.3627 \\ 0.197 & 0.62 & 0.082 \\ 0.904 & 0.1196 & 0.158 \end{matrix} \end{matrix}$$

Table 11

$$\mu_{T_1}(x) \cup \mu_{T_2}(x) = \max_t \{ \mu_{T_1}(x), \mu_{T_2}(x) \}$$

$$= \{ (1_{11}, 0.201), (3_{12}, 0.521), (2_{13}, 0.425), (4_{21}, 0.6349), (5_{22}, 0.62), (1_{23}, 0.222), (7_{31}, 0.904), (3_{32}, 0.644), (1_{32}, 0.194) \}$$

### 4.5 Definition

The membership function of the complement of a fuzzy stacked set  $T_{\mu}$ ,  $\mu^c_T(x)$  is defined by

$$\mu^c_T(x) = 1 - \mu_T(x), x \in T$$

### 4.6 Example

Let :  $T_{\mu_1} = \{ (1_{11}, 0.2), (3_{12}, 1), (2_{13}, 0.5), (4_{21}, 0.5), (5_{22}, 0.2), (1_{23}, 0.2), (7_{31}, 0), (3_{32}, 1), (1_{32}, 0.2) \}$ .

Then :  $T^c_{\mu_1} = \{ (1_{11}, 0.8), (3_{12}, 0), (2_{13}, 0.5), (4_{21}, 0.5), (5_{22}, 0.8), (1_{23}, 0.8), (7_{31}, 1), (3_{32}, 0), (1_{32}, 0.8) \}$ .

### 4.7 Additional operations on fuzzy stacked set :

It has already been mentioned that min and max are not the only operators that could have been chosen to model the intersection or union of fuzzy stacked sets respectively .

The question arises, why those and not others‘!

from a logical point of view, interpreting the intersection as “logical and,” the union as “logical or,” and the fuzzy stacked set Z as the statement “The element x belongs to set Z“ can be accepted as more or less true. It is very instructive to follow their line of argument, which is an excellent example for an axiomatic justification of specific mathematical models. We shall therefore sketch their reasoning: Consider two statements, S and T, for which the truth values are  $\mu_S$  and  $\mu_T$ , respectively,  $\mu_S, \mu_T \in [0, 1]$ .

The truth value of the “and” and “or” combination of these statements,  $\mu(S \text{ and } T)$  and  $\mu(S \text{ or } T)$ , both from the interval  $[0, 1]$  are interpreted as the values of the membership functions of the intersection and union, respectively, of S and T. We are now looking for two real-valued functions f and g such that

$$\mu_{S \text{ and } T} = f(\mu_S, \mu_T)$$

$$\mu_{S \text{ or } T} = g(\mu_S, \mu_T)$$

That the following restrictions are reasonably imposed on f and g:

- i- f and g are non decreasing and continuous in  $\mu_S$  and  $\mu_T$
- ii- f and g are symmetric, that is,
 
$$f(\mu_S, \mu_T) = f(\mu_T, \mu_S)$$
- iii-  $f(\mu_S, \mu_S)$  and  $g(\mu_S, \mu_S)$  are strictly increasing in  $\mu_S$  .
- iv-  $f(\mu_S, \mu_T) \leq \min(\mu_S, \mu_T)$  and  $g(\mu_S, \mu_T) \geq \max(\mu_S, \mu_T)$  . That implies that accepting the truth of the statements “S and T” requires more , and accepting the truth of the statement “S or T” less than accepting S or T alone as true.
- v-  $f(1, 1) = 1$  and  $g(0, 0) = 0$  .
- vi- Logically equivalent statements must have equal truth values and fuzzy sets with the same contents must have the same membership functions, that is,  $S_1$  and  $(S_2 \text{ or } S_3)$  is equivalent to  $(S_1 \text{ and } S_2)$  or  $(S_1 \text{ and } S_3)$  and therefore must be equally true.

Using the symbols  $\wedge$  for “and” (= intersection) and  $\vee$  for “or” (= union), this amounts to the following 7 restrictions, to be imposed on the two commutative (see (ii)) and associative (see (vi)) binary compositions  $\wedge$  and  $\vee$  on the closed interval  $[0, 1]$  which are mutually distributive (see (vi)) with respect to one another.

- 1-  $\mu_S \wedge \mu_T = \mu_T \wedge \mu_S$   
 $\mu_S \vee \mu_T = \mu_T \vee \mu_S$
- 2-  $(\mu_S \wedge \mu_T) \wedge \mu_U = \mu_S \wedge (\mu_T \wedge \mu_U)$   
 $(\mu_S \vee \mu_T) \vee \mu_U = \mu_S \vee (\mu_T \vee \mu_U)$

- 3-  $\mu_S \wedge (\mu_T \wedge \mu_U) = (\mu_S \wedge \mu_T) \wedge (\mu_S \wedge \mu_U)$   
 $\mu_S \vee (\mu_T \vee \mu_U) = (\mu_S \vee \mu_T) \vee (\mu_S \vee \mu_U)$
- 4-  $\mu_S \wedge \mu_T$  and  $\mu_S \vee \mu_T$  are continuous and non decreasing in each component
- 5-  $\mu_S \wedge \mu_T$  and  $\mu_S \vee \mu_T$  are strictly increasing in  $\mu_S$  (see (iii))
- 6-  $\mu_S \wedge \mu_T \leq \min(\mu_S, \mu_T)$   
 $\mu_S \vee \mu_T \geq \max(\mu_S, \mu_T)$  (see (iv))
- 7-  $1 \wedge 1 = 1$   
 $0 \vee 0 = 0$  (see (v))

$$\mu_{S \wedge T} = \min(\mu_S, \mu_T) \text{ and } \mu_{S \vee T} = \max(\mu_S, \mu_T)$$

For the complement it would be reasonable to assume that if statement

“S“ is true, its complement “non S” is false, or if  $\mu_S = 1$  then  $\mu_{\text{nonS}} = 0$  and vice versa . The function h (as complement in analogy to f and g for intersection and union) should also be continuous and monotonically decreasing and we would like the complement of the complement to be the original statement (in order to be in line with traditional logic and set theory).

#### 4.8 Definition

The Cartesian product of fuzzy stacked sets is defined if  $T_{\mu_1}, T_{\mu_2}, \dots, T_{\mu_n}$  be fuzzy stacked sets in  $T_1, T_2, \dots, T_n$  . Then the Cartesian product of fuzzy stacked sets in the product space  $T_1 \times T_2 \times \dots \times T_n$ , and the membership function if  $\delta = T_{\mu_1} \times T_{\mu_2} \times \dots \times T_{\mu_n}$  is :

$$\mu_\delta(x) = \min_i[\mu_{T_{\mu_i}}(x_i) \mid x = (x_1, x_2, \dots, x_n), x_i \in T_i]$$

#### 4.9 Example

In example above :

$$T_{\mu_1} = \{ (1_{11}, 0.2), (3_{12}, 1), (2_{13}, 0.5), (4_{21}, 0.5), (5_{22}, 0.2), (1_{23}, 0.2), (7_{31}, 0), (3_{32}, 1), (1_{33}, 0.2) \}$$

$$T_{\mu_2} = \{ (1_{11}, 0.027), (3_{12}, 0.0588), (2_{13}, 0.03846), (4_{21}, 0.1), (5_{22}, 0.2), (1_{23}, 0.027), (7_{31}, 1), (3_{32}, 0.0588), (1_{33}, 0.027) \}$$

Then :

$$T_{\mu_1} \times T_{\mu_2} = \{ [(1_{11}; 1_{11}), 0.027], [(1_{11}; 3_{12}), 0.0588], [(1_{11}; 2_{13}), 0.03846], [(1_{11}; 4_{21}), 0.1], [(1_{11}; 5_{22}), 0.2], [(1_{11}; 1_{23}), 0.027], [(\underline{1_{11}; 7_{31}}), \underline{0.2}], [(1_{11}; 3_{32}), 0.0588], [(1_{11}; 1_{33}), 0.027], [(3_{12}; 1_{11}), 0.027], [(3_{12}; 3_{12}), 0.0588], [(3_{12}; 2_{13}), 0.03846], [(3_{12}; 4_{21}), 0.1], [(3_{12}; 5_{22}), 0.2], [(3_{12}; 1_{23}), 0.027], [(3_{12}; 7_{31}), 1], [(3_{12}; 3_{32}), 0.0588], [(3_{12}; 1_{33}), 0.027], [(2_{13}; 1_{11}), 0.027], [(2_{13}; 3_{12}), 0.0588], [(2_{13}; 2_{13}), 0.03846], [(2_{13}; 4_{21}), 0.1], [(2_{13}; 5_{22}), 0.2], [(2_{13}; 1_{23}), 0.027], [(\underline{2_{13}; 7_{31}}), \underline{0.5}], [(2_{13}; 3_{32}), 0.0588], [(2_{13}; 1_{33}), 0.027], [(4_{21}; 1_{11}), 0.027], [(4_{21}; 3_{12}), 0.0588], [(4_{21}; 2_{13}), 0.03846], [(4_{21}; 4_{21}), 0.1], [(4_{21}; 5_{22}), 0.2], [(4_{21}; 1_{23}), 0.027], [(\underline{4_{21}; 7_{31}}), \underline{0.5}], [(4_{21}; 3_{32}), 0.0588], [(4_{21}; 1_{33}), 0.027], [(5_{22}; 1_{11}), 0.027], [(5_{22}; 3_{12}), 0.0588], [(5_{22}; 2_{13}), 0.03846], [(5_{22}; 4_{21}), 0.1], [(5_{22}; 5_{22}), 0.2], [(5_{22}; 1_{23}), 0.027], [(\underline{5_{22}; 7_{31}}), \underline{0.2}], [(5_{22}; 3_{32}), 0.0588], [(5_{22}; 1_{33}), 0.027], [(1_{23}; 1_{11}), 0.027],$$

$\{(1_{23}; 3_{12}), 0.0588\}, \{(1_{23}; 2_{13}), 0.03846\}, \{(1_{23}; 4_{21}), 0.1\},$   
 $\{(1_{23}; 5_{22}), 0.2\}, \{(1_{23}; 1_{23}), 0.027\}, \{(1_{23}; 7_{31}), 0.2\}, \{(1_{23}; 3_{32}), 0.0588\},$   
 $\{(1_{23}; 1_{33}), 0.027\}, \{(7_{31}; 1_{11}), 0.1\}, \{(7_{31}; 3_{12}), 0.1\}, \{(7_{31}; 2_{13}), 0.1\},$   
 $\{(7_{31}; 4_{21}), 0.1\}, \{(7_{31}; 5_{22}), 0.1\}, \{(7_{31}; 1_{23}), 0.1\}, \{(7_{31}; 7_{31}), 0.1\},$   
 $\{(7_{31}; 3_{32}), 0.1\}, \{(7_{31}; 1_{33}), 0.1\}, \{(3_{32}; 1_{11}), 0.027\}, \{(3_{32}; 3_{12}), 0.0588\},$   
 $\{(3_{32}; 2_{13}), 0.03846\}, \{(3_{32}; 4_{21}), 0.1\}, \{(3_{32}; 5_{22}), 0.2\}, \{(3_{32}; 1_{23}), 0.027\},$   
 $\{(3_{32}; 7_{31}), 1\}, \{(3_{32}; 3_{32}), 0.0588\}, \{(3_{32}; 1_{33}), 0.027\}, \{(1_{33}; 1_{11}), 0.027\},$   
 $\{(1_{33}; 3_{12}), 0.0588\}, \{(1_{33}; 2_{13}), 0.03846\}, \{(1_{33}; 4_{21}), 0.1\}, \{(1_{33}; 5_{22}), 0.2\},$   
 $\{(1_{33}; 1_{23}), 0.027\}, \{(1_{33}; 7_{31}), 0.2\}, \{(1_{33}; 3_{32}), 0.0588\}, \{(1_{33}; 1_{33}), 0.027\}$

**4.10 Definition**

The nth power of a fuzzy stacked set T is a fuzzy stacked set with the membership function

$$(\mu_{T^n})(x) = [\mu_{T_i}(x)]^n, x \in T_\mu.$$

**4.11 Example**

In example above :

$T_{\mu_1} = \{(1_{11}, 0.2), (3_{12}, 1), (2_{13}, 0.5), (4_{21}, 0.5), (5_{22}, 0.2),$   
 $(1_{23}, 0.2), (7_{31}, 0), (3_{32}, 1), (1_{33}, 0.2)\}$

Then :

$[T_{\mu_1}]^2 = \{(1_{11}, 0.04), (3_{12}, 1), (2_{13}, 0.25), (4_{21}, 0.25), (5_{22}, 0.04),$   
 $(1_{23}, 0.04), (7_{31}, 0), (3_{32}, 1), (1_{33}, 0.04)\}$

**4.12 Definition**

The algebraic sum (probabilistic sum)  $T_{\mu_a} + T_{\mu_b}$  is defined as :

$T_{\mu_a} + T_{\mu_b} = \{(x, \mu_{(T_{\mu_a} + T_{\mu_b})}(x)) | x \in T_\mu\}$ . Where :

$$\mu_{(T_{\mu_a} + T_{\mu_b})}(x) = \mu_{(T_{\mu_a})}(x) + \mu_{(T_{\mu_b})}(x) - \mu_{(T_{\mu_a})}(x) \cdot \mu_{(T_{\mu_b})}(x)$$

**4.13 Example**

In example above :

$T_{\mu_1} = \{(1_{11}, 0.2), (3_{12}, 1), (2_{13}, 0.5), (4_{21}, 0.5), (5_{22}, 0.2),$   
 $(1_{23}, 0.2), (7_{31}, 0), (3_{32}, 1), (1_{33}, 0.2)\}$

$T_{\mu_2} = \{(1_{11}, 0.027), (3_{12}, 0.0588), (2_{13}, 0.03846), (4_{21}, 0.1),$   
 $(5_{22}, 0.2), (1_{23}, 0.027), (7_{31}, 1), (3_{32}, 0.0588), (1_{33}, 0.027)\}$

Then :

$T_{\mu_1} + T_{\mu_2} = \{(1_{11}, 0.2216), (3_{12}, 1), (2_{13}, 0.51923), (4_{21}, 0.55),$   
 $(5_{22}, 0.36), (1_{23}, 0.2216), (7_{31}, 1), (3_{32}, 1), (1_{33}, 0.2216)\}$

**4.14 Definition**

The bounded sum  $T_{\mu_a} \oplus T_{\mu_b}$  is defined as

$$T_{\mu_a} \oplus T_{\mu_b} = \{(x, \mu_{(T_{\mu_a} \oplus T_{\mu_b})}(x)) | x \in T_\mu\}$$

Where

$$\mu_{(T_{\mu_a} \oplus T_{\mu_b})}(x) = \min\{1, \mu_{(T_{\mu_a})}(x) + \mu_{(T_{\mu_b})}(x)\}$$

**4.15 Example**

In example above :

$T_{\mu_1} = \{(1_{11}, 0.2), (3_{12}, 1), (2_{13}, 0.5), (4_{21}, 0.5), (5_{22}, 0.2),$   
 $(1_{23}, 0.2), (7_{31}, 0), (3_{32}, 1), (1_{33}, 0.2)\}$

$T_{\mu_2} = \{(1_{11}, 0.027), (3_{12}, 0.0588), (2_{13}, 0.03846), (4_{21}, 0.1),$   
 $(5_{22}, 0.2), (1_{23}, 0.027), (7_{31}, 1), (3_{32}, 0.0588), (1_{33}, 0.027)\}$

Then :

$T_{\mu_1} \oplus T_{\mu_2} = \{(1_{11}, 0.227), (3_{12}, 1), (2_{13}, 0.53846), (4_{21}, 0.6),$   
 $(5_{22}, 0.4), (1_{23}, 0.227), (7_{31}, 1), (3_{32}, 1), (1_{33}, 0.227)\}$

**4.16 Definition**

The bounded difference  $T_{\mu_a} \ominus T_{\mu_b}$  is defined as

$$T_{\mu_a} \ominus T_{\mu_b} = \{(x, \mu_{(T_{\mu_a} \ominus T_{\mu_b})}(x)) | x \in T_\mu\}$$

Where

$$\mu_{(T_{\mu_a} \ominus T_{\mu_b})}(x) = \max\{0, \mu_{(T_{\mu_a})}(x) + \mu_{(T_{\mu_b})}(x) - 1\}$$

**4.17 Example**

In example above :

$T_{\mu_1} = \{(1_{11}, 0.2), (3_{12}, 1), (2_{13}, 0.5), (4_{21}, 0.5), (5_{22}, 0.2),$   
 $(1_{23}, 0.2), (7_{31}, 0), (3_{32}, 1), (1_{33}, 0.2)\}$

$T_{\mu_2} = \{(1_{11}, 0.027), (3_{12}, 0.0588), (2_{13}, 0.03846), (4_{21}, 0.1),$   
 $(5_{22}, 0.2), (1_{23}, 0.027), (7_{31}, 1), (3_{32}, 0.0588), (1_{33}, 0.027)\}$

Then :

$T_{\mu_1} \ominus T_{\mu_2} = \{(1_{11}, 0), (3_{12}, 0.0588), (2_{13}, 0), (4_{21}, 0), (5_{22}, 0),$   
 $(1_{23}, 0.227), (7_{31}, 0), (3_{32}, 0.0588), (1_{33}, 0)\}$

$$= \{(3_{12}, 0.0588), (3_{32}, 0.0588)\}$$

**4.18 Definition**

The algebraic product of tow fuzzy stacked sets  $T_{\mu_a} \bullet T_{\mu_b}$  is defined as

$$T_{\mu_a} \bullet T_{\mu_b} = \{(x, \mu_{(T_{\mu_a})}(x) \bullet \mu_{(T_{\mu_b})}(x)) | x \in T_\mu\}$$

**4.19 Example**

In example above :

$T_{\mu_1} = \{(1_{11}, 0.2), (3_{12}, 1), (2_{13}, 0.5), (4_{21}, 0.5), (5_{22}, 0.2),$   
 $(1_{23}, 0.2), (7_{31}, 0), (3_{32}, 1), (1_{33}, 0.2)\}$

$T_{\mu_2} = \{(1_{11}, 0.027), (3_{12}, 0.0588), (2_{13}, 0.03846), (4_{21}, 0.1),$   
 $(5_{22}, 0.2), (1_{23}, 0.027), (7_{31}, 1), (3_{32}, 0.0588), (1_{33}, 0.027)\}$

Then :

$T_{\mu_1} \bullet T_{\mu_2} = \{(1_{11}, 0.0054), (3_{12}, 0.0588), (2_{13}, 0.01923), (4_{21}, 0.05),$   
 $(5_{22}, 0.04), (1_{23}, 0.0054), (7_{31}, 0), (3_{32}, 0.0588), (1_{33}, 0.0054)\}$

**V. FUZZY STACKED SEMIGROUPS**

**5.1 Definition**

Let  $T_{\alpha, n}$  be staked set ,and  $(T_{\alpha, n}, \tau)$  be a stacked semigroup , then a map  $\mu: T_{\alpha, n} \rightarrow [0, 1]$  is called a fuzzy stacked semigroup if  $\mu(x \tau y) = \min_i \{\mu(x), \mu(y)\}$  for all  $x, y \in T_{\alpha, n}$ .

**5.2 Example**

From example above , suppose that the distribution of products from all distribution centers, to the point of sale at less cost and taking into account that the biggest cost of distribution is 7 units . And :

$$\mu_T(x) = 1 - (1 + (x - 7)^2)^{-1} : 0 \leq x \leq 7 .$$

when

$$T_{3,2} = \{ 1_{11}, 3_{12}, 2_{13}, 4_{21}, 5_{22}, 1_{23}, 7_{31}, 3_{32}, 1_{32} \} .$$

or  $T_{3,2} =$

|   |   |   |
|---|---|---|
| 1 | 3 | 2 |
| 4 | 5 | 1 |
| 7 | 3 | 1 |

Table 12

$$IT_{3,2}(1_{11}) = 1, IT_{3,2}(3_{12}) = 6, IT_{3,2}(4_{21}) = 5, IT_{3,2}(5_{22}) = 8, IT_{3,2}(7_{31}) = 9, IT_{3,2}(2_{13}) = 7.$$

$$IT_{3,2} =$$

|   |   |   |
|---|---|---|
| 1 | 6 | 7 |
| 5 | 8 | 3 |
| 9 | 4 | 2 |

Table 13

and

$$\min_t(4_{21}, 3_{12}) = 4_{21}, \min_t(1_{11}, 7_{31}) = 1_{11}, \min_t(5_{22}, 2_{13}) = 5_{22}$$

from ,

$$\mu_T(x) = 1 - (1 + (x - 7)^2)^{-1} : 0 \leq x \leq 7$$

$$T_\mu = \{ (1_{11}, 0.97), (3_{12}, 0.94), (2_{13}, 0.96), (4_{21}, 0.9), (5_{22}, 0.8), (1_{23}, 0.97), (7_{31}, 0), (3_{32}, 0.94), (1_{32}, 0.97) \} .$$

Or

$$T_\mu =$$

|      |      |      |
|------|------|------|
| 0.97 | 0.94 | 0.96 |
| 0.9  | 0.8  | 0.97 |
| 0    | 0.94 | 0.97 |

Table 14

$$[a_\gamma]_t = \left[ \frac{|a_{\gamma 1} - t|}{\sum_{i=1}^{\alpha} |a_{\gamma i} - t|} + \frac{|a_{\gamma 2} - t|}{\sum_{i=1}^{\alpha} |a_{\gamma i} - t|} + \dots + \frac{|a_{\gamma \alpha} - t|}{\sum_{i=1}^{\alpha} |a_{\gamma i} - t|} \right] / \alpha$$

$$= \left[ \sum_{i=1}^{\alpha} \frac{|a_{\gamma i} - t|}{\sum_{i=1}^{\alpha} |a_{\gamma i} - t|} \right] / \alpha .$$

Then :

$$[0.97]_{11} = \left[ \left( \frac{0.97}{(0.97 + 0.9 + 0)} \right) + \left( \frac{0.97}{(0.97 + 0.94 + 0.96)} \right) \right] \approx 0.428$$

and so :

$$T_{\mu(3,2)} [ [a_\gamma]_0 ] =$$

|       |        |         |
|-------|--------|---------|
| 0.428 | 0.339  | 0.3329  |
| 0.409 | 0.299  | 0.34889 |
| 0     | 0.4214 | 0.4211  |

Table 15

and so :

$$IT_{\mu(3,2)} [ [a_\gamma]_0 ] =$$

|   |   |   |
|---|---|---|
| 1 | 6 | 7 |
| 4 | 8 | 5 |
| 9 | 2 | 3 |

Table 16

Then :

$$IT_{\mu(3,2)} [ [a_\gamma]_0 ] = IT_{3,2}$$

When

$$\mu_T(4_{21} \tau 3_{12}) = \mu_T [ \min_t(4_{21}, 3_{12}) ] = \mu_T(4_{21}) = 0.9$$

$$\text{And, } \min_t \{ \mu_T(4_{21}), \mu_T(3_{12}) \} = \min_t \{ 0.9, 0.94 \} = 0.9$$

$$\text{Then : } \mu_T(4_{21} \tau 3_{12}) = \min_t \{ \mu_T(4_{21}), \mu_T(3_{12}) \}$$

And  $\forall x, y \in T_{3,2}, \mu(x \tau y) = \min_t \{ \mu(x), \mu(y) \}$ , then  $(T_{3,2}, \tau)$  is fuzzy stacked semigroup .

### 5.3 Theorem

Let  $(T_{\alpha,n}, \tau)$  be a stacked semigroup , then a map  $\mu: T_{\alpha,n} \rightarrow [0, 1]$  is called a fuzzy stacked semigroup if  $IT_\alpha = I(T_\mu)$  or  $IT = I(1-T_\mu)$  .

**Proof:**

Let  $a, b \in T_{\alpha,n}$ , where  $(T_{\alpha,n}, \tau)$  be a stacked semigroup , and  $\mu: T_{\alpha,n} \rightarrow [0, 1]$

Then

$$\min_t(a, b) = a \text{ if } [a]_t < [b]_t \text{ or } b \text{ if } [a]_t < [b]_t$$

So,

$$\min_t(a, b) \text{ corresponds } \min[ [a], [b] ]$$

then there is corresponds between  $\min_t [ \mu_T(a), \mu_T(b) ]$  and  $\min[ [a], [b] ]$  from:

$$\min_t[a_\mu, b_\mu] = a_\mu \text{ if } [a_\mu]_t < [b_\mu]_t \text{ or } b_\mu \text{ if } [a_\mu]_t < [b_\mu]_t .$$

When  $|T_{\alpha,n}| = |T_\mu| \Rightarrow |IT_{\alpha,n}| = |I(T_\mu)| = r$  ( from the corresponds )

$$\text{so } IT_{\alpha,n} = \{ 1, 2, \dots, r \} \text{ and } I(T_\mu) = \{ 1, 2, \dots, r \} \Rightarrow IT_{\alpha,n} = I(T_\mu) .$$

But sometimes  $\mu_T(x)$  is define a  $\max_t$  operations so it is corresponds  $I(1-T_\mu)$  then  $IT_{\alpha,n} = I(1-T_\mu)$  or  $IT_{\alpha,n} = I(T_\mu)$  .

Let  $T_{\alpha,n}$  be a stacked semigroup. A function  $f$  from  $T_{\alpha,n}$  to the unit interval  $[0, 1]$  is a fuzzy stacked subset of  $T_\alpha$  . A stacked semigroup  $T_\alpha$  itself is a fuzzy stacked subset of  $T_\alpha$  such that  $T_\alpha(x) = 1$  for all  $x \in T_\alpha$  denoted by  $T_\alpha$  . Let  $\mu$  and  $\delta$  be any two fuzzy stacked subsets of  $T$  . Then the inclusion relation  $\mu \subseteq \delta$  is defined by  $\mu(x) \leq \delta(x)$  for all  $x \in T$  .  $(1 - \mu)$  is a fuzzy stacked subset of  $T_\alpha$  defined for all  $x \in T_\alpha$  .

### 5.4 Definition

$(1 - \mu)(x) = 1 - \mu(x)$ ,  $\mu \cap \delta$  and  $\mu \cup \delta$  are fuzzy sacked subsets of T defined by :

$(\mu \cap \delta)(x) = \min_i\{\mu(x), \delta(x)\}$ ,  $(\mu \cup \delta)(x) = \max_i\{\mu(x), \delta(x)\}$  for all  $x \in T_\alpha$ . The product  $\mu \bullet \delta$  is defined as follows:

$$(\mu \bullet \delta)(x) = \begin{cases} \sup\{\min[\{\mu(y), \delta(z)\}]\} \\ \text{if } x \text{ is not expressible as } x=yz \end{cases}$$

' $\bullet$ ' is an associative operation .

### 5.5 Example

In example above :

$$T_{\mu_1} = \{ (1_{11}, 0.2), (3_{12}, 1), (2_{13}, 0.5), (4_{21}, 0.5), (5_{22}, 0.2), (1_{23}, 0.2), (7_{31}, 0), (3_{32}, 1), (1_{33}, 0.2) \}$$

$$T_{\mu_2} = \{ (1_{11}, 0.027), (3_{12}, 0.0588), (2_{13}, 0.03846), (4_{21}, 0.1), (5_{22}, 0.2), (1_{23}, 0.027), (7_{31}, 1), (3_{32}, 0.0588), (1_{33}, 0.027) \}$$

$$\begin{aligned} [1_{11}]_0 &= [(1/(1+3+2)) + (1/(1+4+7))] / 2 = 0.125 . \\ [3_{12}]_0 &= 0.38636 . \\ [2_{13}]_0 &= 0.41667 . \\ [4_{21}]_0 &= 0.36667 . \\ [5_{22}]_0 &= 0.47727 . \\ [1_{23}]_0 &= 0.175 . \\ [7_{31}]_0 &= 0.60985 . \\ [3_{32}]_0 &= 0.27273 . \\ [1_{33}]_0 &= 0.17045 . \end{aligned}$$

$$\begin{aligned} 1_{11} T_\alpha &= 1_{11} T_\alpha = \text{Min}_0[1_{11}, T_\alpha] = 1_{11} , \text{ so} \\ - 1_{11} 1_{33} &= 1_{11}, \quad 1_{11} 1_{23} = 1_{11}, \quad 1_{11} 3_{32} = 1_{11}, \quad 1_{11} 4_{21} = 1_{11}, \\ &1_{11} 3_{12} = 1_{11}, \quad 1_{11} 2_{13} = 1_{11}, \quad 1_{11} 5_{22} = 1_{11}, \quad 1_{11} 7_{31} = 1_{11} . \\ - 1_{23} 1_{23} &= 1_{11}, \quad 1_{23} 3_{32} = 1_{23}, \quad 1_{23} 4_{21} = 1_{23}, \quad 1_{23} 3_{12} = 1_{23}, \\ &1_{23} 2_{13} = 1_{23}, \quad 1_{23} 5_{22} = 1_{23}, \quad 1_{23} 7_{31} = 1_{23} . \\ - 3_{32} 3_{32} &= 1_{23}, \quad 3_{32} 4_{21} = 3_{32}, \quad 3_{32} 3_{12} = 3_{32}, \quad 3_{32} 2_{13} = 3_{32}, \\ &3_{32} 5_{22} = 3_{32}, \quad 3_{32} 7_{31} = 3_{32} . \\ - 4_{21} 4_{21} &= 4_{21}, \quad 4_{21} 3_{12} = 4_{21}, \quad 4_{21} 2_{13} = 4_{21}, \quad 4_{21} 5_{22} = 4_{21}, \\ &4_{21} 7_{31} = 4_{21} . \\ - 3_{12} 3_{12} &= 3_{12}, \quad 3_{12} 2_{13} = 3_{12}, \quad 3_{12} 5_{22} = 3_{12}, \quad 3_{12} 7_{31} = 3_{12} . \\ - 2_{13} 2_{13} &= 2_{13}, \quad 2_{13} 5_{22} = 2_{13}, \quad 2_{13} 7_{31} = 2_{13} . \\ - 5_{22} 5_{22} &= 5_{22}, \quad 5_{22} 7_{31} = 5_{22} . \\ - 7_{31} 7_{31} &= 7_{31} . \end{aligned}$$

$$(\mu_1 \bullet \mu_2)(x) = \begin{cases} \sup\{\min[\{\mu_1(y), \mu_2(z)\}]\} \\ \text{if } x \text{ is not expressible as } x=yz . \end{cases}$$

Then :

$$\begin{aligned} (\mu_1 \bullet \mu_2)(1_{11}) &= \sup \{ \min [ \mu_1(1_{11}), \mu_2(1_{33}) ], \min [ \mu_1(1_{11}), \mu_2(1_{23}) ], \min [ \mu_1(1_{11}), \mu_2(3_{32}) ], \min [ \mu_1(1_{11}), \mu_2(4_{21}) ], \min [ \mu_1(1_{11}), \mu_2(5_{22}) ], \min [ \mu_1(1_{11}), \mu_2(7_{31}) ] \} \\ &= \sup \{ 0.027, 0.0588, 0.03846, 0.1, 0.2 \} = 0.2 . \end{aligned}$$

A fuzzy stacked subset f of  $T_\alpha$  is called a fuzzy stacked subsemi-group of  $T_\alpha$  if :

$$f(xy) \geq f(x) \wedge f(y), \forall x, y \in T_\alpha .$$

### 5.7 Definition

for all a, b  $\in T_\alpha$ , and is called a fuzzy stacked left (right) ideal of S if :

$$f(ab) > f(b), (f(ab) > f(a))$$

### 5.8 Definition

- Let  $T_\alpha$  be a stacked semigroup. Let A and B be subsets of  $T_\alpha$ . Then multiplication of A and B is defined as follows:

$$AB = \{ ab \in T_\alpha \mid a \in A \text{ and } b \in B \}$$

- A nonempty subset A of  $T_\alpha$  is called a stacked sub-semigroup of  $T_\alpha$  if  $AA \subseteq A$ .
- A nonempty stacked subset A of  $T_\alpha$  is called a left (right) stacked ideal of  $T_\alpha$  if  $T_\alpha A \subseteq A$  ( $A T_\alpha \subseteq A$ ). Further, A is called a two-sided stacked ideal of  $T_\alpha$  if it is both a left and a right stacked ideal of  $T_\alpha$ .
- A nonempty stacked subset A of  $T_\alpha$  is called an interior stacked ideal of  $T_\alpha$  if  $T_\alpha A T_\alpha \subseteq A$ , and a quasi-stacked ideal of  $T_\alpha$  if  $A T_\alpha \cap T_\alpha A \subseteq A$ . A stacked sub-semigroup A of  $T_\alpha$  is called a stacked bi-ideal of  $T_\alpha$  if  $A T_\alpha A \subseteq A$ . A nonempty subset A is called a generalized stacked bi-ideal of  $T_\alpha$  if  $A T_\alpha A \subseteq A$ .
- A semigroup  $T_\alpha$  is called regular if for each element a of  $T_\alpha$ , there exists an element x  $\in T_\alpha$  such that  $a = axa$ .

### 5.9 Definition

We denote by  $L_i[a]$  ( $R_i[a]$ ,  $J_i[a]$ ,  $I_i[a]$ ,  $Q_i[a]$ ,  $B_i[a]$ ) the principal (left, right, two-sided, interior, quasi- and bi-) ideal of a stacked semigroup S generated by the element a  $\in T_\alpha$ , that is,

- 1-  $L_i[a] = \{a\} \cup T_\alpha a$ ,
- 2-  $R_i[a] = \{a\} \cup a T_\alpha$ ,
- 3-  $J_i[a] = \{a\} \cup T_\alpha a \cup a T_\alpha \cup T_\alpha a T_\alpha$ ,
- 4-  $I_i[a] = \{a\} \cup \{a^2\} \cup T_\alpha a T_\alpha$ ,
- 5-  $Q_i[a] = \{a\} \cup (a T_\alpha \cap T_\alpha a)$ ,
- 6-  $B_i[a] = \{a\} \cup \{a^2\} \cup a T_\alpha a$ .

### 5.10 Definition

A fuzzy stacked subset  $f$  of a stacked semigroup  $T_\alpha$  is called a fuzzy stacked bi-ideal of  $T_\alpha$  if :

$$F(xyz) \geq f(x) \wedge f(z) , \text{ for all } x, y, z \text{ of } T_\alpha$$

### 5.11 Definition

A fuzzy stacked subset  $f$  of  $T_\alpha$  is called a fuzzy stacked interior ideal of  $T_\alpha$  if  $f(xay) \geq f(a)$  for all  $x, a$  and  $y$  of  $T_\alpha$ .

### 5.12 Definition

A fuzzy stacked subset  $f$  of a stacked semigroup  $T_\alpha$  is called a fuzzy stacked quasi-ideal of  $T_\alpha$  if

$$(f \circ T_\alpha) \cap (T_\alpha \circ f) \subseteq f .$$

### 5.13 Definition

A nonempty stacked subset  $A$  of a stacked semigroup  $T_\alpha$  is called a generalized stacked bi-ideal of  $T_\alpha$  if  $A T_\alpha A \subseteq A$  . A fuzzy stacked subset  $f$  of  $T_\alpha$  is called a fuzzy stacked generalized bi-ideal of  $T_\alpha$  if

$$f(xyz) \geq f(x) \wedge f(z)$$

for all  $x, y$  and  $z$  of  $T_\alpha$  .

It is clear that every fuzzy stacked bi-ideal of a stacked semigroup  $T_\alpha$  is a fuzzy stacked generalized bi-ideal of  $T_\alpha$ , but the converse of this statement does not hold in general.

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# Branch and Bound Technique for Single Machine Scheduling Problem Using Type-2 Trapezoidal Fuzzy Numbers.

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**Abstract-** This paper deals branch and bound technique to solve single machine scheduling problem involving two processing times along with due date using Type-2 Trapezoidal fuzzy numbers. Our aim is to obtained optimal sequence of jobs and to minimize the total tardiness. The working of the algorithm has been illustrated by numerical example.

**Index Terms-** Branch and Bound Technique, Processing times  $P_1$  and  $P_2$  , Optimal sequence, Type-2 Trapezoidal fuzzy numbers.

**AMS Subject Classification:** 94D05, 90-XX, Aug 2010.

## I. INTRODUCTION

Job scheduling is a useful tool in decision making problem. The scheduling problems are common occurrence in our daily life. The aim of this technique is used to determine an optimal job scheduling problem and minimizing the total tardiness.

In this paper, We propose a new concept in single machine scheduling problem. For many years, Scheduling research focused on single performance measure. Recent development of new technology, We are consider the single machine having capacity to do two different works to complete a job. Each work having separate processing times (ie)  $P_1$  and  $P_2$  addition to the due date ( $d_j$ ). The most obvious objective is to scheduling the job and minimizing the total tardeness using Branch and Bound technique. This method is basically a stage wise search method of optimization problems whose solutions may be viewed as the result of a sequence of decisions that will help the decision maker in determining a best schedule for a given set of jobs effectively. This method is become lucrative to make decision. In most of the real life problem, There are elements of uncertainty in process. In practical situation processing times and due date are not always deterministic. So, We have associated with fuzzy environment.

The concept of a type-2 fuzzy set, Which is an extension of the concept of an arbitrary fuzzy set, was introduced by Zadeh[13]. A fuzzy set is two dimensional and a type-2 fuzzy set is three dimensional Type-2 fuzzy sets can better improve certain kinds of inference than do fuzzy sets with increasing imprecision, Uncertainty and fuzziness in information. A type-2 fuzzy set is characterized by a membership function (ie) the membership value for each element of this set is a fuzzy set in  $[0,1]$ , unlike an ordinary fuzzy set where the membership value is a crisp number in  $[0,1]$ .

### 1.1 REVIEW OF LITERATURE:

Various researchers have done a lot of work in different directions. Ishii and Tada [6] considered a single machine scheduling problem minimizing the maximum lateness of jobs with fuzzy precedence relations. Hong et.al., [5] introduced a single machine scheduling problem with fuzzy due date. Itoh and Ishii [7] proposed a single machine scheduling problem dealing with fuzzy processing times and due date. Gawiejnowicz et.al., [3] deals with a single machine time dependent scheduling problem. Emmons [2] developed several theorems and dominance rules that can be used to restrict the search effort of a branch and bound algorithm, Lawler [10] applied a dynamic programming approach to the single machine total tardiness problem. Vaiarakarakis and Chung [12] proposed a branch and bound algorithm to minimize total tardiness subject to minimum number of tardy jobs. Azizogulu [1] used a branch and bound method to solve the total earliness and total tardiness problem for the single machine problem. Raymond [11] proposed a branch and bound approach to solve the problem for steel plant involving single machine bi-criteria problem.

The paper is organized as follows: In section-2, Some basic concepts are given. In section-3, Arithmetic operations on Type-2 Trapezoidal fuzzy numbers and algorithm are discussed. In section-4, a numerical example is given, To illustrate the proposed branch and bound technique to solve single machine scheduling problem involving two processing times along with due date .

## II. PRELIMINARIES

**2.1 Fuzzy Set:** A fuzzy set is characterized by a membership function mapping the elements of domain, space or universe of discourse  $X$  to the unit interval  $[0,1]$ .

A fuzzy set  $\tilde{A}$  is set of ordered pairs  $\{x, \mu_A(x) / x \in R\}$  where  $\mu_A(x) : R \rightarrow [0,1]$  is upper semi continuous. Function  $\mu_A(x)$  is called membership function of the fuzzy set.

**2.2 Fuzzy Number :** A fuzzy number  $f$  in the real line  $R$  is a fuzzy set  $f : R \rightarrow [0,1]$  that satisfies the following properties.

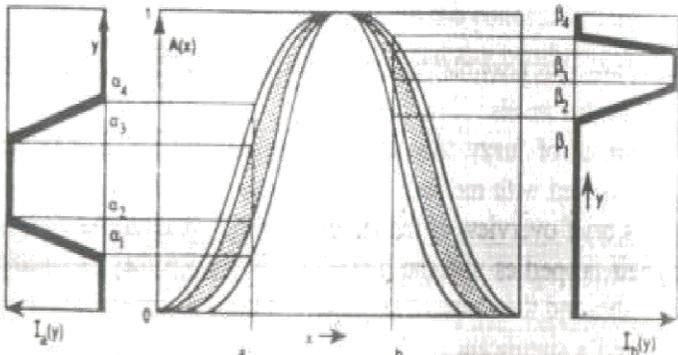
- (i)  $f$  is piecewise continuous
- (ii) There exist an  $x \in R$  such that  $f(x) = 1$
- (iii)  $f$  is convex (ie), if  $x_1, x_2 \in R$  , and

$\alpha \in [0,1]$ , then

$$f(\lambda x_1 + (1 - \lambda)x_2) \geq f(x_1) \wedge f(x_2)$$

**2.3 Type-2 Fuzzy Set:** A Type-2 fuzzy set denoted  $\tilde{A}$  is characterized by a Type-2 membership function  $\mu_A(x,u)$  where  $x \in X$  and  $u \in J_x \subseteq [0,1]$ .

ie,  $\tilde{A} = \{ ((x,u), \mu_A(x,u)) / \forall x \in X, \forall u \in J_x \subseteq [0,1] \}$  in which  $0 \leq \mu_A(x,u) \leq 1$ .  $\tilde{A}$  can be expressed as  $= \int_{x \in X} \int_{u \in J_x} \mu_A(x,u) / (x,u) J_x \subseteq [0,1]$ , where  $\int$  denotes union over all admissible  $u$ . For discrete universe of discourse  $J_x$  is replaced by  $\sum$ .



**2.4 Type-2 Fuzzy Number:** Let  $\tilde{A}$  be a type-2 fuzzy set defined in the universe of discourse  $R$ . If the following conditions are satisfied.

1.  $\tilde{A}$  normal,
2.  $\tilde{A}$  is a convex set,
3. The support of  $\tilde{A}$  is closed and bounded, then  $\tilde{A}$  is called a type-2 fuzzy number.

**2.5 Type-2 Trapezoidal Fuzzy Number :** A type-2 trapezoidal fuzzy number  $\tilde{A}$  on  $R$  is given by  $\tilde{A} = \{(x, \mu_A^1(x), \mu_A^2(x), \mu_A^3(x), \mu_A^4(x); x \in R)\}$  and  $\mu_A^1(x) \leq \mu_A^2(x) \leq \mu_A^3(x) \leq \mu_A^4(x)$ , for all  $x \in R$ . Denote  $\tilde{A} = (\tilde{A}_1, \tilde{A}_2, \tilde{A}_3, \tilde{A}_4)$ , where  $\tilde{A}_1 = (A_1^L, A_1^M, A_1^N, A_1^U)$ ,  $\tilde{A}_2 = (A_2^L, A_2^M, A_2^N, A_2^U)$ ,  $\tilde{A}_3 = (A_3^L, A_3^M, A_3^N, A_3^U)$  and  $\tilde{A}_4 = (A_4^L, A_4^M, A_4^N, A_4^U)$  are same type of fuzzy numbers.

**2.6 Branch and Bound:** Branching is the process of partitioning a large problem into two or more subproblems and Bounding is the process of calculating a lower bound on the optimal solution of a given subproblems.

**2.7 Dominance Property:** While subdividing a subproblem  $P^k_\sigma$  into  $(n-k)$  subproblems, a careful analysis would help us to create only one subproblem instead of  $n-k$  subproblems. This is called dominance property. This will reduce the computational effort to a greater extent. In a subproblem  $P^k_\sigma$ , if there exists a job  $i \in \sigma^1$  such that  $d_i \geq q_\sigma$ , then it is sufficient to create only one subproblem  $P^{k+1}_{i\sigma}$ . The remaining subproblems under  $P^k_\sigma$  can be ignored. In the bounding process,  $V_{i\sigma} = V_\sigma$ .

III. ARITHMETIC OPERATIONS ON TYPE-2 TRAPEZOIDAL FUZZY NUMBER:

**3.1 Arithmetic Operations:**

$$\begin{aligned} \tilde{a} &= (\tilde{a}_1, \tilde{a}_2, \tilde{a}_3, \tilde{a}_4) \\ &= ((a_1^L, a_1^M, a_1^N, a_1^U), (a_2^L, a_2^M, a_2^N, a_2^U), (a_3^L, a_3^M, a_3^N, a_3^U), (a_4^L, a_4^M, a_4^N, a_4^U)) \\ \tilde{b} &= (\tilde{b}_1, \tilde{b}_2, \tilde{b}_3, \tilde{b}_4) \\ &= ((b_1^L, b_1^M, b_1^N, b_1^U), (b_2^L, b_2^M, b_2^N, b_2^U), (b_3^L, b_3^M, b_3^N, b_3^U), (b_4^L, b_4^M, b_4^N, b_4^U)) \end{aligned}$$

be two type-2 trapezoidal fuzzy numbers.

Then we define  $\tilde{a} + \tilde{b} = (a_1^L + b_1^L, a_1^M + b_1^M, a_1^N + b_1^N, a_1^U + b_1^U)$

**(i) Addition**

$$\tilde{a} + \tilde{b} = \{(a_1^L + b_1^L, a_1^M + b_1^M, a_1^N + b_1^N, a_1^U + b_1^U), (a_2^L + b_2^L, a_2^M + b_2^M, a_2^N + b_2^N, a_2^U + b_2^U), (a_3^L + b_3^L, a_3^M + b_3^M, a_3^N + b_3^N, a_3^U + b_3^U), (a_4^L + b_4^L, a_4^M + b_4^M, a_4^N + b_4^N, a_4^U + b_4^U)\}.$$

**(ii) Subtraction:**

$$\tilde{a} - \tilde{b} = \{(a_1^L - b_1^U, a_1^M - b_1^N, a_1^N - b_1^M, a_1^U - b_1^L), (a_2^L - b_2^U, a_2^M - b_2^N, a_2^N - b_2^M, a_2^U - b_2^L), (a_3^L - b_3^U, a_3^M - b_3^N, a_3^N - b_3^M, a_3^U - b_3^L), (a_4^L - b_4^U, a_4^M - b_4^N, a_4^N - b_4^M, a_4^U - b_4^L)\}.$$

**(iii) Multiplication:**

$$\begin{aligned} \tilde{a} \times \tilde{b} &= \\ &= \left( \left( \frac{a_1^L \sigma b}{16}, \frac{a_1^M \sigma b}{16}, \frac{a_1^N \sigma b}{16}, \frac{a_1^U \sigma b}{16} \right), \left( \frac{a_2^L \sigma b}{16}, \frac{a_2^M \sigma b}{16}, \frac{a_2^N \sigma b}{16}, \frac{a_2^U \sigma b}{16} \right), \right. \\ &\left. \left( \frac{a_3^L \sigma b}{16}, \frac{a_3^M \sigma b}{16}, \frac{a_3^N \sigma b}{16}, \frac{a_3^U \sigma b}{16} \right), \left( \frac{a_4^L \sigma b}{16}, \frac{a_4^M \sigma b}{16}, \frac{a_4^N \sigma b}{16}, \frac{a_4^U \sigma b}{16} \right) \right) \end{aligned}$$

Where  $\sigma b = b_1^L + b_1^M + b_1^N + b_1^U + b_2^L + b_2^M + b_2^N + b_2^U + b_3^L + b_3^M + b_3^N + b_3^U + b_4^L + b_4^M + b_4^N + b_4^U$ .

**(iv) Division:**

$$\begin{aligned} \frac{\tilde{a}}{\tilde{b}} &= \\ &= \left( \left( \frac{16a_1^L}{\sigma b}, \frac{16a_1^M}{\sigma b}, \frac{16a_1^N}{\sigma b}, \frac{16a_1^U}{\sigma b} \right), \left( \frac{16a_2^L}{\sigma b}, \frac{16a_2^M}{\sigma b}, \frac{16a_2^N}{\sigma b}, \frac{16a_2^U}{\sigma b} \right), \right. \\ &\left. \left( \frac{16a_3^L}{\sigma b}, \frac{16a_3^M}{\sigma b}, \frac{16a_3^N}{\sigma b}, \frac{16a_3^U}{\sigma b} \right), \left( \frac{16a_4^L}{\sigma b}, \frac{16a_4^M}{\sigma b}, \frac{16a_4^N}{\sigma b}, \frac{16a_4^U}{\sigma b} \right) \right) \end{aligned}$$

$$\left( \frac{16a_3^L}{\sigma b}, \frac{16a_3^M}{\sigma b}, \frac{16a_3^N}{\sigma b}, \frac{16a_3^U}{\sigma b} \right), \left( \frac{16a_4^L}{\sigma b}, \frac{16a_4^M}{\sigma b}, \frac{16a_4^N}{\sigma b}, \frac{16a_4^U}{\sigma b} \right)$$

**3.2. Ranking on Type-2 Trapezoidal Fuzzy number:**

Let F ( R ) be the set of all type-2 normal trapezoidal fuzzy number on convenient approach for solving numerical value problem is based on the concept of comparison of fuzzy number by use of ranking function. An effective approach for ordering the elements of F(R) is to define a linear ranking function  $\tilde{R} : F(R) \rightarrow R$  which maps each fuzzy number into R.

Suppose if  $\tilde{A} = (\tilde{A}_1, \tilde{A}_2, \tilde{A}_3, \tilde{A}_4)$ ,  
 $= ( (A_1^L, A_1^M, A_1^N, A_1^U), (A_2^L, A_2^M, A_2^N, A_2^U), (A_3^L, A_3^M, A_3^N, A_3^U), (A_4^L, A_4^M, A_4^N, A_4^U) )$

Then we define  $R(\tilde{A}) = (A_1^L + A_1^M + A_1^N + A_1^U + A_2^L + A_2^M + A_2^N + A_2^U + A_3^L + A_3^M + A_3^N + A_3^U + A_4^L + A_4^M + A_4^N + A_4^U) / 16$ .

Also, we define orders on F(R) by

$$R \left( \begin{matrix} \approx \\ \tilde{A} \end{matrix} \right) \geq R \left( \begin{matrix} \approx \\ \tilde{B} \end{matrix} \right) \text{ if and only if } \tilde{A} \geq \tilde{B}$$

$$R \left( \begin{matrix} \approx \\ \tilde{A} \end{matrix} \right) \leq R \left( \begin{matrix} \approx \\ \tilde{B} \end{matrix} \right) \text{ if and only if } \tilde{A} \leq \tilde{B}$$

$$R \left( \begin{matrix} \approx \\ \tilde{A} \end{matrix} \right) = R \left( \begin{matrix} \approx \\ \tilde{B} \end{matrix} \right) \text{ if and only if } \tilde{A} = \tilde{B}$$

**3.3 Notations:**

- n : The total number of independent jobs.
- j : Represents the jth job, j = 1, 2, ..., N.
- t<sub>j</sub> : The Processing time of the job j.
- d<sub>j</sub> : The due date of the job j.
- C<sub>j</sub> : The Completion time of the job j

$$T_j : \begin{cases} c_j - d_j & \text{if } c_j > d_j \\ 0, & \text{otherwise} \end{cases}$$

- NT<sub>j</sub> : Number of the tardy jobs.
- T<sub>max</sub> : Maximum tardiness.
- J : Location of ith job on machine k.
- N : Total number of jobs to be scheduled.
- K : Machine on which ith job is assigned at position j.
- σ : The set of Scheduled jobs at the end of the sequence.

- σ : The set of unscheduled jobs.
- (or) complement of σ .
- q<sub>σ</sub> = q<sub>φ</sub> : The sum of the processing times of unscheduled jobs in σ .
- iσ : Partial sequence in which σ is immediately preceded by job i.
- P<sub>σ<sup>k</sup></sub> : A subproblem at level k in the branching tree. In this subproblem the last k positions in the sequence are assigned some jobs.
- V<sub>σ</sub> : Value associated with p<sub>σ<sup>k</sup></sub> which is combination of jobs to total tardiness.

**3.4 Algorithm:**

The processing times of jobs and due date are uncertain. This leads to the use of Type-2 trapezoidal fuzzy numbers for representing these imprecise values. First we convert the Type-2 trapezoidal fuzzy numbers into crisp number described in the processing times and due date.

**Step-1:**

Place P<sub>φ<sup>0</sup></sub> on the active list; its associated values are V<sub>φ</sub> = 0 and q<sub>φ</sub> =  $\sum_{j=1}^n t_j$ . At a given stage of the algorithm, the active list consists of all the terminal nodes of the partial tree created up to that stage.

**Step-2 ;**

Remove the first subproblem P<sub>σ<sup>k</sup></sub> from the active list. If k is equal to n-1, stop. Prefix the missing job with σ and treat it as the optimal sequence. Otherwise, check the dominance property for P<sub>σ<sup>k</sup></sub>. If the property holds, go to step 3; otherwise go to step 4.

**Step -3:**

Let the job j be the job with the largest due date in σ<sup>1</sup>. Create the subproblem P<sub>jσ<sup>k+1</sup></sub> with q<sub>jσ</sub> = q<sub>σ</sub> - t<sub>j</sub>, V<sub>jσ</sub> = V<sub>σ</sub>, b<sub>jσ</sub> = V<sub>σ</sub>. Place P<sub>jσ<sup>k+1</sup></sub> on the active list, ranked by its lower bound. Return to step 2.

**Step-4 :**

Create (n-k) subproblems, one for each i ∈ σ<sup>1</sup>. For P<sub>iσ<sup>k+1</sup></sub>, let, q<sub>iσ</sub> = q<sub>σ</sub> - t<sub>j</sub>, V<sub>iσ</sub> = V<sub>σ</sub> + max ( 0, q<sub>σ</sub> - d<sub>i</sub> ), b<sub>iσ</sub> = V<sub>iσ</sub>. Now place each P<sub>iσ<sup>k+1</sup></sub> on the active list, ranked by its lower bound. Return to step -2.

IV. NUMERICAL ILLUSTRATION

In milk producing factory, they required two processes to produce using single machine.

Initially, put the soya in the machine there are two processes done by the machine. (i) Crushed the soya to produce milk is the first process made by the machine. (ii) That milk will be packed by respective quantities is the second process made by the same machine. These two processes are having separate processing times (P<sub>1</sub>, P<sub>2</sub>). Here, we consider the processing time and due time are not always deterministic. So, we have associated this times with type-2 trapezoidal fuzzy numbers.

| Job j | Processing time P <sub>1</sub>                          | Processing time P <sub>2</sub>                         | Processing time t <sub>j</sub>                               | Due date d <sub>j</sub>   |
|-------|---|--|--|---|
| 1     | (2,4,6,8)<br>(2,6,10,14)<br>(4,8,12,16)<br>(0,6,12,18)  | (2,4,6,8)<br>(4,5,6,7)<br>(6,7,8,9)<br>(4,8,12,16)     | (4,8,12,16)<br>(6,11,16,21)<br>(10,15,20,25)<br>(4,14,24,34) | (8,16,24,32)<br>(13,16,19,22)<br>(14,18,22,26)<br>(15,20,25,30) |
| 2     | (1,2,3,4)<br>(1,3,5,7)<br>(2,4,6,8)<br>(0,3,6,9)        | (1,2,3,4)<br>(1,3,5,7)<br>(2,4,6,8)<br>(0,3,6,9)       | (2,4,6,8)<br>(2,6,10,14)<br>(4,8,12,16)<br>(0,6,12,18)       | (4,8,12,16)<br>(6,12,18,24)<br>(8,16,24,32)<br>(12,14,16,18)    |
| 3     | (1,2,3,4)<br>(3,6,9,12)<br>(6,10,14,18)<br>(8,12,16,20) | (2,4,6,8)<br>(2,6,10,14)<br>(4,8,12,16)<br>(0,6,12,18) | (3,6,9,12)<br>(5,12,19,26)<br>(10,18,26,34)<br>(8,18,28,38)  | (8,16,24,32)<br>(12,24,36,48)<br>(16,32,48,64)<br>(24,28,32,36) |
| 4     | (-2,-1,1,2)<br>(1,2,3,4)<br>(2,4,6,8)<br>(5,10,15,20)   | (1,2,3,4)<br>(1,3,5,7)<br>(2,4,6,8)<br>(0,3,6,9)       | (-1,1,4,6)<br>(2,5,8,11)<br>(4,8,12,16)<br>(5,13,21,29)      | (8,12,16,20)<br>(6,12,18,24)<br>(13,17,21,25)<br>(8,16,24,32)   |
| 5     | (1,2,3,4)<br>(2,4,6,8)<br>(3,6,9,12)<br>(0,6,12,18)     | (1,2,3,4)<br>(2,4,6,8)<br>(3,6,9,12)<br>(0,6,12,18)    | (2,4,6,8)<br>(4,8,12,16)<br>(6,12,18,24)<br>(0,12,24,36)     | (5,10,15,20)<br>(10,20,30,40)<br>(15,20,25,30)<br>(25,35,45,55) |

**Step -1:**

Active list at level 0 = {P<sub>φ</sub><sup>0</sup>}. σ = {φ} σ<sup>1</sup> = {1,2,3,4,5}, V<sub>φ</sub> = 0 & q<sub>φ</sub> = 61. Since the current level k(0) is not equal to n-1(4). Check the dominance property. Also  $\max_{i \in \sigma^1} d_i = 30$ . Since this maximum is not greater than q<sub>φ</sub>. The details of computations of the lower bound for each of the node is

| $P_{i\sigma}^1$ | $V_{i\sigma} = V_{\sigma} + \max(0, q_{\sigma} - d_i)$ | $b_{i\sigma} = v_{i\sigma}$ |
|-----------------|--|-----------------------------|
| $P_1^1$         | $0 + \max(0, 61-20) = 41$                              | 41                          |
| $P_2^1$         | $0 + \max(0, 61-15) = 46$                              | 46                          |
| $P_3^1$         | $0 + \max(0, 61- 30) = 31$                             | 31                          |
| $P_4^1$         | $0 + \max(0, 61- 17) = 44$                             | 44                          |
| $P_5^1$         | $0 + \max(0,61- 25) = 36$                              | 36                          |

Active list =  $\{P_3^1(31), P_2^1(46)\}$

$P_5^1(36), P_1^1(41), P_4^1(44),$

**Step-2:**

check the dominance property,  $\sigma = \{3\}, \sigma' = \{1,2,4,5\}, q_{\sigma} = 61-17 = 44. \max_{i \in \sigma'} d_i = 25.$   
 Since, this maximum value is not greater than  $q_{\sigma}(25)$ . The details of computations of the lower bound for each of the node is

| $P_{i\sigma}^2$ | $V_{i\sigma} = V_{\sigma} + \max(0, q_{\sigma} - d_i)$ | $b_{i\sigma} = v_{i\sigma}$ |
|-----------------|--|-----------------------------|
| $P_{13}^2$      | $31 + \max(0, 44-20) = 55$                             | 55                          |
| $P_{23}^2$      | $31 + \max(0, 44-10) = 60$                             | 60                          |
| $P_{43}^2$      | $31 + \max(0,44-17) = 58$                              | 58                          |
| $P_{53}^2$      | $31 + \max(0,44-25) = 50$                              | 50                          |

Active list =  $\{P_5^1(36), P_1^1(41), P_{13}^2(55), P_{43}^2(58), P_{23}^2(60)\}.$

$P_4^1(44), P_2^1(46), P_{53}^2(50),$

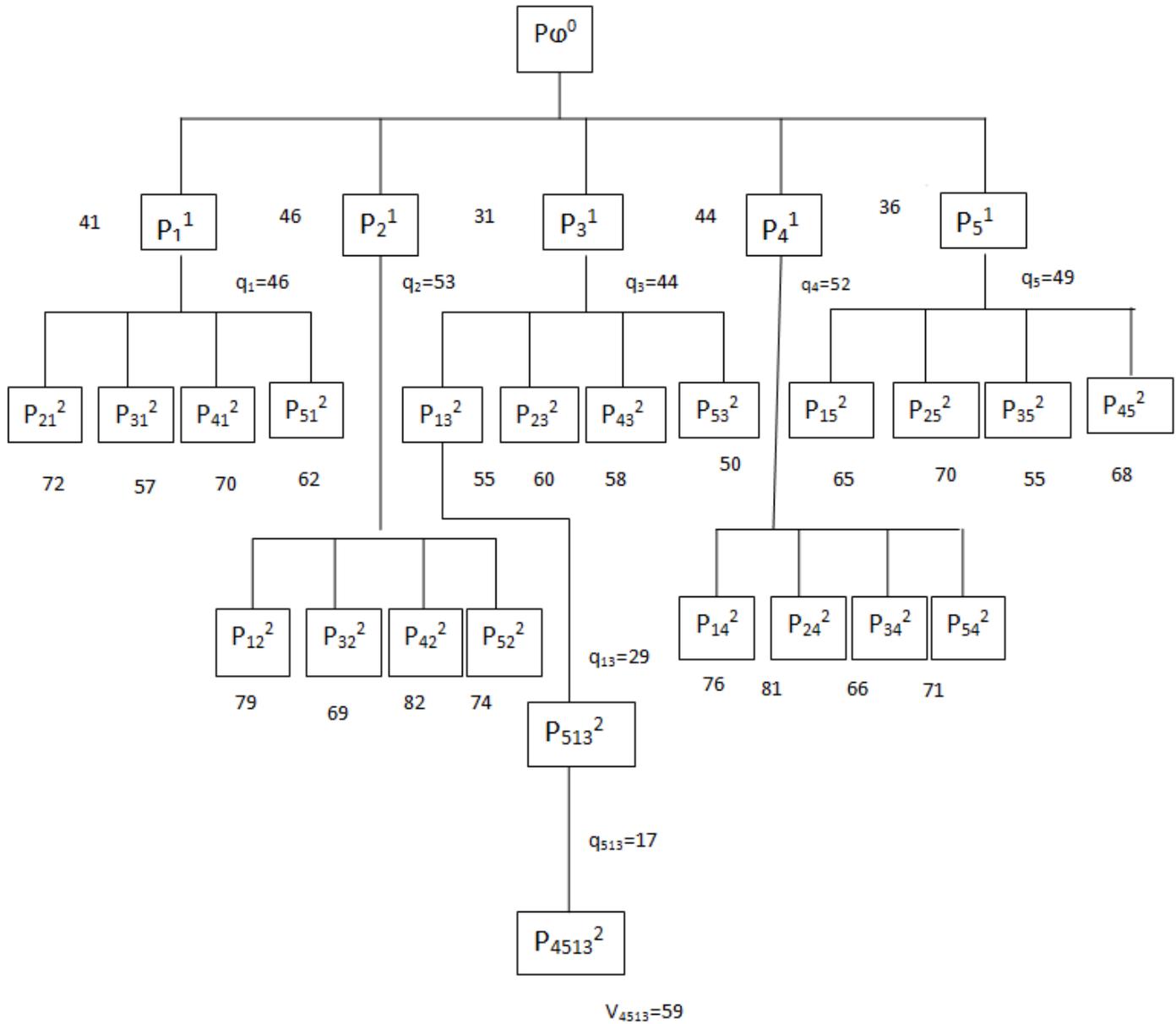
**Step-3:**

This subproblem occurs at level 3 which is not equal to (4). Hence, check the dominance property,  $\sigma = \{5,1,3\} \sigma' = \{2,4\} q_{513} = q_{13} - t_5 29-12 = 17. \max_{i \in \sigma'} d_i = 17.$  Since the maximum value is equal to  $q_{\sigma} (17)..$

**Step-4:**

Job 4 has an element in  $\sigma'$  which has the highest due date. Hence based on the dominance property the subproblem  $P_{513}^3$  is further partitioned with a single branch  $P_{4513}^4.$   
 $\sigma = \{5,1,3\} \& j = 4, q_{\sigma} = 17. V_{j\sigma} = V_{\sigma} + \max(0, q_{\sigma} - d_j) = 59 + \max(0, 17-17) = 59.$

**TREE DIAGRAM**



The minimum total tardiness value is 59.

### V. CONCLUSION

We considered single machine scheduling problem (SMSP) with fuzzy processing time and fuzzy due date to minimize the total tardiness. This method is very easy to understand each stage that will help the decision maker in determining a best schedule for a given set of jobs effectively. This method has significant use of practical results in industries.

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# A Study on Customer Satisfaction in Airways - Coimbatore City

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**Abstract-** Air transport being the most and the quickest mode of transport have been gaining popularity. However, the exorbitant rates have made it the mode of travel of the rich or of the business community for whom time is more expensive than air travel. The main objective of the study was to find out the customer satisfaction in airways in various objects like price, quality, services & source of booking.

**Index Terms-** Airport, Source of Booking, Customer Satisfaction

## I. INDIAN AIR TRANSPORT INFRASTRUCTURE

Indian air transport is one of the fastest developing aviation sectors of the world. In recent years, Indian air transport has witnessed a boom which has given rise to the need for improving Indian air transport infrastructure like never before.

The reason for that is an upsurge in demand for air travel, much of which owes to the opening of a host of low-cost airlines by the private sector.

### Airlines in India

Kingfisher Airlines, Air India and Jet Airways are the most popular brands in domestic air travel in order of their market share. These airlines connect more than 80 cities across India and also operate overseas routes after the liberalization of Indian aviation. However, a large section of country's air transport system remains untapped, even though the Mumbai-Delhi air corridor was ranked 6th by the Official Airline Guide in 2007 among the world's busiest routes.

India's vast unutilized air transport network has attracted several investments in the Indian air industry in the past few years. More than half a dozen low-cost carriers entered the Indian market in 2004-05. Major new entrants include Air Deccan, Kingfisher Airlines, SpiceJet, GoAir, Paramount Airways and IndiGo Airlines. To meet India's rapidly increasing demand for air travel, Air India recently placed orders for more than 68 jets from Boeing for 7.5 billion USD while Indian placed orders for 43 jets from Airbus for 2.5 billion USD. Jet Airways, India's largest private carrier, has invested millions of dollars to increase its fleet, but this has been put on hold due to the recent economic slowdown. This trend is not restricted to traditional air carriers in India. IndiGo Airlines entered the limelight when it announced orders for 100 Airbus A320s worth 6 billion USD during the Paris Air Show; the highest by any Asian domestic carrier. Kingfisher Airlines became the first Indian air carrier in June 15, 2005 to order Airbus A380 aircraft. The total deal with Airbus was worth 3 billion USD.

### Airports in India

Thirty major airports and infinite air terminal are genuinely trying to make India an easily air accessible place from several years. India is a massive country with excellent internal flight routes that reaches almost every nooks and corner of the country. Airport Authority of India administers all the prominent airports throughout the country. Airport Authority was come into being on 1st April 1995, which comprises of international as well as domestic airports in India. To accelerate the integrated progress, extension and modernization of the amenities of airport that meets the needs of the international standard is the only objective of the Airport Authority of India (AAI).

In the last few decades the infrastructure of the country has undergone severe change and development especially in the civil aviation sector of India. To manage the enormous growth in the airline industry of India modern airports have introduced in all over the country. Thus in the recent years several investments have been made in the air industry to make use of its large unutilized air transport network. Low cost air terminal have also introduced in the Indian Market in last few years. This creates a boom in the Indian economy and thus causes huge benefits in the tourism industry in India.

## II. EXISTING POSITION

- There are 449 airports/airstrips in the country. Among these, the AAI owns and manages 5 international airports, 87 domestic airports and 28 civil enclaves at Defence airfields and provides air traffic services over the entire Indian airspace and adjoining oceanic areas.
- In 1998-99, these 120 airports/civil enclaves handled 4.20 lakh aircraft movements involving 24.17 million domestic and 12.83 million international passengers and 221 thousand metric tons of domestic cargo and 468 thousand metric tons of international cargo. 51 percent of traffic was handled at the international airports at Mumbai and Delhi. Presently various airlines are operating only through 61 airports. The remaining are lying unutilised at best handling occasional aircraft operations.
- The turnover of the Authority was Rs.1591.27 crores for the year ended March, 1999 and under audit figure of the Post Tax Profits for the year ended is Rs.208.41 crores as against Rs.196.14 crores for the year ended March, 1998.
- Historically, air traffic at Indian airports has broadly followed a particular distribution pattern, except that some

airports have changed their inter-se position vis-a-vis volume of traffic.

### Air Traffic Control (ATC)

Air traffic control (ATC) involves communication with aircraft to help maintain separation — that is, they ensure that aircraft are sufficiently far enough apart horizontally or vertically for no risk of collision. Controllers may co-ordinate position reports provided by pilots, or in high traffic areas (such as the United States) they may use radar to see aircraft positions.

There are generally four different types of ATC:

- center controllers, who control aircraft en route between airports
- Control towers (including tower, ground control, clearance delivery, and other services), which control aircraft within a small distance (typically 10–15 km horizontal, and 1,000 m vertical) of an airport.
- Oceanic controllers, who control aircraft over international waters between continents, generally without radar service.
- terminal controllers, who control aircraft in a wider area (typically 50–80 km) around busy airports.

### Airports Authority of India

The Airports Authority of India (AAI) is an organization working under the Ministry of Civil Aviation that manages all the airports in India. The AAI manages and operates 126 airports including 12 international airports, 89 domestic airports and 26 civil enclaves. The corporate headquarters(CHQ) are at Rajiv Gandhi Bhawan, Safdarjung Airport, New Delhi. V.P Agrawal is the current chairman of the AAI.

### History

The AAI was formed on 1 April 1995 by merging the National Airports Authority (NAA) and the International Airports Authority of India (IAAI), to create a centralized organization that could effectively manage both the international and domestic airports. Presently, it is owned 100% by the Government of India.

### Main Functions of AAI

- Control and management of the Indian airspace extending beyond the territorial limits of the country, as accepted by ICAO
- Design, Development, Operation and Maintenance of International and Domestic Airports and Civil Enclaves.
- Construction, Modification and Management of Passenger Terminals
- Development and Management of Cargo Terminals at International and Domestic airports.
- Provision of Passenger Facilities and Information System at the Passenger Terminals at airports.
- Expansion and strengthening of operation area viz. Runways, Aprons, Taxiway, etc.
- Provision of visual aids.
- Provision of Communication and Navigational aids viz. ILS, DVOR, DME, Radar, etc.

### III. AIRPORT CLASSIFICATION

Airports are presently classified in the following manner:

- International Airports: - These are declared as international airports and are available for scheduled international operations by Indian and foreign carriers. Presently, Mumbai, Delhi, Chennai, Calcutta and Thiruvananthapuram are in this category.
- Domestic Airports:
  - a) Customs Airports with limited international operations: - These have customs and immigration facilities for limited international operations by national carriers and for foreign tourist and cargo charter flights. These include Bangalore (CE), Hyderabad, Ahmedabad, Calicut, Goa (CE), Varanasi, Patna, Agra (CE), Jaipur, Amritsar,

Tiruchirapally, Coimbatore, Lucknow. (CE - Civil Enclave)

- b) Model Airports:- These domestic airports have minimum runway length of 7500 feet and adequate terminal capacity (400 passengers or more) to handle Airbus 320 type of aircraft. These can cater to limited international traffic also, if required. These include Bhubaneswar, Guwahati, Nagpur, Vadodara, Imphal and Indore. Rest 6 Nos. of airports, developed under Model Airports concept have graduated to the classification of Customs Airports, given above.

- c) Other Domestic Airports:- All other 71 domestic airports are covered in this category.

d) Civil Enclaves in Defence Airport:- There are 28 civil enclaves in Defence airfields. Twenty civil enclaves are in operation.

### Coimbatore Airport

Coimbatore Airport is an accomplished airport of the city of Coimbatore and is located in the Peelamedu region of the city. In the earlier years it was known as the Peelamedu or Coimbatore Civil Aerodrome and is at a distance of 13 Miles (21 kilometers) from the city center. The airport had its commencement in the 1940's in the form of a civil aerodrome with just a few airplanes of the Indian Airlines. From that period for a considerable phase the air services were restricted to the cities of Chennai and Mumbai. However, in the later years services to Cochin and Bangalore were also added. The airport in the 80s had a thorough transformation when it was closed down for runway expansion so as to enable modern day's jets like Boeing 737 and Airbus to operate. The year 1987 is a landmark in the history of this airport since on that year the project of runway expansion was completed and a new terminal started operation.

Nowadays, the airport is served by 10 airlines and 5 more are likely to initiate their operations in the coming years. In the meanwhile, two reputed international airlines SilkAir and SriLankan Airlines started operations to Coimbatore, linking

Coimbatore with Singapore and Colombo. The other two international airlines that are operating from here are Air Arabia and Air India-Express. In the airport there is also a runway that is 10,000 feet in length and it is destined that the final expansion will expand it to 12,500 ft in length. This will be done to handle wide bodied aircrafts in a better manner.

The airport is on the verge of expansion and projects are being chalked out in this direction. The airport authority is pondering over the construction of a parallel taxiway to reduce the runway occupancy time and turnaround of aircraft. In addition, plans for modernizing the present terminal with all modern facilities are sought after.

**History**

The airport commenced operations in 1940 as a civil aerodrome with Indian Airlines operating Fokker F27, Douglas DC-3 and later Hawker Siddeley HS 748 aircraft.[6] Beginning with services to Chennai and Bangalore, other destinations like Cochin and Mumbai were added later. The airport was modernized with an extended runway to accommodate larger aircraft like the Boeing 737 and was reopened in 1987. The Sulur Air Force Base located further east of Coimbatore was temporarily used for civil aviation during this period. As of 2012, the airport is served by more than ten domestic and international carriers.

The Prime Minister of India declared the government's intention to upgrade Coimbatore Airport to International status in a meeting with senior ministers on 6 June 2012 and the Union Cabinet granted it the status of international airport on October 2, 2012.

**Infrastructure**

The airport has one runway that is 9,760 feet (2,970 m) in length extended from 8,500 ft (2,600 m) to accommodate larger aircraft. The runway is further slated to be extended to 12,500 feet (3,800 m) to handle wide bodied aircraft such as the Airbus A380. New domestic and international divisions were added in 2010 to the already existing common terminal and an Instrument Landing System (ILS) is in place since 2008.[9] The airport has a parking management system with a capacity to accommodate

nearly 300 cars.[10] There are two hangars in the airport; one provides housing for the planes of Coimbatore Flying Club, the other provides shelter for private carriers.

Although the status of International airport was conferred only in 2012, the airport has had provisions for, and has been receiving, international flights (primarily from Sharjah) since the 1990s and Silk Air from Singapore Changi airport since 2006. Srilankan Airlines from Colombo operated for a short period. The service was stopped due to security reasons. FluDudai is planning to start their operations in some time

**Airport Structure**

The airport has one runway that is 9,760 feet (2,970 m) in length - previously the runway was 8,500 ft (2,600 m) in length. Because of this runway expansion, the airport can accommodate aircraft such as the Boeing 747 and Airbus A330. An Instrument Landing System (ILS) is also being installed

The further proposed expansion of the airport includes the construction of a parallel taxiway to the runway. This will minimize the runway occupancy time and turnaround of aircraft, as aircraft currently taxi on the runway. Two more parking bays will be added, raising the total number to eight. The terminal will also be modernized with sliding doors, aero-bridges, and modern systems for baggage-handling.

**Proposed Expansion**

The further proposed expansion of the airport includes extension of runway to 12,500 ft (3,800 m) to accommodate larger aircraft such as the Boeing 747 and Airbus A380 and construction of a parallel taxiway to the runway to minimize runway occupancy time and turnaround time of aircraft. Two more parking bays will be added, raising the total number of bays to 10. Now the airport can accommodate a330 aircraft though no airline flies one. The airport is expected to accommodate a380 and 747 when expansion is complete. The airport has received approval for expansion but work has been postponed due to some local problems.

**Airlines in Coimbatore airport**

| Airlines           | Destinations   |
|--------------------|--|
| Air Arabia         | Sharjah  |
| Air Costa          | Bangalore, Hyderabad, Vijayawada, Tirupati                     |
| Air India          | Delhi, Kozhikode, Mumbai                                       |
| IndiGo             | Bhubaneswar, Chennai, Delhi, Mumbai                            |
| Jet Konnect        | Bangalore, Chennai, Mumbai                                     |
| Silkair            | Singapore  |
| SpiceJet           | Ahmedabad, Chennai, Delhi, Hyderabad, Mumbai<br>Chennai, Delhi |
| Blue Dart Aviation | Bangkok-Suvamabhumi, Sharjah                                   |
| Yanda Airlines     |  |

### Boarding Systems

Analytical and simulation results show that group/zone boarding can speed up the airplane boarding process. Airlines use a number of different group/zone boarding systems or boarding rules, the idea (there are numerous variations) of some of them, are shown below. By pressing play you can view a simulation of different airplane boarding strategies. Note, random boarding (i.e. boarding all rows at the same time) is faster than back-to-front boarding. Hence, you will actually speed up the boarding process if you board before your turn in back-to-front boarding.

### Airline meal

An airline meal or in-flight meal is a meal served to passengers on board a commercial airliner. These meals are prepared by airline catering services.

## IV. ENTERTAINMENT

Interior modification and refurbishment work provides an ideal opportunity to improve passenger flight enjoyment with an upgrade to your entertainment systems. With little or no increase in downtime, we can enhance your cabin's entertainment system with state-of-the-art CD/DVD players, flat screen monitors, speakers & headsets, and Airshow moving maps.

### Airline complaints

Airline complaints are any type of formal complaint filed by an airline customer either to the airline responsible for the grievance or the government office responsible for overseeing the airlines national industry. Airline complaints generally arise out of problems experienced during air travel that were left unresolved.

### Air safety

Air safety is a term encompassing the theory, investigation and categorization of flight failures, and the prevention of such failures through regulation, education and training. It can also be applied in the context of campaigns that inform the public as to the safety of air travel.

### Some of the air safety topics are:

Lighting  
Ice and snow  
Engine failure  
Fire  
Bird strike  
Ground damage  
Human factor

### Booking of Airline Tickets

Booking airline tickets has become an art form. One day too late, or choose the wrong layover, and you're paying hundreds more than you need to. It takes a lot of sleuthing and a bit of finesse to get the seat you want, the price you need and the dates you prefer. Here's how to get from point A to point B--on your own terms.

Instructions

1] Start your search at least 21 days ahead of time to take advantage of advance-booking fares. Travel midweek and stay over a Saturday night whenever possible. Stay on your toes: The cheap seats always sell out first.

2] Look for flights on your frequent-flier carrier first and compare its cheapest rate to those on sites such as Priceline.com, Expedia.com and Travelocity.com. Also check out consolidators such as AirTravelCenter.com and auction sites. Many airline Web sites offer lower Internet-only fares.

3] Consider flying through a secondary airport. Orange County and Burbank are alternatives to LAX, and Newark International can substitute for the busier and oft-delayed JFK or LaGuardia airports. You may have to drive further, but if flights are impossible to get or impossibly expensive, you might be surprised by the ease of use and friendlier prices of smaller airports.

4] Request your seat preference (aisle or window) when buying your ticket. You could find yourself with a middle seat if you wait until check-in. SeatGuru.com has detailed maps of the best and worst seats on specific planes, so you can avoid seats that don't recline and keep an eye out for those with extra leg room.

5] Request any special assistance or equipment (such as a wheelchair) for disabled travelers prior to arriving at the airport.

6] Keep the length of the flight, the layovers, the amount of gear you're carrying and the time of day in mind when deciding whether to buy a seat (often discounted) for an infant. Domestic carriers permit you to hold children under 2 years of age on your lap, while international flights require a ticket and a seat for every passenger.

7] Place special meal orders at no extra charge, if they are offered on your flight. For example, United offers diabetic, low fat and low cholesterol, low-calorie, high-fiber, low-protein, low-sodium, kosher and vegan meals. There are also meals for children. These special meals are often tastier than the regular fare.

8] Find out whether tickets are refundable, transferable or changeable (and at what cost) before you buy. Get e-tickets when possible. Having paper tickets mailed usually involves an extra fee, and they're like cash: If you lose them, they're gone.

## V. REVIEW OF LITERATURE

Vasu Krishnasami on 6 may 2006 the review of Coimbatore airport is tiny! Too many passengers use this airport. The potential of this City is enormous! Government needs to show some care for Coimbatore.

Sharon Wilson on 28 April 2006 Contrary to what I had expected to find at a small, domestic airport, the terminal was beautifully clean well laid out with the benefit of some shops, friendly staff who helped us through the security and check- in process. Ladies toilets (both Indian and Western style) were acceptably clean. A/C was okay if you were standing under it. I would have no hesitation in travelling through this airport again on future visits to India. Well done to those who maintain the Airport - keep up the good work.

Coimbatore airport expansion to take off soon By **V.S. Palaniappan** in his review Coimbatore Aug. 20. With the district administration gearing for the land acquisition process, the much-awaited expansion of the Coimbatore Airport at Peelamedu is set to take off shortly. The preliminary work of

land acquisition for airport expansion might get under way before September-end.

The Collector, N. Muruganandam, said an exclusive revenue team would be formed to acquire almost 114 acres most of which are private "patta lands" lying contiguous to the airport.

The administrative sanction which the district administration had sought from the State Government for setting up a team for acquisition is expected any time within a month.

On obtaining it, the land acquisition process would get under way, he said. The entire exercise might take a minimum of six months to a year.

The cost involved had been put at Rs. 3.72 crores and the Airports Authority of India had already given an assurance that it would deposit the money with the Government the moment acquisition process begins, the **Airport Director, N.K. Sinha**, told The Hindu.

The AAI had been keenly pushing through the land acquisition process as the runway expansion and widening would be a pre-requisite for enhancing the airport's capacity in terms of passenger flow and cargo handling.

The main constraint in increasing the passenger/cargo capacity was the length of the runway.

The present 7500 feet runway is inadequate to operate bigger and wider-bodied aircraft especially the higher version of the Boeing or Jet aircraft.

Bigger runways are a must for the Airbus 300 type of aircraft.

The runway length had to be increased to 9000 feet and corresponding strengthening needed to make it suitable to take on higher aircraft load.

The trade and industry in the Coimbatore region has been seeking expansion for handling future increase in passenger as well as cargo traffic considering the growing business potential including the export/import of cargo to and from Coimbatore.

The airport authorities view that lack of infrastructure in general and inadequate runway in particular at airports in a way responsible for the limited freight operation.

The AAI's renewed effort on runway expansion got a fillip after the visit by the Parliamentary Consultative Committee on Civil Aviation to the Coimbatore airport recently.

Once the expansion work is completed, the AAI would be in a position to lure various airliners to operate international flights from Coimbatore, which again depended largely on the passenger traffic potential that Coimbatore could generate, AAI officials pointed out.

**Sujay Mehdudia in his review**, a new integrated terminal building was being constructed at the Madurai airport and the Coimbatore airport terminal building would be expanded by May 2010.

A master plan for upgrading the Tuticorin airport in phases had been prepared and the Tamil Nadu government asked to provide 586 acres of land free and without encumbrances to the Airports Authority of India, he said.

## VI. RESEARCH METHODOLOGY

### SCOPE OF THE STUDY:

The project aims to study the customer's satisfaction level in airways in various objects. For this purpose primary data were collected by questionnaire method.

### OBJECTIVE OF THE STUDY:

- ✓ To study about the consumers opinion on price, quality, services & sources of booking.
- ✓ To study the consumers level of satisfaction towards various factors of airline services.
- ✓ To study the effectiveness of quality & service of the airlines.
- ✓ To study the consumers satisfaction level in the boarding efficiency & baggage delivery timings.
- ✓ To study the consumers satisfaction in overall courteous & helpfulness.

### LIMITATIONS:

- ✓ This study covers only the customers who travel in the air, sample of 75 was selected together.
- ✓ As the questionnaire method was used the analysis was carried out based on the information provided by the respondents.

### TOOLS USED:

The following tools are used to analyse the data for the various objective of the study.

- ✓ Percentage analysis
- ✓ Chi-square test
- ✓ Rank analysis

### PERCENTAGE ANALYSIS

In this section different table formed for all the data available from this sample. Further interpretation is given for the entries given in table. This analysis helps a common man to understand, what percentage of respondents belongs to each category. Also by giving information in term of percentage we use the standardization. The results are given one after another.

### CHI-SQUARE ANALYSIS

This chi-square test is the study of finding whether any one factors has association with other. The chi-square tests were carried out at 5% level significance. Under the hypothesis of independent of attributes the expected frequencies for any of the frequencies can be obtained on modifying in the dividing the product by the total frequency N.

Chi-square formulae, which is used in this study is given below.

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

If p value is less than the  $\alpha$  value , the Null hypothesis may be rejected.

VII. ANALYSIS AND INTERPRETATION

**TABLE NO:1**

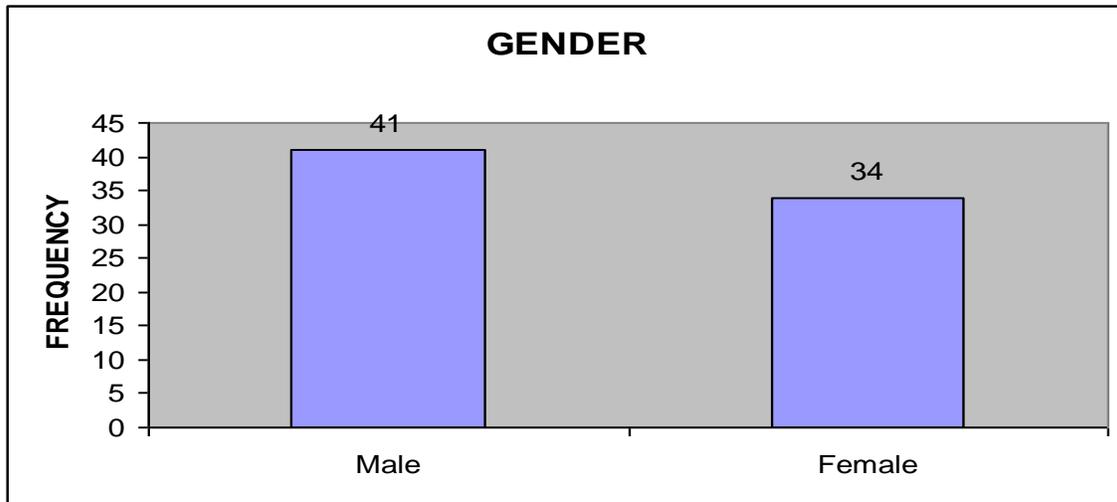
The following table shows the gender details for 75 respondents.

|       |        | <b>gender</b> |         |
|-------|--------|---------------|---------|
|       |        | Frequency     | Percent |
| Valid | male   | 41            | 54.7    |
|       | female | 34            | 45.3    |
|       | Total  | 75            | 100.0   |

The above table shows that 54.7% of the respondents are males, 45.3% of the respondents are females. The majority of the respondents are males.

**CHAT NO: 1**

The following chart shows the gender details for 75 respondents



**TABLE NO:2**

The following table shows the age details for 75 respondents.

### age

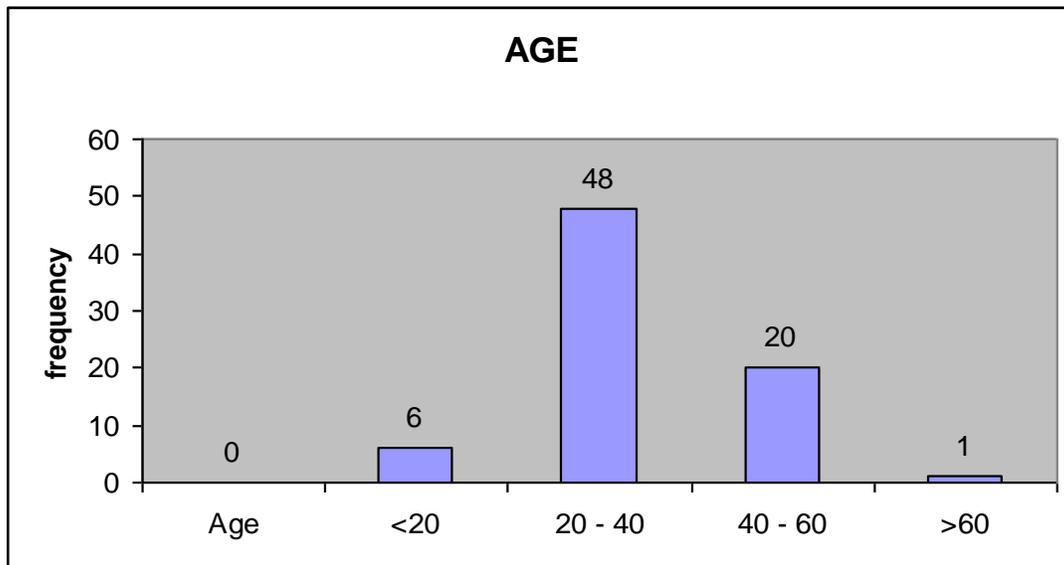
|           | Frequency | Percent |
|-----------|-----------|---------|
| Valid <20 | 6         | 8.0     |
| 20-40     | 48        | 64.0    |
| 40-60     | 20        | 26.7    |
| >60       | 1         | 1.3     |
| Total     | 75        | 100.0   |

The following table shows that 8% of the respondents belongs to the age group below 20 years, 64% of the respondents belong to the age group of 20-40 years, 26.7% of the respondents are belong to the age group 40-60, and 1.3% of the respondents belong to the age group above 60 years.

The majority of the respondents are in the age group of 20-40 years.

#### CHART NO: 2

The following table shows the age details for the 75 respondents.



#### TABLE NO: 3

The following table shows the marital status for 75 respondents.

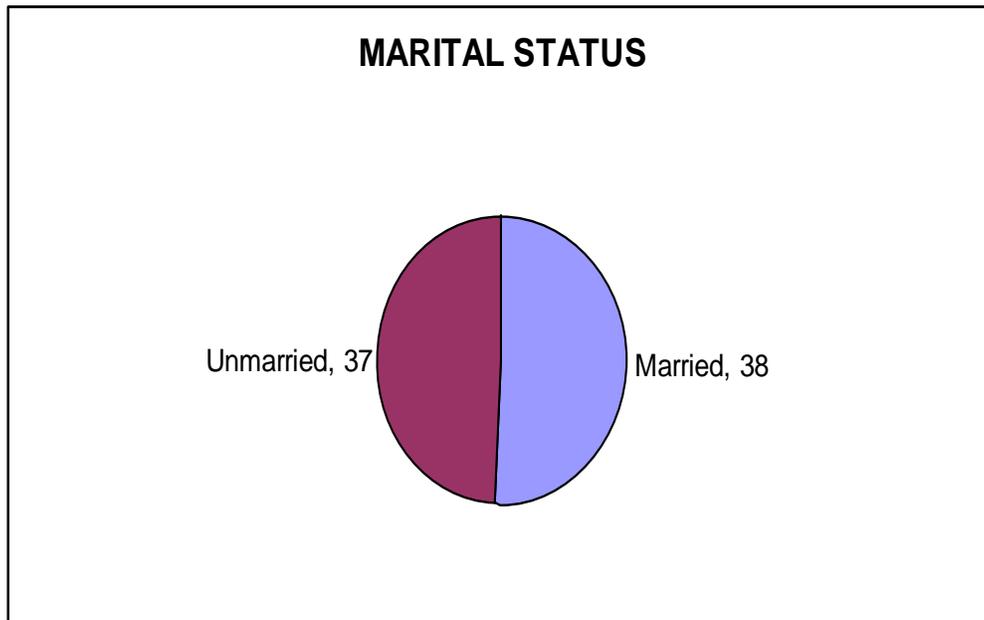
### marital status

|       |           | Frequency | Percent |
|-------|-----------|-----------|---------|
| Valid | married   | 38        | 50.7    |
|       | unmarried | 37        | 49.3    |
|       | Total     | 75        | 100.0   |

The above table shows that 50.7% of the respondents were married and 49.3% of the respondents were unmarried. The majority of the respondents are married people.

#### CHART NO:3

The following chart shows the marital status for 75 respondents.



#### TABLE NO: 4

The following table shows the educational qualification of the respondents.

### educational qualification

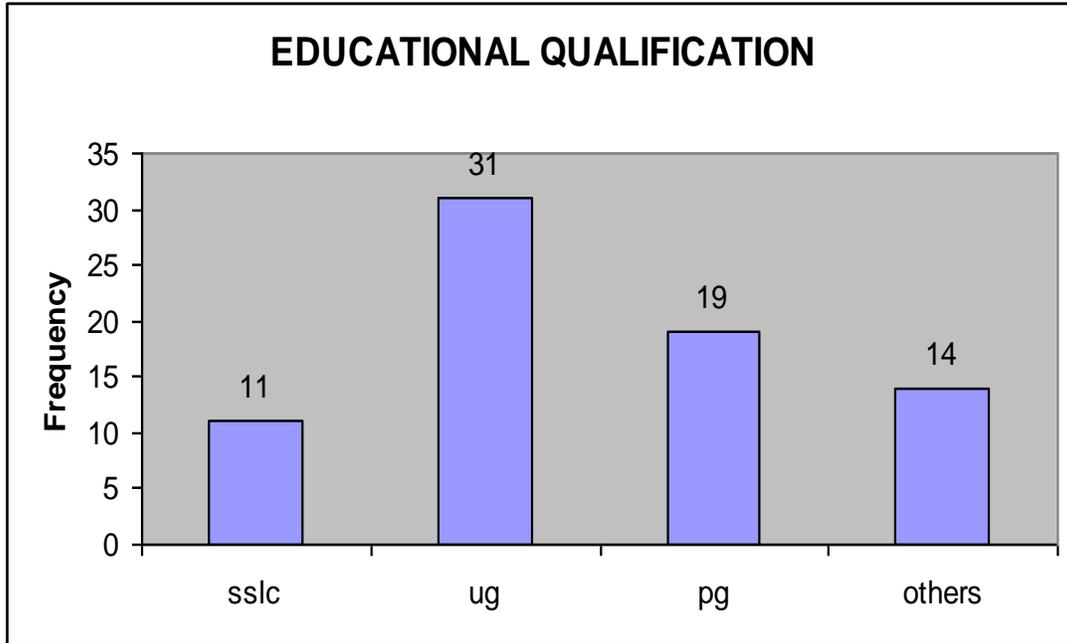
|       |                | Frequency | Percent |
|-------|----------------|-----------|---------|
| Valid | sslc           | 11        | 14.7    |
|       | under graduate | 31        | 41.3    |
|       | post graduate  | 19        | 25.3    |
|       | others         | 14        | 18.7    |
|       | Total          | 75        | 100.0   |

The above table shows that the 14.7% of the respondents belongs to SSLC, 41.3% of the respondents belongs to under graduates, 25.3% of the respondents are belongs to post graduates, & 18.7 percentage of the respondents belongs to other streams.

The majority of the respondents are under graduates.

**CHART NO: 4**

The following chart shows the details of educational qualification of the respondents.



**TABLE NO: 5**

The following table shows the occupation details of the 75 respondents.

**occupation**

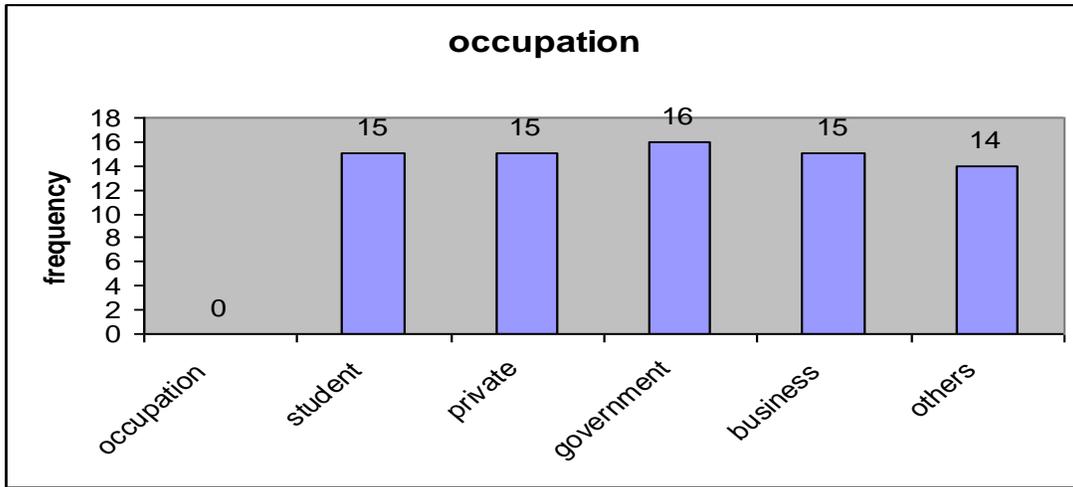
|       |            | Frequency | Percent |
|-------|------------|-----------|---------|
| Valid | student    | 15        | 20.0    |
|       | private    | 15        | 20.0    |
|       | government | 16        | 21.3    |
|       | business   | 15        | 20.0    |
|       | others     | 14        | 18.7    |
|       | Total      | 75        | 100.0   |

The above table shows that 20% of the respondents are students, 20 % of the respondents are private working people, 21.3% of the respondents are working in government sector, 20% of the people are doing business & 18.7% of the respondents are in other jobs.

The majority of the respondents are government sector people.

**CHART NO: 5**

The following table shows the occupation details of the 75 respondents.



**TABLE NO: 6**

The following table shows the monthly income of the 75 respondents.

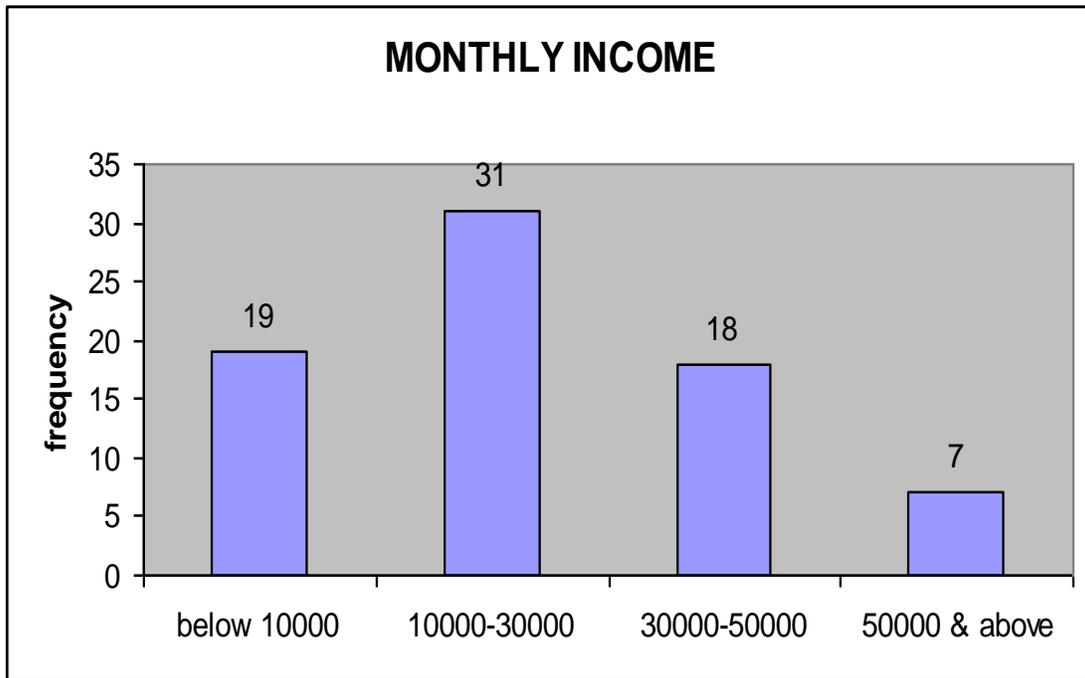
|       |               | Frequency | Percent |
|-------|---------------|-----------|---------|
| Valid | below 10000   | 19        | 25.3    |
|       | 10000-30000   | 31        | 41.3    |
|       | 30000-50000   | 18        | 24.0    |
|       | 50000 & above | 7         | 9.3     |
|       | Total         | 75        | 100.0   |

The above table shows that 25.3% of the respondents belong to the monthly income below 10000, 41.3% of the respondents are belong to the monthly income 10000-30000, 24% of the respondents are belong to the monthly income 30000-50000, 9.3% of the respondents are belong to the monthly income above 50000.

The majority of the respondents are belonging monthly income 10000-30000.

**CHART NO: 6**

The following chart shows the monthly income of the 75 respondents.

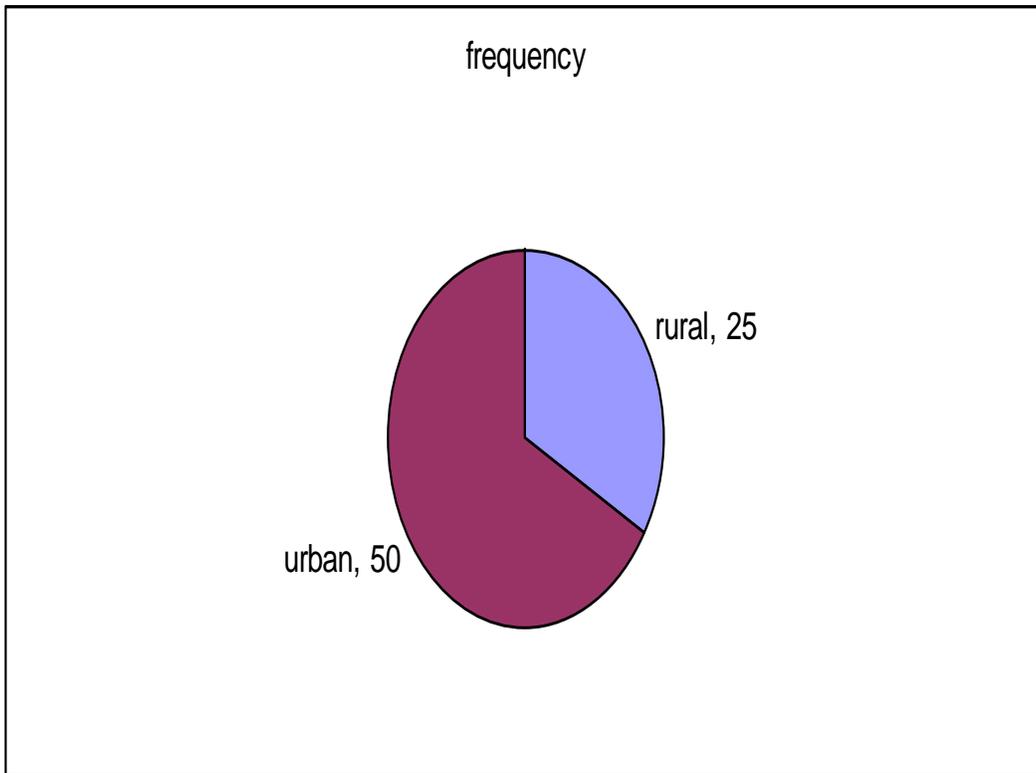


**TABLE NO: 7**  
 The following table shows the residence of the 75 respondents.

|       |       | area      |         |
|-------|-------|-----------|---------|
|       |       | Frequency | Percent |
| Valid | rural | 25        | 33.3    |
|       | urban | 50        | 66.7    |
| Total |       | 75        | 100.0   |

The above table shows that 33.3% of the respondents were rural area and 66.7% of the respondents were urban area. The majority of the respondents are belonging urban area.

**CHART NO: 7**  
 The following chart shows the residence of the 75 respondents.



**TABLE NO: 8**

The following table shows the purpose of traveling of the 75 respondents.

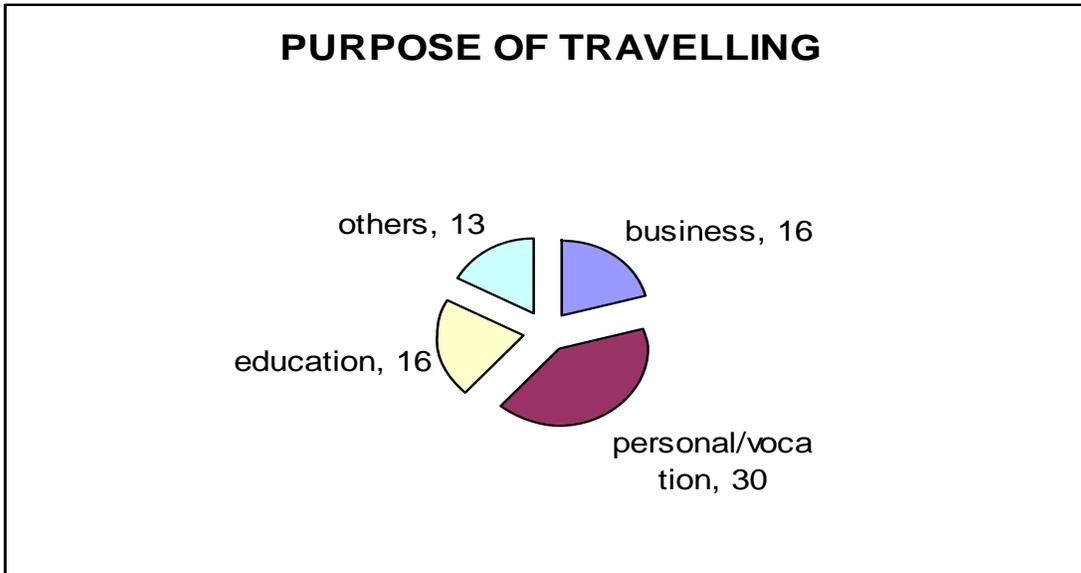
| purpose of travelling |                   |           |         |
|-----------------------|-------------------|-----------|---------|
|                       |                   | Frequency | Percent |
| Valid                 | business          | 16        | 21.3    |
|                       | personal/vocation | 30        | 40.0    |
|                       | education         | 16        | 21.3    |
|                       | others            | 13        | 17.3    |
|                       | Total             | 75        | 100.0   |

The above table shows that 21.3% of the respondents are travelling for the purpose of business, 40% of the respondents are travelling for the purpose of personal/vocation 21.3% of the respondents are travelling for the purpose of education and 13% of the respondents are traveling for other purposes .

The majority of the respondents are travelling for the purpose of personal/vocation.

**CHART NO: 8**

The following chart shows the purpose of traveling of the 75 respondents.



**TABLE NO: 9**  
 The following table shows the class in which the respondents are travelling.

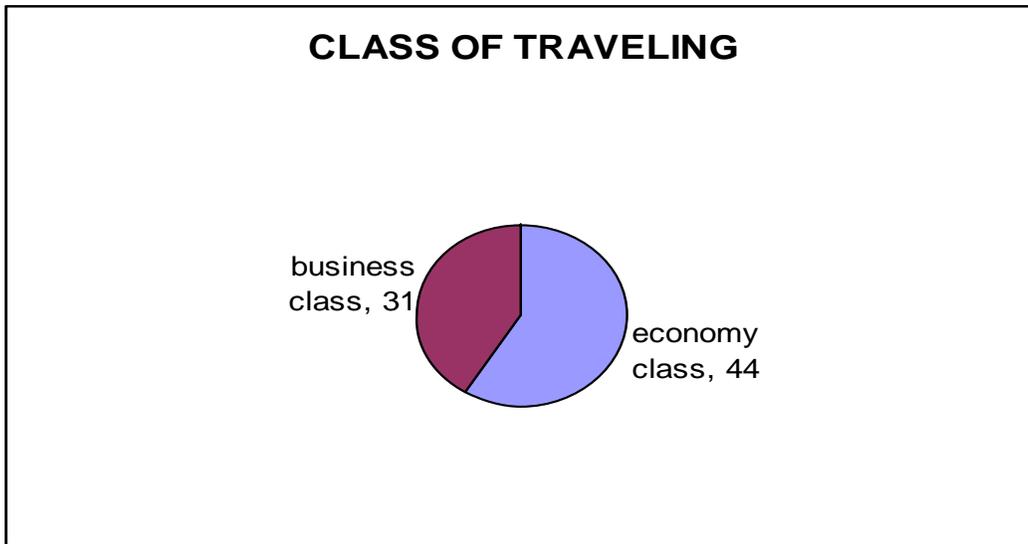
**class of travelling**

|       |                | Frequency | Percent |
|-------|----------------|-----------|---------|
| Valid | economy class  | 44        | 58.7    |
|       | business class | 31        | 41.3    |
|       | Total          | 75        | 100.0   |

The above table shows that 58.7% of the respondents are travelling in economy class and 41.3% of the respondents are travelling in business class.

The majority of the respondents are travelling in economy class.

**CHART NO: 9**  
 The following chart shows the class in which the respondents are travelling.



**TABLE NO: 10**

The following table shows the booking of airline tickets of 75 respondents.

**Booking airline tickets**

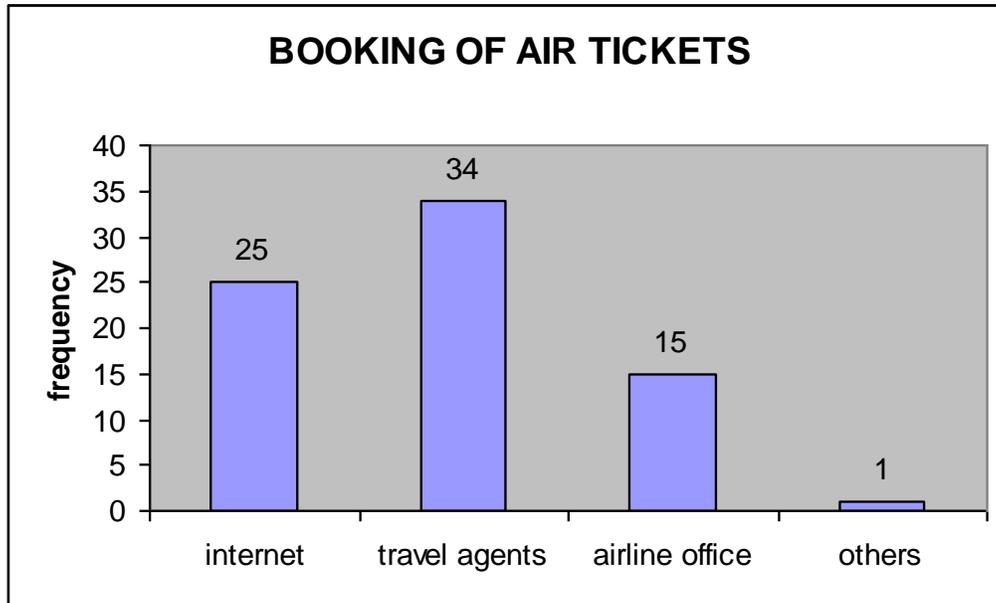
|                | Frequency | Percent |
|----------------|-----------|---------|
| Valid internet | 25        | 33.3    |
| travel agents  | 34        | 45.3    |
| airline office | 15        | 20.0    |
| others         | 1         | 1.3     |
| Total          | 75        | 100.0   |

The above table shows that 33.3% of the respondents are booking the tickets by internet, 45.3% of the respondents are booking the tickets by travel agents, 20% of the respondents are booking the tickets by airline office and 1.3% of the respondents are booking by other ways.

The majority of the respondents are booking their tickets by travel agents.

**CHART NO: 10**

The following chart shows the booking of airline tickets of the 75 respondents.



**TABLE NO: 11**

The following table shows the number of times the respondents travel by air during last year.

**Number of times travelled during last year**

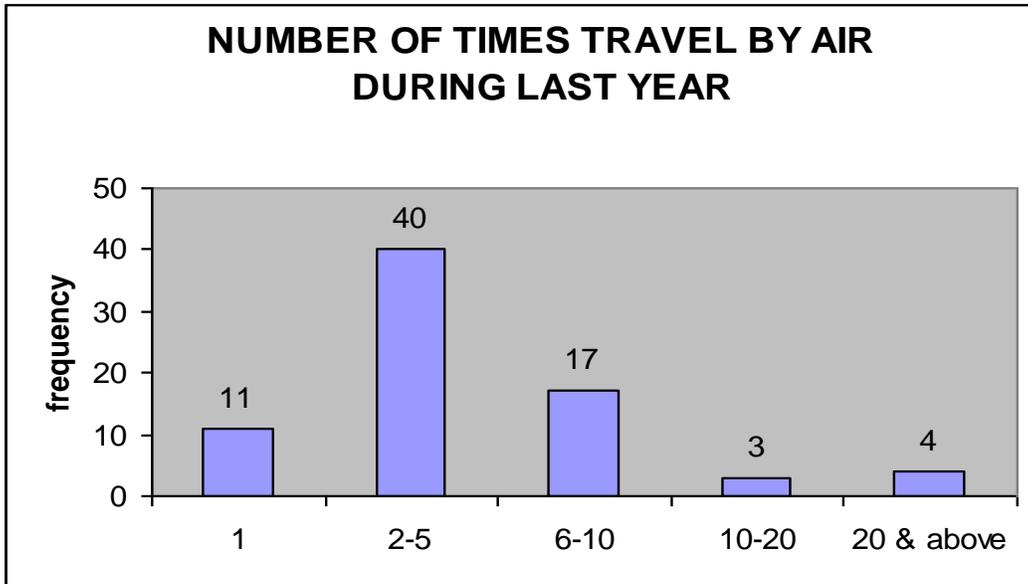
|       |            | Frequency | Percent |
|-------|------------|-----------|---------|
| Valid | 1          | 11        | 14.7    |
|       | 2-5        | 40        | 53.3    |
|       | 6-10       | 17        | 22.7    |
|       | 10-20      | 3         | 4.0     |
|       | 20 & above | 4         | 5.3     |
|       | Total      | 75        | 100.0   |

The above table shows that 14.7% of the respondents are travelled once during the last year, 53.3% of the respondents are travelled 2-5 times in the last year, 22.7% of the respondents are travel 6-10 times in the last year, 5.3% of the respondents are travelled more than 20times in the last year.

The majority of the respondents are travelled 2-5 times by air in the last year.

**CHART NO: 11**

The following chart shows the number of times travel by air during last year of the 75 respondents.



**TABLE NO: 12**

The following table shows the satisfaction level of the price of the airline selected.

**rating the price of the airline**

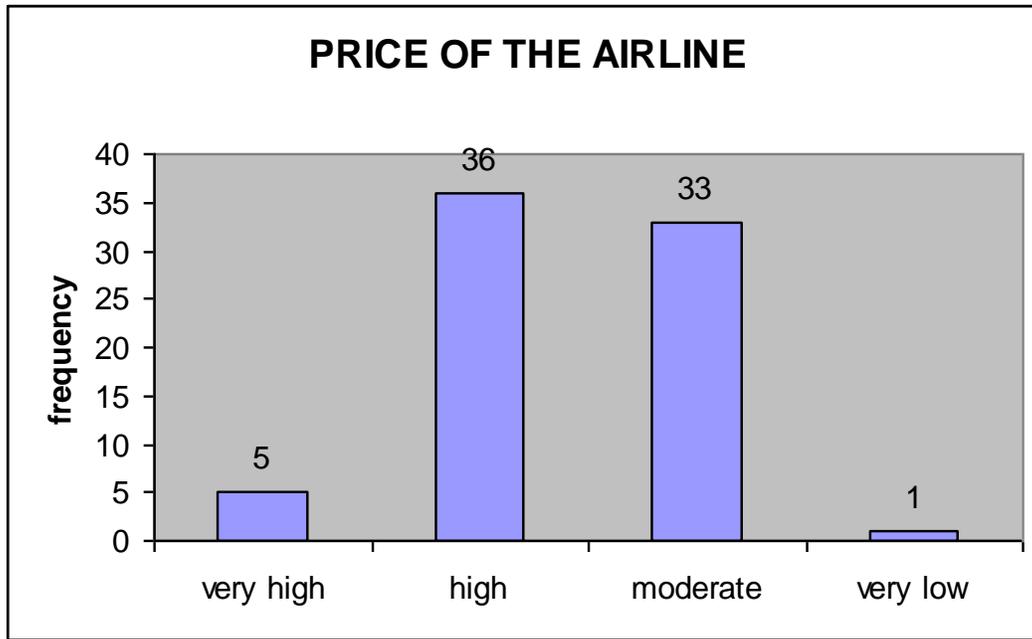
|       |           | Frequency | Percent |
|-------|-----------|-----------|---------|
| Valid | very high | 5         | 6.7     |
|       | high      | 36        | 48.0    |
|       | moderate  | 33        | 44.0    |
|       | very low  | 1         | 1.3     |
|       | Total     | 75        | 100.0   |

The above table shows that 6.7% of the respondents are rate that the price of the airline is very high, 48% of the respondents are rate that the price of the airline is high, 44% of the respondents are rate that the price of the airline is moderate & 1.3% of the respondents are rate that the price of the airline is very low.

The majority of the respondents are rate that the price of the airline is high.

**CHART NO: 12**

The following chart shows the satisfaction level of the price of the airline selected.



**TABLE NO: 13**

The following table shows the satisfaction level of the quality & service of the airline selected.

**Rating the quality and service of the airline**

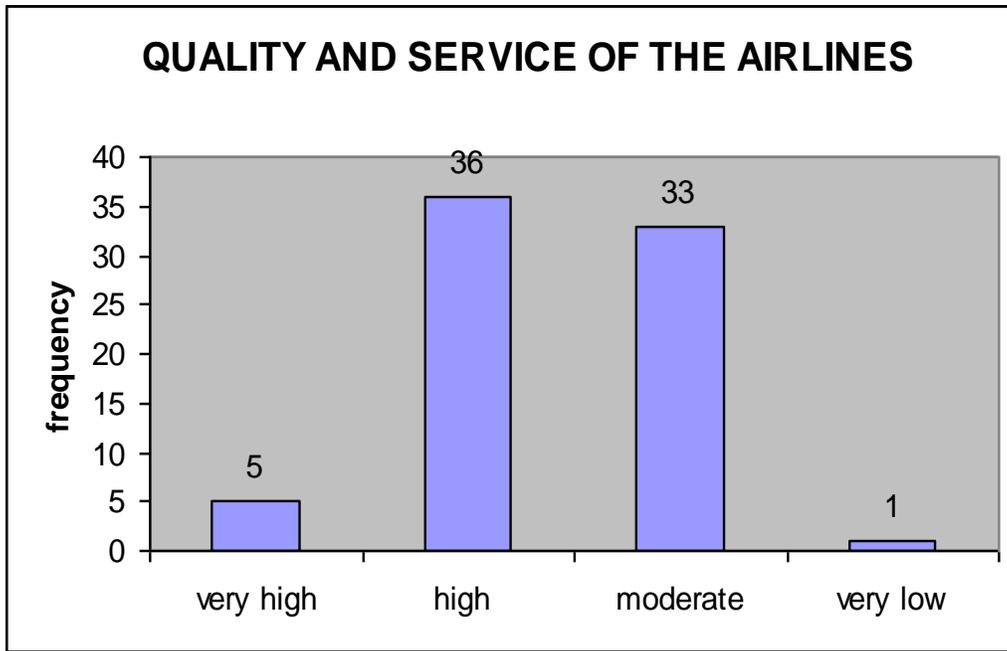
|       |                     | Frequency | Percent |
|-------|---------------------|-----------|---------|
| Valid | highly satisfied    | 9         | 12.0    |
|       | satisfied           | 59        | 78.7    |
|       | moderate            | 6         | 8.0     |
|       | highly dissatisfied | 1         | 1.3     |
| Total |                     | 75        | 100.0   |

The above table shows that 12% of the respondents are highly satisfied with the quality and service provided by the airlines, 78.7% of the respondents are satisfied with the quality and service provided by the airlines, 8% of the respondents are feeling moderate with the quality and service provided by the airlines, 1.3% of the respondents are highly dissatisfied with the quality and service provided by the airlines,

The majority of the respondents are satisfied with the quality and service provided by the airlines.

**CHART NO: 13**

The following chart shows the satisfaction level of the quality & service of the airline selected.



**TABLE NO: 14**

The following table shows the safety of the airline selected.

**rating the safety of the airline**

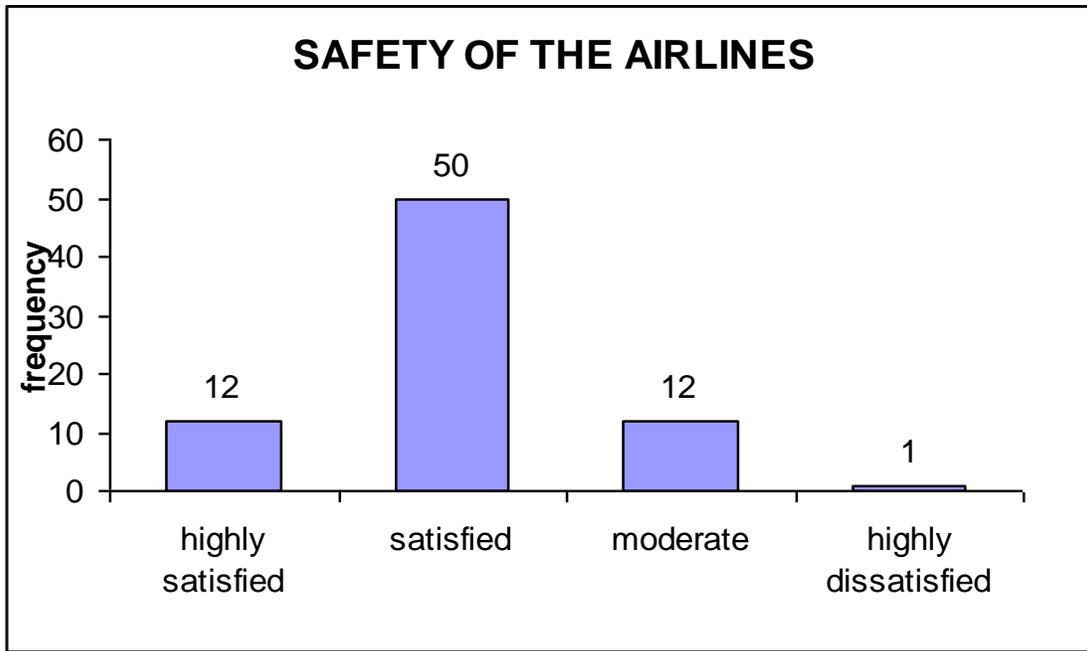
|       |                     | Frequency | Percent |
|-------|---------------------|-----------|---------|
| Valid | highly satisfied    | 12        | 16.0    |
|       | satisfied           | 50        | 66.7    |
|       | moderate            | 12        | 16.0    |
|       | highly dissatisfied | 1         | 1.3     |
|       | Total               | 75        | 100.0   |

The above table shows that 16% of the respondents are highly satisfied with the safety provided by the airlines, 78.7% of the respondents are satisfied with the safety provided by the airlines, 8% of the respondents are feeling moderate with the safety provided by the airlines, 1.3% of the respondents are highly dissatisfied with the safety provided by the airlines.

The majority of the respondents are satisfied with the safety provided by the airlines.

**CHART NO: 14**

The following chart shows the safety of the airline selected.



**TABLE NO: 15**

The following table shows the respondents being waited in the queue of baggage check in counter.

**respondents waiting time in the queue of express baggage check in counter**

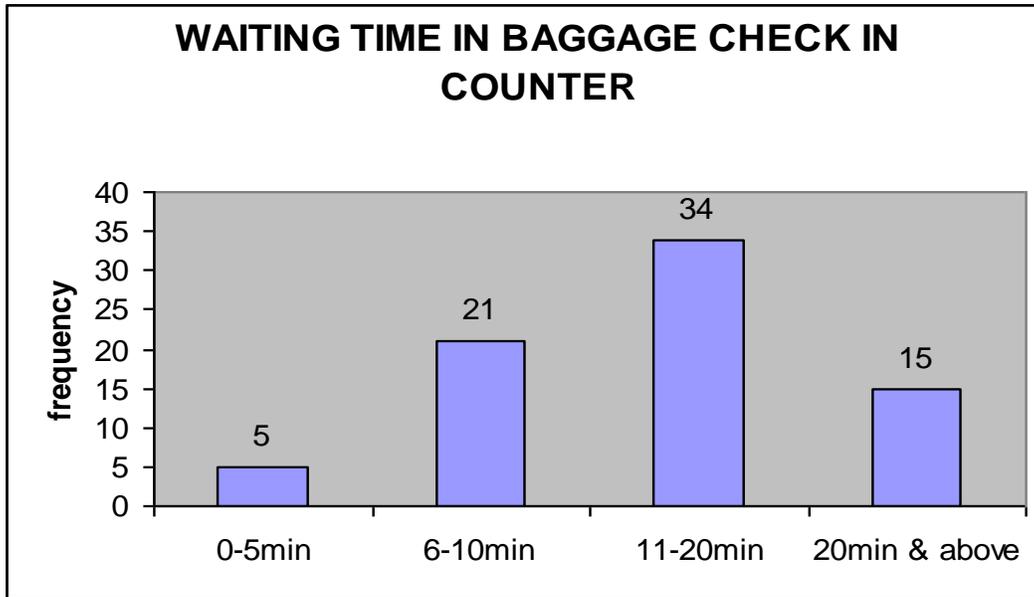
|       |               | Frequency | Percent |
|-------|---------------|-----------|---------|
| Valid | 0-5min        | 5         | 6.7     |
|       | 6-10min       | 21        | 28.0    |
|       | 11-20min      | 34        | 45.3    |
|       | 20min & above | 15        | 20.0    |
|       | Total         | 75        | 100.0   |

The above table shows that 6.7% of the respondents are waited in the queue of baggage check in counter for 0-5minutes, 28% of the respondents are waited in the queue of baggage check in counter for 6-10minutes, 45.3% of the respondents are waited in the queue of baggage check in counter for 11-20minutes, & 20% of the respondents are waited in the queue of baggage check in counter for more than 20minutes time.

The majority of the respondents are waited in the queue of express baggage check in counter for 11-20minutes duration of time.

**CHART NO: 15**

The following chart shows the respondents being waited in the queue of baggage check in counter.



**TABLE NO: 16**

The following table shows the respondents being waited in the queue of aircraft boarding.

**respondents waiting time in the queue of aircraft boarding**

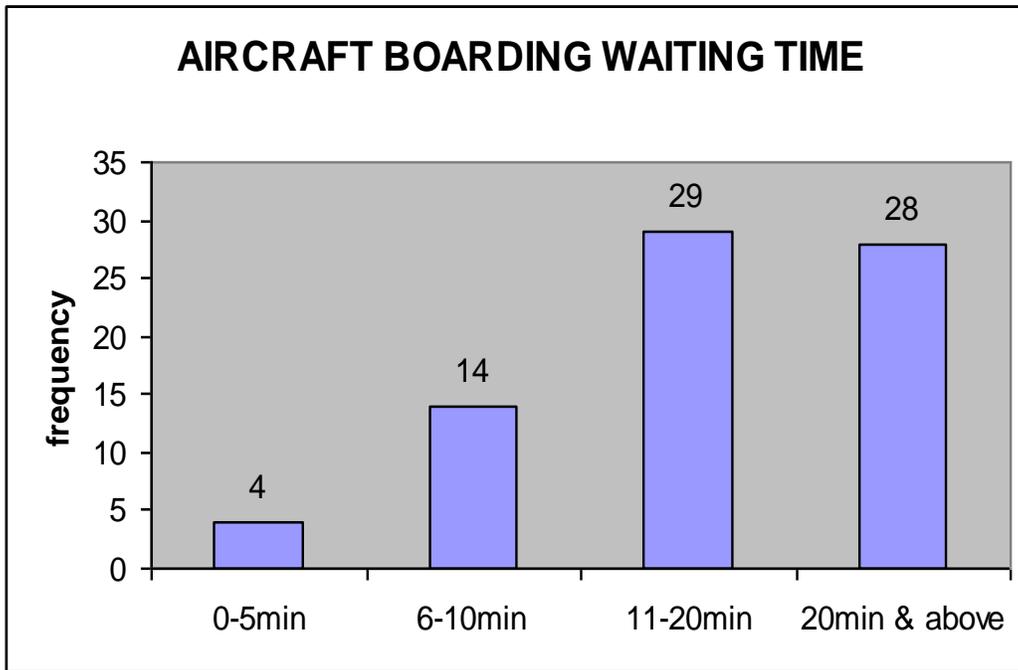
|       |               | Frequency | Percent |
|-------|---------------|-----------|---------|
| Valid | 0-5min        | 4         | 5.3     |
|       | 6-10min       | 14        | 18.7    |
|       | 11-20min      | 29        | 38.7    |
|       | 20min & above | 28        | 37.3    |
| Total |               | 75        | 100.0   |

The above table shows that 5.3% of the respondents are waited in the queue of aircraft boarding for 0-5minutes, 18.7% of the respondents are waited in the queue of aircraft boarding for 6-10minutes, 38.7% of the respondents are waited in the queue of aircraft boarding for 11-20minutes, & 37.3% of the respondents are waited in the queue of aircraft boarding for more than 20minutes time.

The majority of the respondents are waited in the queue of aircraft boarding counter for 11-20minutes of time.

**CHART NO: 16**

The following chart shows the respondents being waited in the queue of aircraft boarding.



**TABLE NO: 17**

The following table shows the respondents being waited in the queue of security check point.

**respondents waiting time in the queue of security check point**

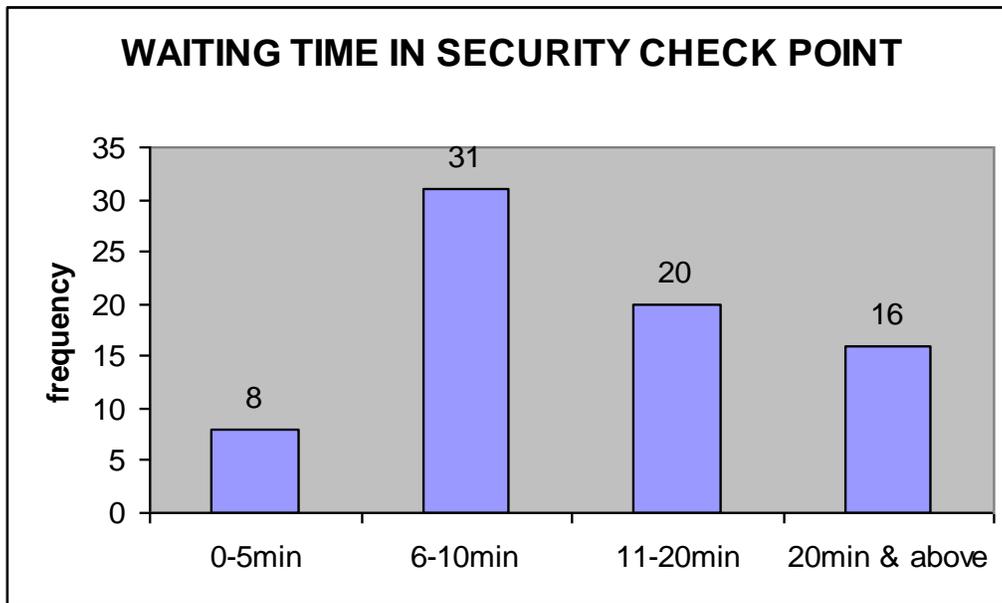
|       |               | Frequency | Percent |
|-------|---------------|-----------|---------|
| Valid | 0-5min        | 8         | 10.7    |
|       | 6-10min       | 31        | 41.3    |
|       | 11-20min      | 20        | 26.7    |
|       | 20min & above | 16        | 21.3    |
|       | Total         | 75        | 100.0   |

The above table shows that 10.7% of the respondents are waited in the queue of security check point for 0-5minutes, 41.3% of the respondents are waited in the queue of security check point for 6-10minutes, 26.7% of the respondents are waited in the queue of security check point for 11-20minutes, & 21.3% of the respondents are waited in the queue of security check point for more than 20minutes time.

The majority of the respondents are waited in the queue of security check point counter for 6-10minutes duration of time.

**CHART NO: 17**

The following chart shows the respondents being waited in the queue of aircraft boarding.



**TABLE NO: 18**

The following table shows how much important the departure or arrival time while making a decision to choose the airline.

**importance of departure & arrival time**

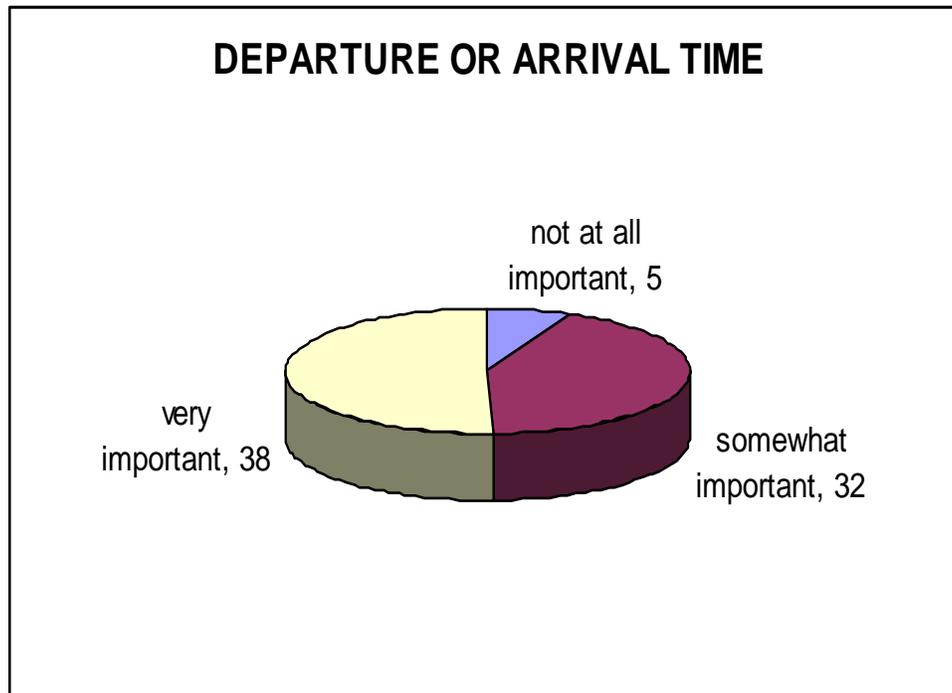
|       |                      | Frequency | Percent |
|-------|----------------------|-----------|---------|
| Valid | not at all important | 5         | 6.7     |
|       | somewhat important   | 32        | 42.7    |
|       | very important       | 38        | 50.7    |
|       | Total                | 75        | 100.0   |

The above table shows that 6.7% of the respondents are think that the departure or arrival time was not at all important, 42.7% of the respondents are think that the departure or arrival time was somewhat important, & 50.7% of the respondents are think that the departure or arrival time was very important.

The majority of the respondents are think that the departure or arrival time was very important while making a decision to choose the airline.

**CHART NO: 18**

The following chart shows how much important the departure or arrival time while making a decision to choose the airline.



**TABLE NO: 19**

The following table shows how much important the stops of the flight while making a decision to choose the airline.

**importance of stops or better connections of the flights**

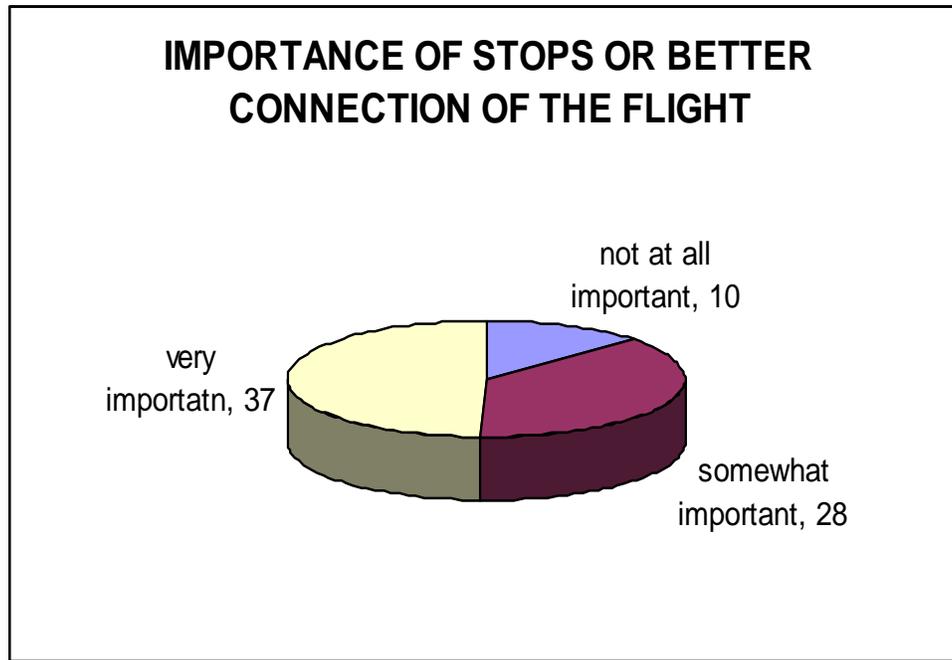
|       |                      | Frequency | Percent |
|-------|----------------------|-----------|---------|
| Valid | not at all important | 10        | 13.3    |
|       | somewhat important   | 28        | 37.3    |
|       | very important       | 37        | 49.3    |
|       | Total                | 75        | 100.0   |

The above table shows that 13.3% of the respondents are think that the fewer stops of flight and better connection was not at all important, 37.3% of the respondents are think that the fewer stops of flight and better connection was somewhat important, & 49.3% of the respondents are think that the fewer stops of flight and better connection was very important.

The majority of the respondents are think that the fewer stops of flight and better connection was very important while making a decision to choose the airline.

**CHART NO: 19**

The following chart shows how much important the stops of the flight while making a decision to choose the airline.



**TABLE NO: 20**

The following table shows how much important the air fare of the flight while making a decision to choose the airline.

**importance of air fair**

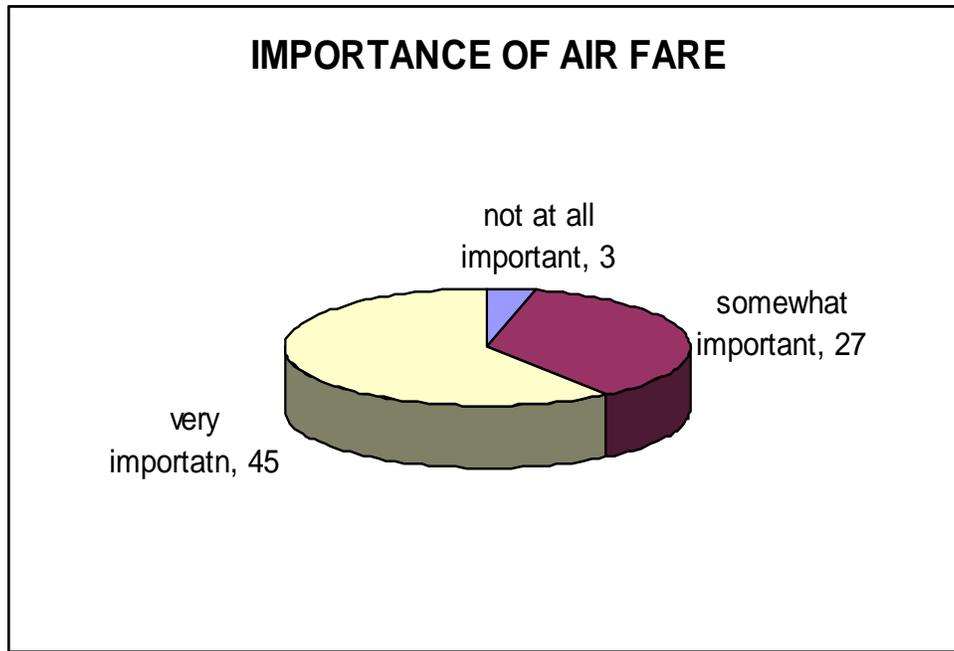
|       |                      | Frequency | Percent |
|-------|----------------------|-----------|---------|
| Valid | not at all important | 3         | 4.0     |
|       | somewhat important   | 27        | 36.0    |
|       | very important       | 45        | 60.0    |
|       | Total                | 75        | 100.0   |

The above table shows that 4% of the respondents are think that the air fare of flight was not at all important, 36% of the respondents are think that the air fare of flight was somewhat important, 60% of the respondents are think that the air fare of the flight was very important.

The majority of the respondents are think that the air fare of the flight is very important while making a decision to choose the airline.

**CHART NO: 20**

The following chart shows how much important the air fare of the flight while making a decision to choose the airline.



**TABLE NO: 21**

The following table shows how much important the seats availability of the flight while making a decision to choose the airline.

**importance of seats availability**

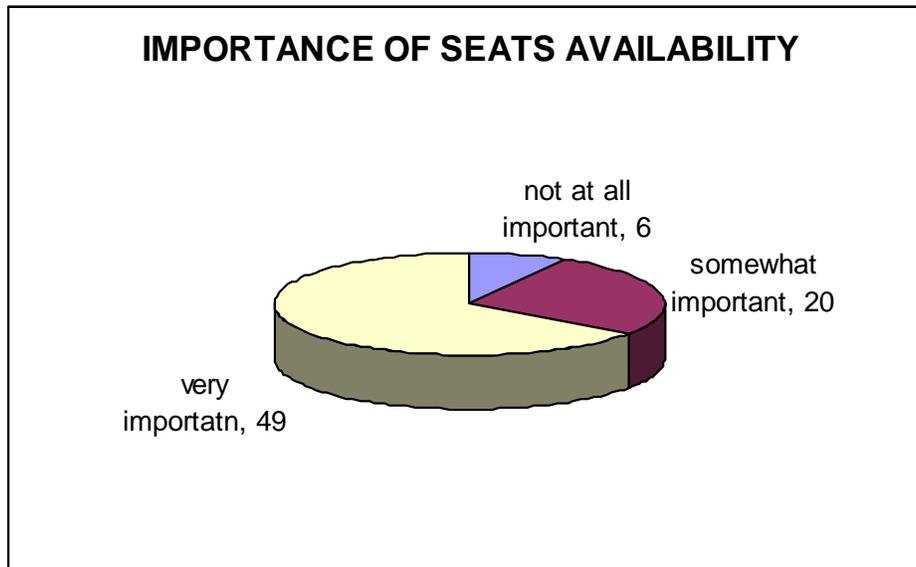
|       |                      | Frequency | Percent |
|-------|----------------------|-----------|---------|
| Valid | not at all important | 6         | 8.0     |
|       | somewhat important   | 20        | 26.7    |
|       | very important       | 49        | 65.3    |
|       | Total                | 75        | 100.0   |

The above table shows that 4% of the respondents are think that the seats availability of the flight was not at all important, 36% of the respondents are think that the seats availability of the flight was somewhat important, & 60% of the respondents are think that the seats availability of the flight was very important.

The majority of the respondents are think that the seats availability of the flight was very important while making a decision to choose the airline.

**CHART NO: 21**

The following chart shows how much important the seats availability of the flight while making a decision to choose the airline.



**TABLE NO: 22**

The following table shows how much important the personal preference of the flight while making a decision to choose the airline.

**importance of personal preference**

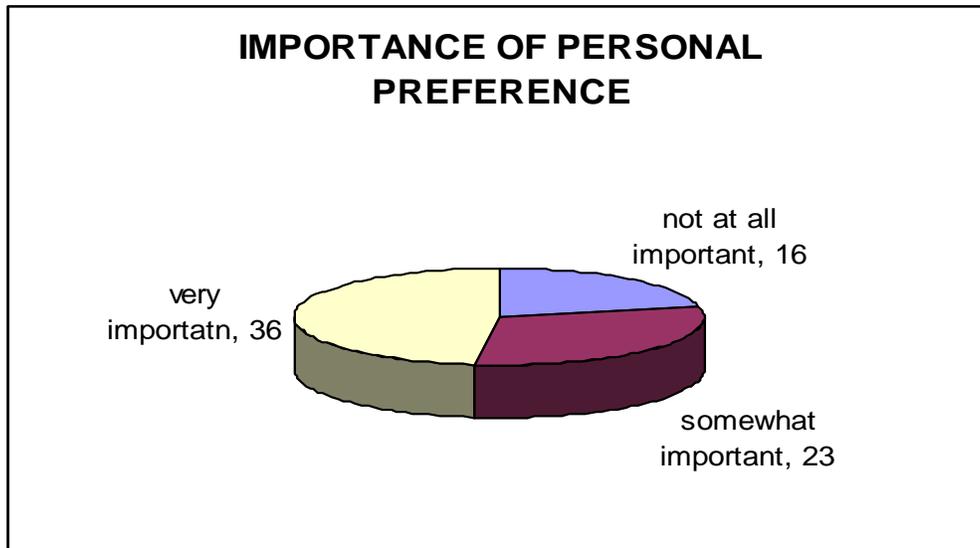
|       |                      | Frequency | Percent |
|-------|----------------------|-----------|---------|
| Valid | not at all important | 16        | 21.3    |
|       | somewhat important   | 23        | 30.7    |
|       | very important       | 36        | 48.0    |
| Total |                      | 75        | 100.0   |

The above table shows that 21.3% of the respondents are think that the personal preference of the flight was not at all important, 30.7% of the respondents are think that the personal preference of the flight was somewhat important, & 48% of the respondents are think that the personal preference of the flight was very important.

The majority of the respondents are thinking that the personal preference of the flight was very important while making a decision to choose the airline.

**CHART NO: 22**

The following chart how much important the personal preference of the flight while making a decision to choose the airline.



**TABLE NO: 23**

The following table shows how much important the aircraft preference of the flight while making a decision to choose the airline.

**importance of aircraft preference**

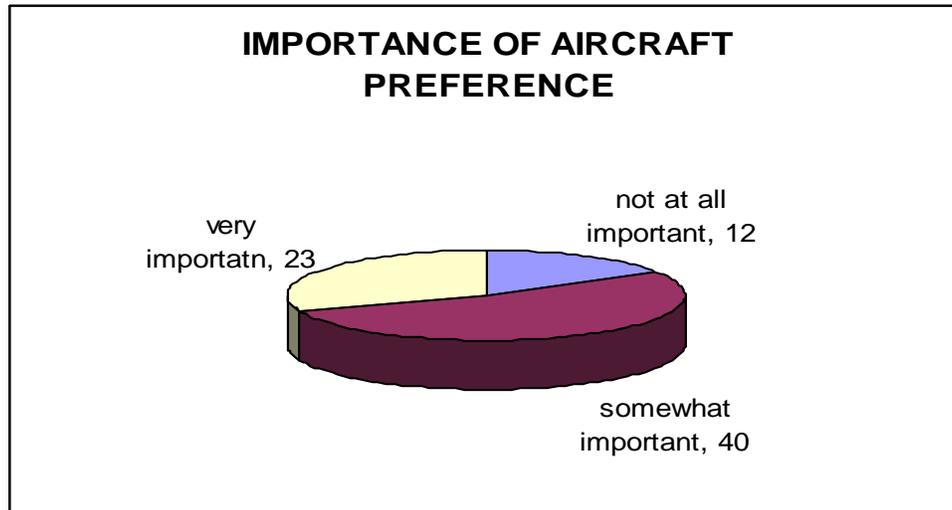
|       |                      | Frequency | Percent |
|-------|----------------------|-----------|---------|
| Valid | not at all important | 12        | 16.0    |
|       | somewhat important   | 40        | 53.3    |
|       | very important       | 23        | 30.7    |
|       | Total                | 75        | 100.0   |

The above table shows that 16% of the respondents are think that the aircraft preference of the flight was not at all important, 53.3% of the respondents are think that the aircraft preference of the flight was somewhat important, & 30.7% of the respondents are think that the aircraft preference of the flight was very important.

The majority of the respondents are think that the aircraft preference of the flight was very important while making a decision to choose the airline.

**CHART NO: 23**

The following chart shows how much important the aircraft preference of the flight while making a decision to choose the airline.



**TABLE NO: 24**

The following table shows the satisfaction level of the respondents in speed of getting through the agent.

**satisfaction level in speed of getting through the agent**

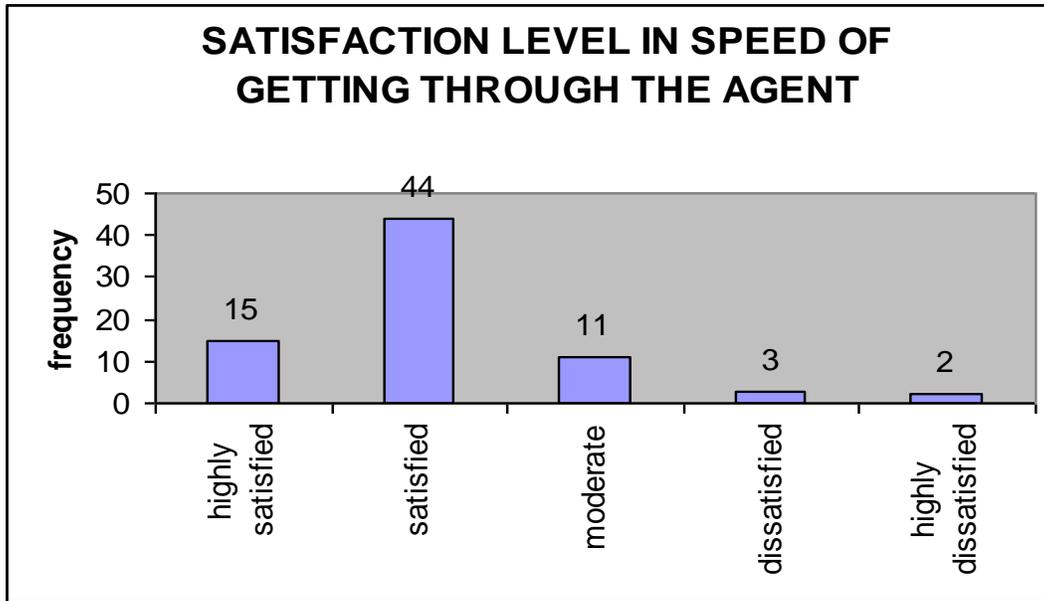
|       |                     | Frequency | Percent |
|-------|---------------------|-----------|---------|
| Valid | highly satisfied    | 15        | 20.0    |
|       | satisfied           | 44        | 58.7    |
|       | moderate            | 11        | 14.7    |
|       | dissatisfied        | 3         | 4.0     |
|       | highly dissatisfied | 2         | 2.7     |
| Total |                     | 75        | 100.0   |

The above table shows that 20% of the respondents are highly satisfied with the speed of getting through the agent, 58.7% of the respondents are satisfied with the speed of getting through the agent, 14.7% of the respondents are moderate with the speed of getting through the agent, 4% of the respondents are dissatisfied with the speed of getting through the agent, 2.7% of the respondents are highly dissatisfied with the speed of getting through the agent.

The majority of the respondents are satisfied with the speed of getting through the agent.

**CHART NO: 24**

The following chart shows the satisfaction level of the respondents in speed of getting through the agent.



**TABLE NO: 25**

The following table shows the satisfaction level of the respondents in the helpfulness & courtesy of the reservation agent.

**satisfaction level in helpfulness & courtesy of the reservation agent**

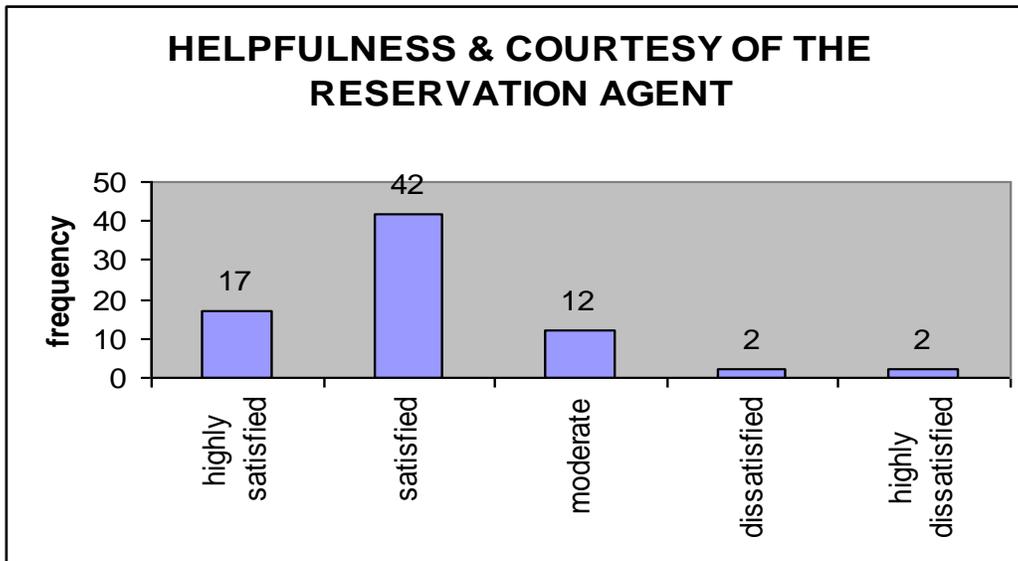
|       |                     | Frequency | Percent |
|-------|---------------------|-----------|---------|
| Valid | highly satisfied    | 17        | 22.7    |
|       | satisfied           | 42        | 56.0    |
|       | moderate            | 12        | 16.0    |
|       | dissatisfied        | 2         | 2.7     |
|       | highly dissatisfied | 2         | 2.7     |
|       | Total               | 75        | 100.0   |

The above table shows that 22.7% of the respondents are highly satisfied with the helpfulness & courtesy of the reservation agent, 56% of the respondents are satisfied with the helpfulness & courtesy of the reservation agent, 16% of the respondents are moderate with the helpfulness & courtesy of the reservation agent, 2.7% of the respondents are dissatisfied with the helpfulness & courtesy of the reservation agent, 2.7% of the respondents are highly dissatisfied with the helpfulness & courtesy of the reservation agent.

The majority of the respondents are satisfied with the helpfulness & courtesy of the reservation agent.

**CHART NO: 25**

The following chart shows the satisfaction level of the respondents in the helpfulness & courtesy of the reservation agent.



**TABLE NO: 26**

The following table shows the satisfaction level of the respondents in the accuracy of flight & fare information.

**satisfaction level in accuracy of the flight & fare information**

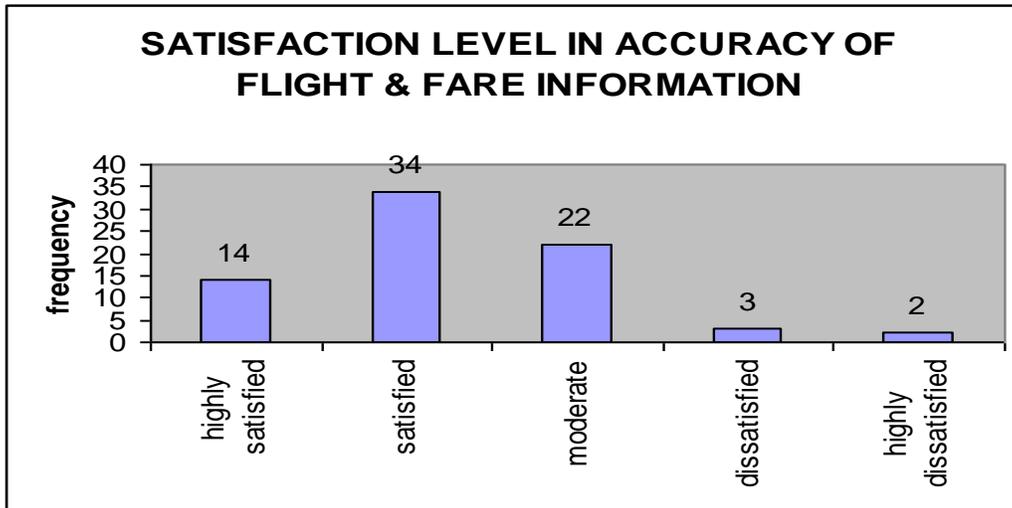
|       |                     | Frequency | Percent |
|-------|---------------------|-----------|---------|
| Valid | highly satisfied    | 14        | 18.7    |
|       | satisfied           | 34        | 45.3    |
|       | moderate            | 22        | 29.3    |
|       | dissatisfied        | 3         | 4.0     |
|       | highly dissatisfied | 2         | 2.7     |
| Total |                     | 75        | 100.0   |

The above table shows that 18.7% of the respondents are highly satisfied with the accuracy of flight & fare information, 45.3% of the respondents are satisfied with the accuracy of flight & fare information, 29.3% of the respondents are moderate with the accuracy of flight & fare information, 4% of the respondents are dissatisfied with the accuracy of flight & fare information, 2.7% of the respondents are highly dissatisfied with the accuracy of flight & fare information.

The majority of the respondents are moderately satisfied with the accuracy of flight & fare information given by the reservation agent.

**CHART NO: 26**

The following chart shows the satisfaction level of the respondents in the accuracy of flight & fare information.



**TABLE NO: 27**

The following table shows the satisfaction level of the respondents in the cabin cleanliness.

**satisfaction level in cabin cleanliness/ cabin condition**

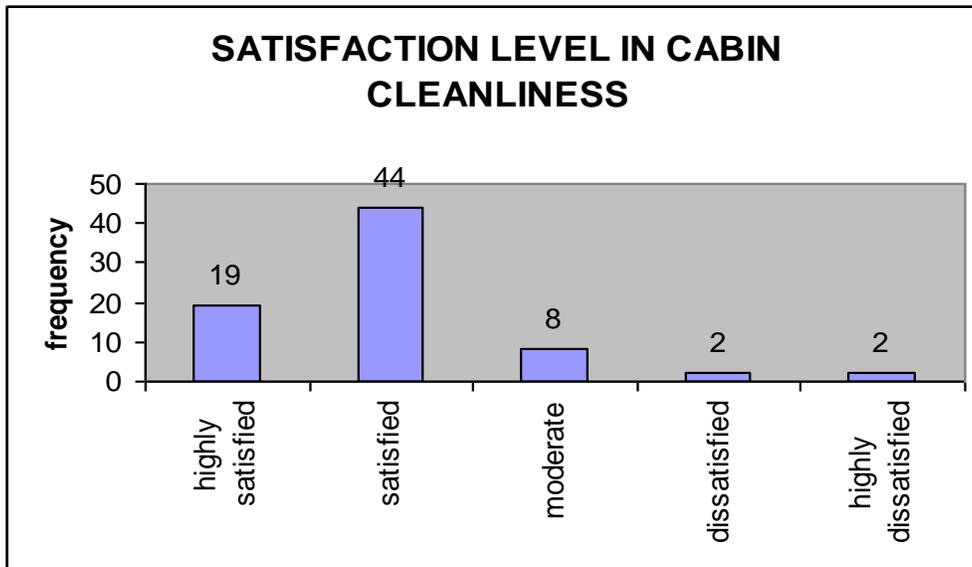
|       |                     | Frequency | Percent |
|-------|---------------------|-----------|---------|
| Valid | highly satisfied    | 19        | 25.3    |
|       | satisfied           | 44        | 58.7    |
|       | moderate            | 8         | 10.7    |
|       | dissatisfied        | 2         | 2.7     |
|       | highly dissatisfied | 2         | 2.7     |
| Total |                     | 75        | 100.0   |

The above table shows that 25.3% of the respondents are highly satisfied with the cabin cleanliness, 58.7% of the respondents are satisfied with the cabin cleanliness, 10.7% of the respondents are moderate with the cabin cleanliness, 2.7% of the respondents are dissatisfied with the cabin cleanliness, 2.7% of the respondents are highly dissatisfied with the cabin cleanliness.

The majority of the respondents are satisfied with the cabin cleanliness of the flight.

**CHART NO: 27**

The following chart shows the satisfaction level of the respondents in the cabin cleanliness.



**TABLE NO: 28**

The following table shows the satisfaction level of the respondents in the in-flight entertainment.

**satisfaction level in in-flight entertainment(movies, magazine, etc)**

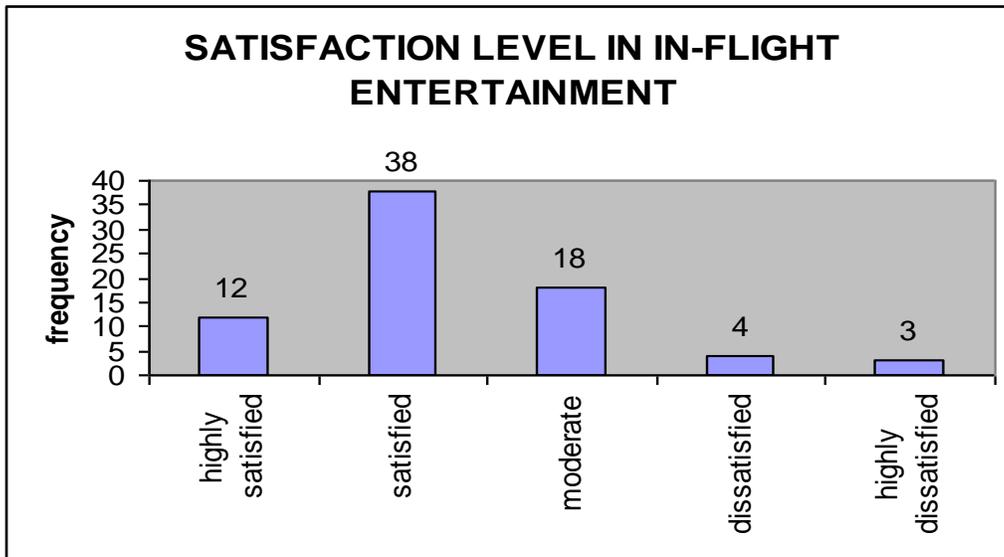
|       |                     | Frequency | Percent |
|-------|---------------------|-----------|---------|
| Valid | highly satisfied    | 12        | 16.0    |
|       | satisfied           | 38        | 50.7    |
|       | moderate            | 18        | 24.0    |
|       | dissatisfied        | 4         | 5.3     |
|       | highly dissatisfied | 3         | 4.0     |
| Total |                     | 75        | 100.0   |

The above table shows that 16% of the respondents are highly satisfied with the in-flight entertainment, 50.7% of the respondents are satisfied with the in-flight entertainment, 24% of the respondents are moderate with the in-flight entertainment, 5.3% of the respondents are dissatisfied with the in-flight entertainment, 4% of the respondents are highly dissatisfied with the in-flight entertainment.

The majority of the respondents are satisfied with the in-flight entertainment of the flight.

**CHART NO: 28**

The following chart shows the satisfaction level of the respondents in the in-flight entertainment.



**TABLE NO: 29**

The following chart shows the satisfaction level of the respondents in the seats comfort.

**satisfaction level in seat comfort**

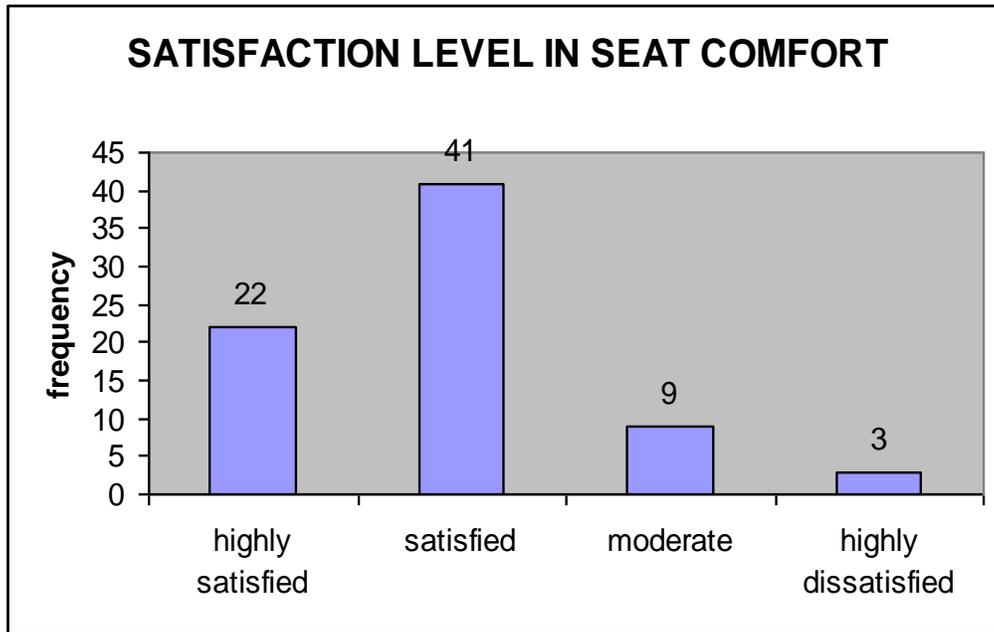
|       |                     | Frequency | Percent |
|-------|---------------------|-----------|---------|
| Valid | highly satisfied    | 22        | 29.3    |
|       | satisfied           | 41        | 54.7    |
|       | moderate            | 9         | 12.0    |
|       | highly dissatisfied | 3         | 4.0     |
|       | Total               | 75        | 100.0   |

The above table shows that 29.3% of the respondents are highly satisfied with the seats comfort in flight, 54.7% of the respondents are satisfied with the seats comfort in flight, 12% of the respondents are moderate with the seats comfort in flight, 4% of the respondents are highly dissatisfied with the seats comfort in flight.

The majority of the respondents are satisfied with the seats comfort in flight.

**CHART NO: 29**

The following chart shows the satisfaction level of the respondents in the seats comfort.



**TABLE NO: 30**

The following chart shows the satisfaction level of the respondents in the overall courteous & helpfulness.

**rate of overall courteous and helpfulness**

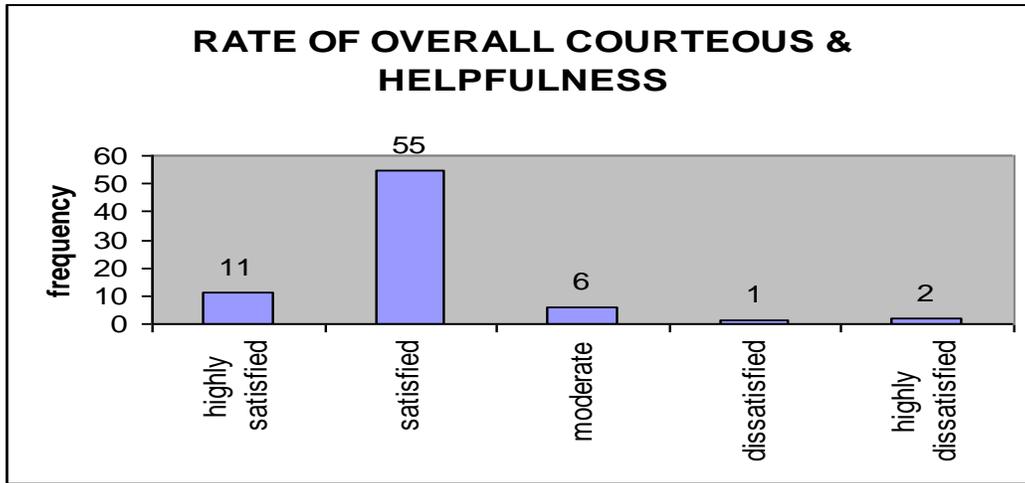
|       |                     | Frequency | Percent |
|-------|---------------------|-----------|---------|
| Valid | highly satisfied    | 11        | 14.7    |
|       | satisfied           | 55        | 73.3    |
|       | moderate            | 6         | 8.0     |
|       | dissatisfied        | 1         | 1.3     |
|       | highly dissatisfied | 2         | 2.7     |
|       | Total               | 75        | 100.0   |

The above table shows that 14.7% of the respondents are highly satisfied with the overall courteous & helpfulness, 73.3% of the respondents are satisfied with the overall courteous & helpfulness, 8% of the respondents are moderate with the overall courteous & helpfulness, 1.3% of the respondents are dissatisfied with the overall courteous & helpfulness, 2.7% of the respondents are highly dissatisfied with the overall courteous & helpfulness.

The majority of the respondents are satisfied with the overall courteous & helpfulness.

**CHART NO: 30**

The following chart shows the satisfaction level of the respondents in the overall courteous & helpfulness.



**TABLE NO: 31**

The following chart shows the respondents thinking of the value for their money.

**value for money in airline**

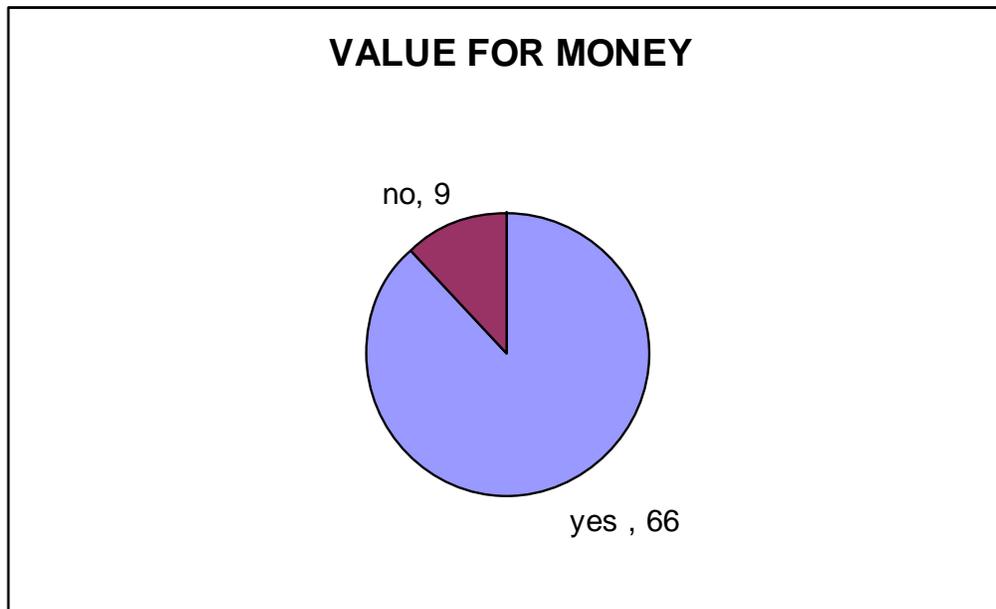
|       |                  | Frequency | Percent |
|-------|------------------|-----------|---------|
| Valid | highly satisfied | 66        | 88.0    |
|       | satisfied        | 9         | 12.0    |
|       | Total            | 75        | 100.0   |

The above table shows that 88% of the respondents are thinking that they are getting high value for their money, 12% of the respondents are thinking that they are not getting high value for their money.

The majority of the respondents are getting high value for their money.

**CHART NO: 31**

The following chart shows the respondents thinking of the value for their money.



**RANK ANALYSIS**

**TABLE NO: 32**

| Rate  | 1                 | 2                 | 3                 | 4                 | 5                | 6                | Total       | Rank     |
|---|-------------------|-------------------|-------------------|-------------------|------------------|------------------|-------------|----------|
| Score (X)                                     | 77                | 63                | 54                | 46                | 37               | 23               |             |          |
| Availability of the ticket (F1)<br><b>XF1</b> | 23<br><b>1771</b> | 45<br><b>2835</b> | 13<br><b>702</b>  | 7<br><b>322</b>   | 2<br><b>74</b>   | 5<br><b>115</b>  | <b>5819</b> | <b>1</b> |
| Price of the ticket (F2)<br><b>XF2</b>        | 23<br><b>1771</b> | 20<br><b>1260</b> | 16<br><b>864</b>  | 8<br><b>368</b>   | 6<br><b>222</b>  | 2<br><b>46</b>   | <b>4531</b> | <b>2</b> |
| Safety and reliability (F3)<br><b>XF3</b>     | 19<br><b>1463</b> | 13<br><b>819</b>  | 19<br><b>1026</b> | 10<br><b>460</b>  | 10<br><b>370</b> | 4<br><b>92</b>   | <b>4230</b> | <b>3</b> |
| Airport location (F4)<br><b>XF4</b>           | 3<br><b>231</b>   | 4<br><b>252</b>   | 10<br><b>540</b>  | 10<br><b>460</b>  | 26<br><b>962</b> | 22<br><b>506</b> | <b>2951</b> | <b>6</b> |
| Preferable aircraft (F5)<br><b>XF5</b>        | 4<br><b>308</b>   | 9<br><b>567</b>   | 8<br><b>432</b>   | 18<br><b>828</b>  | 13<br><b>481</b> | 23<br><b>529</b> | <b>3145</b> | <b>4</b> |
| Quality and service (F6)<br><b>XF6</b>        | 3<br><b>231</b>   | 4<br><b>252</b>   | 9<br><b>486</b>   | 22<br><b>1012</b> | 18<br><b>666</b> | 19<br><b>437</b> | <b>3084</b> | <b>5</b> |

From the above table it shows that the customers giving priority at first to the availability of the ticket, they are giving second preference to the price of the ticket, the third preference goes to safety and reliability, fourth preference goes to preferable aircraft, fifth preference goes to quality and service of the airlines, sixth preference goes to airport location.

The majority of the respondents giving their first priority to the availability of the ticket.

**CHI-SQUARE  
 TABLE NO:33**

The following table shows the chi-square test for area of residence & booking of airline tickets.

| Count |       | how do you book your airline tickets |               |                |        | Total |
|-------|-------|--------------------------------------|---------------|----------------|--------|-------|
|       |       | internet                             | travel agents | airline office | others |       |
| area  | rural | 6                                    | 14            | 5              | 0      | 25    |
|       | urban | 19                                   | 20            | 10             | 1      | 50    |
| Total |       | 25                                   | 34            | 15             | 1      | 75    |

Null hypothesis:

$H_0$ : There is no association between the area of residence & the booking of airline tickets.

Alternative hypothesis:

$H_1$ : There is association between the area of residence & the booking of airline tickets.

LEVEL OF SIGNIFICANCE:

$\alpha = 0.05$  (or) 5% level of significance

**TABLE VALUES:**

**Chi-Square Tests**

|                    | Value | df | Asymp. Sig.<br>(2-sided) |
|--------------------|-------|----|--------------------------|
| Pearson Chi-Square | 2.421 | 3  | .490                     |

**INFERENCE:**

Since P value is greater than table value

ie)  $0.490 > 0.05$

Therefore  $H_0$  is accepted.

There is no association between the area of residence & the booking of airline tickets.

**TABLE NO:34**

The following table shows the chi-square test for occupation & the purpose of traveling in air.

| Count      |            | purpose of travelling |                       |           |        | Total |
|------------|------------|-----------------------|-----------------------|-----------|--------|-------|
|            |            | business              | personal/<br>vocation | education | others |       |
| occupation | student    | 0                     | 2                     | 13        | 0      | 15    |
|            | private    | 3                     | 4                     | 0         | 8      | 15    |
|            | government | 3                     | 12                    | 0         | 1      | 16    |
|            | business   | 7                     | 3                     | 3         | 2      | 15    |
|            | others     | 3                     | 9                     | 0         | 2      | 14    |
| Total      |            | 16                    | 30                    | 16        | 13     | 75    |

Null hypothesis:

$H_0$ : There is no association between the occupation & the purpose of traveling.

Alternative hypothesis:

$H_1$ : There is association between the occupation & the purpose of traveling.

LEVEL OF SIGNIFICANCE:

$\alpha = 0.05$  (or) 5% level of significance

TABLE VALUES:

**Chi-Square Tests**

|                    | Value  | df | Asymp. Sig.<br>(2-sided) |
|--------------------|--------|----|--------------------------|
| Pearson Chi-Square | 74.361 | 12 | .000                     |

**INFERENCE:**

Since P value is less than table value

ie)  $0.000 < 0.05$

Therefore  $H_0$  is rejected.

There is association between the occupation & the purpose of traveling.

**TABLE NO:35**

The following table shows the chi-square test for occupation & the number of times travel by air during the last year.

| Count      |            | how many time did you travel by air during the last year |     |      |       |            | Total |
|------------|------------|--|-----|------|-------|------------|-------|
|            |            | 1  | 2-5 | 6-10 | 10-20 | 20 & above |       |
| occupation | student    | 4  | 2   | 6    | 1     | 2          | 15    |
|            | private    | 2  | 12  | 1    | 0     | 0          | 15    |
|            | government | 3  | 11  | 2    | 0     | 0          | 16    |
|            | business   | 2  | 4   | 6    | 2     | 1          | 15    |
|            | others     | 0  | 11  | 2    | 0     | 1          | 14    |
| Total      |            | 11   | 40  | 17   | 3     | 4          | 75    |

Null hypothesis:

$H_0$ : There is no association between the occupation & the number of times travelled by air during the last year.

Alternative hypothesis:

$H_1$ : There is association between the occupation & the number of times travelled by air during the last year.

LEVEL OF SIGNIFICANCE:

$\alpha = 0.05$  (or) 5% level of significance

TABLE VALUES:

**Chi-Square Tests**

|                    | Value  | df | Asymp. Sig. (2-sided) |
|--------------------|--------|----|-----------------------|
| Pearson Chi-Square | 30.386 | 16 | .016                  |

**INFERENCE:**

Since P value is less than table value

ie)  $0.016 < 0.05$

Therefore  $H_0$  is rejected.

There is association between the occupation & the number of times travelled by air during the last year.

**TABLE NO:36**

The following table shows the chi-square test for monthly income & the class in which they travel.

| Count          |               | in which class you travel |                | Total |
|----------------|---------------|---------------------------|----------------|-------|
|                |               | economy class             | business class |       |
| monthly income | below 10000   | 6                         | 13             | 19    |
|                | 10000-30000   | 25                        | 6              | 31    |
|                | 30000-50000   | 11                        | 7              | 18    |
|                | 50000 & above | 2                         | 5              | 7     |
| Total          |               | 44                        | 31             | 75    |

Null hypothesis:

$H_0$ : There is no association between the monthly income & the class in which they travel.

Alternative hypothesis:

$H_1$ : There is association between the monthly income & the class in which they travel.

LEVEL OF SIGNIFICANCE:

$\alpha = 0.05$  (or) 5% level of significance

**TABLE VALUES:**

**Chi-Square Tests**

|                    | Value  | df | Asymp. Sig. (2-sided) |
|--------------------|--------|----|-----------------------|
| Pearson Chi-Square | 14.584 | 3  | .002                  |

**INFERENCE:**

Since P value is less than table value

ie)  $0.002 < 0.05$

Therefore  $H_0$  is rejected.

There is association between the monthly income & the class in which they travel.

**TABLE NO:37**

The following table shows the chi-square test for the class in which they travel & the price of the airlines.

| Count          |                | how do you rate the price of the airline |      |          |          | Total |
|----------------|----------------|--|------|----------|----------|-------|
|                |                | very high                                | high | moderate | very low |       |
| in which class | economy class  | 3  | 24   | 17       | 0        | 44    |
| you travel     | business class | 2  | 12   | 16       | 1        | 31    |
| Total          |                | 5  | 36   | 33       | 1        | 75    |

Null hypothesis:

$H_0$ : There is no association between class in which they travel & the price of the airlines.

Alternative hypothesis.

$H_1$ : There is association between the class in which they travel & the price of the airlines.

LEVEL OF SIGNIFICANCE:

$\alpha = 0.05$  (or) 5% level of significance

**TABLE VALUES:**

**Chi-Square Tests**

|                    | Value | df | Asymp. Sig. (2-sided) |
|--------------------|-------|----|-----------------------|
| Pearson Chi-Square | 3.069 | 3  | .381                  |

**INFERENCE:**

Since P value is less than table value

ie)  $0.381 > 0.05$

Therefore  $H_0$  is accepted.

There is no association between class in which they travel & the price of the airlines.

**TABLE NO:38**

The following table shows the chi-square test for the class in which they travel & the quality & service of the airlines.

Count

|                             | how do you rate the quality and service |           |          |                     | Total |
|-----------------------------|---|-----------|----------|---------------------|-------|
|                             | highly satisfied                        | satisfied | moderate | highly dissatisfied |       |
| in which classeconomy class | 3                                       | 35        | 5        | 1                   | 44    |
| you travel business class   | 6                                       | 24        | 1        | 0                   | 31    |
| Total                       | 9                                       | 59        | 6        | 1                   | 75    |

Null hypothesis:

$H_0$ : There is no association between class in which they travel & the quality & service of the airlines.

Alternative hypothesis:

$H_1$ : There is association between the class in which they travel & the quality & service of the airlines.

LEVEL OF SIGNIFICANCE:

$\alpha = 0.05$  (or) 5% level of significance

**TABLE VALUES:**

**Chi-Square Tests**

|                    | Value | df | Asymp. Sig. (2-sided) |
|--------------------|-------|----|-----------------------|
| Pearson Chi-Square | 4.602 | 3  | .203                  |

**INFERENCE:**

Since P value is less than table value

ie)  $0.203 > 0.05$

Therefore  $H_0$  is accepted.

There is no association between class in which they travel & the quality & service of the airlines.

**TABLE NO:39**

The following table shows the chi-square test for age & the purpose of traveling.

Count

|       |       | purpose of travelling |                       |           |        | Total |
|-------|-------|-----------------------|-----------------------|-----------|--------|-------|
|       |       | business              | personal/<br>vocation | education | others |       |
| age   | <20   | 0                     | 2                     | 4         | 0      | 6     |
|       | 20-40 | 13                    | 14                    | 10        | 11     | 48    |
|       | 40-60 | 3                     | 13                    | 2         | 2      | 20    |
|       | >60   | 0                     | 1                     | 0         | 0      | 1     |
| Total |       | 16                    | 30                    | 16        | 13     | 75    |

Null hypothesis:

$H_0$ : There is no association between the age & the purpose of traveling.

Alternative hypothesis:

$H_1$ : There is association between the age & the purpose of traveling.

LEVEL OF SIGNIFICANCE:

$\alpha = 0.05$  (or) 5% level of significance

TABLE VALUES:

**Chi-Square Tests**

|                    | Value  | df | Asymp. Sig.<br>(2-sided) |
|--------------------|--------|----|--------------------------|
| Pearson Chi-Square | 18.014 | 9  | .035                     |

**INFERENCE:**

Since P value is less than table value

ie)  $0.035 > 0.05$

Therefore  $H_0$  is rejected.

There is association between between the age & the purpose of traveling.

**TABLE NO:40**

The following table shows the chi-square test for marital status & the purpose of traveling.

Count

|                   |           | purpose of travelling |                       |           |        | Total |
|-------------------|-----------|-----------------------|-----------------------|-----------|--------|-------|
|                   |           | business              | personal/<br>vocation | education | others |       |
| marital<br>status | married   | 11                    | 18                    | 3         | 6      | 38    |
|                   | unmarried | 5                     | 12                    | 13        | 7      | 37    |
| Total             |           | 16                    | 30                    | 16        | 13     | 75    |

Null hypothesis:

$H_0$ : There is no association between the marital status & the purpose of traveling.

Alternative hypothesis:

H<sub>1</sub>: There is association between the the marital status & the purpose of traveling.

LEVEL OF SIGNIFICANCE:

$\alpha = 0.05$  (or) 5% level of significance

TABLE VALUES:

**Chi-Square Tests**

|                    | Value | df | Asymp. Sig. (2-sided) |
|--------------------|-------|----|-----------------------|
| Pearson Chi-Square | 9.765 | 3  | .021                  |

**INFERENCE:**

Since P value is less than table value

ie)  $0.021 > 0.05$

Therefore H<sub>0</sub> is rejected.

There is association between the the marital status & the purpose of traveling.

**TABLE NO:41**

The following table shows the chi-square test for educational qualification & the purpose of traveling.

| Count                        |                | purpose of travelling |                       |           |        | Total |
|------------------------------|----------------|-----------------------|-----------------------|-----------|--------|-------|
|                              |                | business              | personal/<br>vocation | education | others |       |
| educational<br>qualification | sslc           | 2                     | 7                     | 1         | 1      | 11    |
|                              | under graduate | 5                     | 12                    | 8         | 6      | 31    |
|                              | post graduate  | 4                     | 6                     | 5         | 4      | 19    |
|                              | others         | 5                     | 5                     | 2         | 2      | 14    |
| Total                        |                | 16                    | 30                    | 16        | 13     | 75    |

Null hypothesis:

H<sub>0</sub>: There is no association between the educational qualification & the purpose of traveling.

Alternative hypothesis:

H<sub>1</sub>: There is association between the educational qualification & the purpose of traveling.

LEVEL OF SIGNIFICANCE:

$\alpha = 0.05$  (or) 5% level of significance

TABLE VALUES:

**Chi-Square Tests**

|                    | Value | df | Asymp. Sig. (2-sided) |
|--------------------|-------|----|-----------------------|
| Pearson Chi-Square | 6.095 | 9  | .730                  |

## INFERENCE:

Since P value is greater than table value

ie)  $0.730 > 0.05$

Therefore  $H_0$  is accepted.

There is no association between the educational qualification & the purpose of traveling.

## VIII. FINDINGS

The project is concerned with the survey of the customers travel by air in Coimbatore districts. In this study the following findings and conclusions were made after analyzing the collected data carefully.

- ✓ The majority of the respondents are males.
- ✓ The majority of the respondents are in the age group of 20-40 years.
- ✓ The majority of the respondents are married people.
- ✓ The majority of the respondents are UG students.
- ✓ The majority of the respondents are government sector people.
- ✓ The majority of the respondents are belonging monthly income 10000-30000.
- ✓ The majority of the respondents are belonging to urban area.
- ✓ The majority of the respondents are travelling for the purpose of personal/vocation.
- ✓ The majority of the respondents are travelling in economy class.
- ✓ The majority of the respondents are booking their tickets by travel agents.
- ✓ The majority of the respondents are travelled 2-5 times by air in the last year.
- ✓ The majority of the respondents are rate that the price of the airline is high.
- ✓ The majority of the respondents are satisfied with the quality and service provided by the airlines.
- ✓ The majority of the respondents are satisfied with the safety provided by the airlines.
- ✓ The majority of the respondents are waited in the queue of express baggage check in counter for 11-20minutes duration of time.
- ✓ The majority of the respondents are waited in the queue of aircraft boarding counter for 11-20minutes duration of time.
- ✓ The majority of the respondents are waited in the queue of security check point counter for 6-10minutes duration of time.
- ✓ The majority of the respondents are think that the departure or arrival time was very important while making a decision to choose the airline.
- ✓ The majority of the respondents are think that the fewer stops of flight and better connection was very important while making a decision to choose the airline.
- ✓ The majority of the respondents are think that the air fare of the flight is very important while making a decision to choose the airline.
- ✓ The majority of the respondents are think that the seats availability of the flight was very important while making a decision to choose the airline.

- ✓ The majority of the respondents are think that the personal preference of the flight was very important while making a decision to choose the airline.
- ✓ The majority of the respondents are think that the aircraft preference of the flight was very important while making a decision to choose the airline.
- ✓ The majority of the respondents are satisfied with the speed of getting through the agent.
- ✓ The majority of the respondents are satisfied with the helpfulness & courtesy of the reservation agent.
- ✓ The majority of the respondents are moderate with the accuracy of flight & fare information given by the reservation agent.
- ✓ The majority of the respondents are satisfied with the cabin cleanliness of the flight.
- ✓ The majority of the respondents are satisfied with the in-flight entertainment of the flight.
- ✓ The majority of the respondents are satisfied with the seats comfort in flight.
- ✓ The majority of the respondents are satisfied with the overall courteous & helpfulness.
- ✓ The majority of the respondents are getting high value for their money.
- ✓ The majority of the respondents giving their first priority to the availability of the ticket.

## IX. CONCLUSION

It is concluded from the study that customers are satisfied with the quality ,service and, safety provided by the airlines. Customers are also satisfied with the cabin cleanliness , in-flight entertainment, and the seats comfort in flight. Customers are think that they are getting high value for their money and satisfied with the overall courteous & helpfulness.

## X. SUGGESTION

From the above analysis the following suggestions are made.

- ✓ The airlines may particularly concentrate in the time of boarding and baggage check-in counter.
- ✓ The airlines should give importance to the departure & arrival time.
- ✓ The airlines should reduce the ticket price.
- ✓ The reservation agent should give the accuracy of flight & should provide full information about the air fare.

## AUTHORS

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# An Inventory System with Retrial Demands and Working Vacation

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**Abstract-** This article considers a continuous review retrial inventory system at a service facility, wherein an item demanded by a customer is issued after performing service on the item. The arrival time points of customers form a Poisson process. The inventory replenished according to an  $(s, Q)$  policy and the lead times are assumed to follow an exponential distribution. The demands that occur during the stock out period or the server busy (regular or working vacation) are permitted to enter into the orbit of infinite size. When the inventory level is zero or no demands in the system or both, server goes to a working vacation which is exponentially distributed. If the server is in working vacation or the inventory level is zero, the impatience occurs in orbiting customers, that follows an exponential distribution. The joint probability distribution of the number of demands in the orbit, the inventory level and the server status is obtained in the steady state case. Some system performance measures are derived, the long-run total expected cost rate is calculated and the results are illustrated numerically.

**Index Terms-** Continuous review inventory system,  $(s, Q)$  Policy, Positive leadtime, Retrial demand, Working vacation.

**AMS Classification:** 90B05, 60J27

## I. INTRODUCTION

The concept of server vacation in inventory with two servers was first introduced by Daniel and Ramanarayanan [1]. Also they have studied an inventory system in which the server takes rest when the level of the inventory is zero in [2]. They assumed that the demands that occurred during stock-out period are assumed to be lost. The inter-occurrence times between successive demands, the lead times, and the rest times are assumed to follow mutually independent general distributions. Using renewal and convolution techniques they obtained the state transition probabilities.

The various types of vacation models in queueing systems have been widely studied in the literature. We refer the reader to Doshi [4]. Working vacation is a kind of semi-vacation policy that was introduced by Servi and Finn[9]. In the classical vacation queuing models, during the vacation period the server doesn't continue on the original work and such policy may cause the loss or dissatisfaction of the customers. For the working vacation policy, the server can still work during the vacation and may accomplish other assistant work simultaneously. So, the working vacation more reasonable that the classical vacation in some cases. Tien Van Do[8] studied, M/M/1 retrial queue with

working vacations. Paul Manual et al. [10] analyzed a service facility inventory system with impatient customers. The authors have assumed the customers arrive in Poisson fashion. The service time, life time of items in stock and the lead time are all assumed to be independently distributed as exponential.

The concept of retrial demands in inventory was introduced by Artalejo et al. [3]. They have assumed Poisson demand, exponential lead time and exponential retrial time. In that work, the authors proceeded with an algorithmic analysis of the system. Jeganathan et al. [5] studied a retrial inventory system with non-preemptive priority service. Narayanan et al. [6] studied on an  $(s, S)$  inventory policy with service time, vacation to server and correlated lead time.

In this present paper, we address a continuous review inventory system with Poisson demand. The server served at different service rates (working vacation and regular), which are exponentially distributed. When the server is busy or the inventory level is zero, any arriving primary demands enter into orbit. When the server is in a working vacation or the inventory level is zero, the orbiting customer either may retry or may leave, which is exponentially distributed. The joint probability distribution of the inventory level, the number of customers in the orbit and the server status is obtained in the steady state case. Various system performance measures in the steady state are derived and the long-run total expected cost rate is calculated and some numerical examples.

The rest of the paper is organized as follows. In Section 2, we describe the mathematical model. In Section 3 and 4, we discuss the steady-state analysis of the model and some key system performance measures respectively. In Section 5, calculate the long-run total expected cost rate and the final section 6, a cost function is also studied numerically.

## II. MODEL DESCRIPTION

We consider a continuous review stochastic inventory system on the replenishment policy of  $(s, Q)$ . The basic assumptions of this inventory model are described as follows: we assume that the inter-arrival times of demands to a single server station according to a Poisson process with rate  $\lambda (> 0)$  and demands only single unit at a time. It is assumed that there is no waiting space in the system. The items are issued by a server to the customer after some service time due to the service performed on the items. When the server is busy (regular or working vacation) or the inventory level is zero, any arriving primary de-

demands enter into an orbit of infinite size. The service rates are  $\mu_b$  and  $\mu_v (< \mu_b)$ , when the system is in regular and working vacation, respectively, which are exponentially distributed. The server takes a working vacation at times when no customers in the system or the inventory level is zero or both. Working vacation durations are exponentially distributed with parameter  $\theta$ . At the completion time of the working vacation, the server switches a regular busy ((ie) service rate from  $\mu_v$  to  $\mu_b$ ) if there are customers (primary or retrial) in the system. Otherwise, the server continues the working vacation. The orbiting customers may either retry or may leave the orbit. The leaving orbiting customers are described as impatient (reneging) customers. If the server is in working vacation or the inventory level is zero, the impatience occurs in orbiting customers. An impatient customer

leaves the orbit independently after a random time which is distributed exponentially with parameter  $\eta (> 0)$ .

We assume the constant retrial policy for these orbit demands, that is probability of a repeated attempt of an orbiting demand is independent of the number of demands in the orbit. Retrial requests from the orbit follow an exponential distribution with parameter  $\alpha (> 0)$ . As the  $(s, Q)$  replenishment policy, when the on-hand inventory level drops to a prefixed level, say  $s (> 0)$  an order for  $Q (= S - s > s + 1)$  units is placed. The positive lead time is exponentially distributed with parameter  $\beta (> 0)$ . We assume that the inter-demand times between the primary demands, the lead times, retrial demand times, server regular periods and server working vacation periods are mutually independent random variables.

**Notations**

$[A]_{ij}$  : The element / submatrix at  $(i, j)$  the position of  $A$ .  
 $\mathbf{0}$  : Zero matrix.

$I$  : Identity matrix.

$e$  : A column vector of 1's of appropriate dimension.

$\delta_{ij}$  :  $\begin{cases} 1, & \text{if } i = j, \\ 0, & \text{otherwise.} \end{cases}$

$\bar{\delta}_{ij}$  :  $1 - \delta_{ij}$

$Y(t)$  :  $\begin{cases} 0, & \text{the server is idle in working vacation period at time } t. \\ 1, & \text{the server is busy in working vacation period at time } t. \\ 2, & \text{the server is idle in regular period at time } t. \\ 3, & \text{the server is busy in regular period at time } t. \end{cases}$

$E$  :  $\{(i,0,0) : i = 0,1,2,K\} \cup \{(i,k,m) : i = 0,1,2,K, k = 1,2,K, S, m = 0,1,2,3\}$

III. ANALYSIS

Let  $X(t)$ ,  $L(t)$  and  $Y(t)$  denote the number of demands in the orbit, inventory position of the commodity and the server status at time  $t^+$ . From the assumptions made on the input and output processes, it can be shown that the triplet  $\{(X(t), L(t), Y(t)), t \geq 0\}$  with the state space  $E$  is a Markov process.

To determine the infinitesimal generator

$$P = (p((i,k,m), (j,l,n))) \quad (i,k,m), (j,l,n) \in E$$

of this process we use the following arguments:

Let  $i = 0, k = 1,2,K, S$

- any arriving primary demand takes the state of the process from  $(i, k, 0)$  to  $(i, k, 1)$  with the intensity  $\lambda$ .
- any arriving primary demand takes the state of the process from  $(i, k, m)$  to  $(i + 1, k, m)$  with the intensity  $\lambda$ ,  $m = 1, 3$ .
- The server changes from working vacation to regular takes the state of the process from  $(i, k, 1)$  to  $(i, k, 3)$  with the intensity  $\theta$ .
- The completion of service from primary demand makes a transition from  $(i, k, 1)$  to  $(i, k - 1, 0)$  with the intensity  $\mu_v$ .
- The completion of service from primary demand makes a transition from  $(i, k, 3)$  to  $(i, k - 1, 0)$  with the intensity  $\mu_b$ .

Let  $i \geq 0$ ,  $k = 0$

- any arriving primary demand takes the state of the process from  $(i, k, 0)$  to  $(i + 1, k, 0)$  with the intensity  $\lambda$ .

Let  $i \geq 1$ ,  $k = 1, 2, K, S$

- any arriving primary demand takes the state of the process from  $(i, k, m)$  to  $(i, k, m + 1)$  with the intensity  $\lambda$ ,  $m = 0, 2$ .
- any arriving primary demand takes the state of the process from  $(i, k, m)$  to  $(i + 1, k, m)$  with the intensity  $\lambda$ ,  $m = 1, 3$ .
- The server changes from working vacation to regular takes the state of the process from  $(i, k, m)$  to  $(i, k, m + 2)$  with the intensity  $\theta$ ,  $m = 0, 1$ .
- a retrial requests takes the state of the process from  $(i, k, m)$  to  $(i - 1, k, m + 1)$  with the intensity  $\alpha$ ,  $m = 0, 2$ .
- an impatient customer takes the state of the process from  $(i, k, m)$  to  $(i - 1, k, m)$  with the intensity  $\eta$ ,  $m = 0, 1$ .
- an impatient customer takes the state of the process from  $(i, 0, 0)$  to  $(i - 1, 0, 0)$  with the intensity  $\eta$ .
- The completion of service in the system makes a transition from  $(i, k, 1)$  to  $(i, k - 1, 0)$  with the intensity  $\mu_v$ .

Let  $i \geq 1$ ,  $k = 2, 3, K, S$

- The completion of service in the system makes a transition from  $(i, k, 3)$  to  $(i, k - 1, 2)$  with the intensity  $\mu_b$ .
- The completion of service in the system makes a transition from  $(i, 1, 3)$  to  $(i, 0, 0)$  with the intensity

$\mu_b$ .

Let  $i \geq 0, k = 1, 2, \dots, S$

— a transition from  $(i, k, m)$  to  $(i, k + Q, m)$  for  $m = 0, 1, 2, 3$  takes place with the intensity  $\beta$  when a replenishment occurs.

— a transition from  $(i, 0, 0)$  to  $(i, Q, 0)$  takes place with the intensity  $\beta$  when a replenishment occurs.

We observe that no transition other than the above is possible.

Finally, the value of  $p((i, k, m), (i, k, m))$  is obtained by

$$p((i, k, m), (i, k, m)) = - \sum_{\substack{j \\ (i,k,m) \neq (j,l,n)}} \sum_l \sum_n p((i, k, m), (j, l, n))$$

Hence we have,  $p((i, k, m), (j, l, n)) =$

$$\left\{ \begin{array}{lll} \lambda, & j = i, & l = k, & n = m + 1 \\ & i = 0, & k = 1, 2, \dots, S, & m = 0 \\ & & or \\ & j = i + 1, & l = k, & n = m \\ & i \geq 0, & k = 1, 2, \dots, S, & m = 1, 3 \\ & & or \\ & j = i + 1, & l = k, & n = m \\ & i \geq 0, & k = 0, & m = 0 \\ & & or \\ & j = i, & l = k, & n = m + 1 \\ & i \geq 1, & k = 1, 2, \dots, S, & m = 0, 2 \end{array} \right.$$

$$\left\{ \begin{array}{llll}
 \mu_v, & j = i, & l = k - 1, & n = 0 \\
 & i \geq 0, & k = 1, 2, K, S, & m = 1 \\
 \\
 \mu_b, & j = i, & l = k - 1, & n = 0 \\
 & i = 0, & k = 1, 2, K, S, & m = 3 \\
 \\
 & & or & \\
 & j = i, & l = k - 1, & n = m - 1 \\
 & i \geq 1, & k = 2, K, S, & m = 3 \\
 \\
 & & or & \\
 & j = i, & l = k - 1, & n = 0 \\
 & i \geq 1, & k = 1, & m = 3 \\
 \\
 \theta, & j = i, & l = k, & n = m + 2 \\
 & i = 0, & k = 1, 2, K, S, & m = 1 \\
 \\
 & & or & \\
 & j = i, & l = k, & n = m + 2 \\
 & i \geq 1, & k = 1, 2, K, S, & m = 0, 1 \\
 \\
 \alpha, & j = i - 1, & l = k, & n = m + 1 \\
 & i \geq 1, & k = 1, 2, K, S, & m = 0, 2 \\
 \\
 \eta, & j = i - 1, & l = k, & n = m \\
 & & & m = 0, 1 \\
 \\
 & & or & \\
 & j = i - 1, & l = k, & n = m \\
 & i \geq 1, & k = 0 & m = 0
 \end{array} \right.$$

|  |                                |                           |                           |                  |
|--|--------------------------------|---------------------------|---------------------------|------------------|
| {                                      | $\beta,$                       | $j = i,$                  | $l = k + Q,$              | $n = m$          |
|  |                                | $i \geq 0,$               | $k = 1, 2, K, s,$         | $m = 0, 1, 2, 3$ |
|  |                                | <i>or</i>                 |                           |                  |
|  |                                | $j = i,$                  | $l = k + Q,$              | $n = m$          |
|  |                                | $i \geq 0,$               | $k = 0,$                  | $m = 0$          |
|  | $-\lambda,$                    | $j = i,$                  | $l = k,$                  | $n = m$          |
|  |                                | $i = 0,$                  | $k = s + 1, s + 2, K, S,$ | $m = 0$          |
|  | $-(\lambda + \mu_v + \theta),$ | $j = i,$                  | $l = k,$                  | $n = m$          |
|  |                                | $i = 0,$                  | $k = s + 1, s + 2, K, S,$ | $m = 1$          |
|  | $-(\lambda + \mu_b),$          | $j = i,$                  | $l = k,$                  | $n = m$          |
|  | $i \geq 0,$                    | $k = s + 1, s + 2, K, S,$ | $m = 3$                   |                  |
| $-(\lambda + \beta),$                  | $j = i,$                       | $l = k,$                  | $n = m$                   |                  |
|  | $i = 0,$                       | $k = 0, 1, 2, K, s,$      | $m = 0$                   |                  |
| $-(\lambda + \mu_v + \theta + \beta),$ | $j = i,$                       | $l = k,$                  | $n = m$                   |                  |
|  | $i = 0,$                       | $k = 1, 2, K, s,$         | $m = 1$                   |                  |
| $-(\lambda + \mu_b + \beta),$          | $j = i,$                       | $l = k,$                  | $n = m$                   |                  |
|  | $i \geq 0,$                    | $k = 1, 2, K, s,$         | $m = 3$                   |                  |
| $-\beta,$                              | $j = i,$                       | $l = k,$                  | $n = m$                   |                  |
|  | $i = 0,$                       | $k = 1, 2, K, s,$         | $m = 2$                   |                  |
| $-(\lambda + \theta + \eta + \alpha),$ | $j = i,$                       | $l = k,$                  | $n = m$                   |                  |
|  | $i \geq 1,$                    | $k = s + 1, s + 2, K, S,$ | $m = 0$                   |                  |

$$\left[ \begin{array}{llll}
 -(\lambda + \mu_v + \theta + \beta), & j = i, & l = k, & n = m \\
 & i \geq 1, & k = s + 1, s + 2, \dots, S, & m = 1 \\
 \\
 -(\lambda + \alpha), & j = i, & l = k, & n = m \\
 & i \geq 1, & k = s + 1, s + 2, \dots, S, & m = 2 \\
 \\
 -(\lambda + \theta + \eta + \alpha + \beta), & j = i, & l = k, & n = m \\
 & i \geq 1, & k = 1, 2, \dots, s, & m = 0 \\
 \\
 -(\lambda + \mu_v + \theta + \eta + \beta), & j = i, & l = k, & n = m \\
 & i \geq 1, & k = 1, 2, \dots, s, & m = 1 \\
 \\
 -(\lambda + \alpha + \beta), & j = i, & l = k, & n = m \\
 & i \geq 1, & k = 1, 2, \dots, s, & m = 2 \\
 \\
 -(\lambda + \eta + \beta), & j = i, & l = k, & n = m \\
 & i \geq 1, & k = 0, & m = 0 \\
 \\
 0, & \text{otherwise} & & 
 \end{array} \right.$$

Denoting  $q = ((q,0,0), (q,1,0), (q,1,1), (q,1,2), (q,1,3), \dots, (q,S,0), (q,S,1), (q,S,2), (q,S,3))$  for  $q = 0, 1, \dots, K$ .

By ordering states lexicographically, the infinitesimal generator  $P$  can be conveniently expressed in a block partitioned matrix with entries

$$[P]_{ij} = \left\{ \begin{array}{lll}
 A_1, & j = i, & i = 0 \\
 A, & j = i, & i = 1, 2, \dots, K \\
 L, & j = i + 1, & i = 0, 1, 2, \dots, K \\
 M, & j = i - 1, & i = 1, 2, \dots, K \\
 0, & \text{otherwise} & 
 \end{array} \right.$$

More explicitly,

$$P = \begin{pmatrix} A_1 & L & 0 & 0 & 0 & \Lambda \\ M & A & L & 0 & 0 & \Lambda \\ 0 & M & A & L & 0 & \Lambda \\ 0 & 0 & M & A & L & \Lambda \\ M & M & M & M & M & O \end{pmatrix}$$

where

$$[A_1] = \begin{cases} J, & j = i, & i = s + 1, s + 2, K, S \\ J_1, & j = i, & i = 1, 2, K, s \\ -(\lambda + \beta), & j = i, & i = 0 \\ J_3, & j = i - 1, & i = 2, K, S \\ J_4 & j = i - 1 & i = 1 \\ C, & j = i + Q, & i = 1, 2, K, s \\ C_1, & j = i + Q, & i = 0 \\ 0, & \text{otherwise} \end{cases}$$

with

$$[J]_{kl} = \begin{cases} \lambda, & l = k + 1, & k = 0 \\ \theta, & l = k + 2, & k = 1 \\ -\lambda, & l = k, & k = 0 \\ -(\lambda + \mu_v + \theta), & l = k, & k = 1 \\ -(\lambda + \mu_b), & l = k, & k = 3 \\ 0, & \text{otherwise} \end{cases}$$

$$[J_1]_{kl} = \begin{cases} \lambda, & l = k + 1, & k = 0 \\ \theta, & l = k + 2, & k = 1 \\ -(\lambda + \beta), & l = k, & k = 0 \\ -(\lambda + \mu_v + \theta + \beta), & l = k, & k = 1 \\ -(\lambda + \mu_b + \beta), & l = k, & k = 3 \\ -\beta, & l = k, & k = 2 \\ 0, & \text{otherwise} \end{cases}$$

$$[J_3]_{kl} = \begin{cases} \mu_v, & l = k - 1, & k = 1 \\ \mu_b, & l = k - 3, & k = 3 \\ 0, & \text{otherwise} \end{cases}$$

$$[J_4]_{kl} = \begin{cases} \mu_v, & l = k - 1, & k = 1 \\ \mu_b, & l = k - 3, & k = 3 \\ 0, & \text{otherwise} \end{cases}$$

$$[C]_{kl} = \begin{cases} \beta, & l = k, & k = 0, 1, 2, 3 \\ 0, & \text{otherwise} \end{cases}$$

$$[C_1]_{kl} = \begin{cases} \beta, & l = k, & k = 0 \\ 0, & \text{otherwise} \end{cases}$$

$$[L]_{ij} = \begin{cases} F, & j = i, & i = 1, 2, K, S \\ \lambda, & j = i, & i = 0 \\ 0, & \text{otherwise} \end{cases}$$

with

$$[F]_{kl} = \begin{cases} \lambda, & l = k, & k = 1, 3 \\ 0, & \text{otherwise} \end{cases}$$

$$[M]_{ij} = \begin{cases} K, & j = i, & i = 1, 2, K, S \\ \eta, & j = i, & i = 0 \\ 0, & \text{otherwise} \end{cases}$$

with

$$[K]_{kl} = \begin{cases} \alpha, & l = k + 1, & k = 0, 2 \\ \eta, & l = k, & k = 0, 1 \\ 0, & \text{otherwise} \end{cases}$$

$$[A]_{ij} = \begin{cases} G, & j = i, & i = s + 1, s + 2, K, S \\ G_1, & j = i, & i = 1, 2, K, s \\ -(\lambda + \eta + \beta), & j = i, & i = 0 \\ G_3, & j = i - 1, & i = 2, 3, K, S \\ J_4, & j = i - 1, & i = 1 \\ C, & j = i + Q, & i = 1, 2, K, s \\ C_1, & j = i + Q, & i = 0 \\ 0, & \text{otherwise} \end{cases}$$

with

$$[G]_{kl} = \begin{cases} \lambda, & l = k + 1, & k = 0, 2 \\ \theta, & l = k + 2, & k = 0, 1 \\ -(\lambda + \theta + \eta + \alpha), & l = k, & k = 0 \\ -(\lambda + \mu_v + \theta + \eta), & l = k, & k = 1 \\ -(\lambda + \alpha), & l = k, & k = 2 \\ -(\lambda + \mu_b), & l = k, & k = 3 \\ 0, & \text{otherwise} \end{cases}$$

$$[G_1]_{kl} = \begin{cases} \lambda, & l = k + 1, & k = 0, 2 \\ \theta, & l = k + 2, & k = 0, 1 \\ -(\lambda + \theta + \eta + \alpha + \beta), & l = k, & k = 0 \\ -(\lambda + \mu_v + \theta + \eta + \beta), & l = k, & k = 1 \\ -(\lambda + \alpha + \beta), & l = k, & k = 2 \\ -(\lambda + \mu_b + \beta), & l = k, & k = 3 \\ 0, & \text{otherwise} \end{cases}$$

$$[G_3]_{kl} = \begin{cases} \mu_v, & l = k - 1, & k = 1 \\ \mu_b, & l = k - 1, & k = 3 \\ 0, & \text{otherwise} \end{cases}$$

It may be noted that the matrices  $A_1, A, M$  and  $L$  are square matrices of order  $(4S + 1)$  and  $J, J_1, J_3, F, K, G, G_1, G_3$  and  $C$  are square matrices of order 4. The matrix  $J_4$  is of size  $4 \times 1$  and the matrix  $C_1$  is of size  $1 \times 4$ .

### 3.1 Stability Analysis

To discuss the stability condition of the process, we consider the matrix  $Q = M + A + L$  which is given by

$$[Q]_{ij} = \begin{cases} H_0, & j = i, & i = s + 1, s + 2, K, S \\ H_1, & j = i, & i = 1, 2, K, s \\ H_2, & j = i, & i = 0 \\ H_3, & j = i - 1, & i = 2, 3, K, S \\ H_4, & j = i - 1, & i = 1 \\ C, & j = i + Q, & i = 1, 2, K, s \\ C_1, & j = i + Q, & i = 0 \\ 0, & \text{otherwise} \end{cases}$$

Where

$$[H_0]_k = \begin{cases} (\lambda + \alpha), & l = k + 1, & k = 0, 2 \\ \theta, & l = k + 2, & k = 0, 1 \\ -(\lambda + \theta + \alpha), & l = k, & k = 0 \\ -(\mu_v + \theta), & l = k, & k = 1 \\ -(\lambda + \alpha), & l = k, & k = 2 \\ -\mu_b, & l = k, & k = 3 \\ 0, & \text{otherwise} \end{cases}$$

$$[H_1]_{kl} = \begin{cases} (\lambda + \alpha), & l = k + 1, & k = 0, 2 \\ \theta, & l = k + 2, & k = 0, 1 \\ -(\lambda + \theta + \alpha + \beta), & l = k, & k = 0 \\ -(\mu_v + \theta + \beta), & l = k, & k = 1 \\ -(\lambda + \alpha + \beta), & l = k, & k = 2 \\ -(\mu_b + \beta), & l = k, & k = 3 \\ 0, & \text{otherwise} \end{cases}$$

$$[H_2]_{kl} = \begin{cases} -\beta, & l = k, & k = 0 \end{cases}$$

$$[H_3]_{kl} = \begin{cases} \mu_v, & l = k - 1, & k = 1 \\ \mu_b, & l = k - 1, & k = 3 \\ 0, & \text{otherwise} \end{cases}$$

$$[H_4]_{kl} = \begin{cases} \mu_v, & l = k - 1, & k = 1 \\ \mu_b, & l = k - 3, & k = 3 \\ 0, & \text{otherwise} \end{cases}$$

$$[C]_{kl} = \begin{cases} \beta, & l = k, & k = 0, 1, 2, 3 \\ 0, & \text{otherwise} \end{cases}$$

$$[C_1]_{kl} = \begin{cases} \beta, & l = k, & k = 0 \\ 0, & \text{otherwise} \end{cases}$$

Clearly  $H_0, H_1, H_3, H_4$  and  $C$  are square matrices of order 4. The matrix  $H_4$  is of size  $4 \times 1$  and the matrix  $C_1$  is of size  $1 \times 4$ . The matrix  $H_2$  is of size  $1 \times 1$ .

Let  $\Pi$  be the steady-state probability vector of  $Q$ . That is,  $\Pi$  satisfies

$$\Pi Q = 0, \quad \Pi e = 1.$$

The vector  $\Pi$  can be represented by

$$\Pi = (\Pi^{(0)}, \Pi^{(1)}, \dots, \Pi^{(S)})$$

where

$$\Pi^{(0)} = (\pi^{(0,0)})$$

$$\Pi^{(i)} = (\pi^{(i,0)}, \pi^{(i,1)}, \pi^{(i,2)}, \pi^{(i,3)}), \quad i = 1, 2, \dots, S$$

**Theorem 1** The steady-state probability vector  $\Pi$  corresponding to the generator  $Q$  is given by

$$\Pi^{(i)} H_4 + \Pi^{(i-1)} H_2 = 0, \quad i = 1,$$

$$\Pi^{(i)} H_3 + \Pi^{(i-1)} H_1 = 0, \quad i = 2, 3, \dots, s+1,$$

$$\Pi^{(i)} H_3 + \Pi^{(i-1)} H_0 = 0, \quad i = s+2, s+3, \dots, Q,$$

$$\Pi^{(i)} H_3 + \Pi^{(i-1)} H_0 + \Pi^{(i-Q-1)} C_1 = 0, \quad i = Q+1$$

$$\Pi^{(i)} H_3 + \Pi^{(i-1)} H_0 + \Pi^{(i-Q-1)} C = 0, \quad i = Q+2, Q+3, \dots, S,$$

$$\Pi^{(S)} H_0 + \Pi^{(S)} C = 0.$$

**Proof:** We have

$$\Pi Q = 0, \quad \Pi e = 1.$$

After long simplifications, the above equations, except the last one, yields

$$\Pi^{(i)} = \begin{cases} (-1)^i \Pi^{(0)} \left( \frac{H_2}{H_4} \right) \left( \frac{H_1}{H_3} \right)^{i-1}, & i = 1, 2, \dots, s+1 \\ (-1)^i \Pi^{(0)} \left( \frac{H_2}{H_4} \right) \left( \frac{H_1}{H_3} \right)^s \left( \frac{H_0}{H_3} \right)^{i-s-1}, & i = s+2, s+3, \dots, Q \\ (-1)^i \Pi^{(0)} \left\{ \left( \frac{H_2}{H_4} \right) \left( \frac{H_1}{H_3} \right)^s \left( \frac{H_0}{H_3} \right)^{i-s-1} + \left( \frac{C_1}{H_3} \right) \right\}, & i = Q+1 \\ (-1)^i \Pi^{(0)} \left( \frac{H_2}{H_4} \right) \left( \frac{H_1}{H_3} \right)^s \left( \frac{H_0}{H_3} \right)^{i-s-1} + \left\{ \left( \frac{H_0}{H_3} \right)^{i-Q-1} + \sum_{k=1}^{i-Q-1} \left( \frac{H_2}{H_4} \right) \left( \frac{H_1}{H_3} \right)^{k-1} \left( \frac{H_0}{H_3} \right)^{i-Q-k-1} \right\} \Pi^{(0)} \left( \frac{-C}{H_3} \right)^{i-Q}, & i = Q+2, Q+3, \dots, S \end{cases}$$

where  $\Pi^{(0)}$  can be obtained by solving,

$$\Pi^{(S)} H_0 + \Pi^{(S)} C = 0 \text{ and } \sum_{i=0}^S \Pi^{(i)} e = 1,$$

that is

$$\Pi^{(0)} \left[ \left\{ \left( \frac{H_2}{H_4} \right) \left( \frac{H_1}{H_3} \right)^s \left( \frac{H_0}{H_3} \right)^{S-s-1} (-1)^S + \left\{ \left( \frac{H_0}{H_3} \right)^{S-Q-1} + \sum_{k=1}^{S-Q-1} \left( \frac{H_2}{H_4} \right) \left( \frac{H_1}{H_3} \right)^{k-1} \left( \frac{H_0}{H_3} \right)^{S-Q-k-1} \right\} \left( \frac{-C}{H_3} \right)^{S-Q} \right\} H_0 + \left( \frac{H_2}{H_4} \right) \left( \frac{H_1}{H_3} \right)^{s-1} C (-1)^{(s)} \right] = 0$$

and

$$\Pi^{(0)} \left[ I + \sum_{i=1}^{s+1} (-1)^i \left( \frac{H_2}{H_4} \right) \left( \frac{H_1}{H_3} \right)^{i-1} + \sum_{i=s+2}^Q (-1)^i \left( \frac{H_2}{H_4} \right) \left( \frac{H_1}{H_3} \right)^s \left( \frac{H_0}{H_3} \right)^{i-s-1} + (-1)^{Q+1} \left\{ \left( \frac{H_2}{H_4} \right) \left( \frac{H_1}{H_3} \right)^s \left( \frac{H_0}{H_3} \right)^{Q-s} + \left( \frac{C_1}{H_3} \right) \right\} + \sum_{i=Q+2}^S \left\{ (-1)^i \left( \frac{H_2}{H_4} \right) \left( \frac{H_1}{H_3} \right)^s \left( \frac{H_0}{H_3} \right)^{i-s-1} + \left( \frac{H_0}{H_3} \right)^{i-Q-1} + \sum_{k=1}^{i-Q-1} \left( \frac{H_2}{H_4} \right) \left( \frac{H_1}{H_3} \right)^{k-1} \left( \frac{H_0}{H_3} \right)^{i-Q-k-1} \right\} \left( \frac{-C}{H_3} \right)^{i-Q} \right] e = 1$$

Next, we derive the condition under which the system is stable.

**Lemma 1** The stability condition of the system under study is given by

$$(K - F)\mathbf{e} > \pi^{(0)}(K - K_1 - F - F_1)\mathbf{e} \quad (1)$$

**Proof:** From the well known result of Neuts(7) on the positive recurrence of  $P$  we have

$$\mathbf{\Pi}M\mathbf{e} > \mathbf{\Pi}L\mathbf{e}$$

and by the exploiting the structure of matrices  $M$  and  $L$  and  $\mathbf{\Pi}$  the stated result follows.

### 3.2 Steady state analysis

It can be seen from the structure of the rate matrix  $P$  and from the lemma (1) that the markov process  $\{(X(t), L(t), Y(t)), t \geq 0\}$  with the state space  $E$  is regular. Hence the limiting probability distribution  $\phi^{(i,k,m)} = \lim_{t \rightarrow \infty} pr\{X(t) = i, L(t) = k, Y(t) = m | X(0), L(0), Y(0)\}$ , exists and is independent of the initial state. That is,  $\Phi = (\Phi^{(0)}, \Phi^{(1)}, \mathbf{K})$  satisfies  $\Phi P = 0, \Phi \mathbf{e} = 1$ .

We partition the vector  $\Phi^{(i)}$ , for  $i = 0, 1, 2, \dots, K$  as follows

$$\Phi^{(i)} = (\phi^{(i,0)}, \phi^{(i,1)}, \mathbf{K}, \phi^{(i,S)})$$

which is partitioned as follows, for  $1 \leq k \leq S$

$$\phi^{(i,0)} = (\phi^{(i,0,0)})$$

$$\phi^{(i,k)} = (\phi^{(i,k,0)}, \phi^{(i,k,1)}, \phi^{(i,k,2)}, \phi^{(i,k,3)})$$

**Theorem 2** When the stability condition (1) holds good, the steady state probability vector  $\Phi$  is given by

$$\Phi^{(i)} = \Phi^{(0)} R^{(i)}, \quad i = 0, 1, 2, \dots, K \quad (2)$$

where the matrix  $R$  satisfies the matrix quadratic equation

$$R^2 M + R A + L = 0 \quad (3)$$

and the vector  $\Phi^{(0)}$  is obtained by solving

$$\Phi^{(0)}(A_1 + R M) = 0$$

subject to normalizing condition

$$\Phi^{(0)}(I - R)^{-1} \mathbf{e} = 1$$

**Proof:** The theorem follows from the well known result on matrix-geometric methods (Neuts(7)).

### 3.3 Computation of R matrix

In this subsection we present an efficient algorithm for computing the rate matrix  $R$  which is the main ingredient for discussing qualitative behavior of the model under study. The  $R$  matrix is of size  $(4S + 1)$  can be computed by using logarithmic reduction algorithm.

#### Logarithmic reduction algorithm

Logarithmic reduction algorithm is developed by Latouche and Ramaswami [11] which has extremely fast quadratic convergence. Here we discuss only the important steps involved in this algorithm. We refer the reader to Latouche and Ramaswami [11] for more details about this algorithm.

**Step 0:**  $H \leftarrow (-A)^{-1}L$ ,  $F \leftarrow (-A)^{-1}M$ ,  $G = F$ , and  $T = H$

**Step 1:**

$$U = HF + FH$$

$$E = H^2$$

$$H \leftarrow (I - U)^{-1}E$$

$$E \leftarrow F^2$$

$$F \leftarrow (I - U)^{-1}E$$

$$G \leftarrow G + TL$$

$$T \leftarrow TH$$

Continue **Step 1:** until  $\|e - Ge\|_{\infty} < \epsilon$ .

**Step 2:**  $R = -L(A + LG)^{-1}$ .

#### IV. SYSTEM PERFORMANCE MEASURES

In this section some performance measures of the system under consideration in the steady state are derived.

##### 4.1 Expected inventory level

Let  $\eta_i$  denote the average inventory position in the steady state. Then

$$\eta_i = \sum_{i=0}^{\infty} \sum_{j=1}^S \sum_{k=0}^3 j \left[ \pi^{(i,j,k)} \right] \quad (4)$$

##### 4.2 Expected reorder rate

Let  $\eta_r$  denote the expected reorder rate in the steady state. Then

$$\eta_r = \sum_{i=0}^{\infty} \left[ \mu_v \pi^{(i,s+1,1)} + \mu_b \pi^{(i,s+1,3)} \right] \quad (5)$$

##### 4.3 Expected number of demands in the orbit

Let  $\eta_o$  denote the average inventory position in the steady state. Then

$$\eta_o = \sum_{i=1}^{\infty} \sum_{j=1}^S \sum_{k=0}^3 i \left[ \pi^{(i,j,k)} \right] + \sum_{i=1}^{\infty} i \left[ \pi^{(i,0,0)} \right] \quad (6)$$

##### 4.4 Effective reneging rate for an orbiting customer

Let  $\eta_{ro}$  denote the effective reneging rate for an orbiting customer in the steady state. Then

$$\eta_{ro} = \sum_{i=1}^{\infty} \sum_{j=1}^S \sum_{k=0}^3 \eta \left[ \pi^{(i,0,0)} + \pi^{(i,j,k)} \right] \quad (7)$$

##### 4.5 Overall rate of retrials

Let  $\eta_{or}$  denote overall rate of retrials in the steady state. Then

$$\eta_{or} = \sum_{i=1}^{\infty} \sum_{j=1}^S \sum_{k=0}^3 \alpha \left[ \pi^{(i,j,k)} \right] + \sum_{i=1}^{\infty} \alpha \left[ \pi^{(i,0,0)} \right] \quad (8)$$

##### 4.6 The successful retrial rate

Let  $\eta_{sr}$  denote successful retrial rate in the steady state. Then

$$\eta_{sr} = \sum_{i=1}^{\infty} \sum_{j=1}^S \alpha \left[ \pi^{(i,j,0)} + \pi^{(i,j,2)} \right] \quad (9)$$

##### 4.7 The fraction of successful rate of retrial

Let  $\eta_{sr}$  denote successful retrial rate in the steady state. Then

$$\eta_{fr} = \frac{\eta_{sr}}{\eta_{or}} \quad (10)$$

### V. TOTAL EXPECTED COST RATE

To compute the total expected cost per unit time, we consider the following costs.

$c_s$  : Setup cost per order.

$c_h$  : The inventory carrying cost per unit item per unit time.

$c_w$  : Waiting cost of a customer in the orbit per unit time.

$c_r$  : renegeing cost per customer per unit time.

The long run total expected cost rate is given by

$$TC(s, S) = c_s \eta_i + c_h \eta_r + c_w \eta_o + c_r \eta_{ro}$$

From equations (4),(5),(6) and (7), we obtain

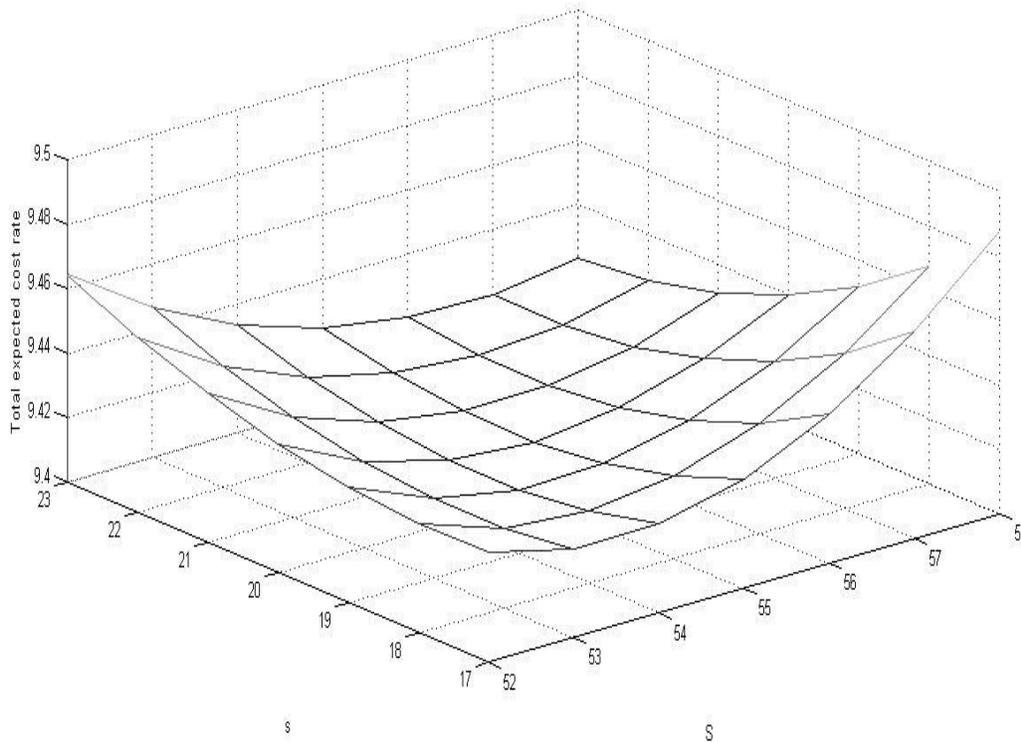
$$TC(s, S) = c_s \left( \sum_{i=0}^{\infty} \sum_{j=1}^S \sum_{k=0}^3 j \pi^{(i,j,k)} \right) + c_h \left( \sum_{i=0}^{\infty} [\mu_v \pi^{(i,s+1,1)} + \mu_b \pi^{(i,s+1,3)}] \right) + c_w \left( \sum_{i=1}^{\infty} \sum_{j=1}^S \sum_{k=0}^3 i \pi^{(i,j,k)} + \sum_{i=1}^{\infty} i \pi^{(i,0,0)} \right) + c_r \left( \sum_{i=1}^{\infty} \sum_{j=1}^S \sum_{k=0}^1 \eta [\pi^{(i,0,0)} + \pi^{(i,j,k)}] \right).$$

### VI. NUMERICAL ILLUSTRATIONS

In this section, we discuss some numerical examples indicates the function  $TC(s, S)$  to be convex. Figure 1 refers the changes of  $s$  and  $S$  are how to affect the total expected cost rate. The table 1 presents the total expected cost rate for various combinations of  $s$  and  $S$  by fixing the other parameters and costs as  $\lambda = 5, \beta = 1.8, \eta = 0.4, \alpha = 2, \mu_v = 17.7, \mu_b = 19, \theta = 0.2$  and  $c_s = 0.09, c_h = 3.8, c_w = 0.48, c_r = 1$ . The simple numerical search procedure are used to obtain the optimal values of  $TC(s, S)$  (say  $TC^*(s^*, S^*)$ ). The optimal value of the total expected cost rate is  $TC(20, 55) = 9.41742$ . The optimal cost for each  $S$  is shown in underline and the optimal cost for each  $s$  is bold. Some of the results are presented in Tables 2 through 13 where the lower entry in each cell gives the optimal total expected cost rate and the upper entries the corresponding  $S^*$  and  $s^*$ .

**Table 1: Total expected cost rate as a function of  $S$  and  $s$**

| $s$<br>$S$ | 17             | 18             | 19             | 20             | 21             | 22             | 23      |
|------------|----------------|----------------|----------------|----------------|----------------|----------------|---------|
| 52         | 9.43446        | <u>9.42764</u> | 9.42770        | 9.43400        | 9.44618        | 9.46413        | 9.48790 |
| 53         | <b>9.43385</b> | 9.42473        | <u>9.42213</u> | 9.42540        | 9.43417        | 9.44829        | 9.46777 |
| 54         | 9.43574        | <b>9.42450</b> | <u>9.41946</u> | 9.41996        | 9.42562        | 9.43626        | 9.45185 |
| 55         | 9.43990        | 9.42673        | <b>9.41945</b> | <u>9.41742</u> | 9.42023        | 9.42769        | 9.43975 |
| 56         | 9.44618        | 9.43122        | 9.42189        | <u>9.41752</u> | <b>9.41773</b> | 9.42228        | 9.43111 |
| 57         | 9.45440        | 9.43780        | 9.42657        | 9.42007        | <u>9.41787</u> | <b>9.41976</b> | 9.42563 |
| 58         | 9.46443        | 9.44631        | 9.43333        | 9.42485        | 9.42045        | <u>9.41988</u> | 9.42304 |



$\lambda = 5, \beta = 1.8, \eta = 0.4, \alpha = 2, \mu_v = 17.7, \mu_b = 19, \theta = 0.2, c_s = 0.09, c_h = 3.8, c_w = 0.48, c_r = 1$

**Fig. 1:** A three dimensional plot of the cost function  $TC(s, S)$

**Example 1** In this example we study the impact of arrival rate  $\lambda$ , service rates  $\mu_v$  and  $\mu_b$ , the lead time parameter  $\beta$ , the retrial rate  $\alpha$ , and the renaging rate  $\eta$ , on the optimal values  $(s^*, S^*)$  and the corresponding total expected cost rate  $TC^*$ . By fixing parameter  $\theta = 0.2$  and the costs values as  $c_s = 0.09, c_h = 3.8, c_w = 0.46, c_r = 1$ . We observe the following from table 2 to 7.

1. The total expected cost rate increases when  $\lambda$  increases and the total expected cost rate decreases when  $\beta, \eta, \alpha, \mu_v, \mu_b$  increase.
2. If  $\lambda, \mu_v$  increase, then  $S^*$  monotonically increases. If  $\beta, \eta, \alpha, \mu_b$  increase, then  $S^*$  monotonically decrease.
3. If  $\lambda$  increases, then  $s^*$  monotonically increases. If  $\beta, \eta, \alpha, \mu_v, \mu_b$  increase, then  $s^*$  monotonically decreases .

**Table 2: Effect of arrival rate  $\lambda$  and sevice rate  $\mu_v$  on the optimal values**  
 $\beta = 1.8, \eta = 0.4, \alpha = 2, \mu_b = 19$

| $\mu_v$ | 17.5    |    | 17.6    |    | 17.7    |    | 17.8    |    | 17.9    |    |
|---------|---------|----|---------|----|---------|----|---------|----|---------|----|
| 4.99    | 55      | 20 | 55      | 20 | 55      | 20 | 56      | 20 | 56      | 20 |
|         | 8.98862 |    | 8.97611 |    | 8.96371 |    | 8.95137 |    | 9.93898 |    |
| 5.00    | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 | 56      | 20 |
|         | 9.20023 |    | 9.18744 |    | 9.17475 |    | 9.16217 |    | 9.14959 |    |
| 5.01    | 56      | 21 | 56      | 21 | 56      | 21 | 56      | 21 | 56      | 21 |
|         | 9.43021 |    | 9.41729 |    | 9.40448 |    | 9.39176 |    | 9.37915 |    |
| 5.02    | 56      | 21 | 56      | 21 | 56      | 21 | 56      | 21 | 56      | 21 |
|         | 9.68171 |    | 9.66850 |    | 9.65539 |    | 9.64239 |    | 9.62948 |    |
| 5.03    | 57      | 22 | 57      | 22 | 56      | 21 | 56      | 21 | 56      | 21 |
|         | 9.95759 |    | 9.94430 |    | 9.93090 |    | 9.91759 |    | 9.90439 |    |

**Table 3: Effect of arrival rate  $\lambda$  and sevice rate  $\mu_b$  on the optimal values**  
 $\beta = 1.8, \eta = 0.4, \alpha = 2, \mu_v = 17.7$

| $\mu_b$ | 18.8     |    | 18.9     |    | 19.0    |    | 19.1    |    | 19.2    |    |
|---------|----------|----|----------|----|---------|----|---------|----|---------|----|
| 4.99    | 56       | 21 | 55       | 20 | 55      | 20 | 56      | 20 | 55      | 19 |
|         | 9.63374  |    | 9.27375  |    | 8.96371 |    | 8.69475 |    | 8.45912 |    |
| 5.00    | 56       | 21 | 56       | 21 | 55      | 20 | 55      | 20 | 56      | 20 |
|         | 9.91251  |    | 9.51501  |    | 9.17475 |    | 8.88071 |    | 8.62467 |    |
| 5.01    | 57       | 22 | 56       | 21 | 56      | 21 | 55      | 20 | 56      | 20 |
|         | 10.21998 |    | 9.77924  |    | 9.40447 |    | 9.08232 |    | 8.80211 |    |
| 5.02    | 57       | 22 | 57       | 22 | 56      | 21 | 56      | 21 | 56      | 20 |
|         | 10.56019 |    | 10.07003 |    | 9.65539 |    | 9.30142 |    | 8.99502 |    |
| 5.03    | 57       | 22 | 57       | 22 | 56      | 21 | 56      | 21 | 56      | 21 |
|         | 10.61398 |    | 10.39072 |    | 9.93090 |    | 9.54012 |    | 9.20521 |    |

**Table 4: Effect of arrival rate  $\lambda$  and retrial rate  $\alpha$  on the optimal values**  
 $\beta = 1.8, \eta = 0.4, \mu_v = 17.7, \mu_b = 19$

| $\alpha$ | 1.99    |    | 2.00    |    | 2.01    |    | 2.02    |    | 2.03    |    |
|----------|---------|----|---------|----|---------|----|---------|----|---------|----|
| 4.99     | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 19 | 55      | 19 |
|          | 9.18425 |    | 8.96371 |    | 8.76306 |    | 8.57946 |    | 8.41008 |    |
| 5.00     | 56      | 21 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 19 |
|          | 9.41545 |    | 9.17475 |    | 8.95623 |    | 8.75729 |    | 8.57523 |    |
| 5.01     | 56      | 21 | 56      | 21 | 55      | 20 | 55      | 20 | 55      | 20 |
|          | 9.66804 |    | 9.40447 |    | 9.16612 |    | 8.94953 |    | 8.75221 |    |

|      |          |    |         |    |         |    |         |    |         |    |
|------|----------|----|---------|----|---------|----|---------|----|---------|----|
| 5.02 | 56       | 21 | 56      | 21 | 56      | 21 | 55      | 20 | 55      | 20 |
|      | 9.94549  |    | 9.65539 |    | 9.39443 |    | 9.15832 |    | 8.94356 |    |
| 5.03 | 57       | 22 | 56      | 21 | 56      | 21 | 56      | 21 | 55      | 20 |
|      | 10.25085 |    | 9.93090 |    | 9.64379 |    | 9.38531 |    | 9.15135 |    |

**Table 5: Effect of lead time  $\beta$  and sevice rate  $\mu_v$  on the optimal values**  
 $\lambda = 5, \eta = 0.4, \alpha = 2, \mu_b = 19$

| $\beta$ | $\mu_v$ 17.5 |    | 17.6    |    | 17.7    |    | 17.8    |    | 17.9    |    |
|---------|--------------|----|---------|----|---------|----|---------|----|---------|----|
| 1.79    | 56           | 21 | 56      | 21 | 55      | 20 | 55      | 20 | 56      | 20 |
|         | 9.20086      |    | 9.18820 |    | 9.17556 |    | 9.16296 |    | 9.15033 |    |
| 1.80    | 55           | 20 | 55      | 20 | 55      | 20 | 55      | 20 | 56      | 20 |
|         | 9.20023      |    | 9.18744 |    | 9.17475 |    | 9.16217 |    | 9.14959 |    |
| 1.81    | 55           | 20 | 55      | 20 | 55      | 20 | 55      | 20 | 56      | 20 |
|         | 9.19944      |    | 9.18666 |    | 9.17400 |    | 9.16144 |    | 9.14889 |    |
| 1.82    | 55           | 20 | 55      | 20 | 55      | 20 | 55      | 20 | 56      | 20 |
|         | 9.19869      |    | 9.18594 |    | 9.17330 |    | 9.16076 |    | 9.14824 |    |
| 1.83    | 55           | 20 | 55      | 20 | 55      | 20 | 55      | 20 | 56      | 20 |
|         | 9.19800      |    | 9.18527 |    | 9.17264 |    | 9.16012 |    | 9.14764 |    |

**Table 6: Effect of lead time  $\beta$  and sevice rate  $\mu_b$  on the optimal values**  
 $\lambda = 5, \eta = 0.4, \alpha = 2, \mu_v = 17.7$

| $\beta$ | $\mu_b$ 18.8 |    | 18.9    |    | 19.0    |    | 19.1    |    | 19.2    |    |
|---------|--------------|----|---------|----|---------|----|---------|----|---------|----|
| 1.79    | 56           | 21 | 56      | 21 | 55      | 20 | 55      | 20 | 56      | 19 |
|         | 9.91335      |    | 9.51569 |    | 9.17556 |    | 8.88137 |    | 8.62519 |    |
| 1.80    | 56           | 21 | 56      | 21 | 55      | 20 | 55      | 20 | 56      | 20 |
|         | 9.91251      |    | 9.51501 |    | 9.17475 |    | 8.88071 |    | 8.62467 |    |
| 1.81    | 56           | 21 | 56      | 21 | 55      | 20 | 55      | 20 | 55      | 19 |
|         | 9.91172      |    | 9.51437 |    | 9.17400 |    | 8.88009 |    | 8.62407 |    |
| 1.82    | 56           | 21 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 19 |
|         | 9.91098      |    | 9.51371 |    | 9.17330 |    | 8.87953 |    | 8.62338 |    |
| 1.83    | 56           | 21 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 19 |
|         | 9.91028      |    | 9.51291 |    | 9.17264 |    | 8.87901 |    | 8.62274 |    |

**Table 7: Effect of lead time  $\beta$  and sevice rate  $\eta$  on the optimal values**  
 $\lambda = 5, \alpha = 2, \mu_v = 17.7, \mu_b = 19$

| $\beta$ | $\eta$ 0.39 |    | 0.40    |    | 0.41    |    | 0.42    |    | 0.43    |    |
|---------|-------------|----|---------|----|---------|----|---------|----|---------|----|
| 1.79    | 56          | 21 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 |
|         | 9.19097     |    | 9.17556 |    | 9.16013 |    | 9.14477 |    | 9.12949 |    |
| 1.80    | 55          | 20 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 |
|         | 9.19023     |    | 9.17475 |    | 9.15935 |    | 9.14402 |    | 9.12876 |    |
| 1.81    | 55          | 20 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 |
|         | 9.18946     |    | 9.17400 |    | 9.15862 |    | 9.14331 |    | 9.12808 |    |
| 1.82    | 55          | 20 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 |
|         | 9.18873     |    | 9.17330 |    | 9.15794 |    | 9.14265 |    | 9.12744 |    |
| 1.83    | 55          | 20 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 |
|         |             |    |         |    |         |    |         |    |         |    |

|  |         |         |         |         |         |
|--|---------|---------|---------|---------|---------|
|  | 9.18805 | 9.17264 | 9.15730 | 9.14204 | 9.12685 |
|--|---------|---------|---------|---------|---------|

**Exapmle 2** In this example we study the impact of setup cost  $c_s$ , holdiing cost  $c_h$ , waiting cost  $c_w$  and the reneging cost  $c_r$  on the optimal values  $(s^*, S^*)$  and the corresponding total expected cost rate  $TC^*$ . By fixing the parameter values as  $\lambda = 5, \beta = 1.8, \eta = 0.4, \alpha = 2, \mu_v = 17.7, \mu_b = 19, \theta = 0.2$ . We observe the following from table 8 to 13.

1. The total expected cost rate increases when  $c_s, c_h, c_w$  and  $c_r$  increase.
2. If  $c_h, c_w$  increase, then  $S^*$  monotonically increases. If  $c_s$  increases, then  $S^*$  monotonically decreases.

**Table 8: Sensitivity of  $c_s$  and  $c_h$  on the optimal values**  
 $c_w = 0.46, c_r = 1$

| $c_h$ | 3.6     |    | 3.7     |    | 3.8     |    | 3.9     |    | 4.0     |    |
|-------|---------|----|---------|----|---------|----|---------|----|---------|----|
| 0.087 | 55      | 20 | 56      | 20 | 56      | 20 | 56      | 20 | 57      | 20 |
|       | 9.03707 |    | 9.07498 |    | 9.11200 |    | 9.14902 |    | 9.18524 |    |
| 0.088 | 55      | 20 | 55      | 20 | 56      | 20 | 56      | 20 | 57      | 20 |
|       | 9.05758 |    | 9.09566 |    | 9.13301 |    | 9.17003 |    | 9.20675 |    |
| 0.089 | 55      | 20 | 55      | 20 | 56      | 20 | 56      | 20 | 56      | 20 |
|       | 9.07809 |    | 9.11617 |    | 9.15402 |    | 9.19104 |    | 9.22806 |    |
| 0.090 | 55      | 20 | 55      | 20 | 55      | 20 | 56      | 20 | 56      | 20 |
|       | 9.09860 |    | 9.13668 |    | 9.17975 |    | 9.21205 |    | 9.24907 |    |
| 0.091 | 54      | 20 | 55      | 20 | 55      | 20 | 56      | 20 | 56      | 20 |
|       | 9.11873 |    | 9.15719 |    | 9.19526 |    | 9.23306 |    | 9.27008 |    |

**Table 9: Sensitivity of  $c_s$  and  $c_w$  on the optimal values**  
 $c_h = 3.8, c_r = 1$

| $c_w$ | 0.43     |    | 0.44    |    | 0.45    |    | 0.46    |    | 0.47    |    |
|-------|----------|----|---------|----|---------|----|---------|----|---------|----|
| 0.087 | 56       | 20 | 56      | 20 | 56      | 20 | 56      | 20 | 56      | 20 |
|       | 8.74826  |    | 8.86950 |    | 8.99075 |    | 9.11200 |    | 9.23325 |    |
| 0.088 | 56       | 20 | 56      | 20 | 56      | 20 | 56      | 20 | 56      | 20 |
|       | 8.76927  |    | 8.89051 |    | 9.01176 |    | 9.13301 |    | 9.25426 |    |
| 0.089 | 55       | 20 | 56      | 20 | 56      | 20 | 56      | 20 | 56      | 20 |
|       | 8.790244 |    | 8.91153 |    | 9.03277 |    | 9.15402 |    | 9.27527 |    |
| 0.090 | 55       | 20 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 |
|       | 8.81075  |    | 8.93209 |    | 9.05342 |    | 9.17475 |    | 9.29609 |    |
| 0.091 | 55       | 20 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 |
|       | 8.83126  |    | 8.95260 |    | 9.07393 |    | 9.19526 |    | 9.31660 |    |

**Table 10: Sensitivity of  $c_s$  and  $c_r$  on the optimal values**  
 $c_h = 3.8, c_w = 0.46$

| $c_r$ | 0.99 |    | 1.00 |    | 1.01 |    | 1.02 |    | 1.03 |    |
|-------|------|----|------|----|------|----|------|----|------|----|
| 0.087 | 56   | 20 | 56   | 20 | 56   | 20 | 56   | 20 | 56   | 20 |

|       |         |    |         |    |         |    |         |    |         |    |
|-------|---------|----|---------|----|---------|----|---------|----|---------|----|
|       | 9.10900 |    | 9.11200 |    | 9.11500 |    | 9.11800 |    | 9.12100 |    |
| 0.088 | 56      | 20 | 55      | 20 | 56      | 20 | 56      | 20 | 56      | 20 |
|       | 9.13001 |    | 9.13301 |    | 9.13601 |    | 9.13901 |    | 9.14201 |    |
| 0.089 | 56      | 20 | 56      | 20 | 56      | 20 | 56      | 20 | 55      | 20 |
|       | 9.15102 |    | 9.15402 |    | 9.15702 |    | 9.16002 |    | 9.16302 |    |
| 0.090 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 |
|       | 9.17175 |    | 9.17475 |    | 9.17776 |    | 9.18076 |    | 9.18377 |    |
| 0.091 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 |
|       | 9.19226 |    | 9.19526 |    | 9.19827 |    | 9.20128 |    | 9.20428 |    |

**Table 11: Sensitivity of  $c_h$  and  $c_w$  on the optimal values**  
 $c_s = 0.09, c_r = 1$

|       |         |    |         |    |         |    |         |    |         |    |    |
|-------|---------|----|---------|----|---------|----|---------|----|---------|----|----|
| $c_w$ | 0.43    |    | 0.44    |    | 0.45    |    | 0.46    |    | 0.47    |    |    |
| $c_h$ | 3.6     | 54 | 20      | 54 | 20      | 55 | 20      | 55 | 20      | 55 | 20 |
|       | 8.73445 |    | 8.85588 |    | 8.97727 |    | 9.09860 |    | 9.21993 |    |    |
| 3.7   | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 |    |
|       | 8.77268 |    | 8.89401 |    | 9.01534 |    | 9.13668 |    | 9.25801 |    |    |
| 3.8   | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 |    |
|       | 8.81075 |    | 8.93209 |    | 9.05342 |    | 9.17475 |    | 9.29609 |    |    |
| 3.9   | 56      | 20 | 56      | 20 | 56      | 20 | 56      | 20 | 56      | 20 |    |
|       | 8.84831 |    | 8.96955 |    | 9.09080 |    | 9.21205 |    | 9.33330 |    |    |
| 4.0   | 56      | 20 | 56      | 20 | 56      | 20 | 56      | 20 | 56      | 20 |    |
|       | 8.88533 |    | 9.00657 |    | 9.12782 |    | 9.24907 |    | 9.37032 |    |    |

**Table 12: Sensitivity of  $c_h$  and  $c_r$  on the optimal values**  
 $c_s = 0.09, c_w = 0.46$

|       |         |    |         |    |         |    |         |    |         |    |    |
|-------|---------|----|---------|----|---------|----|---------|----|---------|----|----|
| $c_r$ | 0.99    |    | 1.00    |    | 1.01    |    | 1.02    |    | 1.03    |    |    |
| $c_h$ | 3.6     | 55 | 20      | 55 | 20      | 55 | 20      | 55 | 20      | 55 | 20 |
|       | 9.09559 |    | 9.09860 |    | 9.10161 |    | 9.10461 |    | 9.10762 |    |    |
| 3.7   | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 |    |
|       | 9.13367 |    | 9.13668 |    | 9.13968 |    | 9.14269 |    | 9.14569 |    |    |
| 3.8   | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 |    |
|       | 9.17175 |    | 9.17475 |    | 9.17776 |    | 9.18076 |    | 9.18377 |    |    |
| 3.9   | 56      | 20 | 56      | 20 | 56      | 20 | 56      | 20 | 56      | 20 |    |
|       | 9.20905 |    | 9.21205 |    | 9.21505 |    | 9.21805 |    | 9.22105 |    |    |
| 4.0   | 56      | 20 | 56      | 20 | 56      | 20 | 56      | 20 | 56      | 20 |    |
|       | 9.24607 |    | 9.24907 |    | 9.25221 |    | 9.25507 |    | 9.25807 |    |    |

**Table 13: Sensitivity of  $c_w$  and  $c_r$  on the optimal values**  
 $c_s = 0.09, c_h = 3.8$

|       |         |    |         |    |         |    |         |    |         |    |    |
|-------|---------|----|---------|----|---------|----|---------|----|---------|----|----|
| $c_r$ | 0.99    |    | 1.00    |    | 1.01    |    | 1.02    |    | 1.03    |    |    |
| $c_w$ | 0.43    | 55 | 20      | 55 | 20      | 55 | 20      | 55 | 20      | 55 | 20 |
|       | 8.80775 |    | 8.81075 |    | 8.81376 |    | 8.81677 |    | 8.81977 |    |    |
| 0.44  | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 |    |
|       | 8.92908 |    | 8.93209 |    | 8.93509 |    | 8.93810 |    | 8.94111 |    |    |

|      |         |    |         |    |         |    |         |    |         |    |
|------|---------|----|---------|----|---------|----|---------|----|---------|----|
| 0.45 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 |
|      | 9.05041 |    | 9.05342 |    | 9.05643 |    | 9.05943 |    | 9.06244 |    |
| 0.46 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 |
|      | 9.17175 |    | 9.17475 |    | 9.17776 |    | 9.18076 |    | 9.18377 |    |
| 0.47 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 | 55      | 20 |
|      | 9.29308 |    | 9.29609 |    | 9.29909 |    | 9.30210 |    | 9.30510 |    |

VII. CONCLUSION

We analysed an  $(s, Q)$  inventory system with retrial customers and working vacation. Primary inter arrival times, retrial times, service times and working vacation times are independent exponentially distributed random variables. We have derived the steady state distribution of the system using Matrix analytic methods and several performance measures have also been calculated. Some numerical solutions are presented to illustrate the qualitative behavior of the system.

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# Resource Cost Prediction and Comparison System for Cloud Consumers to achieve Cost Effective Uses

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**Abstract-** Cloud Computing or in shorthand just the “cloud”, is a pool of resources, software and information that are accessed over a network (Internet). Cloud provides services based on “Pay for what you use” principle i.e., pay for only those resources used for a particular time. The information and services are provided to various computers and devices as utility (like electricity grid).

Cloud users require a usage accounting infrastructure not only capable of supporting billing as an accounting application, but is also supporting all kinds of applications.

There are scenarios where the service providers fail to anticipate the requirements of the customers and hence they may add additional capacity from a trusted third party (TTP) service provider. The consumer is unaware of that they are dealing with an additional cloud service provider. Thus, the cost to be paid will increase for the consumer. Billing risks associated with ensuring that you are billed correctly and only for the resources consumed. The meters rate can change depending on the billing options chosen and the time of the day.

In the proposed system, the consumer will not only keep an account of the billing, but also can predict the different schemes matching with the current requirement of the customer with their different list of charges. Consumers will be able to know different schemes provided by various providers and have option to select the best cost effective scheme matching to their requirements.

**Index Terms-** Cloud Computing, Price Prediction, Price Comparison, Pricing Models, Resource Metering.

## I. INTRODUCTION

Cloud Computing is a new style of computing in which dynamically scalable and often virtualized resources are provided as a service over internet. Consumers pay for the services and capacity as they need them. Pricing for cloud platforms and services is based on three key dimensions: Storage, Bandwidth and Compute. Depending on the application characteristics, cost of deploying an application could vary based on the selected platforms. Besides the unit pricing, it is also important to calculate monthly development of application, deployment and its maintenance costs.

Needless to say that for each pay-per-use service, users must be provided with an unambiguous resource accounting model that precisely describes all the constituent chargeable resources of the service and how billing charges are calculated from the resource usage (resource consumption) data collected on behalf of the consumer over a given period. The consumers can use such resource usage data in many interesting ways, like - making their applications billing aware, IT budget planning, creating brokering services that automate the selection of services in line.

An issue that is raised[1] is the *accountability* of the resource usage data: who performs the measurement to collect the resource usage data - the provider, the consumer, a trusted third party (TTP), or some combination of them? Provider-side accountability is the norm for the traditional utility services such as for water, gas and electricity, where providers make use of metering devices (trusted by consumers) that are deployed in the consumers' premises.

For this above issue, we have proposed a system that keeps the accounts of resource billing. The proposed system also predicts the upcoming bill for a given time- hourly or monthly.

Such system will help the consumers to maintain and control their IT budgets. Users may also search for other providers with the same resources with their costs charged.

## II. BACKGROUND

Different providers provided different models to show the accountability of chargeable resources. The charges are applied for the traffic consumption, operation consumption and network consumption. Many Authors brought up many solutions for calculating the resource consumption at client side and also schemes for comparing the costs of different providers in the market.

An approach to help non-expert users with limited or no knowledge on legal and virtual appliance image format compatibility issues to deploy their services flawlessly. If these solutions are brought together in a single platform, then the consumers those are non-expert users can also perform accounting and selecting the proper schemes in a single platform. Thus, reducing the burden of searching individual provider's site for checking of the costs.

The user's satisfaction can be evaluated through a utility measure which depends not only on the resource properties but also on the user's preference to choose certain providers, i.e., two providers with the same resource capacities and usage price may be considered different for a user due to the user's choice behavior and loyalty. Furthermore, the task of optimally pricing cloud resources to attract users and improve revenue is very challenging.

In this paper, we show different schemes for cloud resource metering and prediction of bills for a particular time and how a non-expert consumer can access the pricing details of the cloud resources from various providers and select the best suited scheme as per their requirements.

## III. LITERATURE SURVEY

In a cloud environment, the resources are charged for their use, i.e. "pay-as-you-use" strategy. It is necessary for a cloud consumer to know whether the bill charged by the provider is relevant to the use or not. Thus, there must be some metering service that extracts relevant data required for calculating resource usage.

In this section we will see different strategies used for billing the cloud resources and also the schemes used to compare the costs of different cloud providers.

In [1], Author speaks about the weak and strong resource accounting models. Consumer of cloud gets clear idea of the discrepancies in their resource billing. Hence consumers will become aware of the billing and IT budgeting. Dynamic adjustment of resource capacity throughout the life cycle of the cloud based application to stay within bounds of predetermined cost.

In [2], Author speaks about Cloud service composition, which includes several tasks such as discovering, compatibility checking, selection and deployment. Most of the find it difficult to select the best one among the hundreds of possible compositions available. Author includes several algorithms for the selection of the required resources, helps to non-expert users with limited or no knowledge to deploy their services faultlessly. Can only perform well when the number of given alternatives is given small and the number of objectives is limited.

Cloud pricing has attracted many researcher attentions. Existing papers discuss how the optimal pricing can be obtained with revenue gain to the providers. Yaug Feng [3], proposed a Nash equilibrium, which was used in monopoly, duopoly and oligopoly markets, showed that how providers change their prices according to the market competition.

Some previous work also refers to the dynamic pricing, which increases the efficiency of cloud resources. The mechanism is introduced by author [4], is based on reverse auction. The mechanism allows user to select the appropriate cloud vendors and decide price dynamically.

Another approach that can be used for dynamic pricing is using game theory [5]. Using the game theory author tries to solve the problem between the competition of providers and propose dynamic pricing. This is done by Markov Decision Process that produces Markov Perfect Equilibrium.

Agent based cloud computing is concerned with design and development of software agents for bolstering the cloud service discovery, service negotiation and service composition. The advantage of using this is Software tools and testbeds are used for managing cloud resources, Complex cloud negotiation mechanism was devised to support cloud commerce and a multicriteria search engine that accepts as its inputs functional, technical and budgetary requirements from consumers.

In [7], Author speaks about different pricing models and new pricing policies for federated cloud. The two pricing models are – fixed and dynamic models, where fixed pricing model fixes the prices for a particular time horizon and where as dynamic pricing scheme allows to charge consumer with different prices for the same product depending on the characteristics of transaction. The pricing policies that the author introduces are On-demand (OD), Spot (S), and Reserved(R).

IV. COMPARISON OF EXISTING SYSTEM

| Paper name   | Current Bill Status | Comparison of schemes with different providers. | Dynamic Pricing | Graphical Representation on Cost | Sync |
|--|---------------------|---|-----------------|----------------------------------|------|
| Consumer-centric resource accounting in the cloud                              | Yes                 | No  | No              | Yes                              | No   |
| Compatibility-Aware Cloud Service Composition under Fuzzy Preferences of Users | Yes                 | No  | Yes             | Yes                              | Yes  |
| Price Competition in an Oligopoly Market with Multiple IaaS Cloud Providers    | No                  | Yes   | Yes             | Yes                              | No   |
| Mechanism Design Approach to Resource Procurement in Cloud Computing           | No                  | Yes   | Yes             | Yes                              | No   |
| A Novel Model for Competition and Cooperation among Cloud Providers            | No                  | Yes   | Yes             | Yes                              | No   |
| Agent-Based Cloud Computing  | No                  | Yes   | No              | No                               | No   |
| New Pricing Policies for   | No                  | Yes   | Yes             | No                               | No   |

|                    |  |  |  |  |  |
|--------------------|--|--|--|--|--|
| Federated<br>Cloud |  |  |  |  |  |
|--------------------|--|--|--|--|--|

Table 1 : Comparison chart of the existing systems.

### V. PROPOSED SYSTEM

From the above survey, we can conclude that the cloud pricing has become an important topic of research and how to improve it is a challenge. We propose a system that provides the bill of the consumed resources, predicts the bill for a given time period and compares cost of resources from different providers for the purpose of increasing cost effective selection of the provider by the users.

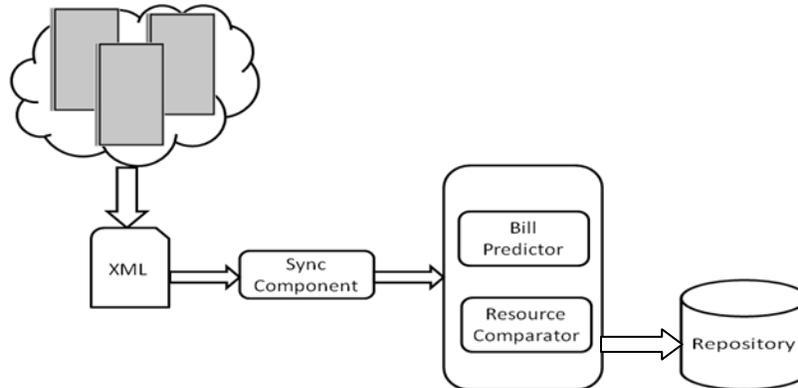


Figure 1: Module Diagram of Proposed System.

As shown in the Figure 1, there are three important modules in the proposed system. Bill Predictor (BP), Resource Comparator(RC) and Sync Component. The BP module provides the consumers the current bill of the resources consumed by the consumer and also it predicts the bill for a given time period. The dynamic bill prediction is done based on three parameters, hourly, daily and monthly bill prediction. This module will tell the consumer how much budget would be required for the upcoming bill.

The second module is Resource Comparator(RC), which is used to compare different prices of various provider in a single platform so as to help consumers to select for the best suitable price for their requirements. The selection of the providers is could be carried out on the parameters like, most recently used resource combinations.

The Sync Component is the last module which is will link the system to the cloud providers. Its responsibility is to keep the repository consistent with latest metadata provided by cloud providers.

### VI. CONCLUSION

Cloud is a collection of resources called as “resource pool”. Users hire resources based on “pay-as-you-use” strategy. In this survey, we studied different ways of pricing and how to select the best resource schemes from different providers. Selection of different schemes and making it automated will help non-expert users to hire the cloud resources easily and efficiently, and within their budget.

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# Community Involvement in Tourism Development: As Strategy for Poverty Alleviation after the earthquake (Case Study: Kasongan Village Yogyakarta)

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**Abstract-** Kasongan it is very important village due to tourism that based on small scale enterprised, and after the earthquake hit Kasongan not only the village was collapse but also the small scale enterprised that people earn their living. This thesis discusses the involvement and participation of local communities in tourism development using a case study in Kasongan village. The research is guided by three research questions: (1) what are the views of local people towards community involvement in tourism development especially after the earthquake; (2) what are appropriate roles and participate of local people in tourism development; and (3) what are the views of the local people on the contribution of tourism development towards poverty alleviation.

Based on the findings, this research concludes that local people a role in the tourism development decision-making process. In general, local people want to see decisions about tourism development in their area made jointly by government officials and local leaders in consultation with the local community. Tourism development is contributing positively towards poverty alleviation, and has made improvement on accessibility, prices of goods and services, employment, income-generating.

**Index Terms-** Tourism, Community, and Poverty Alleviation

## I. INTRODUCTION

Poverty is one of the very important development indicators for tourism.....The success of the development program will be clearly observed in the significant changes in magnitude of poverty per se. It why The government fundamentally concern with the effort to alleviate the poverty (Janiaton. D, 2005).

It has been quite long that tourism sector becomes a reliable sector with respect to the effort to alleviating the poverty. The governments of developing countries are highly convinced that the development programs of tourism has the very potential to alleviate the poverty of the majority of their people when it is designed on the basis of the objective reality of the life of those suffering under the poverty and the implementation meet with the planning of tourism. Concerning to the very wide scope of its implementation, the contribution of the tourism to poverty alleviation can be optimized by augmenting the multiplier effect in job opportunity entrepreneurial opportunity and income distribution.

In Indonesia there is an interesting shifts in discourse, paradigm and policy development from development to empower-

ment. On the other hand the development also brings a lot of disparity between rural and urban life. The negative impact of development is the poverty that affects more by the villagers.

Though it is admitted that in a macro scale the contribution of the tourism sector to the foreign exchange and the creation of job opportunity is significant, in a micro scale there is not any empirical fact found about the correlation between magnitude of the foreign exchange and the changes of the people in poverty.

## II. AIM OF RESEARCH

This study aims to reveal the relationship between (a) views of local people towards community involvement in tourism development especially after the earthquake; (2) the roles local people in tourism development; and (3) the views of the local people due tourism development towards poverty alleviation to improved quality of life.

## III. RESEARCH METHOD

The current research explores the experience of women and men in a natural context by adopting phenomenological approach. In particular the author visited Kasongan in several times. At the first visit took place in Mei 2007. No formal preparation were made at that time since the visit was not undertaken for research purposes. Only when the author arrived at Kasongan she started observing with more professional eye, participating in activity and venturing to talk with people that make the pottery. The visit offered the opportunity to gain clarity from her own preconditions and to design the methodology.

In phenomenology is a generic term that refers to all the views of the social sciences which assumes that human consciousness and the meaning of opinion as a focus for understanding social action. Of course, in relation to cultural studies was subjective view of informants is necessary. Opinion would be valid if there is intersubjective process between cultural researchers with informants. In phenomenology the researcher attempts to taking account of its psychological origin and casual explanations which the scientist may be able to provide (Marleau Ponty 1962). Thus phenomenological approaches can be applied to those disciplines, such as tourism where the focus in understanding human experience (Casmir 1983).

Participant observation provided complementary forms of experimental material to those collected from face to face conversations. In phenomenological research close observation, where the researcher enters the "world of immediate experience" (Hussrel 1970), entails data gathering that remains natural and authentic (Sarantakos 2005).

#### IV. LITERATURE READING

##### 1. The Roles of Community Due to Poverty Alleviation

The term empowerment is sometimes very difficult to distinguish from the strengthening of the community and community development (community development). In practice the terminology often overlap, interchangeable and refer to a similar understanding. Cook (1994) underline that specific development or community development is a concept relating to the improvement or development. This is a particular type of change towards a positive direction. In short community development is a particular type of a deliberate attempt to spur an increase or community development. While Giarci (2001) sees community development as a matter of having the center of attention in helping people in various age groups to grow and evolve through various facilitation and support to enable them to decide, plan and take action to manage and develop their physical environment and social welfare. This process facilitates the strengthening of the local economy and allows people to take collective action and conduct political pressure and bring a concerted effort to initiate changes at the local level where networking becomes one of the key words. Bartle (2003) defines community development as a means to make society more complex and powerful. This is a social change in which society becomes more complex, growing local institutions, collective power is increased and qualitative changes in the organization.

Based on the intersection and replace mutual understanding of community development and community empowerment, it can simply be summarized some key essence in community empowerment. "Community empowerment is an intentional effort to facilitate local communities in planning, deciding and managing local resources owned through collective action and networking so that in the end they have the ability and independence in economic, ecological, and social".

Poverty continues to be a phenomenal issue throughout the history of Indonesia as a nation state. In the countries that mismanaged, there is no bigger issue, in addition to the problems of poverty. Poverty has made millions of children can not be have a good education, lack of health financing, lack of savings and lack of investment, lack of access to public services, lack of jobs, lack of social security and protection of the family, the strengthening of urbanization to the city, and worse, poverty causes millions of people to meet the needs of food, clothing and shelter are limited. Poverty, causing the villagers are willing to sacrifice anything for the sake of survival, safety life (Scott, 1981).

Poverty becomes a perfect excuse for Human Development Index (HDI) that low. Overall quality of Indonesia people is still relatively low, compared to the other countries in the world. Based on the Human Development Report 2004 which uses 2002 data, the rate Human Development Index (HDI) Indonesia is 0.692. The index number is a composite of life expectancy at birth of 66.6 years, literacy rates of people aged 15 years and

over by 87.9 percent, combined gross enrollment rate in basic education to higher education by 65 percent, and the Domestic Revenue gross per capita calculated at purchasing power parity (purchasing power parity) of U.S. \$ 3,230. Indonesia's HDI ranks only 111th out of 177 countries (Kompas, 2004).

##### 2. Tourism as Strategy To Alleviate Poverty

Based on the analyses that have been made, expert (de Kadt, 1979; Mathieson and Wall; Luebben, 1995; Max, 2004) ultimately concluded that the significant contribution of the tourism to the economic development of a country or a region may clearly be observed in there form which are: the widening the job opportunity, the increase in foreign exchange and the equal distribution of interregional development.

Choice on the tourism sector for poverty alleviation does not mean limited efforts of poverty alleviation from the economical point of view. Poverty, in the context of tourism development, is not only limited to the meaning of poverty in economical and physical aspect but also includes cultural, ethical and morals poverty. The increasing contribution of the tourism sector in national economic growth, job opportunity and developing community activities in the tourism sector as shown from data above has proved that the tourism sector has an important role in improving national economy recovery and community based economy. On the other hand, the increasing creativity of local culture, rising social interaction among people and the increasing ethics of social intercourse among others, are positive side of the tourism sector in alleviating social poverty.

The first strategy to foster greater strength of the tourism sector to reduced poverty is trying to encourage the growth of domestic tourists. From the economic side, approximately 29.8 million domestic tourist (Statistical Bureau, 2004) will directly be able to expand economic transactions to the lowest segment of society. The important is that the growth of domestic tourists will drive this is the introduction of educational effort in the sense of nature and culture through various interactions carried out between tourists with local communities.

The efforts to encourage the growth of domestic tourism, can be done through the introduction of cultural tourism from elementary school, making educational tour packages, ease of accessibility through inter-regional transportation system settings and inter-capital transport, promotion of the tourist attraction that exist in the territories, the creation of the activity-supporting activities such as drawing competitions ODTW, writing competitions and so on.

Another very important strategy is to seek to develop the concept of community based tourism that is the basis of the Sustainable Tourism Development. This concept asserts that society is no longer the object of development but as a determinant of development – building itself. As a determinant of development, the community will be able to alleviate themselves from poverty and reduce the level of dependence on external factors (Ashley and Hayhom 2004)

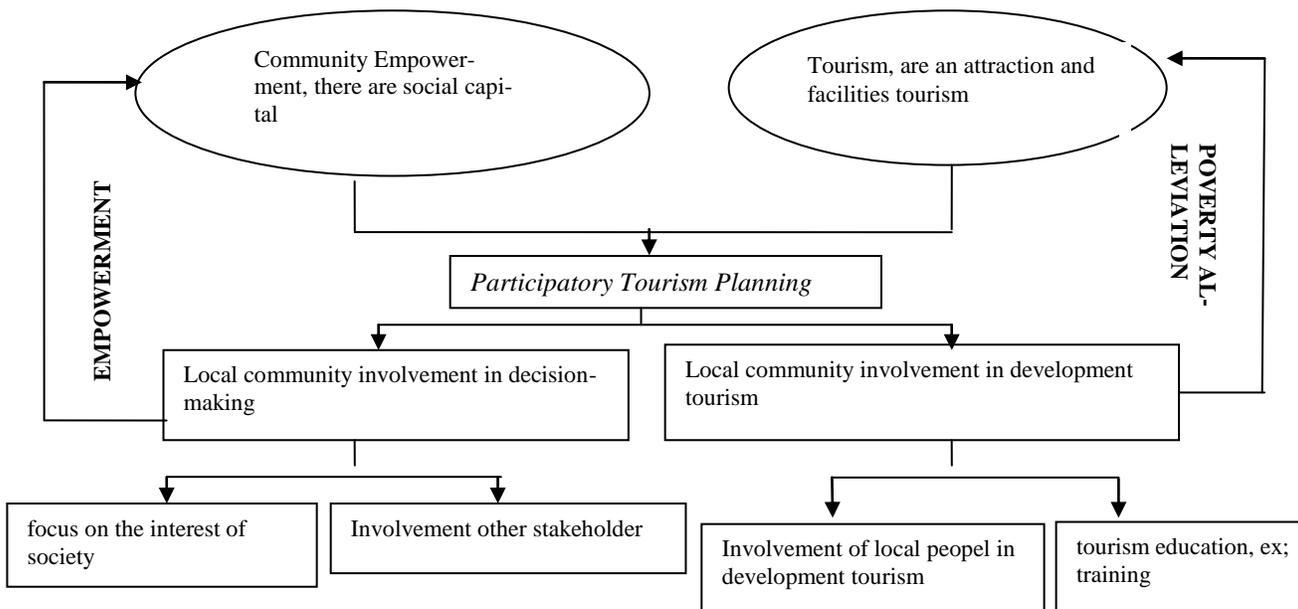
Tourism is therefore an appropriate mechanism for poverty reduction. It not only contributes to economic growth but can also have social, environmental and cultural benefits and costs. Tourism provides employment opportunities by diversifying and increasing income which reduces the vulnerability of the poor. Through increased national income (foreign exchange earnings

and taxation), additional funds can be diverted to poverty reduction program There are several advantages due to inherent characteristics of tourism which make the sector conducive for pro poor growth. These advantages are (as stated in *Tourism and Poverty Alleviation*, WTO, 2002):

- a. Tourism is consumed at the point of production increasing opportunities for individual and micro-enterprises to sell additional products or services.
- b. The restriction of access to international markets as faced by the traditional sectors of developing countries is not applicable to tourism.
- c. Tourism depends not only on financial, productive and human capital but also largely on natural and cultural capital which are often assets possessed by the poor.

- d. Tourism is labour-intensive providing the poor, who have large labour reserves, with opportunities.
- e. Tourism thrives on diversity, drawing from a large resource base which increases scope for wider participation.
- f. Tourism provides important opportunities for women to find employment
- g. Tourism directly responds to poverty reduction objectives since it:

Figure of community empowerment in the development of tourism as a poverty alleviation efforts are as:



Source: many sources, 2008

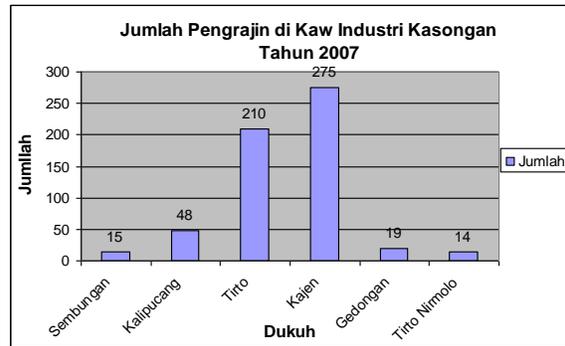
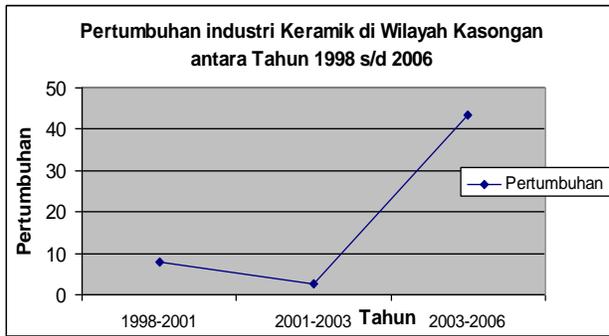
## V. STUDY RESULT

### 1. Tourism in Kasongan

The development of tourism in rural tourism starting when Kasongan village declared as a tourist village in 1988. But before the area is the village by village Kasongan predominately a ceramic craftsmen. It is then triggers the growth and development of the village as a tourist village Kasongan Crafts pottery. The distribution of the ceramic industry before the earthquake can be seen on the map below. For areas with the most craftsmen are on Kajen with 3 village of the Kajen, Sentanan and Kasongan. The

third hamlet is this which is the forerunner Kasongan tourist villages, and developing rapidly to the other like village like Tirta, Sembungan. Pucang Gedongan and Kali Pucang.

Growth in the pottery industry reached its heyday in Kasongan 2000 this can be seen from the increasing number of industrial ceramics in Kasongan as shown in the table below. On the table shows that after 2003 the development of a close very fast growth rate of 40.2%. While the largest number of craftsmen in the village and Tirta Kajen (more than 200 craftsmen)

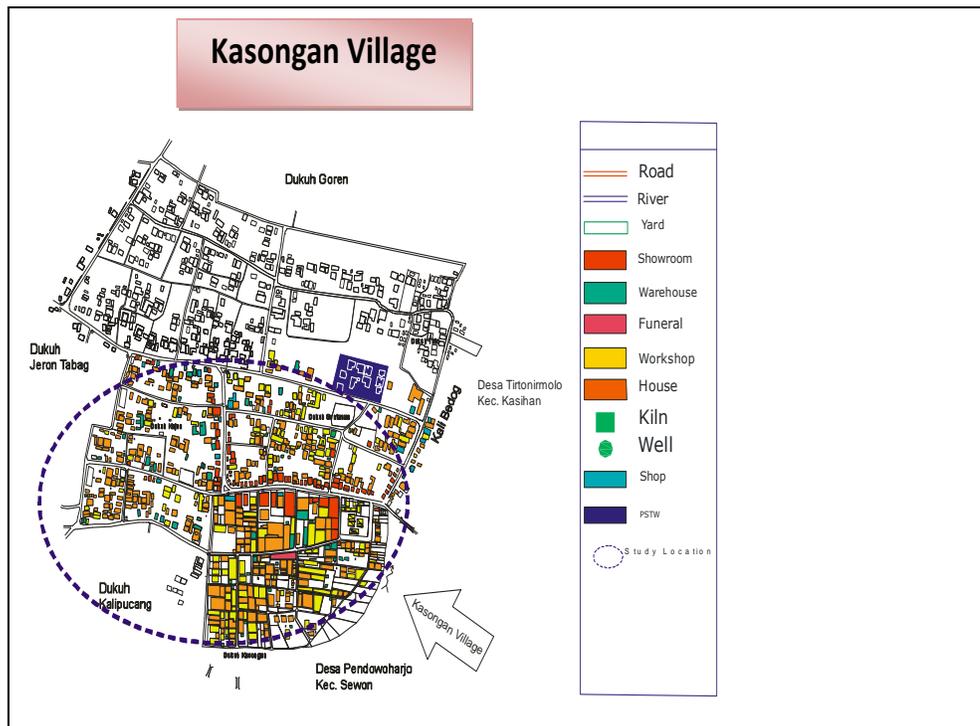


Source: Statistic Bureau of Bantul Regency 2006

**Table 1. Growth of Pottery Industry from 1998-2006**

**Table 2. The number of Pottery maker in 2007 in Kasongan Village**

The distribution of the ceramic industry can be seen on Map 1. From year to year the number of craftsmen continue to grow. The role of craftsmen as a business unit within the Ceramics Industry Kasongan very important to the ongoing industrial activities in Kasongan. According to the Technical Services Unit (UPT) Construction Crafts pottery craftsmen as Kasongan number of business units in Kasongan are as follows:



## 2. Community Development and Poverty Alleviation Through Tourism

In the subsequent development of tourist villages Kasongan have ups and downs this is caused by the increasing number of pottery makers in the region which ranges from 500 artisans, as well as natural disasters (earthquakes) that occurred on May 26, 2006, has made tourism village suffered significant damage. According to Mr. Nangsib as head of Kasongan Village that most of these villages suffered damage from severe to mild, the most severe damage occurred on RT 04 as manifested

*"... .. After the earthquake, how to, start to rise with the help of NGOs and government in the form of funds 15 Million, Kasongan village that have 344 households. The largest damage experienced by Kasongan village,,,,,,,,,,,,,,,,,,,,,"*

The earthquake has made the community around a lot of houses were damaged either as a residence as well as workshops (*brak*) then in 2006 in collaboration with NGOs outside a process of community empowerment which has now evolved into a number of activities in addition to the pottery-making activities. NGOs are assisting communities is Relief.

The institute previously helped people in the earthquake recovery, but the beginning of 2007 this institution was no longer help people in the process of restoration / repair of buildings, but more on efforts to empower the community in accordance with the capabilities and local resources. At present there are 36 members and 16 of whom were women. Currently the agency has turned into cooperatives with the Cooperative's name "Joint Kasongan" (KUB), which stands about mid-2008 after recovery program conducted by the Relief completed.

Today the KUB cooperation focus its efforts to help communities start of training improved quality pottery, to the marketing. In addition to empowering the community then the program is run by KUB village tour, making bamboo panels and manufacture of pottery (terracotta). Training provided by the Relief include finishing training, computer training and marketing. According to one member of the KUB that training can increase knowledge and useful for increasing their market segment.

It is also supported by statements made by a member of KUB by Mbak nFrom benefit from the training KUB is quite a lot but can not be seen because of the current orders of pottery is down, and as it was delivered that the other advantages obtained are him getting job as one of the staff at the KUB.

..... yesterday there is training like that from the start of training to make prints, make a good mixture of clay how,, make the motifs painted finish With KUB..... there are many advantages that I have, for example now a staff in KUB office .....

**Paket Wisata Belajar**

Paket Wisata TK/SD merupakan paket belajar pengenalan gerabah dengan bermain membuat gerabah sederhana serta mewarnai gerabah.

Paket Wisata SMP/SMA merupakan paket belajar pengenalan gerabah tingkat lanjut dengan membuat gerabah fungsional serta warna gerabah dengan teknik tertentu

**Paket Wisata Kursus**

Paket Kursus Pemula-Pembuatan Gerabah merupakan paket belajar untuk masyarakat umum baik individu maupun kelompok, dimana peserta belajar teknik pembuatan keramik serta proses pembakarannya menjadi gerabah jadi

Paket Kursus Pemula-Finishing Gerabah merupakan paket belajar memfinishing gerabah menjadi lebih menarik dengan berbagai teknik (ekstur, wash, foam, laminating, dll)

**Paket Khusus**

Merupakan paket pendukung acara belajar di Kasongan, antara lain:

- Paket Makan siang di Kasongan (Nasi Pecel Belut, Nasi Gudeg dan Kenduri)
- Paket Kesenian (Atraksi Prian Jawa, Jathilan, paket belajar menari Jawa)

Untuk Paket Wisata Belajar sudah termasuk kegiatan kunjungan ke bengkel kerja dan tungku untuk melihat proses pembuatan dan pembakaran gerabah.

**CSF VILLAGE TOUR**  
*Wisata Belajar Gerabah Kasongan*

*bermain sambil belajar*

JOSILO MBAYU CARIK Paksiwang, Kasongan, Yogyakarta-Indonesia

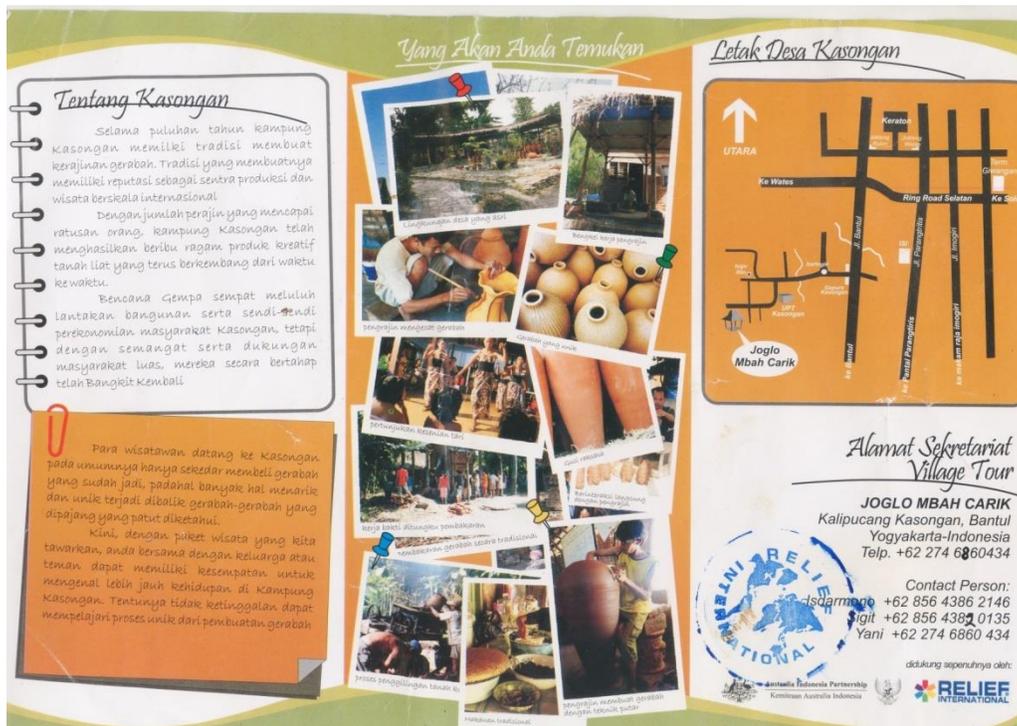


Figure 1 one of the work done by KUB in order to promote Kasongan and pottery village, through the manufacture and distribution of leaflets and brochures

As stated by one member of the KUB that most members of the empowered women / mothers are accompanied by households, which until now still continue to be assisted in improving the quality of crafts produced. In addition to providing training to women in the technical aspects of pottery-making then the KUB also helped their members to find a market like have an exhibition in Jakarta, in Jogjakarta (Plasa and Vredenburg Ambarukmo), such as those told by mbak Ndari. While efforts to find a buyer from outside still have some difficulties address to achieving the

desired quality by the consumer (buyer) as presented by Miss Yani as the Manager of KUB.

**3. The Role of Community in Tourism Sector**

As we know that Kasongan village is a village that known as pottery village, (cause all of the habitant work as pottery makers, and after Kasongan village declare a tourism village many roles taken by the community as a consequences of the tourism village, and the roles shown as the table below:

**Table 3. The Role of Actor and Level of Participation in Kasongan Village**

| Role of Actor                          | Community  | Government  | Other Stakeholders  |
|--|--|---|---|
| Level of Participation                 |  |   |   |
| Make a pottery (as attraction tourism) | Most of the people living as pottery craftsmen, as well as the livelihood activities of the production process is also a tourist attraction in Kasongan  | In this process the government role in providing guidance related to design (UPT Kasongan)  |   |
| Marketing                              | Marketing process undertaken by the community there are two ways, namely to leave the showroom located on the main road, even this is one tourist attraction, (the visit and buy) pottery a second is to sell directly to buyers who | The role of government in the marketing of pottery is not maximized (the exhibition is only done if there are funds) so that the activities to market non-routine | KUB is a cooperative that was formed after the quake, often provide an opportunity for artisans to exhibit at both local and national |

Source: Based on Research 2010

## VI. CONCLUSION

Based on the cases of community empowerment and its relationship with poverty eradication, then some of the conclusions obtained are:

1. Community Empowerment with improved the quality of society

Community empowerment through increased production is a crucial step in the empowerment of communities, these activities are part of community economic development through cooperatives. According to Ife (2008) that the cooperative is one of the alternatives in the development of society and to strengthen solidarity, and recommended that cooperatives are formed based on needs and local culture. In cases in Kasongan although cooperatives have been formed and has a management board but is still not running with a maximum due to the lack of monitoring and evaluation of some existing activities. Besides community involvement needs to be improved.

2. Become a subject of the programs

The idea that people should be able to define their own needs and how to comply, at the local level people mostly knew what they need is the idea of social justice and change from below that delivered by the (Chamber, 1983; Salleh 1997). In accordance with the principles of change from the bottom of one of them is respect for local knowledge and local skills. In the current conditions in Kasongan society has become a subject or citizen control in the empowerment.

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# **Feasibility Study and Development of Refrigerator cum Air Conditioner**

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**Abstract-** This paper is about our attempt to merge Domestic Refrigerator and Air conditioner into a combined system such that an ordinary man can have a sound sleep which automatically increases his working productivity for the next day. Refrigerator has become a necessity of all households in 21<sup>st</sup> Century. As the country's GDP is 8 to 9% and is likely to be 10%, hence the standard of living of common man is bound to be better. In all metropolitan cities, environment degradation due to automobile & other factors is on the rise, therefore the requirement of air-conditioner has already been felt. The motivation for the project comes from rising energy demands and hence its cost. As we all know that we are lacking of power resources, so this product will help us in tackling this problem as we are trying to make a personalized cooling system which will run at a very low cost that can be afforded by a common man. In minimum construction, maintenance and running cost, this attempt is quite useful for domestic purpose so that our ultimate aim of the project that is those who cannot afford an Air Conditioner can have the comfort of Air Conditioner could be completed. Since all energy cost are on a rise, therefore this project is a way forward in realizing the economic as well as environmental demands. As it is said "the energy saved is the energy produced". On the other hand the common man can have the comfort of Air conditioner.

**Index Terms-** Affordable, Air Conditioner, Domestic Refrigerator, Productivity

## I. INTRODUCTION

Refrigerator is ranked as one of the best innovations of the 20<sup>th</sup> century where Refrigerator explored in earlier of 20<sup>th</sup> century and Air-Conditioner is lately in that of 20<sup>th</sup> century. However it has become the prime necessity in 21<sup>st</sup> century. In over a span of three decades, there has been a surge in energy demands due to the everlasting population especially in India. This has led to increase in pollution and energy cost that cannot be afforded by poor men. The idea of this project explores the possibility of combining two units i.e. Refrigerator and Air-Conditioner into a single unit, such that the running cost becomes zero or almost negligible. The name of the device is termed as Refrigerator cum Air-Conditioner where both the Refrigerator and Air-Conditioner are working on the cost of only Refrigerator. This is how we are trying to make the environment and a common man comfortable. By this product a common man could have a sound sleep so that his productivity for the next day increases.

## II. SYSTEM DESCRIPTION

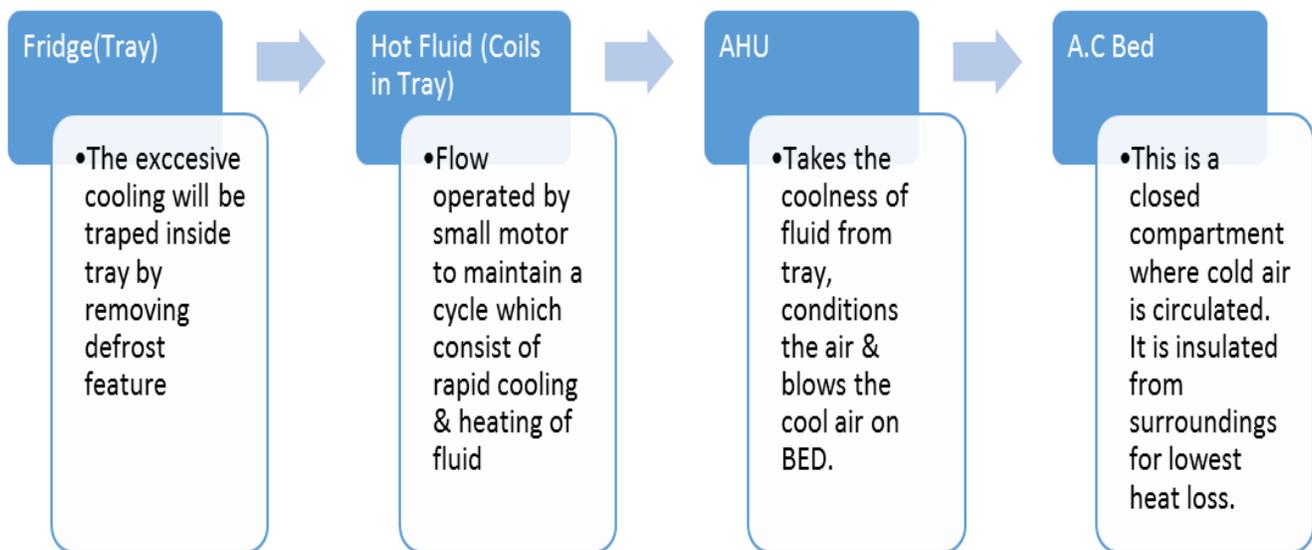


Figure 1: Block diagram of whole setup

### Components

- Refrigerator with Closed Tray

#### Refrigerator

- Compressor = Reciprocating type hermetically sealed, 1/8 hp, 240 volt
- Refrigerant = R-22/R-134a

- *Throttle Valve* = Capillary tube, Dia – 1 mm, Length – 2 m
- *Condenser* = Air cooled type, Copper tube, Diameter – 5 mm, No. of turns 7
- Copper Pipes (Coils)
- Air Handling Unit
- Low Power Pump
- A.C Bed

### TRAY

In this research, dripping tray is been replaced by a closed tray.

A tray is like a closed compartment to use the extra cooling of freezer which is until wasted by defrosting feature of refrigerator. It will set beneath the freezer, where dripping tray is held. The area would be kept same as that of ordinary tray that can easily fit inside the fridge. Specific height is provided to the tray so that it shapes like a box, insulated from each side.

Now the working is simple, the excess coolness is passed inside the closed tray compartment where the conductive coils (Copper tubes) carrying the flowing fluid to be cooled is lying. As the fluid is under room temperature, the heat exchange will take place as a result of temperature gradient. This will cool down the fluid so that it can be employed as a coolant for Air Handling Unit.

### AIR HANDLING UNIT

An (AHU) comprises of following components

- 1) Fans/Blowers – the purpose of fan is related to the movement of air. It may operate at a single speed or may offer different air speeds.

Commonly used types of fans are –

- a) Constant air volume (CAV)
- b) Variable air volume(VAV)

- 2) Coils- coils carry the coolant. It is in the coils where heat exchange takes place. Heat exchange may occur in cross flow or counter flow fashion.

Coolant used in the project is water and the material of which coils are made of is copper

- 3) Dampers – the fan in an AHU create a substantial vibration & duct system could transmit this noise to the occupants of the bed. To avoid this, vibration isolators are used between the fan & the rest of the (AHU).
- 4) Filters- air filtration is necessary as the air may comprise of dust particles or microbes. If large amount of dust & microbes are present they will make air unfit for breathing.

For maintain air quality the filter has to regard to odour, dust, toxic gasses & bacteria.

### AC BED

AC bed is made from a very light weight and high thermal resistivity **Polyurethane foam** having thermal conductivity of  $K=0.03$  of dimensions 6' X 4' X 3'6" (L X B X H).the thickness of insulation is from 2cm-3cm.

## III. THEORY

A vapor compression cycle is used in most household refrigerators, refrigerator-freezers and freezers. In this cycle, a circulating refrigerant such as R134a enters a compressor as low-pressure vapor at or slightly above the temperature of the refrigerator interior.

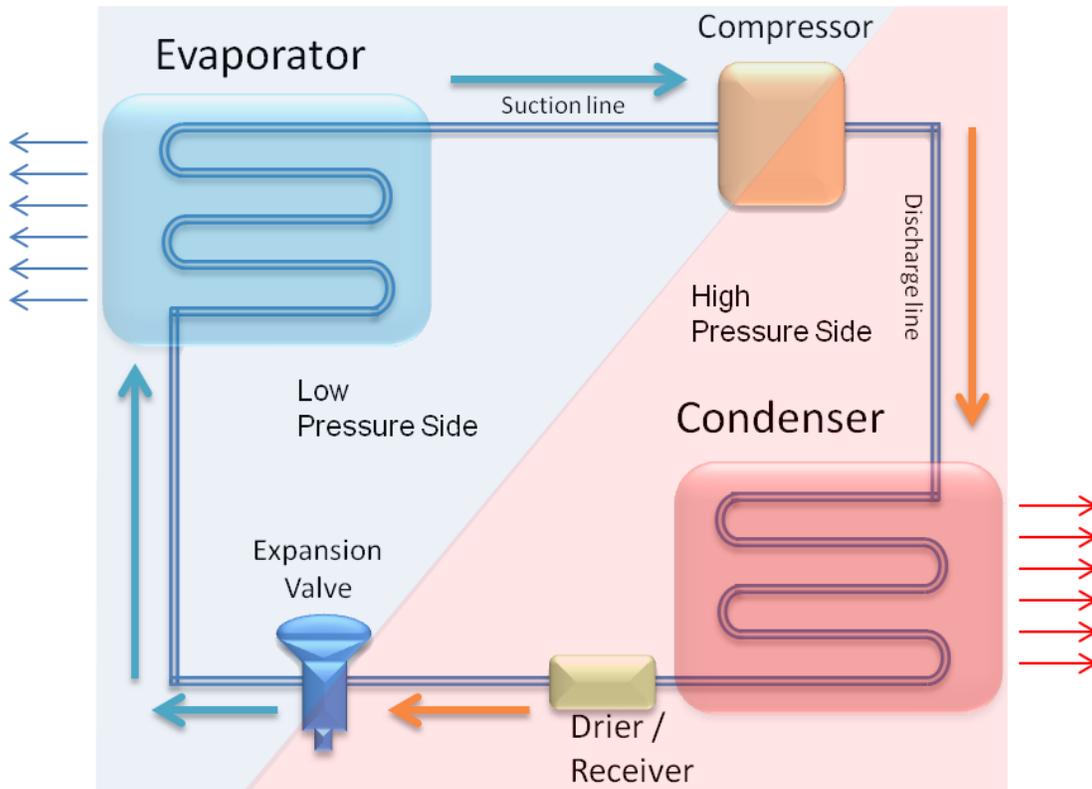


Figure 2: Vapor Compression (Refrigeration) Plant-flow Diagram

The vapor is compressed and exits the **compressor** as high-pressure superheated vapor.

The superheated vapor travels under pressure through coils or tubes that make up the **condenser**; the coils or tubes are passively cooled by exposure to air in the room. The condenser cools the vapor, which liquefies. As the refrigerant leaves the condenser, it is still under pressure but is now only slightly above room temperature.

This liquid refrigerant is forced through a **metering or throttling device**, also known as an expansion valve (essentially a pin-hole sized constriction in the tubing) to an area of much lower pressure. The sudden decrease in pressure results in explosive-like flash evaporation of a portion (typically about half) of the liquid. The latent heat absorbed by this flash evaporation is drawn mostly from adjacent still-liquid refrigerant, a phenomenon known as *auto-refrigeration*.

This cold and partially vaporized refrigerant continues through the coils or tubes of the **evaporator** unit. A fan blows air from the refrigerator or freezer compartment ("box air") across these coils or tubes and the refrigerant completely vaporizes, drawing further latent heat from the box air. This cooled air is returned to the refrigerator or freezer compartment, and so keeps the box air cold. Note that the cool air in the refrigerator or freezer is still warmer than the refrigerant in the evaporator. Refrigerant leaves the evaporator, now fully vaporized and slightly heated, and returns to the compressor inlet to continue the cycle. Domestic refrigerators are extremely reliable because the moving parts and fluids are sealed from the atmosphere for life, with no possibility of leakage or contamination. In comparison, mechanically-driven refrigeration compressors, such as those in automobile air conditioning, inevitably leak fluid and lubricant past the shaft seals. This leads to a requirement for periodic recharging and, if ignored, possible compressor failure.

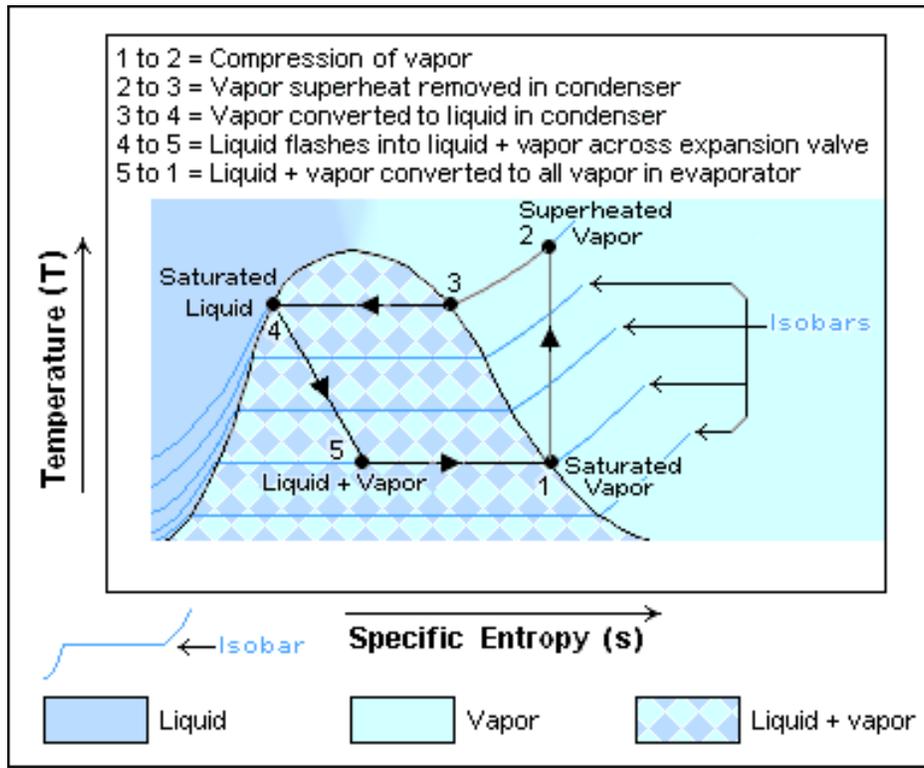


Figure 3: Vapor Compression (Refrigeration) Temperature-entropy Diagram

### Unit of refrigeration

Domestic & commercial refrigerators may be rated in kJ/s, or Btu/h of cooling. One British thermal unit is equal to about 1055 Joules. It is the amount of energy needed to cool or heat one pound (0.453 kg) of water by 1 deg. Fahrenheit. Commercial refrigerators in the US are mostly rated in tons of refrigeration, but elsewhere in kW. One ton of refrigeration can freeze one short ton of water at 0 deg. C in 24 hours i.e. 2000 pounds of ice at 144 BTUs per pound (heat of fusion of water) = 288000 BTUs  
 $288000/24 = 12000$  BTUs/hr. or one ton of refrigeration.

Now, an **air handling unit (AHU)** is device used to regulate & circulate air. It is a part of air conditioning system. They usually connect to duct ventilation system that distributes the conditioned air to the desired area. AHU are of different types and sizes. They are used to offer cooling as well as heating purposes; also they can be just used to as a ventilation system to provide fresh air into office buildings. Small AHU may comprise of only air filter, coils & blower & these are called *fan coil units*. A large air handler that contains 100% outside air & no recirculated air is known as *makeup air unit (MAU)*. An air handler for outdoor use, typically on rooftops is known as *rooftop units (RTU)*.

We allow the cool air to the AC Bed. An AC bed is a thermal insulating covering upon existing beds, like a mosquito net. This bed helps to maintain a certain temperature to make person comfortable so that he can relax better at night and become more productive on next day

### IV. MEASUREMENTS AND CALCULATIONS

Cooling capacity is directly related to size of area. 2 tons i.e. 48000 BTU/hr of AC is required to cool 2000 sq. feet home. Hence, 1500 BTU/hr is sufficient to cool 50 sq. (7\*7) feet A.C Bed i.e. approximately 0.12 ton of refrigeration. According to the heat exchange inside A.C Bed the corresponding cooling capacity is provided by tray. The cooling capacity can be varied by:-

- Changing dimensions (number of turns, diameter of pipe) of coils through which working fluid (water) flows.
- Controlling the flow rate of water, that is driven by pump.

Various thermal losses are involved in flowing fluid, which is required to be minimized:-

- Convective & Conductive Losses, due to temperature gradient between surroundings & inside fluid.
- Frictional Losses.

**Tray Technicalities:**

- Temperature maintained inside tray: -10 to -15°C
- Working fluid used: Water
- Temperature of Working fluid :-
  - Before entering tray,  $T_{h1}$  : 45°C
  - After leaving tray,  $T_{h2}$  : 15°C(expected)
- Material for coils: Copper (Thermal Conductivity – 385-386 W/m.K)

Consider cross-flow heat exchange inside tray between refrigerant & working fluid.

Hence, Heat exchanged is,  $Q = m_h c_h \Delta T$

Here,  $m_h = \text{mass flow rate of water } (\frac{kg}{s})$

$c_h = \text{specific heat of the water} = 4.18 \text{ kJ/kg}^{\circ}\text{C}$

$\Delta T =$

$T_{h1} - T_{h2}$  (Temperate diff.of water before & after passing through tray)

$$Q = m_h * 4.18 * 30 \text{ kW}$$

**A.C Bed Calculations**

Measurements are done on two materials one is PVC strips and second is polyurethane form.

Table 1: Measurement for A.C Bed Insulation

| Using PVC strips      |              | Using polyurethane foam |              |
|-----------------------|--------------|-------------------------|--------------|
| Thickness( $\delta$ ) | Heat Rate(Q) | Thickness( $\delta$ )   | Heat Rate(Q) |
| 1 cm                  | 2452 W       | 1 cm                    | 383 W        |
| 2 cm                  | 1216 W       | 2 cm                    | 192 W        |
| 3 cm                  | 810 W        | 3 cm                    | 128 W        |

V. CONCLUSION

The refrigerator’s defrost function is utilized to extract excessive coolness and is fed to an AHU to work like an Air conditioner which is used for personalized cooling. After this paper we conclude that a common man can have comfort of air conditioner at very low running cost or zero cost, which would prepare him for better productivity for the next day.

ACKNOWLEDGMENT

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# Enhancing data mining techniques for secured data sharing and privacy preserving on web mining

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**Abstract-** The enhancing data techniques are used in the user database for secure their database from other unauthorized user. This technique is useful for privacy preserving; securely share data among  $N$  number of parties. And also apply data mining approach on web service.

**Keyword-** Data Mining, Privacy Preserving, Security, Web Services

## I. INTRODUCTION

Algorithms for assigning anonymous IDs are examined with respect to threshold between communication and computational requirements. The new algorithms are built on top of a secure sum data mining operation using Newton's identities and Sturm's theorem. An algorithm for distributed solution of certain polynomials over finite fields enhances the scalability of the algorithms. Markov chain representations are used to find statistics on the number of iterations required, and computer algebra gives closed form results for the completion rates.

The popularity of internet as a communication medium whether for personal or business use depends in part on its support for anonymous communication. Businesses also have legitimate reasons to engage in anonymous communication and avoid the consequences of identity revelation. For example, to allow dissemination of summary data without revealing the identity of the entity the underlying data is associated with, or to protect whistle-blower's right to be anonymous and free from political or economic retributions.

Each algorithm can be reasonably implemented and each has its advantages. Our use of the Newton identities greatly decreases communication overhead. This can enable the use of a larger number of "slots" with a consequent reduction in the number of rounds required. The solution of a polynomial can be avoided at some expense by using Sturm's theorem. The development of a result similar to the Sturm's method over a finite field is an enticing possibility.

## II. REVIEW OF LITERATURE

In proposed system algorithms are secure in an information theoretic sense. Provide security for sharing data using AES and RSA algorithm. Existing and new algorithms for assigning anonymous IDs are examined with respect to trade-offs between communication and computational requirements. The new algorithms are built on top of a secure sum data mining operation. (K-means).

### AES Algorithm

The AES cipher like DES, AES is a symmetric block cipher. This means that it uses the same key for both encryption and decryption. However, AES is quite different from DES in a number of ways. The algorithm Rijndael allows for a variety of block and key sizes and not just the 64 and 56 bits of DES' block and key size. The block and key can in fact be chosen independently from 128,160,192,224,256 bits and need not be the same. However, the AES standard states that the algorithm can only accept a block size of 128 bits and a choice of three keys -128,192,256 bits. Depending on which version is used, the name of the standard is modified to AES-128, AES-192 or AES-256 respectively. As well as these differences AES differs from DES in that it is not a feistel structure. Recall that in a feistel structure, half of the data block is used to modify the other half of the data block and then the halves are swapped. In this case the entire data block is processed in parallel during each round using substitutions and permutations.

A number of AES parameters depend on the key length. For example, if the key size used is 128 then the number of rounds is 10 whereas it is 12 and 14 for 192 and 256 bits respectively. At present the most common key size likely to be used is the 128 bit key. This description of the AES algorithm therefore describes this particular

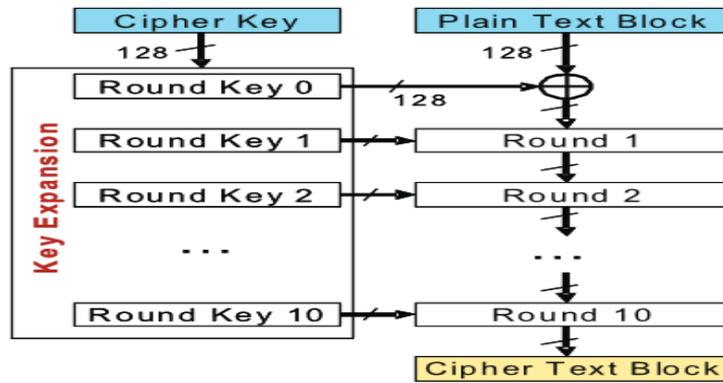


Figure 1. AES Algorithm Structure

## RSA Algorithm

RSA is one of the first practicable public-key cryptosystems and is widely used for secure data transmission. In such a cryptosystem, the encryption key is public and differs from the decryption key which is kept secret. In RSA, this asymmetry is based on the practical difficulty of factoring the product of two large prime numbers, the factoring problem. RSA stands for Ron Rivest, Adi Shamir and Leonard Adleman, who first publicly described the algorithm in 1977. Clifford Cocks, an English mathematician, had developed an equivalent system in 1973, but it wasn't declassified until 1997.<sup>[1]</sup>

A user of RSA creates and then publishes a public key based on the two large prime numbers, along with an auxiliary value. The prime numbers must be kept secret. Anyone can use the public key to encrypt a message, but with currently published methods, if the public key is large enough, only someone with knowledge of the prime numbers can feasibly decode the message.<sup>[2]</sup> Breaking RSA encryption is known as the RSA problem. It is an open question whether it is as hard as the factoring problem

## Key generation

RSA involves a *public key* and a *private key*. The public key can be known by everyone and is used for encrypting messages. Messages encrypted with the public key can only be decrypted in a reasonable amount of time using the private key. The keys for the RSA algorithm are generated the following way:

1. Choose two distinct prime numbers  $p$  and  $q$ .
  - For security purposes, the integers  $p$  and  $q$  should be chosen at random, and should be of similar bit-length. Prime integers can be efficiently found using a primality test.
2. Compute  $n = pq$ .
  - $n$  is used as the modulus for both the public and private keys. Its length, usually expressed in bits, is the key length.
3. Compute  $\phi(n) = \phi(p)\phi(q) = (p - 1)(q - 1) = n - (p + q - 1)$ , where  $\phi$  is Euler's totient function.
4. Choose an integer  $e$  such that  $1 < e < \phi(n)$  and  $\text{gcd}(e, \phi(n)) = 1$ ; i.e.,  $e$  and  $\phi(n)$  are coprime.
  - $e$  is released as the public key exponent.
  - $e$  having a short bit-length and small Hamming weight results in more efficient encryption – most commonly  $2^{16} + 1 = 65,537$ . However, much smaller values of  $e$  (such as 3) have been shown to be less secure in some settings.<sup>[5]</sup>
5. Determine  $d$  as  $d \equiv e^{-1} \pmod{\phi(n)}$ ; i.e.,  $d$  is the multiplicative inverse of  $e$  (modulo  $\phi(n)$ ).
  - This is more clearly stated as: solve for  $d$  given  $d \cdot e \equiv 1 \pmod{\phi(n)}$
  - This is often computed using the extended Euclidean algorithm. Using the pseudocode in the *Modular integers* section, inputs  $a$  and  $n$  correspond to  $e$  and  $\phi(n)$ , respectively.
  - $d$  is kept as the private key exponent.

The *public key* consists of the modulus  $n$  and the public (or encryption) exponent  $e$ . The *private key* consists of the modulus  $n$  and the private (or decryption) exponent  $d$ , which must be kept secret.  $p$ ,  $q$ , and  $\phi(n)$  must also be kept secret because they can be used to calculate  $d$ .

- An alternative, used by PKCS#1, is to choose  $d$  matching  $de \equiv 1 \pmod{\lambda}$  with  $\lambda = \text{lcm}(p-1, q-1)$ , where  $\text{lcm}$  is the least common multiple. Using  $\lambda$  instead of  $\phi(n)$  allows more choices for  $d$ .  $\lambda$  can also be defined using the Carmichael function,  $\lambda(n)$ .
- The ANSI X9.31 standard prescribes, IEEE 1363 describes, and PKCS#1 allows, that  $p$  and  $q$  match additional requirements: being strong primes, and being different enough that Fermat factorization fails.

## Encryption

Alice transmits her public key  $(n, e)$  to Bob and keeps the private key  $d$  secret. Bob then wishes to send message  $M$  to Alice.

He first turns  $M$  into an integer  $m$ , such that  $0 \leq m < n$  by using an agreed-upon reversible protocol known as a padding scheme. He then computes the ciphertext  $c$  corresponding to

$$c \equiv m^e \pmod{n}$$

This can be done efficiently, even for 500-bit numbers, using Modular exponentiation. Bob then transmits  $c$  to Alice.

Note that at least nine values of  $m$  will yield a ciphertext  $c$  equal to  $m$ ,<sup>[note 1]</sup> but this is very unlikely to occur in practice.

## Decryption

Alice can recover  $m$  from  $c$  by using her private key exponent  $d$  via computing

$$m \equiv c^d \pmod{n}$$

Given  $m$ , she can recover the original message  $M$  by reversing the padding scheme.

(In practice, there are more efficient methods of calculating  $c^d$  using the precomputed values below.)

## K-Means

K-Means clustering generates a specific number of disjoint, flat (non-hierarchical) clusters. It is well suited to generating globular clusters. The K-Means method is numerical, unsupervised, non-deterministic and iterative.

### K-Means Algorithm Properties

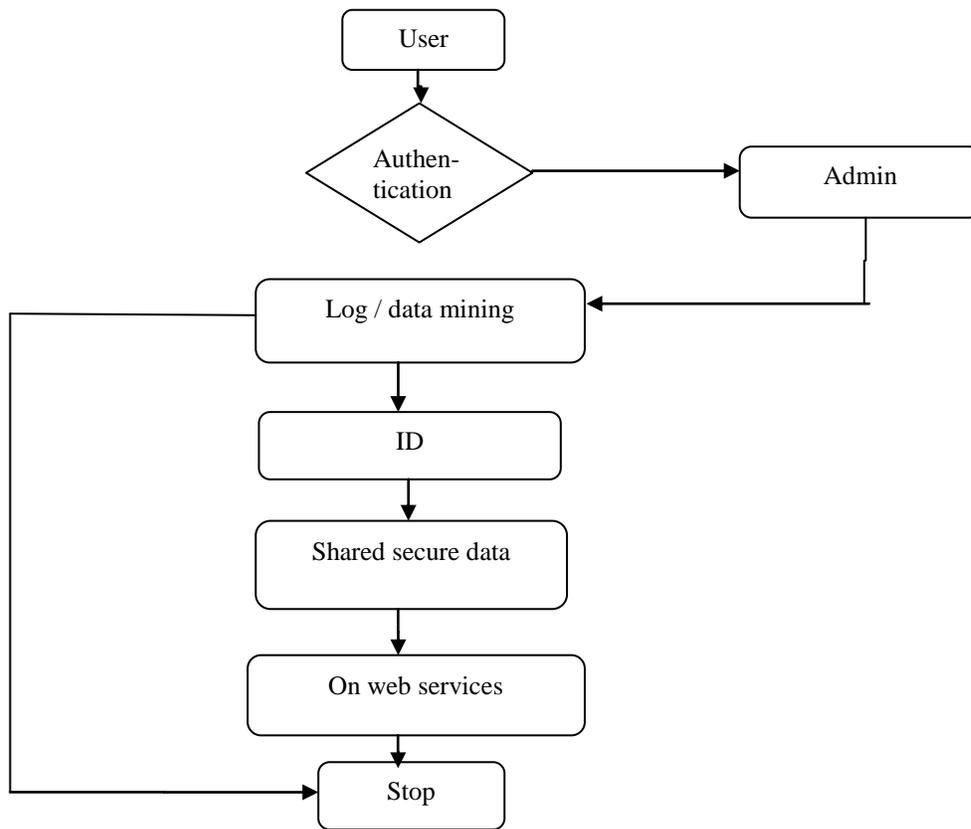
- There are always  $K$  clusters.
- There is always at least one item in each cluster.
- The clusters are non-hierarchical and they do not overlap.
- Every member of a cluster is closer to its cluster than any other cluster because closeness does not always involve the 'center' of clusters.

### The K-Means Algorithm Process

- The dataset is partitioned into  $K$  clusters and the data points are randomly assigned to the clusters resulting in clusters that have roughly the same number of data points.
- For each data point:
- Calculate the distance from the data point to each cluster.

- If the data point is closest to its own cluster, leave it where it is. If the data point is not closest to its own cluster, move it into the closest cluster.
- Repeat the above step until a complete pass through all the data points results in no data point moving from one cluster to another. At this point the clusters are stable and the clustering process ends.
- The choice of initial partition can greatly affect the final clusters that result, in terms of inter-cluster and intracluster distances and cohesion.

### III. PROJECT PLANNING



### IV. CONCLUSION

In this report, we presented a survey of the broad areas of privacy-preserving data mining and the underlying algorithms. Data modification techniques such as k-Means based techniques. We discussed methods for privacy-preserving mining. Further, we discussed some fundamental limitations of the problem of privacy-preservation in presence of increased amounts of public information and background knowledge. We presented a set of experimental results and also analyzed them from the perspective of data privacy and data utilization. We have also presented a number of diverse application domains for which privacy-preserving data mining methods are useful. Finally, we identified few areas which require further research efforts in the domain of privacy-preserving data mining.

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# An AC-AC Converter for Doubly Fed Induction Generator Driven By Wind Turbine

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**Abstract-** This paper deals with a DFIG model employing nine switches AC/AC converter. As compared to the conventional DFIG employing Back to Back power converter the nine switch converter requires fewer switches and gate drive circuits. Therefore proposed topology results in reduction of installation area and cost. The nine switch converter DFIG is applied to the wind turbine and integrated with the grid. The results reveal that even though change in wind speed occurred, the generator terminal voltage and frequency remain same. The generator output power follows the wind speed and delivers the more power to the grid.

**Index Terms-** DFIG (Doubly Fed Induction Generator), RSC (Rotor Side Converter), GSC (Grid Side Converter), PWM (Pulse Width Modulator), Nine Switch Converter

## I. INTRODUCTION

As conventional energy sources are going to be depleted very soon, wind power is the most reliable and developed renewable energy source over past decades. The WECS utilizing variable speed variable pitch wind turbine with DFIG is the most popular in the wind power industry especially for multi megawatt size. The power converters being utilized in the DFIG play very important role in maintaining the constant voltage and frequency. Harmonics will be certainly produced whenever converter parts are being used. However presence of this harmonic level can be reduced by reducing the size of the converter. Hence there is need to reduce the size of the power converters in the Doubly Fed Induction Generators system in order to reduce the harmonics produced. Usually in the conventional DFIG system totally 12 number of switches are being utilized i.e. six number of switches for rectification and another six number of switches for invertification. Hence there is need to minimize the number of switches by developing a new model which must consist of less number of switches as compared to conventional Back to Back converter. So by developing new less number of switches being utilized converter the cost and space requirement of power converters can be reduced.

The main reason for the popularity of the doubly fed induction generators connected to the national networks is their ability to supply power at constant voltage and frequency while the rotor speed varies [2]. And the power converters being used in the DFIG system are not required to convert the full rated generation power as in the singly fed induction generator power converters requiring conversion of full generated power. It handles only 25-30 % of rated generation power i.e. the slip power in the rotor

circuit and remaining power is directly fed to the grid from the stator part [1].

Fig.1 shows,[1] the DFIG wind turbines use wound rotor induction generators, where the rotor winding is fed through a back-to-back variable frequency and amplitude PWM converter. The variable frequency converter consists of a rotor side converter (RSC) and a grid side converter (GSC) and only handles rotor power. The rotor side converter (RSC) usually provides active and reactive power control of the machine while the grid-side converter (GSC) keeps the voltage of the DC-link constant [6].

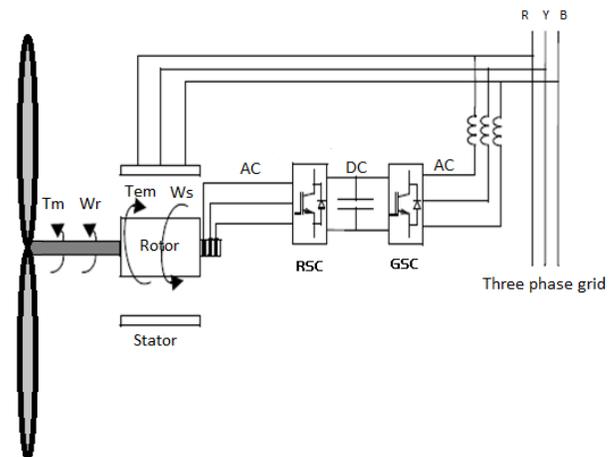


Fig.1: Conventional wind turbine based on a DFIG

In the conventional DFIG system totally twelve number of switches are being utilized i.e. six number of switches for rectification and another six number of switches for invertification. Harmonics will be certainly produced whenever converter parts are being used. Hence there is need to minimize the number of switches by developing a new model which must consist of less number of switches as compared to conventional Back to Back converter[1]. So by developing less number of switches, therefore converter cost and space requirement of power converters can be reduced [1].

## II. OPERATING PRINCIPLE OF DFIG

As shown in fig.2 the stator is directly connected to the AC mains, while the wound rotor is fed from the power electronics converter via slip rings to allow DFIG to operate at a variety of speeds in response to changing wind speed. Indeed, the basic concept is to interpose a frequency converter between the varia-

ble frequency induction generator and fixed frequency grid. The DC capacitor linking stator and rotor side converters allows the storage of power from induction generator for further generation. To achieve full control of grid current, the DC-link voltage must be boosted to a level higher than the amplitude of grid line-to-line voltage. The slip power can flow in both directions, i.e. to the rotor from the supply and from supply to the rotor and hence the speed of the machine can be controlled from either rotor or stator side converter in both super and sub-synchronous speed ranges. As a result, the machine can be controlled as a generator or a motor in both super and sub-synchronous operating modes realizing four operating modes. Below the synchronous speed in the motoring mode and above the synchronous speed in the generating mode, rotor-side converter operates as a rectifier and stator-side converter as an inverter, where slip power is returned to the stator. Below the synchronous speed in the generating mode and above the synchronous speed in the motoring mode, rotor-side converter operates as an inverter and stator side converter as a rectifier, where slip power is supplied to the rotor. At the synchronous speed, slip power is taken from supply to excite the rotor windings and in this case machine behaves as a synchronous machine.

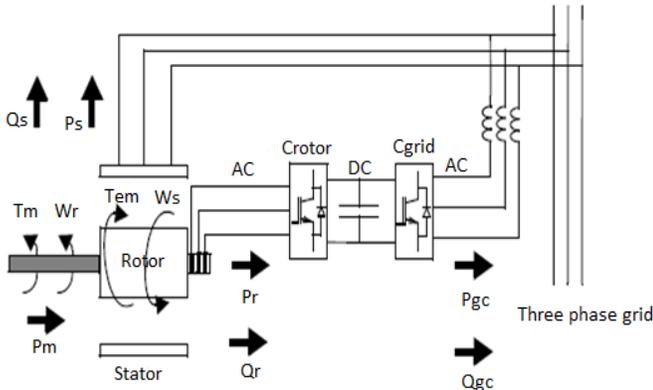


Fig.2: Power flow diagram of DFIG

This paper presents a control strategy by means of algebraic analytical relationships given by the mathematical model of the machine to the performances of doubly fed induction generators using back to back converter, thereby maximizing the efficiency of the generation system. The main problem using renewable energy sources is to make them work at full power for different operating conditions of the source. This is usually achieved by means of the implementation of control algorithms known as MPPT algorithms. For wind plants it is not so easy because wind changes rapidly and randomly. The output power of a wind turbine can be written as;

$$P = \frac{1}{2} C_p(\lambda, \beta) \rho \pi R^2 V_w^3 \dots \dots \dots (1)$$

The power co-efficient  $C_p$  is a function of the pitch angle  $\beta$  and tip speed ratio  $\lambda$ . The results reveal that the output power regulation of a wind turbine can be achieved in two ways; acting on the tip speed ratio and acting on the pitch angle.

This paper gives information about the controlling of DFIG wind turbines using back to back variable frequency converter.

The mechanical power and the stator electric power output are computed as follows:

$$P_r = T_m * \omega_r \dots \dots \dots (2)$$

$$P_s = T_{em} * \omega_r \dots \dots \dots (3)$$

For a loss less generator the mechanical equation is:

$$\frac{d\omega_r}{dt} = T_m - T_{em} \dots \dots \dots (4)$$

In steady-state at fixed speed for a loss less generator

$$T_m = T_{em} \text{ And } P_m = P_s + P_r \dots \dots \dots (5)$$

And it follows that:

$$P_r = P_m - P_s = T_m \omega_r - T_{em} \omega_s = -s P_s \dots \dots \dots (6)$$

Where,  $\frac{\omega_s - \omega_r}{\omega_s}$

$s = \frac{\omega_s - \omega_r}{\omega_s}$  is defined as the slip of the generator

Generally the absolute value of slip is much lower than 1 and, consequently,  $P_r$  is only a fraction of  $P_s$ . Since  $T_m$  is positive for power generation and since  $\omega_s$  is positive and constant for a constant frequency grid voltage, the sign of  $P_r$  is a function of the slip sign.  $P_r$  is positive for negative slip (speed greater than synchronous speed) and it is negative for positive slip (speed lower than synchronous speed). For super synchronous speed operation,  $P_r$  is transmitted to DC bus capacitor and tends to raise the DC voltage. For sub-synchronous speed operation,  $P_r$  is taken out of DC bus capacitor and tends to decrease the DC voltage.  $C_{grid}$  is used to generate or absorb the power  $P_{gc}$  in order to keep the DC voltage constant. In steady-state for a lossless AC/DC/AC converter  $P_{gc}$  is equal to  $P_r$  and the speed of the wind turbine is determined by the power  $P_r$  absorbed or generated by  $C_{rotor}$ . The phase - sequence of the AC voltage generated by  $C_{rotor}$  is positive for sub-synchronous speed and negative for super synchronous speed. The frequency of this voltage is equal to the product of the grid frequency and the absolute value of the slip.  $C_{rotor}$  and  $C_{grid}$  have the capability for generating or absorbing reactive power and could be used to control the reactive power or the voltage at the grid terminals.

A. Steady State Characteristics

The steady state equivalent circuit of DFIG is shown in below fig.2.A

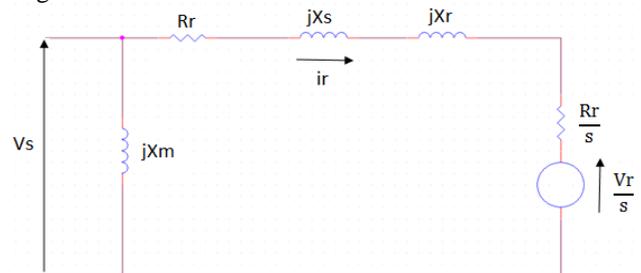


Fig.2.A: Steady state equivalent circuit of DFIG

To obtain the torque equation from the equivalent circuit, we can simplify the steady state induction motor circuit by moving  $X_m$  to the stator terminal. The rotor current  $I_r$  is expressed as;

$$I_r = \frac{V_s - \frac{V_r}{s}}{(r_s + \frac{r_r}{s}) + j(X_s + X_r)} \dots\dots\dots (7)$$

The electrical torque  $T_e$ , from the power balance across the stator to rotor gap, can be calculated from;

$$T_e = \left( I_r^2 \frac{r_r}{s} \right) + \frac{P_r}{s} \dots\dots\dots (8)$$

Where the power supplied or absorbed by the controllable source injecting voltage into the rotor circuit, that is the rotor active power,  $P_r$  can be calculated from

$$P_r = \frac{V_r}{s} I_r \cos \theta \dots\dots\dots (9)$$

$$P_r = P_s \left( \frac{V_r}{s} I_r^* \right) \dots\dots\dots (10)$$

III. OPERATION OF NINE SWITCH CONVERTER

As shown in Fig.1.2 [5], the proposed converter has three legs with three switches per leg. The middle switch in each of phase legs is shared by rectifier and inverter, therefore count of switches reduces. In this topology, the converter input and output voltages can be independently controlled although the middle switch in each leg is shared by the rectifier and inverter. Table.1 indicates the switching states. Here the converter has only three valid switching states per phase and  $V_{AR}$ ,  $V_{XR}$  are the voltage at nodes A and X with respect to the negative dc link R respectively.

For the convenience it is considered that x, y, z are the input nodes of the converter and A, B, C are the output nodes. Modulation waveform to switching algorithm is the carrier based PWM control method for a nine-switch converter [3]-[8]. There are two reference signals for every phase. The principle of switching algorithm for upper and lower switches is obtained for the conditions given below:

Condition 1:  $Se1 > C$  then  $S_{AO}$  is on

Condition 2:  $Se2 < C$  then  $S_{AI}$  is on

**Table.1: Switching states and converter output voltages**

| Mode | ON Switches      | Input and Output node voltages |
|------|------------------|--------------------------------|
| 1    | $S_{AO}, S_{AM}$ | $V_{AR}=V_{dc}, V_{XR}=V_{dc}$ |
| 2    | $S_{AM}, S_{AI}$ | $V_{AR}=0, V_{XR}=0$           |
| 3    | $S_{AO}, S_{AI}$ | $V_{AR}=V_{dc}, V_{XR}=0$      |

Se1 and Se2 can be expressed as:

$$Se1 = m_{out} \sin(2 * \pi * f_{out}) + of_{out} \dots\dots\dots (11)$$

$$Se2 = m_{in} \sin(2 * \pi * f_{in}) + of_{in} \dots\dots\dots (12)$$

Where,

$f_{out}, f_{in}$  is the output and input frequency respectively.  $m_{out}, m_{in}$  are the modulation index and  $of_{out}, of_{in}$  are the offset of output and input references signals respectively.

In this topology x, y, z are connected to the grid and lower switches ( $S_{AI}, S_{BI}, S_{CI}$ ) operate as a rectifier or Grid Side Converter. A, B, C are connected to the rotor, therefore upper switches ( $S_{AO}, S_{BO}, S_{CO}$ ) operate as an inverter or Rotor Side Converter.

IV. CONTROL OF NINE SWITCH CONVERTER

In the DFIG based wind turbines rotor current regulation on the stator flux oriented reference frame. Therefore the d axis is aligned with the stator flux linkage vector  $\lambda_s$ , namely,  $\lambda_s = \lambda_{ds}$  and  $\lambda_{qs} = 0$ . This results in following relationships [6]:

$$i_{qs} = - \frac{L_m i_{qr}}{L_s} \dots\dots\dots (13)$$

$$i_{ds} = \frac{L_m (i_{ms} - i_{dr})}{L_s} \dots\dots\dots (14)$$

$$T_e = - \frac{L_m i_{ms} i_{qr}}{L_s} \dots\dots\dots (15)$$

$$Q_s = \frac{3}{2} \frac{w_s L_m^2 i_{ms} (i_{ms} - i_{dr})}{L_s} \dots\dots\dots (16)$$

$$V_{dr} = r_r i_{dr} + \sigma L_r \frac{di_{dr}}{dt} - sw_s \sigma L_r i_{qr} \dots\dots\dots (17)$$

$$V_{qr} = r_r i_{qr} + \sigma L_r \frac{di_{qr}}{dt} + sw_s \left( \frac{\sigma L_r i_{dr} + L_m^2 i_{ms}}{L_s} \right) \dots\dots (18)$$

Where,

$$i_{ms} = \frac{V_{qs} - r_s i_{qs}}{w_s L_m} \dots\dots\dots (19)$$

$$\sigma = 1 - \frac{l_m^2}{L_r L_s} \dots\dots\dots (20)$$

Equation (14) shows that the DFIG electrical torque can depends on  $i_{qr}$ , as a result the rotor speed  $\omega_r$ , can be controlled by regulating  $i_{qr}$ . Equation (15) indicates that the  $Q_s$  can be controlled by regulating the  $i_{dr}$ , therefore, the reference values of  $i_{dr}$  and  $i_{qr}$  can be determined from  $Q_s$  and  $\omega_r$  regulation. Fig.4 shows the overall vector control scheme of the Rotor Side Converter (RSC).

The instantaneous three-phase rotor current  $i_{rabc}$  is transformed to d-q components  $i_{dr}$  and  $i_{qr}$  in the stator – flux oriented reference frame. Then  $i_{dr}$  and  $i_{qr}$  are compared with their reference signals ( $i_{dr}^*$  and  $i_{qr}^*$ ) to generate the error signals, which are passed through two PI controllers to form the voltage signals  $V_{dr1}$  and  $V_{qr1}$ . These two voltage signals are compensated by the corresponding cross coupling terms ( $V_{dr2}$  and  $V_{qr2}$ ) to form the

d-q voltage signals  $V_{dr}$  and  $V_{qr}$ . Where  $V_{dr2}$  and  $V_{qr2}$  are assumed as:

$$V_{dr2} = -s\omega_s \sigma L_r i_{qr} \dots\dots\dots (21)$$

$$V_{qr2} = s\omega_s (\sigma L_r i_{dr} + L_m^2 \frac{i_{ms}}{L_s}) \dots\dots\dots (22)$$

They are then used by the carrier based PWM method to generate MOSFET gate control signals of the RSC.

The objective of the GSC is to keep the DC link voltage constant regardless of the magnitude and direction of the rotor power. The control of DC link voltage,  $V_{dc}$  and DFIG stator terminals voltage,  $V_s$ , are achieved by current regulation on a synchronously rotating reference frame. The output voltage signals  $V_{dg}$  and  $V_{qg}$  from the current controllers are used by the carrier based PWM algorithm to switch the grid side of nine-switch converter. Figure 4.1 shows the overall vector control scheme of the Grid Side Converter [6].

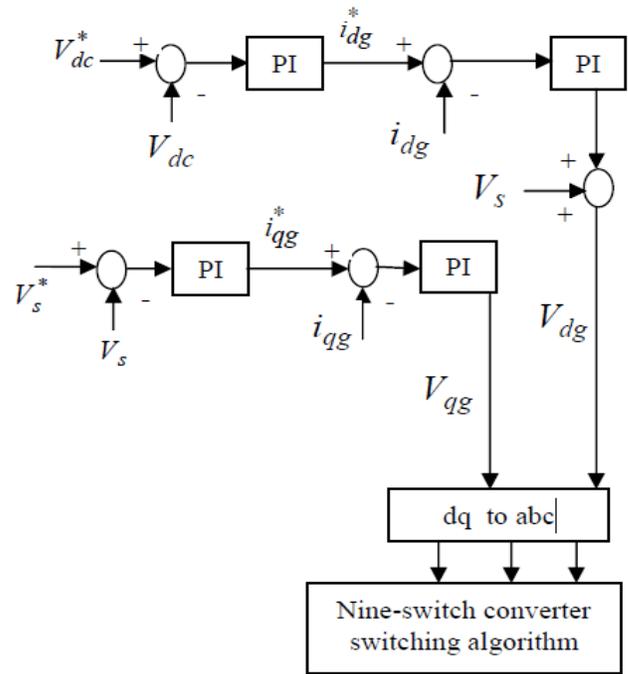


Fig.4.1: Overall vector control of GSC

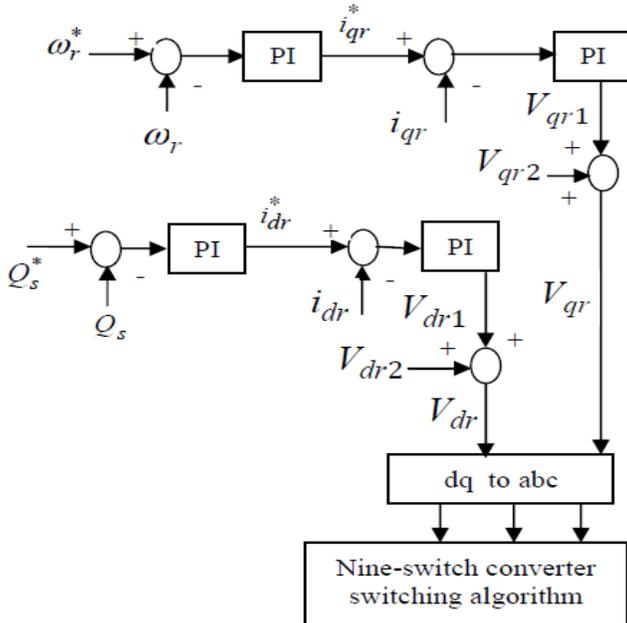


Fig.4: Overall vector control of RSC

V. SIMULATION MODELS

A. Simulation of overall pulse generation

Fig.16 shows the overall pulse generation model for nine switch converter. As mentioned earlier the nine switch converter model consists of three legs and each consisting of three switches. Fig.16 shows how the pulses have been generated for all the three leg MOSFET switches. For all the nine switches, voltage signals generated from the Rotor Side Converter and Grid Side Converter are compared with the carrier wave signal and an appropriate gate pulse is generated.

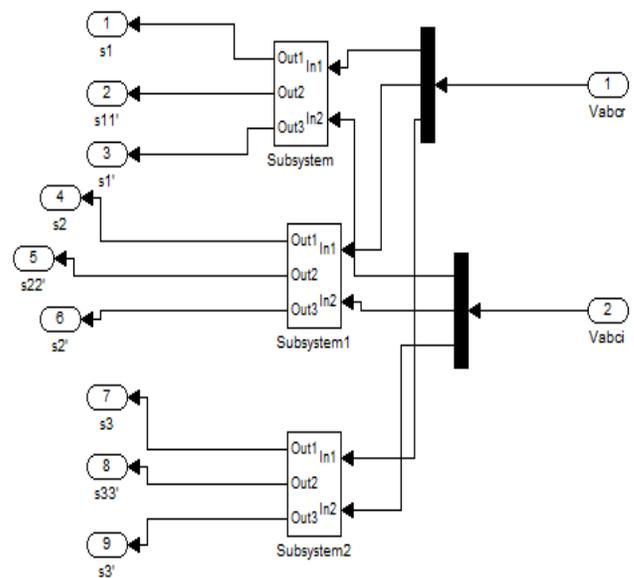
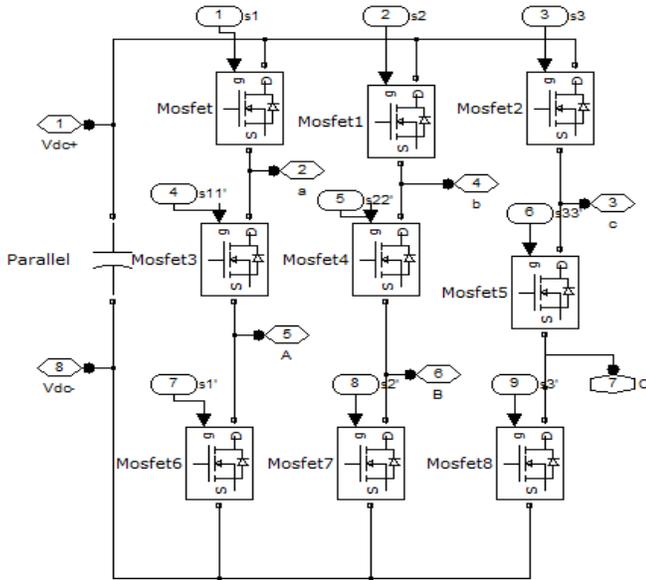


Fig.5.A: Simulation model of overall pulse generation

**B. Simulation of nine switch converter**

Fig.17 shows the simulation model of nine switch converter. It consists of totally three legs, each leg consisting of three switches. Then total number of switches is nine. The above six switches act as Rectifier i.e. the conversion of AC/DC and the below six switches act as Inverter i.e. the conversion of DC/AC. The pulses for all the MOSFET gates are generated using the voltage signals generated from RSC and GSC comparing with the carrier wave signal.



**Fig.5.B: Simulation model of nine switch converter**

**VI. SIMULATION RESULTS**

The DFIG parameters are given in Table 2.

**Table.2: Parameters of the DFIG simulated**

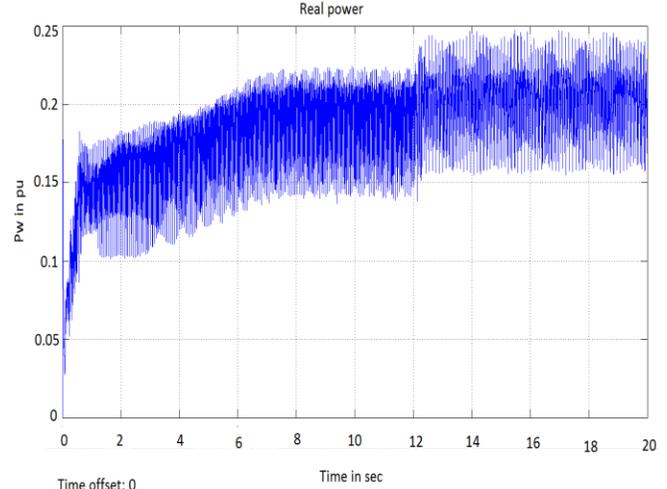
|                      |                                   |
|----------------------|-----------------------------------|
| Rated Power          | 2MW                               |
| Stator Voltage       | 690V                              |
| Rs                   | 0.0108pu                          |
| Rr                   | 0.0121pu (referred to the stator) |
| Lm                   | 3.362pu                           |
| Ls                   | 0.102pu                           |
| Lr                   | 0.11pu (referred to the stator)   |
| Number of pole pairs | 2                                 |

In order to evaluate the dynamic performance of the proposed DFIG, sudden variation in the wind speed is made.

**A. Generator output power**

Fig.6.A shows the generator output power. It is observed that when the wind speed is increased at 12 sec, the power output of the generator also slightly increased. In means the generator out-

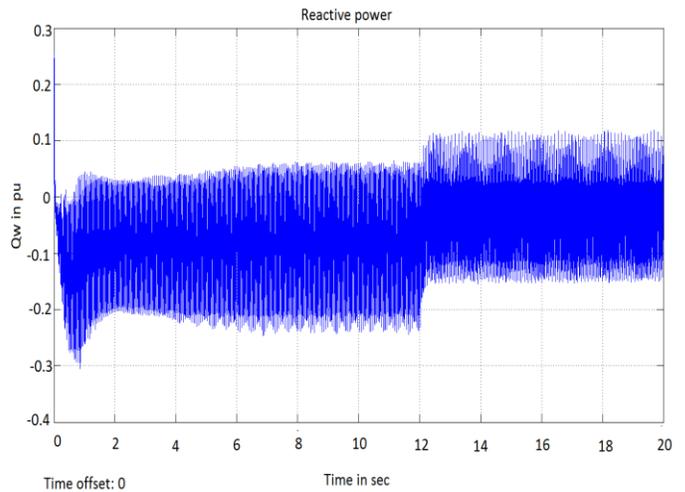
put power follows the wind speed and delivers more power to the grid whenever wind speed increases



**Fig.6.A: Generator output power**

**B. Stator output reactive power**

Fig.6.B shows the stator output reactive power. At 12 sec there is sudden variation in the wind speed i.e. initially wind blowing at 12m/s increased to 15m/s at 12 sec. The reference value of reactive power is set to zero and stator reactive power produced by generator is tried to keep around zero. In the above figure it is observed that at the time of wind speed change the reactive power generated by stator is maintained constant around zero.

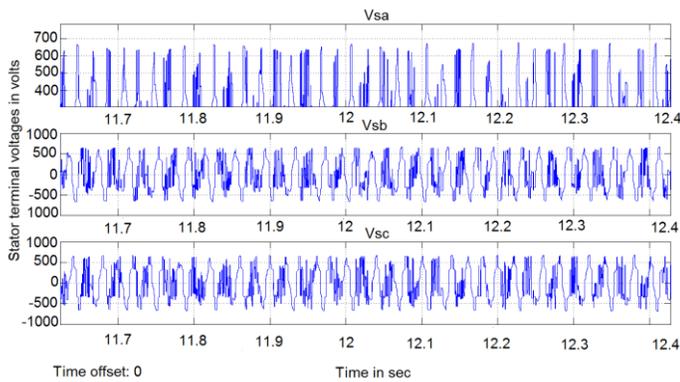


**Fig.6.B: Stator output reactive power**

**C. Generator terminal voltage**

Fig.6.C shows the stator each phase output voltage. It is observed that, initially when the wind is blowing at 12 m/s stator terminal each phase voltage is around 690 volts. Then at 12 sec, when wind speed changes to 15m/s the magnitude of stator output each phase voltage is not affected and is maintained almost constant i.e. around 690 volts. It means irrespective of the wind speed changes and rotor speed variation the stator output each voltage remains almost constant in order to make it possible to integrate the wind turbine generated power with the grid. This is

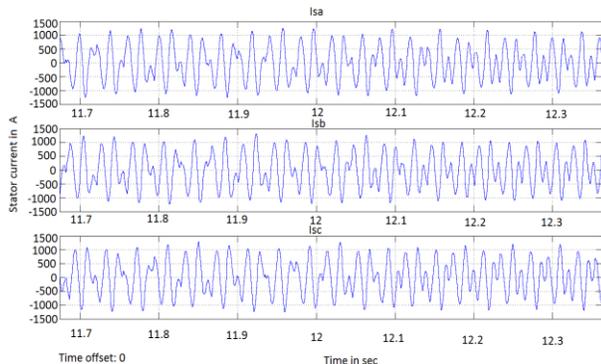
one of the very essential controlling aspects in doubly fed induction generators achieved through nine switch converter.



**Fig.6.C: Generator terminal voltages**

**D. Generator terminal current**

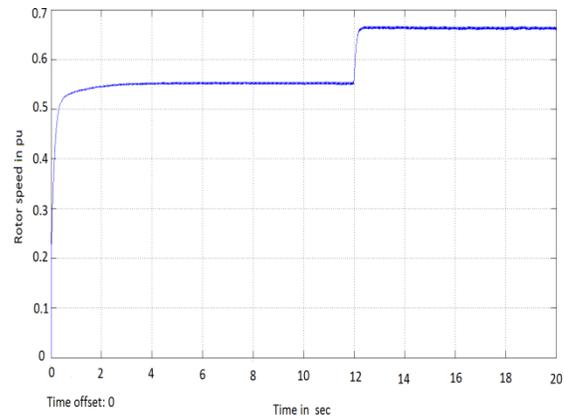
Fig.6.D shows the each phase generator terminal current. We know that when wind speed increases the power delivered to the grid also increases. As stator terminal voltage is going to remain constant during wind changes, the current drawn by the grid increases in order to increase the power delivered to the grid. It can be observed in Fig.22 that when there is sudden change in the wind speed at 12 sec the magnitude of each phase stator output current increases slightly. Stator output terminal each phase voltage and current are in phase. It means that the generator is operating approximately at its unity power factor.



**Fig.6.D: Generator terminal current**

**E. Generator rotor speed**

Fig.6.E shows the generator rotor speed. It is observed that before the step change in wind speed occurred i.e. wind blowing at 12m/s, the rotor is rotating at 0.55pu but when the wind speed increases to 15m/s the rotor speed also increases. After a fraction of second the rotor speed again gains its steady state at 0.67pu. From Fig.21 and 23 it can be clearly observed that even though there is change in rotor speed in course of time period because of change in wind speed the stator terminal each phase output voltages remains almost constant. From Fig.19 and 23 it is clear that the power delivered to the grid from the generator increases with increase in rotor speed because of change in wind speed.



**Fig.6.E: Generator rotor speed**

**VII. CONCLUSION**

This thesis presented a DFIG model employing new nine switches AC/AC converter. As compared to the conventional DFIG employing Back to Back power converter the new nine switch converter requires fewer switches and gate drive circuits. Therefore proposed topology results in reduction of installation area and cost. The new nine switch converter DFIG is applied to the wind turbine and integrated with the grid. The results reveal that even though change in wind speed occurred, the generator terminal voltage and frequency remain same. The generator output power follows the wind speed and delivers the more power to the grid. It means proposed DFIG will operate according to control strategies aims in the wind speed sudden variations

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# A Comparative Analysis on Encryption and Decryption Algorithms

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**Abstract-** In this modern world of communications, cryptography has an important role in the security of data transmission and is the best method of data protection against passive and active fraud. Cryptography is an algorithmic process of converting a plain text or clear text message to a cipher text or cipher message based on an algorithm that both the sender and receiver know. There are a number of algorithms for performing encryption and decryption, but comparatively few such algorithms have stood the test of time. The most successful algorithms use a key. In this paper, we may gain knowledge about the cryptography algorithms and its role in Encryption and Decryption.

**Index Terms-** cipher text, decryption, encryption, key generation

## I. INTRODUCTION

**E**ncryption is a process of coding information which could either be a file or mail message into cipher text a form unreadable without a decoding key in order to prevent anyone except the intended recipient from reading that data. Decryption is the reverse process of converting encoded data to its original un-encoded form, plaintext. A key in cryptography is a long sequence of bits used by encryption/ decryption algorithms. For example, the following represents a hypothetical 40-bit key:  
00001010 01101001 10011110 00011100 01010101

A given encryption algorithm takes the original message, and a key, and alters the original message mathematically based on the key's bits to create a new encrypted message. Likewise, a decryption algorithm takes an encrypted message and restores it to its original form using one or more keys. To encode plaintext, an encryption key is used to impose an encryption algorithm onto the data. To decode cipher, a user must possess the appropriate decryption key.

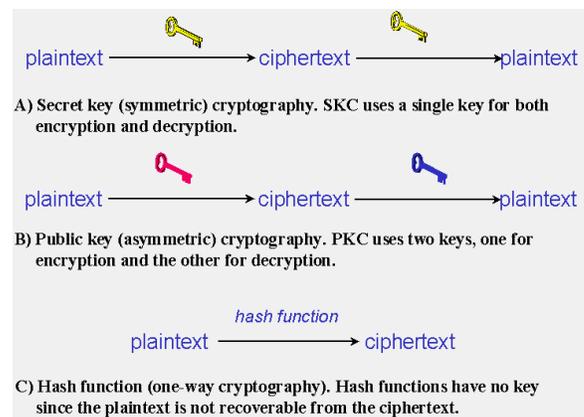
## II. BACKGROUND OF ENCRYPTION AND DECRYPTION ALGORITHMS

CRYPTOGRAPHY is an algorithmic process of converting a plain text or clear text message to a cipher text or cipher message based on an algorithm that both the sender and receiver know, so that the cipher text message can be returned to its original, plain text form. In its cipher form, a message cannot be read by anyone but the intended receiver. The act of converting a plain text message to its cipher text form is called enciphering. Reversing that act is deciphering. There are two primary approaches to encryption: symmetric and public-key. Symmetric encryption is the most common type of encryption and uses the

same key for encoding and decoding data. This key is known as a session key. Public-key encryption uses two different keys, a public key and a private key. One key encodes the message and the other decodes it. The public key is widely distributed while the private key is secret.

A. *Types of cryptographic algorithms-* There are several ways of classifying cryptographic algorithms. For purposes of this report they will be categorized based on the number of keys that are employed for encryption and decryption, and further defined by their application and use. The following are the three types of Algorithm that are discussed

1. Secret Key Cryptography (SKC): Uses a single key for both encryption and decryption
2. Public Key Cryptography (PKC): Uses one key for encryption and another for decryption
3. Hash Functions: Uses a mathematical transformation to irreversibly "encrypt" information



**Figure 1: ijsrp.org Three types of cryptography: secret-key, public key, and hash function**

*Symmetric Key Cryptography-* The most widely used symmetric key cryptographic method is the Data Encryption Standard (DES), published in 1977 by the National Bureau of Standards. DES It is still the most widely used symmetric-key approach. It uses a fixed length, 56-bit key and an efficient algorithm to quickly encrypt and decrypt messages. It can be easily implemented in hardware, making the encryption and decryption process even faster. In general, increasing the key size makes the system more secure. A variation of DES, called Triple-DES or DES-EDE (encrypt-decrypt-encrypt), uses three applications of DES and two independent DES keys to produce an effective key length of 168 bits [ANSI 85].

**Public/Private Key Cryptography**-Asymmetric key cryptography overcomes the key management problem by using different encryption and decryption key pairs. Having knowledge of one key, say the encryption key, is not sufficient enough to determine the other key - the decryption key. Therefore, the encryption key can be made public, provided the decryption key is held only by the party wishing to receive encrypted messages (hence the name public/private key cryptography). Anyone can use the public key to encrypt a message, but only the recipient can decrypt it.

**Hash functions**-“Is a type of one-way function this are fundamental for much of cryptography. A one way function - is a function that is easy to calculate but hard to invert. It is difficult to calculate the input to the function given its output. The precise meanings of "easy" and "hard" can be specified mathematically. With rare exceptions, almost the entire field of public key cryptography rests on the existence of one-way functions.

### III. STUDIES AND FINDINGS

#### A. Secret/Symmetric key cryptography

Secret key cryptography schemes are generally categorized as being either stream ciphers or block ciphers. Stream ciphers operate on a single bit (byte or computer word) at a time, and implement some form of feedback mechanism so that the key is constantly changing.

##### ❖ Encryption algorithm

Step 1: Generate the ASCII value of the letter

Step 2: Generate the corresponding binary value of it.

[Binary value should be 8 digits e.g. for decimal 32 binary number should be 00100000]

Step 3: Reverse the 8 digit's binary number

Step 4: Take a 4 digits divisor ( $\geq 1000$ ) as the Key

Step 5: Divide the reversed number with the divisor

Step 6: Store the remainder in first 3 digits & quotient in next 5 digits (remainder and quotient wouldn't be more than 3 digits and 5 digits long respectively. If any of these are less than 3 and 5 digits respectively we need to add required number of 0s (zeros) in the left hand side. So, this would be the cipher text i.e. encrypted text.

Now store the remainder in first 3 digits & quotient in next 5 digits.

##### ❖ Decryption algorithm

Step 1: Multiply last 5 digits of the cipher text by the Key

Step 2: Add first 3 digits of the cipher text with the result produced in the previous step

Step 3: If the result produced in the previous step i.e. step 2 is not an 8-bit number we need to make it an 8-bit number

Step 4: Reverse the number to get the original text i.e. the plain text.

#### Example

Let, the character is "T". Now according to the steps we will get the following:

Step 1: ASCII of "T" is 84 in decimal.

Step 2: The Binary value of 84 is 1010100. Since it is not an 8 bit binary numbers we need to make it 8 bit number as per the encryption algorithm. So it would be 01010100

|       |        |        |        |        |        |        |        |
|-------|--------|--------|--------|--------|--------|--------|--------|
| [9] 0 | [10] 1 | [11] 0 | [12] 1 | [13] 0 | [14] 1 | [15] 0 | [16] 0 |
|-------|--------|--------|--------|--------|--------|--------|--------|

Step 3: Reverse of this binary number would be 00101010

|        |        |        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|--------|--------|
| [17] 0 | [18] 0 | [19] 1 | [20] 0 | [21] 1 | [22] 0 | [23] 1 | [24] 0 |
|--------|--------|--------|--------|--------|--------|--------|--------|

Step 4: Let 1000 as divisor i.e. Key

Step 5: Divide 00101010 (dividend) by 1000(divisor)

Step 6: The remainder would be 10 and the quotient would be 101.

So as per the algorithm the cipher text would be 01000101 which is

ASCII 69 in decimal i.e. "E"

|        |        |        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|--------|--------|
| [25] 0 | [26] 1 | [27] 0 | [28] 0 | [29] 0 | [30] 1 | [31] 0 | [32] 1 |
|--------|--------|--------|--------|--------|--------|--------|--------|

#### B. Public key cryptography

RSA is one of the first practicable public-key cryptosystems and is widely used for secure data transmission. In such a cryptosystem, the encryption key is public and differs from the decryption key which is kept secret. In RSA, this asymmetry is based on the practical difficulty of factoring the product of two large prime numbers, the factoring problem. RSA stands for Ron Rivest, Adi Shamir and Leonard Adleman, who first publicly described the algorithm in 1977. Clifford Cocks, an English mathematician, had developed an equivalent system in 1973, but it wasn't declassified until 1997.

A user of RSA creates and then publishes a public key based on the two large prime numbers, along with an auxiliary value. The prime numbers must be kept secret. Anyone can use the public key to encrypt a message, but with currently published methods, if the public key is large enough, only someone with knowledge of the prime factors can feasibly decode the message. Breaking RSA encryption is known as the RSA problem. It is an open question whether it is as hard as the factoring problem.

##### ❖ Key generation

RSA involves a *public key* and a *private key*. The public key can be known by everyone and is used for encrypting messages. Messages encrypted with the public key can only be decrypted in a reasonable amount of time using the private key. The keys for the RSA algorithm are generated the following way:

1. Choose two distinct prime numbers  $p$  and  $q$ .
  - For security purposes, the integer's  $p$  and  $q$  should be chosen at random, and should be of similar bit-length. Prime integers can be efficiently found using a primarily test.
2. Compute  $n = pq$ .
  - $n$  is used as the modulus for both the public and private keys. Its length, usually expressed in bits, is the key length.
3. Compute  $\phi(n) = \phi(p)\phi(q) = (p - 1)(q - 1) = n - (p + q - 1)$ , where  $\phi$  is Euler's totient function.
4. Choose an integer  $e$  such that  $1 < e < \phi(n)$  and  $\gcd(e, \phi(n)) = 1$ ; i.e.,  $e$  and  $\phi(n)$  are coprime.

- $e$  is released as the public key exponent.
  - $e$  having a short bit-length and small Hamming weight results in more efficient encryption – most commonly  $2^{16} + 1 = 65,537$ . However, much smaller values of  $e$  (such as 3) have been shown to be less secure in some settings.<sup>[5]</sup>
5. Determine  $d$  as  $d \equiv e^{-1} \pmod{\varphi(n)}$ ; i.e.,  $d$  is the multiplicative inverse of  $e$  (modulo  $\varphi(n)$ ).
- This is more clearly stated as: solve for  $d$  given  $d \cdot e \equiv 1 \pmod{\varphi(n)}$
  - This is often computed using the extended Euclidean algorithm. Using the pseudo code in the *Modular integers* section, inputs  $a$  and  $n$  correspond to  $e$  and  $\varphi(n)$ , respectively.
  - $d$  is kept as the private key exponent.

The *public key* consists of the modulus  $n$  and the public (or encryption) exponent  $e$ . The *private key* consists of the modulus  $n$  and the private (or decryption) exponent  $d$ , which must be kept secret.  $p$ ,  $q$ , and  $\varphi(n)$  must also be kept secret because they can be used to calculate  $d$ .

- An alternative, used by PKCS#1, is to choose  $d$  matching  $de \equiv 1 \pmod{\lambda}$  with  $\lambda = \text{lcm}(p - 1, q - 1)$ , where  $\text{lcm}$  is the least common multiple. Using  $\lambda$  instead of  $\varphi(n)$  allows more choices for  $d$ .  $\lambda$  can also be defined using the Carmichael function,  $\lambda(n)$ .
- The ANSI X9.31 standard prescribes, IEEE 1363 describes, and PKCS#1 allows, that  $p$  and  $q$  match additional requirements: being strong primes, and being different enough that Fermat factorization fails.

❖ Encryption

Alice transmits her public key  $(n, e)$  to Bob and keeps the private key  $d$  secret. Bob then wishes to send message  $M$  to Alice.

He first turns  $M$  into an integer  $m$ , such that  $0 \leq m < n$  by using an agreed-upon reversible protocol known as a padding scheme. He then computes the cipher text  $c$  corresponding to

$$c \equiv m^e \pmod{n}$$

This can be done quickly using the method of exponentiation by squaring. Bob then transmits  $c$  to Alice.

Note that at least nine values of  $m$  will yield a cipher text  $c$  equal to  $m$ ,<sup>[note 1]</sup> but this is very unlikely to occur in practice.

❖ Decryption

Alice can recover  $m$  from  $c$  by using her private key exponent  $d$  via computing

$$m \equiv c^d \pmod{n}$$

Given  $m$ , she can recover the original message  $M$  by reversing the padding scheme.

C. Cryptographic hash function

Hash functions (a type of one-way function) are fundamental for much of cryptography. In this application, functions are characterized and evaluated in terms of their ability to withstand attack by an adversary. More specifically, given a message  $x$ , if it is computationally infeasible to find a message  $y$  not equal to  $x$  such that  $H(x) = H(y)$  then  $H$  is said to be a weakly collision-free hash function. A *strongly collision-free hash function*  $H$  is one

for which it is computationally infeasible to find any two messages  $x$  and  $y$  such that  $H(x) = H(y)$ .

The requirements for a good cryptographic hash function are stronger than those in many other applications (error correction and audio identification *not* included). For this reason, cryptographic hash functions make good stock hash functions--even functions whose cryptographic security is compromised, such as MD5 and SHA-1. The SHA-2 algorithm, however, has no known compromises". Hash function can also be referred to as a function with certain additional security properties to make it suitable for use as a primitive in various information security applications, such as authentication and message integrity. It takes a long string (or message) of any length as input and produces a fixed length string as output, sometimes termed a message digest or a digital fingerprint.

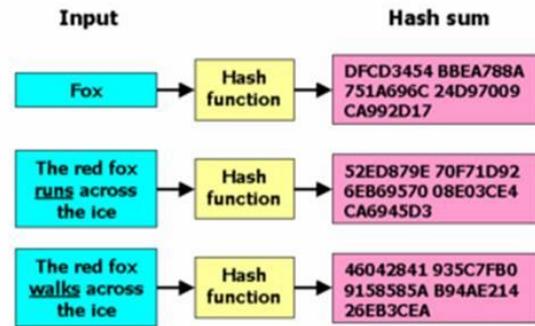


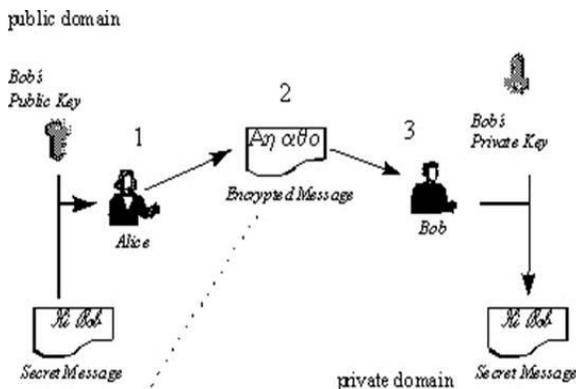
Figure 2: ijsrp.org Hash function

Above figure illustrates the proper and intended use of public/private key cryptography for sending confidential messages. In the illustration, a user, Bob, has a public/private key pair. The public portion of that key pair is placed in the public domain (for example in a Web server). The private portion is guarded in a private domain, for example, on a digital key card or in a password-protected file.

For Alice to send a secret message to Bob, the following process needs to be followed:

1. Alice passes the secret message and Bob's public key to the appropriate encryption algorithm to construct the encrypted message.
2. Alice transmits the encrypted message (perhaps via e-mail) to Bob.
3. Bob decrypts the transmitted, encrypted message with his private key and the appropriate decryption algorithm.

Bob can be assured that Alice's encrypted secret message was not seen by anyone else since only his private key is capable of decrypting the message



**Figure 3: ijsrp.org Communication between alias and bob in PGP e-mail encryption program.**

*Both Are Used Together* - Secret key and public key systems are often used together, such as the AES secret key and the RSA public key. The secret key method provides the fastest decryption, and the public key method provides a convenient way to transmit the secret key. This is called a "digital envelope." For example, the PGP e-mail encryption program uses one of several public key methods to send the secret key along with the message that has been encrypted with that secret key.

*Get Faster - Get Stronger* - It has been said that any encryption code can be broken given enough time to compute all permutations. However, if it takes months to break a code, the war could already be lost, or the thief could have long absconded with the money from the forged financial transaction.

#### D. Use in software

In UNIX systems things are difficult if you are user since super user has full access your keys/log keystrokes. Securing UNIX is very large topic, there is a wealth of information available however, but it revolves around the same principles of any operating systems.

- Keep software up-to-date, this is how most remote attacks succeed.
- Use an anti-virus scanner, and keep it update.
- Don't run mystery attachments, especially executable once are data formats.
- Run a little software as possible if u don't need something to get your job done, remove it, it won't be a problem that way.
- Keep the machine physically secure if possible use BIOS passwords and so on to secure access to the machine.
- 

#### IV. CRYPTOGRAPHY REVIEW

Cryptography is used for four basic purposes:

- Confidentiality/privacy
- Integrity
- Authentication
- Nonrepudiation

*Confidentiality/privacy*: Ensuring the data can't be revealed to un-authorized entities. This involves full encryption of user data. Those who can't decrypt the message see only gibberish.

*Integrity*: Ensuring that data has not been modified or corrupted. It is typically verified using cryptographic data checksums, which is a less expensive operation than full encryptions of data. The data isn't secret-anyone can see/read it, but it can't be modified without detection.

*Authentication*- Securely proving entities are who they claim are, so that they may trust each other.

*Nonrepudiation*: Preventing an entity who took part in a communication from later denying or part of that communication.

#### V. CONCLUSION

Cryptography is used to achieve few goals like Confidentiality, Data integrity, Authentication etc. of the send data. Now, in order to achieve these goals various cryptographic algorithms are developed by various people. For a very minimal amount of data those algorithms wouldn't be cost effective since those are not designed for small amount of data. A single algorithm is used for both encryption and decryption i.e. it is fallen under secret key cryptographic algorithm. But as public key cryptography is more secured then secret key cryptography our next task would be to develop and design a public key cryptographic algorithm in a simple manner as it is done in this paper.

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# A Project to Promote Awareness of Jatropha Plantation

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**Abstract-** Since the surge of interest in renewable-energy alternatives to liquid fossil fuels hit in 2004/5, the possibility of growing *Jatropha curcas* for the purpose of producing biofuel has attracted the attention of investors and policy-makers worldwide. The seeds of *jatropha* contain non-edible oil with properties that are well suited for the production of biodiesel. Today, rural communities continue to use it for its medicinal value and for local soap production. India and many countries in Africa use the *jatropha* plant as a living hedge to keep out grazing livestock.

**Index Terms-** *Jatropha Curcas*; Renewable-Energy; Bio-Diesel; Liquid Fossil Fuels; rural communities

## I. INTRODUCTION

In 1991, the European Community, (EC) Proposed a 90% tax reduction for the use of biofuels, including biodiesel. Today, 21 countries worldwide, produces Biodiesel. *Jatropha*: A Small-holder Bioenergy Crop has Potential for Pro-Poor Development. This paper provides a brief overview of biofuels, their growth drivers and their potential impacts on poor societies. It looks at how *jatropha* which originated in Central America and then spread across Africa and Asia, has become widespread throughout the tropics and subtropics. It also builds upon technical and scientific information on key issues affecting *jatropha* for pro-poor development that was presented during the Consultation by specialists from around the world. The review also summarizes the most recent data on the cultivation, seed harvesting and processing, uses and genetic improvement of *jatropha* and our visit at Navsari Agriculture University.

## II. ORIGIN AND SPREAD

*Jatropha* is believed to have been spread by Portuguese seafarers from its centre of origin in Central America and Mexico via Cape Verde and Guinea Bissau to other countries in Africa and Asia. It is now widespread throughout the tropics and subtropics. Until recently, *jatropha* had economic importance in Cape Verde. Since the first half of the nineteenth century, with its ability to grow on poor soils with low rainfall, it could be exploited for oilseed production. Cape Verde exported about 35000 tonnes of *jatropha* seeds per year to Lisbon. Along with Madagascar, Benin and Guinea, it also exported *jatropha* seeds to Marseille where oil was extracted for soap production.

## III. CULTIVATION OF JATROPHA PLANT

Cultivation is uncomplicated. *Jatropha curcas* grows in tropical and subtropical regions. The plant can grow in wastelands

and grows on almost any terrain, even on gravelly, sandy and saline soils. It can thrive in poor and stony soils, although new research suggests that the plant's ability to adapt to these poor soils is not as extensive as had been previously stated. Complete germination is achieved within 9 days. Adding manure during the germination has negative effects during that phase, but is favourable if applied after germination is achieved. It can be propagated by cuttings, which yields faster results than multiplication by seeds. The flowers only develop terminally (at the end of a stem), so a good ramification (plants presenting many branches) produces the greatest amount of fruits. The plants are self-compatible. Another productivity factor is the ratio between female and male flowers within an inflorescence; more female flowers mean more fruits. *Jatropha curcas* thrives on a mere 250 mm (10 in) of rain a year, and only during its first two years does it need to be watered in the closing days of the dry season. Ploughing and planting are not needed regularly, as this shrub has a life expectancy of approximately forty years.

## IV. PROPAGATION AND CROP ESTABLISHMENT

Seed from high-yielding *jatropha* plants is not generally available, due to the fact that the out-crossing seed selected from productive plants may or may not result in high-yielding and high-quality plants. Trees capable of producing more than 2 tonnes of dry seed per ha with 30% seed oil content should be selected as source material. Cuttings of at least 30 mm diameter gave earlier and higher initial yields than plants raised from seed, although little or no yield difference was seen for later harvests. Plants are ploughing by 2 m \* 2 m and 1.5 m \* 1.5 m.



Fig 1 Live propagation at Navsari(Surat) Agriculture University

## V. OIL EXTRACTION

Traditional oil extraction methods are highly labour intensive, requiring some 12 hours to produce one litre of oil. The process requires roasting the seed kernels, pounding them to a paste, adding water and boiling, and then separating the oil by skimming and filtering. The Bielenberg ram press (shown in Plate 15) is a hand-operated expeller designed for construction and repair by small and simply equipped workshops. It has a low work rate – one litre of oil produced per hour – and therefore is only suited to small-scale or demonstration use. A hand-operated screw press is more efficient, but maintenance and repairs become more problematic. Engine-driven expellers can have work rates of 55 litres per hour (Henning, 2008b), with about 10% of the oil produced required to fuel the diesel engine that powers the press (see Plate 16). The Sayari expeller, manufactured in Tanzania, has a work rate of 15–33 litres per hour with a 4–5 kW engine and is capable of extracting 15 litres of oil from 75 kg of seed.

## VI. PROPERTIES OF JATROPHA OIL

Oil quality and consistency are important for producing biodiesel. The Physical and chemical content of jatropha oil can be extremely variable. Oil characteristics appear to be influenced by environment and genetic interaction, as are seed size, weight and oil content. The maturity of the fruits also can affect the fatty acid composition of the oil, and processing and storage further affect oil quality.

## VII. CLIMATE

Jatropha grows in tropical and sub-tropical regions, with cultivation limits at 30°N and 35°S. It also grows in lower altitudes of 0-500 metres above sea level. Jatropha is not sensitive to day length (flowering is independent of latitude) and may flower at any time of the year. While jatropha can survive with as little as 250 to 300 mm of annual rainfall, at least 600 mm are needed to flower and set fruit. The optimum rainfalls for seed production is considered between 1000 and 1500 mm. Optimum temperatures are between 20°C and 28°C. Very high temperatures can depress yields.

## VIII. PROCESS

The process of converting vegetable oil into biodiesel fuel is called transesterification and is luckily less complex than it sounds. Chemically, transesterification means taking a triglyceride molecule or a complex fatty acid, neutralizing the free fatty acids, removing the glycerine, and creating an alcohol ester. This is accomplished by mixing methanol with sodium hydroxide to make sodium methoxide. This liquid is then mixed into the vegetable oil. After the mixture has settled, glycerine is left on the bottom and methyl esters, or biodiesel, is left on top and is washed and filtered. The final product Bio Diesel fuel, when used directly in a Diesel Engine will burn up to 75% cleaner than mineral oil Diesel fuel.

## IX. INTERNATIONAL LAWS AND REGULATION

Several countries have active Biodiesel programmes. Such countries also have given legislative support and have drawn up national policies on biodiesel development. Wide variety of motives for action taken can be observed like Increase of energy supply security, Energy forms, Reduction of harmful locally acting emissions. Protection of soil by biodegradable products, Reduction of health hazard by using non-toxic products.

## X. BIODIESEL SCENARIO IN INDIA

As India is deficient in edible oils, non-edible oil is the main choice for producing biodiesel. According to Indian government policy and Indian technology effects. Some development works have been carried out with regards to the production of transesterified non-edible oil and its use in biodiesel by units such as Indian Institute of Science, Bangalore, Tamilnadu Agriculture University Coimbatore and Kumaraguru College of Technology in association with Pan Horti consultants, Coimbatore. Generally a Blend of 5% to 20% is used in India (B5 to B20). Indian Oil Corporation has taken up Research and development work to establish the parameters of the production of transesterified Jatropha Vegetable oil and use of bio diesel in its R&D centre at Faridabad. Research is carried out in Kumaraguru College of Technology for marginally altering the engine parameters to suit the Indian Jatropha seeds and to minimize the cost of transesterification.

## XI. ADVANTAGES

- **Energy Independence:**

Considering that oil priced at \$60 per barrel has had a disproportionate impact on the poorest countries, 38 of which are net importers and 25 of which import all of their oil; the question of trying to achieve greater energy independence one day through the development of biofuels has become one of 'when' rather than 'if,' and, now on a near daily basis, a biofuels programme is being launched somewhere in the developing world.

- **Smaller Trade Deficit:**

Rather than importing other countries' ancient natural resources, we could be using our own living resources to power our development and enhance our economies. Instead of looking to the Mideast for oil, the world could look to the tropics for biofuels. Producing more biofuels will save foreign exchange and reduce energy expenditures and allow developing countries to put more of their resources into health, education and other services for their neediest citizens.

- **Economic Growth:**

Jatropha bio-diesel creates new markets for agricultural products and stimulates rural development because biofuels are generated from crops; they hold enormous potential for farmers. In the near future—especially for the two-thirds of the people in the developing world who derive their incomes from agriculture.

- **Cleaner Air:**

Biofuels burn more cleanly than gasoline and diesel. Using biofuels means producing fewer emissions of carbon monoxide, particulates, and toxic chemicals that cause smog,

aggravate respiratory and heart disease, and contribute to thousands of premature deaths each year.

• **Less Global Warming:**

Biofuels contain carbon that was taken out of the atmosphere by plants and trees as they grew. The Fossil fuels are adding huge amounts of stored carbon dioxide (CO<sub>2</sub>) to the atmosphere, where it traps the Earth's heat like a heavy blanket and causes the world to warm. Studies show that biodiesel reduces CO<sub>2</sub> emissions to a considerable extent and in some cases all most nearly to zero.

Table 1. comparison of common diesel oil And jatropha oil

|                             | Diesel oil | Jatropha oil |
|-----------------------------|------------|--------------|
| density(kg/l) (15/40 °c)    | 0.84-0.85  | 0.95-0.98    |
| Cold solidifying point (°C) | -14        | 2.0          |
| Flesh pt. (°C)              | 80         | 150-240      |
| Cetane number               | 47.8       | 51.0         |
| Sulphur (%)                 | 1.0-1.3    | 0.13         |

We also do the site visit of farm of jatropha plants at navsari vishwa Krushi University, navsari (Gujarat).



Fig 2. Jetropha seeds at Navsari(surat) krushi university

XII. OUR SMALL PROCESS OF EXTRACTING OIL IN LAB

Pressure needed 68 bars with piston arrangement and around 550 Gms of jatropha seeds. Extract around 0.218 litre oil!

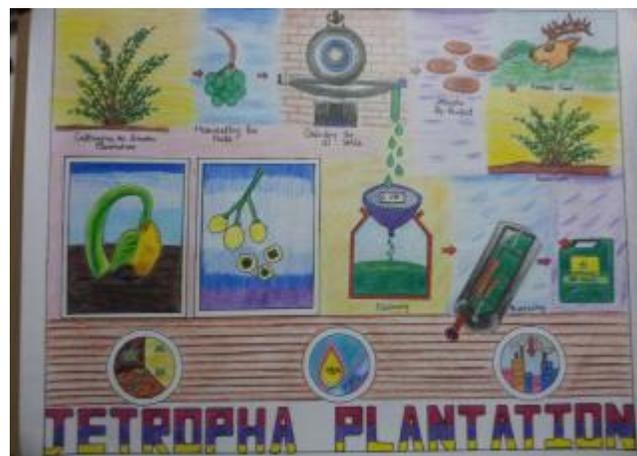


Fig. 3 Our handmade poster for clear understanding of mechanical process of extracting oil

XIII. CHEMICAL PROCESS



XIV. CONCLUSION

At the global level, there is a need for coordination of biofuel development and an international food reserve system to protect the vulnerable poor. To meet pro-poor objectives, international support for research into jatropha agronomy and genetic improvement is needed. The development of nontoxic

Varieties should be a priority. CDM methodologies and certification to support sustainable jatropha production systems need to be accessible by the rural poor. Taking advantage of the opportunity jatropha presents for rural development will require developing countries to address the policy, regulatory and public investment constraints that generally affect their agricultural development. Biofuels need to be integrated within a broader framework of investment in rural infrastructure and human capital. Here some comparison of common usage diesel and jatropha diesel (table 1). This data is makeable in our research paper.



Fig 4: oil extraction at the surface of the knife while doing experiment at home

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# Comparative study of typical R.C. building using INDIAN STANDARDS and EURO STANDARDS under seismic forces

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**Abstract-** In R.C. buildings, frames are considered as main structural elements, which resist shear, moment and torsion effectively. These frames are subjected to variety of loads, where lateral loads are always predominant. Infrastructures of Gulf countries are always remarkable as they mostly follow EURO standards for construction development. In view of the demand of such codes across the developing countries like India, an attempt is made to compare EURO standards with Indian standards using structural software.

**Index Terms-** R.C. buildings, INDIAN standards, EURO standards, lateral forces, structural software.

## I. INTRODUCTION

Reinforced concrete, as a composite material, has occupied a special place in the modern construction of different types of structures due to its several advantages. Due to its flexibility in form and superiority in performance, it has replaced, to a large extent, the earlier materials like stone, timber etc. Moreover, its role in structural forms like multistoried frames, bridges, foundations etc. is enormous. With the rapid growth of urban population in both the developing as well as the developed countries, reinforced concrete has become a material of choice for residential construction.

There are mainly two types of structures;

1) Post and beam structure: Here, beam simply rests on top of column.

2) Rigid frame structure: In this type of structure beam and column are rigidly joined. A rigid frame structure is a structure made up of linear elements, typically beams and columns that are connected to one another at their ends with joints that do not allow any relative rotations to occur between the ends of the attached members, although the joints themselves may rotate as a unit. In India, for reinforced concrete structures, Indian standard was introduced in the year 1953, which was further revised and implemented with the course of time. For lateral load, Indian Bureau Standard has introduced criteria for earthquake resistant design of structures in 1993, which is under the stage of revision.

This paper adopts the Recent Indian Standards which are as follows:

- 1) **IS 456:2000: Code of Practice for Plain and Reinforced Concrete**

- 2) **IS 1893 (Part-1):2002: Criteria for Earthquake Resistant Design of Structures**

Although Indian Standards are sufficient for construction of buildings in India, there are some International standards which contains some parameters that are not included in IS codes. Infrastructures of Gulf countries are always remarkable. And it is observed that they mostly follow EURO standards for variety of structures. So such codes are very much important in developing Countries like India. This paper adopts the Recent European Standards which are as follows:

- 1) **EURO CODE 2 (EC 2): Design Of Concrete Structures**
- 2) **EURO CODE 8 (EC 8): Design Of Structures For Earthquake Resistance**

This paper extends the comparison further and presents a comparative study of the expected performance of a multistoried building under lateral loading using INDIAN AND EURO STANDARDS by means of computer tools. Following discussions are made on some of the parameters which have a due importance in seismic force.

## II. RESPONSE REDUCTION FACTOR

All modern national seismic design codes converge on the issue of design methodology. These are based on a prescriptive Force-Based Design approach, where the design is performed using a linear elastic analysis, and inelastic energy dissipation is considered indirectly, through a response reduction factor (or behavior factor). Behavior factor, along with other interrelated provisions, governs the seismic design forces and hence the seismic performance of code-designed buildings. The response reduction factor, as considered in the design codes, depends on the ductility and over strength of the structure. Building codes define different ductility classes and specify corresponding response reduction factors based on the structural material, configuration and detailing. Response reduction factor for OMRF and SMRF is 3 and 5 respectively according to IS 1893. According to EC 8 it is 1.5, 3.9 and 5.85 for DCL, DCM and DCH respectively. So if it is compared SMRF with DCM according to Table 1 response reduction factor for EUROCODE is higher than that provided in IS CODE.

### III. DUCTILITY CLASSES

EUROCODE 8 (EN 1998-1) classifies the building ductility as Low (DCL), Medium (DCM) and High (DCH). IS 1893 classifies RC frame buildings as Ordinary Moment Resisting Frames (OMRF) and Special Moment Resisting Frames (SMRF).

**Table 1. Ductility classes according to various categories of building**

| Category                             | Ductility class |      |
|--------------------------------------|-----------------|------|
|                                      | IS 1893         | EC 8 |
| <b>Low dissipative structures</b>    | OMRF            | DCL  |
| <b>Medium dissipative structures</b> | SMRF            | DCM  |
| <b>High dissipative structures</b>   | -               | DCH  |

### IV. DRIFT

Drift governs the design and expected seismic performance of a building. In various codes procedure to estimate drift is varying considerably. Drift differ according to effective stiffness of R.C members. Further, as discussed earlier, the drift may govern the design in many cases, resulting in further discrepancies in the actually provided strength. Therefore, in this study, the seismic performance of a building designed for both (i.e. EC 8 and IS 1893) seismic design codes have been compared.

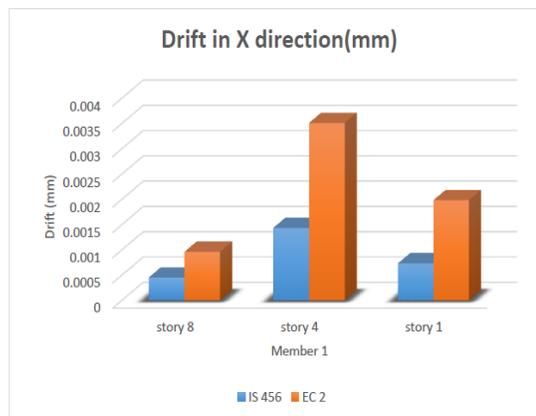
### V. MODELLING

For comparison, a residential building of G+7 story is taken under reference. Importance factor is taken as 1 which is same specified in both codes. To have a similar hazardous level, soil condition is taken as medium soil according to IS CODE provisions which is equivalent to soil type B(PGA=0.35g) according to ASCE. (In EUROCODE soil classification is describe based on ASCE code.)So, type B soil in ASCE is equivalent to medium soil condition in India. Here, building type is medium dissipative structure. According to Table 1 ductility class is SMRF for IS 1893 and DCM for EC 8.The story height is 3 m for all floors. Modeling of structure, analysis and design is done on ETABS software.

### VI. ANALYSIS OF RESULT

The seismic load according to the relevant codes has been estimated and the building is designed for combined effect of gravity and seismic forces, considering all the design load combinations specified in each code. Poisson's ratio may be taken equal to 0 for cracked concrete as per EC 2(3.1.3.4).

### VII. DRIFT:



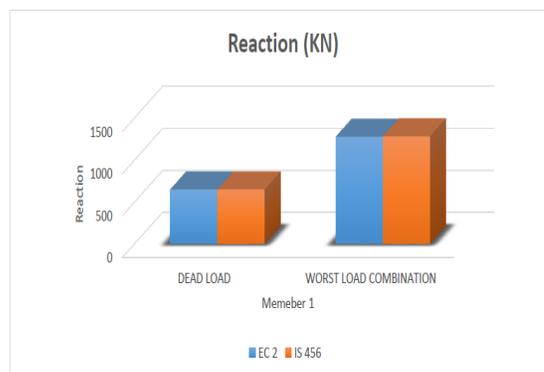
**Fig.1**

**Graphical comparison of drift in X direction**

As mentioned earlier, all the codes considered for the study specify drift limits on the total (inelastic) displacement, except for the Indian code, which specifies drift limit on the elastic displacement. Fig.1 depicts drift in x direction by adopting both codes for worst load combination.

### VIII. REACTION:

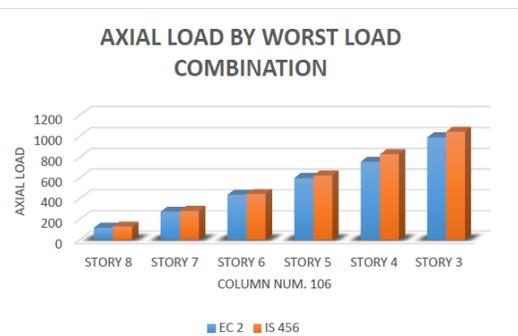
Estimation of reaction generated due to dead load and worst load combination at the base of the building is shown below by means of graphical representation.



**Fig.2 Graphical comparison of reaction value using dl and worst load combination**

### VII. AXIAL LOAD

Axial load is increasing if we move from 7<sup>th</sup> story to base level. Axial load is estimated by adopting both codes at various story levels.

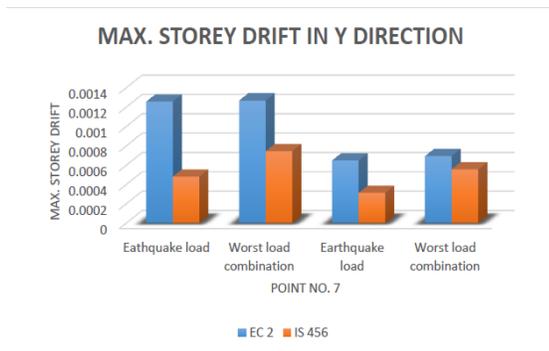


**Fig.**

**3 Graphical comparison of axial load at various story levels**

**VIII. MAXIMUM STORY DISPLACEMENT**

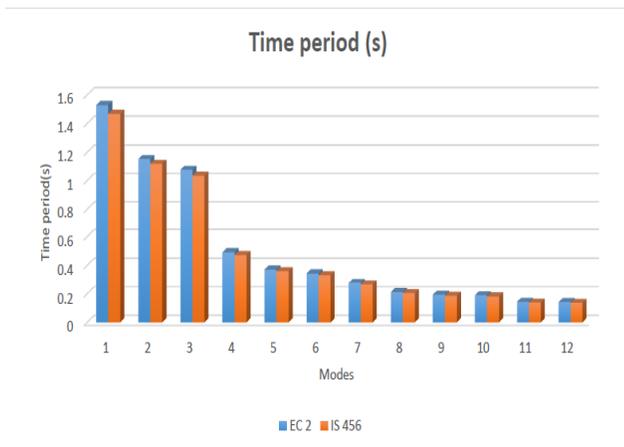
There are differences among both codes in case of inter story drift also, but the differences are not as drastic.



**Fig.4 Graphical comparison of maximum story displacement in Y direction**

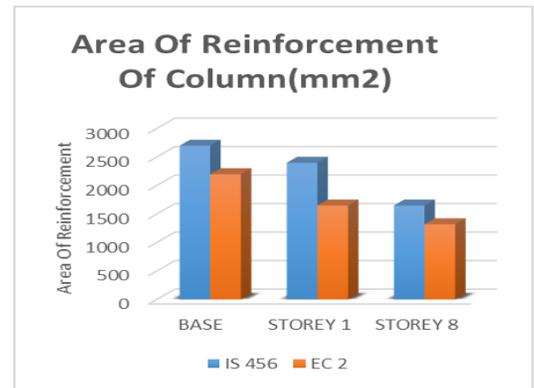
**IX. TIME PERIOD**

By the comparison of results, time period is comparable resulted by both codes. There are 12 modes among full height of building.



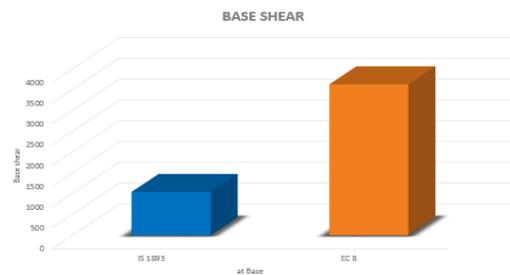
**Fig.5 Graphical comparison of time period(s) at various modes**

**X. REINFORCEMENT DETAIL OF PARTICULAR COLUMN**

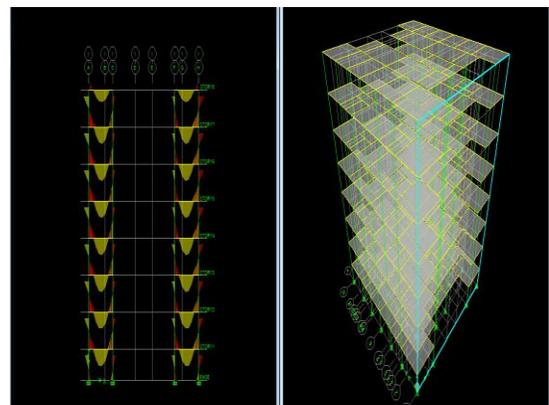


**Fig.6 Graphical comparison of area of reinforcement at various story levels**

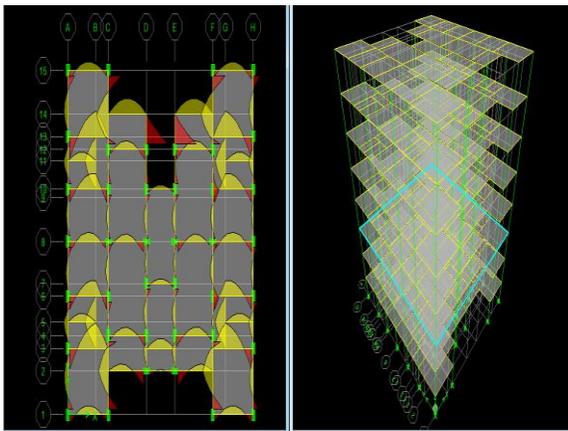
**XI. BASE SHEAR**



**Fig.7 Graphical comparison of base shear**



**Fig.8 Graphical representation of bending moment diagram of 3rd floor**



**Fig.9 Graphical representation of bending moment diagram of particular column**

## XII. CONCLUDING REMARKS:

All the above parameters are compared by using both Standards under gravity loading as well as seismic loading. It can be observed from the results and graphs that variation in values of different parameters is dependent on the load combinations of both the code. This paper conclude that the design base shear as per IS 1893 is lower as compared to EUROCODE 8 because of higher value of RESPONSE REDUCTION FACTOR. The allowable story drift as per EURO CODE 8 is 1.5%.while as per IS 1893 is 0.4%.Due to this maximum story drift as per EURO CODE 8 is higher than IS 1893.The area of reinforcement required in column is lower in EC 2 than IS 456. This is because the modulus of elasticity is higher in EC 2. Also the maximum percentage of steel required, suggested by IS 456 in the column is 6% while that suggested by EC 2 is 4%.Therefore, the ductility of column in EC 2 is controlled by modulus of elasticity while that in IS 456 is controlled by area of reinforcement. Variation of the modulus of elasticity with time can be estimated by:

$$E_{cm}(t) = (f_{cm}(t) / f_{cm})^{0.3} E_{cm}$$

where  $E_{cm}(t)$  and  $f_{cm}(t)$  are the values at an age of  $t$  days and  $E_{cm}$  and  $f_{cm}$  are the values determined at an age of 28 days. Where  $E_{cm}$  denotes secant modulus of elasticity of concrete and  $f_{cm}$  denotes mean value of concrete cylinder compressive strength.

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# Phytotoxic activity of the zinc oxyde nanoparticles synthesized from different precursors on germination and radicle growth of seeds *lepidium sativum*

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**Abstract-** In this study, the zinc oxide prepared from three different precursors: zinc sulfate hepta hydrate, zinc nitrate hexahydrate and zinc acetate dihydrate, has been tested on the germination of *Lepidium sativum* seeds. Radicles growth of selected seeds responded differently to the treatment of various oxides synthesized. The results show a very significant inhibitory effect on the germination and the growth of rootlets observed in the case of ZnO synthesized from zinc sulfate heptahydrate, compared to the control and other oxides prepared from zinc nitrate or acetate zinc. We found that, after a week of incubation in the presence of ZnO synthesized from zinc sulfate, 65% inhibition of seed germination, the length of the radicles *Lepidium sativum* decreased almost 90 to 100% and the inhibitory action of this oxide is irreversible after cessation of treatment.

**Index Terms-** Zinc oxides, precursors, *Lepidium sativum*, germination, index of inhibition.

## I. INTRODUCTION

Zinc oxide "ZnO" is a semiconductor widely used in many fields because of its impressive mechanical, chemical and electrical properties [1-3]. It showed considerable interest in the agri-food sector as a preservative [4], in the wastewater treatment for their recycling [5] and in the field hygiene as a bactericidal agent [6-11] and antifungal agent [12, 13].

Reestablished studies of these oxides in relation to plant and animal eukaryotic cells are very limited. However, their biological responses and behavior following treatment with these nanoparticles may be the source of information and novel therapeutic indications. The study of the antimetabolic activity of these molecules can, for example, give us another opportunity in the therapy of cancer diseases. It may also be useful in agriculture for better storage and storing crops seeds and controlling the growth of weeds, because the use of herbicides can result in serious ecological consequences [14].

The objective of this study is to illustrate the inhibitory effect of zinc oxides synthesized from various precursors, the potential for germination and mitotic activity, and the growth of radicles *Lepidium sativum* seeds, using the phytotest method.

## II. MATERIAL AND METHODS

The species used in this work is the garden cress (*Lepidium sativum*). It is an annual plant from the family of Brassicaceae. Seeds purchased commercially, belong to the same batch. The tested seeds are carefully selected by removing any damaged or small seed in order to have a uniform size. Seeds are washed with pure distilled water to remove any impurities and are tested at a rate of greater than 95% germination [15-17].

The preparation of zinc oxide was carried out in collaboration with the team of Materials and Applied Catalysis Laboratory "Chemistry Biology Applied to the Environment" of the University of Science of Meknes. From zinc sulfate heptahydrate, zinc nitrate hexahydrate and zinc acetate dihydrate according to the methods described by Zegaoui and al. [6].

Seeds are sown in Petri dishes of 50 mm diameter, coated by a layer of Whatman filter paper type impregnated with 5 ml of aqueous solution of each oxide at a concentration of 1mg / ml. The control Petri dish is impregnated by 5 ml of distilled water and would be the control test. The hydration is done only once at the beginning of the test. All plates are placed in an incubator at 25 ° C in the dark. The process of germination and Radicles elongation of seeds is observed directly in the Petri dishes, every 24 hours for a week. A seed is considered germinated when the protrusion of the root is obvious [18,19]. Three replica control and three replica of each of the oxides are used in Petri dishes each one containing 20 seeds of average size of (20×3) used for each test. Data are expressed as mean elongation Radicles and the results are reported in mm.

**Table I: Notation adopted for the oxides prepared from different precursors [6]:**

| Sample | Notation | Precursor  |
|--------|----------|--|
| ZnO(X) | ZnO(S)   | ZnSO <sub>4</sub> , 7H <sub>2</sub> O                    |
|        | ZnO(N)   | Zn(NO <sub>3</sub> ) <sub>2</sub> , 6H <sub>2</sub> O    |
|        | ZnO(A)   | Zn(CH <sub>3</sub> COO) <sub>2</sub> , 2H <sub>2</sub> O |

### III. CALCULATION AND EXPRESSION OF RESULTS

#### III.1. Determining the capacity of germination of the seeds of *Lepidium sativum*:

The percentage of germination of control seeds was 95%, the inhibition observed in the control group is subtracted from the test groups. Also, the percentage inhibition of germination is expressed on all the tested seeds.

The criterion for germination was evaluated by the opening of the seed over the emergence of a rod 3 mm and information relating to the success of germination is noted [16,20].

The germination capacity of seeds is determined by calculating the level of seed germination percentage [16, 21]:

$$[\text{Number of germinated seeds} / \text{total number of seeds}] \times 100$$

#### III.2. Determination of inhibition of germination index (GI):

This method is generally developed to determine the phytotoxicity of the solid residues and contaminated soil. In this work, the synthesized oxides are used for doing this testing. Monitoring of seed germination is determined every 24 hours. The number of seeds germinated was noted and the percentage inhibition of germination is calculated as follows:

$$GI\% = (GP_{co} - GP_{tr} / GP_{co}) \times 100$$

GP<sub>co</sub>: Germination percentage of the control lot

GP<sub>tr</sub>: Germination percentage of the lot treated by oxide

#### III.3. Plantlets Vigor of *Lepidium sativum*

After determining the successful germination for seven days for each of the replica, we proceeded to measure the length of the

radical. This value is expressed as mean elongation Radicles and the results are reported in mm.

Plantlets vigor= Percentage of germination x Plantlets length

#### III.4. Study of the reversibility of the growth of rootlets *Lepidium sativum*

We also examined whether, at a concentration of 1mg/ml oxides prepared, if we would observe an irreversible toxic phenomenon, causing cell damage by inhibition. Reversibility was verified on radicles grown in the presence of oxides for a time of two days. The seeds are transferred to a medium containing distilled water, for periods of 1, 2, 3 and 4 days.

### IV. RESULTS AND DISCUSSION

#### IV.1. Capacity of germination of *Lepidium sativum*:

The results concerning capacity to seed germination of *Lepidium sativum* treated with different zinc oxide prepared from different precursors (Figure 1) show that all the oxides tested exert an inhibitory effect on germination, by comparing them with the control. The shape of the curves in this graph shows an exponential shape, the speed of germination capacity varies with the type of zinc oxide synthesized. ZnO (S) is more effective on the inhibition of germination compared to ZnO (N) and ZnO (A). On the second day of germination, ZnO prepared from zinc sulfate hexahydrate gives only 30% seed germination, compared to 70% in the control, 55% for Zinc oxide prepared from Zinc acetate dihydrate and 50% seed germination in the case of oxide synthesized from zinc nitrate hexahydrate.

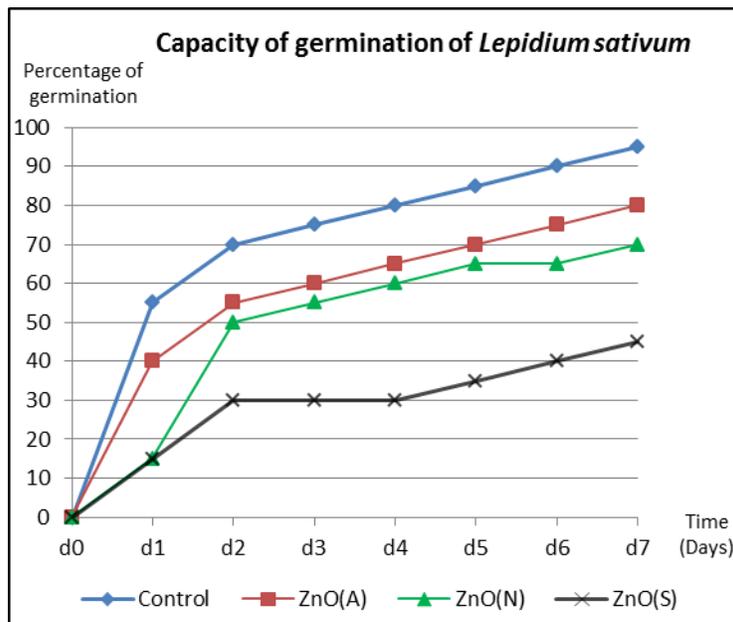
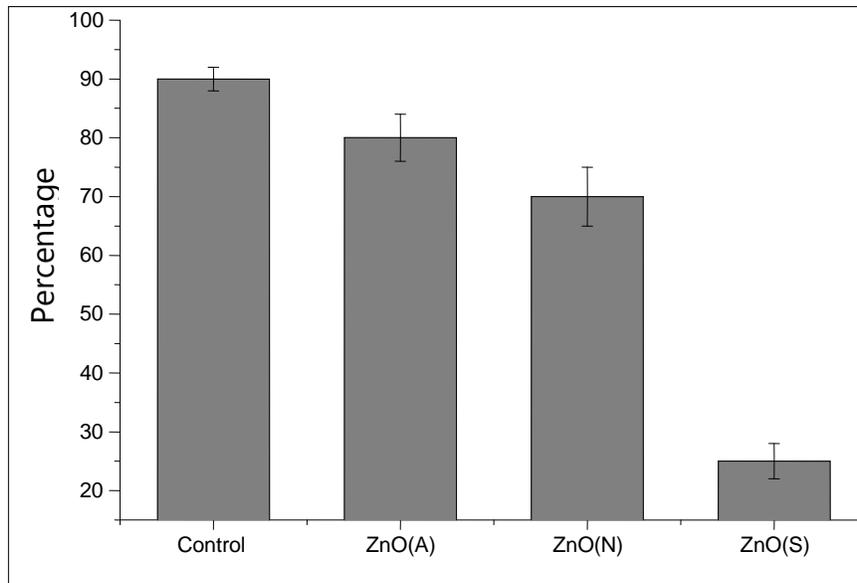


Figure 1: Effect of zinc oxide synthesized from different precursors on the germination of seeds of *Lepidium sativum* versus time. The values are the means of three replicates.



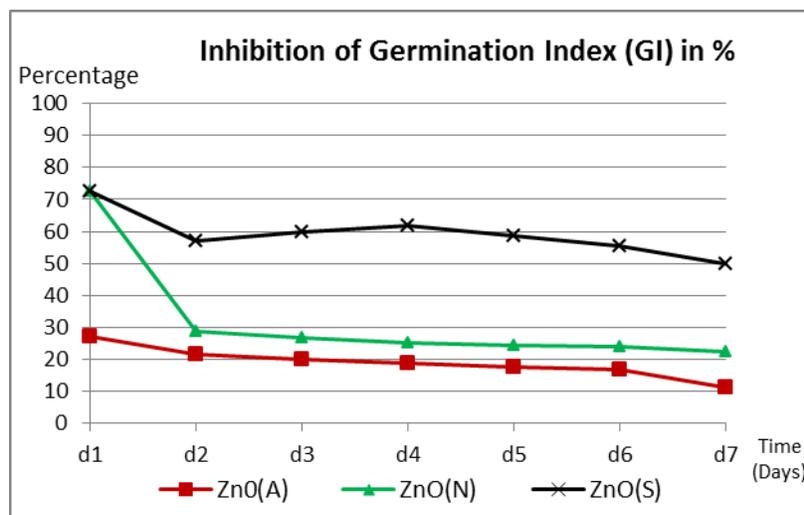
**Figure 2: Effect of zinc oxide synthesized from different precursors on rate of germination of *Lepidium sativum* after 7 days of treatment. The values are the means ± SD for three replicates.**

Figure 2 summarizes the ability of seed germination after 7 days of incubation and therefore confirms the inhibitory effect of the three oxides which ZnO(S) is the most effective followed by ZnO(N) and ZnO(A). The germination rate of seeds was tested is 40%, 70% and 80% for ZnO (S), ZnO (N) and ZnO (A) respectively, and is 95% for the control. Comparing the growth inhibiting activity observed in this study, in eukaryotic vegetal cells radicles seeds of *Lepidium sativum*, with the bacterial prokaryotic cells [6], we found a similarity concerning the behavior of the two types of cells. Indeed, ZnO (S) is effective as a bactericide agent on both Gram positive bacteria (*Staphylococcus aureus*)

and gram negative (*Escherichia coli*). ZnO(N) and ZnO (A) have an effect more or less moderate on these bacteria studied [6].

**IV.2. Inhibition of Germination Index(GI):**

The GI is an indicator parameter of toxicity of the product tested on seed germination. Figure 3 shows the magnitude of inhibition index of the germination of each ZnO studied by expressing it as percentage inhibition of germination. Treatment with ZnO (S) shows a significant inhibitory effect on the germination of *Lepidium sativum*, this inhibition reached 50% after seven days of treatment. For the others oxides such inhibition reached 20% for ZnO (N) and 10% for ZnO (A).

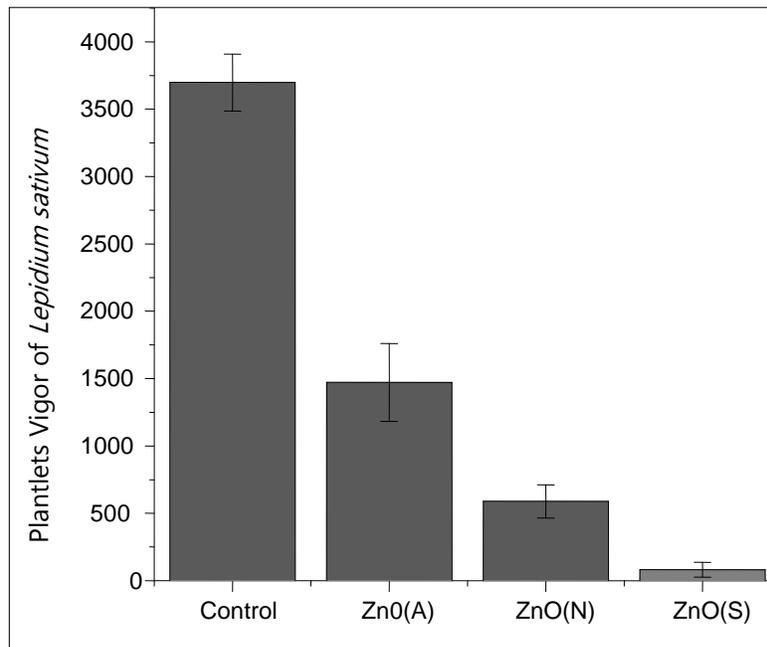


**Figure 3: Inhibition Index of seed germination of *Lepidium sativum* in% for three Zinc oxides synthesized from different precursors. The values are the means of three replicates.**

### IV.3. Plantlets Vigor of *Lepidium sativum*

The plantlets vigor of *Lepidium sativum* informs us about the mitotic capacity of radicles, the greater their length, the more speed of growth and multiplication of cells are increased and vice

versa. Figure 4 shows that the length of the radicle *Lepidium sativum* after 7 days incubation is decreased nearly half in the presence of ZnO (A), 75% for ZnO (N) and 90 to 100% for the ZnO (S) compared to the control.



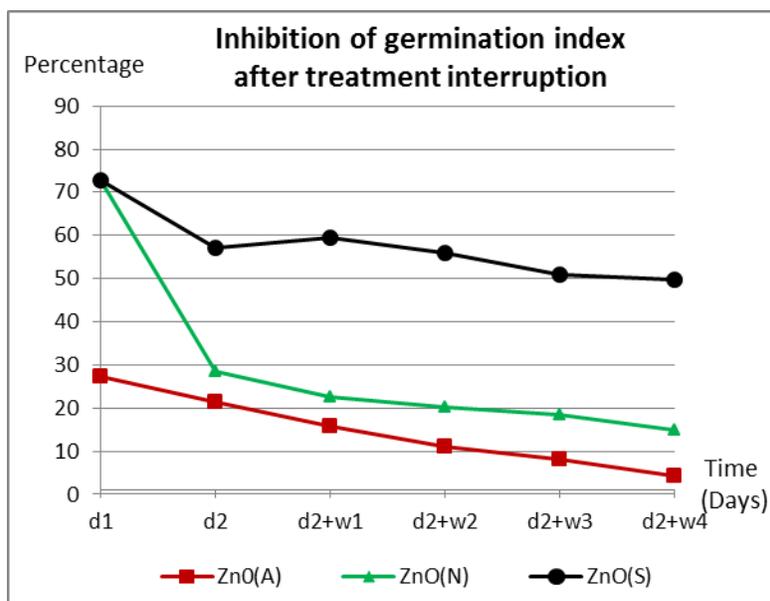
**Figure 4: Effect of zinc oxide synthesized from different Precursors against the Plantlets Vigor of *Lepidium sativum*. The values are the means  $\pm$  SD of three replicates.**

### IV.4. Reversibility of the growth of rootlets *Lepidium sativum*

The interest provided by this test consists in verifying the durability of the growth inhibitory activity or antimitotic ability of the product studied. The results that emanated may be of considerable importance in the medical and health sector. Indeed, the treatment of multi resistant organisms and invasive cancer cells is the biggest disappointment present in public health.

In this study, the use of zinc oxide as inhibitor of cell growth, and test the reversibility of growth after treatment, allowed us to classify them according to their effectiveness. We

found that rehydration of the seeds tested after two days of incubation shows that the length of the radicles of *Lepidium sativum* has not changed significantly in the case of ZnO (S); the recovery rate of germination is null after two days of hydration and less than 10% after four days of rehydration, figure5. However, the rootlets have continued to grow in a more or less moderate rate in the case of ZnO (N) and more pronounced in the case of ZnO (A). We conclude that the use of zinc oxide synthesized from zinc sulfate heptahydrate definitely inhibits the growth of eukaryotic plant cells as well as those bacterial prokaryotic [6].



w: Distilled water  
d1: seeds treated for 1 day  
d2: seeds treated for 2 day  
d2+w1: Seeds treated for 2 day, then transferred into distilled water for 1 day  
d2+w2: Seeds treated for 2 day, then transferred into distilled water for 2 day  
d2+w3: Seeds treated for 2 day, then transferred into distilled water for 3 day  
d2+w4: Seeds treated for 2 day, then transferred into distilled water for 4 day

**Figure 5: Effect of interruption of treatment with zinc oxide synthesized from different precursors on the growth of radicles of *Lepidium sativum*. The values are the means of three replicates.**

This particular activity of ZnO (S), compared to the other above-mentioned oxides can be explained by the shape and size of crystalline particles of each. Crystallographic studies and electron microscopy [6] showed that ZnO (S) is formed of heavily agglomerated nanoparticles are in the form of clusters having an average size greater than 100 nm while the nanoparticles of ZnO(A) have an hexagonal crystal form and an mean size of about 40 nm. The ZnO (N) is present in the form of elongated particles with a size between 22 and 85nm. According to the literature, the mechanism of action on living cells involves the hydroxyl radical; regeneration of H<sub>2</sub>O<sub>2</sub> molecules appear to be toxic to cells [22-24]. The hydroxide radical is more abundant in the ZnO (S) crystal form [6], it is more likely that these radicals involved in the inhibitory efficiency more marked on the vital activity of prokaryotic and eukaryotic cells.

## V. CONCLUSION

The effect of the oxides on the seeds of *Lepidium sativum* varies as a function of the precursor in which they are synthesized. The overall results obtained in this work allowed us to conclude that zinc oxide has an inhibitory effect on the germination and growth of seeds of *Lepidium sativum*. The sprouting inhibitory activity is very significant and irreversible in the presence of zinc oxide synthesized from zinc sulfate heptahydrate.

ZnO (S) appears to be effective in the inhibition of mitotic activity of cells in roots division. This irreversible antimitotic power, needs to be tested on animal cells that are mitotically ac-

tive such as cancer cells generating malignant tumors in order to operate in medicine to eradicate their invasion and growth.

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# Home Monitoring System

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**Abstract-** In today's world safety and security plays an important role; hence in this paper we propose a realistic automation and monitoring system for our homes and living places. It includes centralize control of lighting, temperature and other resources to provide better convenience, comfort and energy efficiency with reliable automation. It is the arrangement of electronics and computer technology that fulfills all the requirements for a monitoring system. The application of serial communication is provided in the system to enhance the reliability and feasibility of the system.

**Index Terms-** Automation, monitoring system, resources, computer, electronic technology.

## I. INTRODUCTION

The home monitoring system is the application of embedded system where the combination of physical world takes place with digital world. In recent year science and technology has developed broadly and still developing now. The technology has provided many resources that made our life easy and efficient but sometimes these resources become perilous when we are using them. The Home monitoring system prevents the hazards of use of these resources and gives indication of them. This includes the home automation and monitoring of the home that provide easy controlling of home appliances and monitoring of the environment of home.

## II. INPUT TERMINAL

The input terminal of the system contains various devices i.e. CCTV camera, gas sensor, temperature sensor LM35, DS1307 others. A closed-circuit television (CCTV) camera is a type of input device for monitoring system that can produce images or recordings which are accessible for observation purposes. This device will monitor all the activities in the home and provide the data to the digital video recorder (DVR) for recording and displaying the data to the monitor. MQ-5 gas sensor is used for sensing combustible gas leakage. When the combustible gases exist in environment, the sensor's conductivity becomes higher along with the gas concentration increases. We have used a simple circuit that converts change of conductivity to corresponding output signal of gas concentration. The sensitivity of MQ-5 gas sensor is very high for detection of Propane, Methane and Butane. The output of the sensor fed to the microcontroller and if the sensor sense the combustible gas leakage and gives output to the led board and buzzer than the exhaust fan start to through the leakage gas outside the home.

The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in °C). The temperature of the home is calculated by the following equation

$$\text{Temperature} = (4.8828 * \text{adc\_reading}) \text{ } ^\circ\text{C}. \quad (1)$$

The sensor is connected to the microcontroller. The microcontroller performs operation on the adc value taken by the temperature sensor LM35. The reading of the adc and the calculated temperature will be display on the display.

The laptop is the main input device of the system. Personal computer (PC) can also be used instead of the laptop. The laptop is controlling device which will control the appliance according

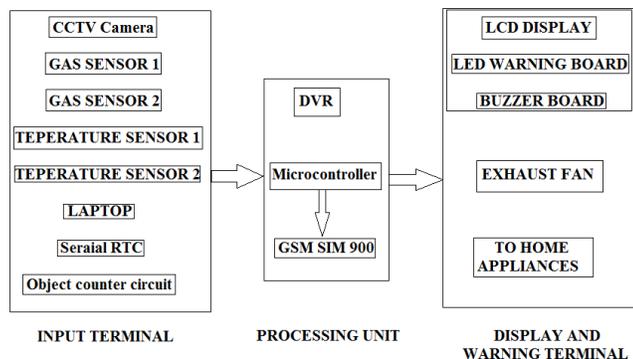


Fig.1. Architecture of Home monitoring system

Fig. 1 shows the basic architecture of the system. This system involves various component i.e. input terminal, processing unit, control unit and display & warning wizard. The input terminal includes many devices that provided to processing and control unit. The processing unit also includes the GSM module to pro-

to the output. The laptop is connected to the microcontroller using the USB to serial cable. A software X-CTU is used for the serial input purpose which is a Windows-based application provided by Digi. This software was designed to interact with the firmware files found on Digi's RF products and to provide a simple-to-use graphical user interface to them. When the serial input fed to the microcontroller through the USB to serial cable the appliance controlled using predefined inputs. The DS1307 serial real-time clock (RTC) is a low-power, full binary-coded decimal (BCD) clock/calendar plus 56 bytes of NV SRAM. Address and data are transferred serially through an I2C, bidirectional bus. The clock/calendar provides seconds, minutes, hours, day, date, month, and year information. The end of the month date is automatically adjusted for months with fewer than 31 days, including corrections for leap year. The clock operates in either the 24-hour or 12-hour format with AM/PM indicator. The DS1307 has a built-in power-sense circuit that detects power failures and automatically switches to the backup supply. Time-keeping operation continues while the part operates from the backup supply. The DS1307 is connected to the microcontroller and the microcontroller gives real time clock output which is fed to the display.

The digital object counter system counts all the visitors or persons which are coming inside and gives indication at the display and warning terminal. This is based on the light dependent resistor. If the resistance of LDR decreases by the disturbance due to the person which is coming inside the counter counts the disturbance and gives output of the number of disturbance at the display.

### III. PROCESSING UNIT

The processing unit is the backbone unit of the system. This performs all the necessary tasks with the help of microcontroller to control and monitor the home. The processing unit includes three main devices those are DVR, microcontroller and GSM module. A digital video recorder (DVR) is used which is a consumer electronics device that records video in a digital format to a disk drive, USB flash drive, SD memory card, SSD or other local or networked mass storage device. The DVR is connected to the CCTV camera and stores all the data of CCTV and displays on monitor. The recorded data can be access whenever we required to access or to view the recorded videos. A microcontroller is a mini computer that consists of ALU, memory, input and output ports on a single chip. The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontroller. Here we are using ATmega16 microcontroller. AT stands for ATMEL and is a company which manufactures microcontroller. The ATmega16 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega16 achieves throughputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed.

In this system the mi-

crocontroller is the main device which performs all the operation based upon the predefined programs which are stored in the memory of the microcontroller. The microcontroller is directly connected to the gas sensor, temperature sensor, USB to serial, serial RTC. It gives out to the display and warning terminal in accordance of the input. GSM (Global System for Mobile Communications: originally from Groupe Special Mobile is the most popular standard for mobile telephony systems in the world. GSM differs from its predecessor technologies in that both signaling and speech channels are digital, and thus GSM is considered a *second generation* (2G) mobile phone system. This also facilitates the wide-spread implementation of data communication applications into the system. GSM also pioneered low-cost implementation of the short message service (SMS), also called text messaging, which has since been supported on other mobile phone standards as well. The standard includes a worldwide emergency telephone number feature. This GSM module is built with the advance SIM900 engine, works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS 1900 MHz. This module is connected to the microcontroller. The GSM module is used to share the warning of the system with the user if user is outside the home. The GSM module is send messages when the warnings are critical.

### IV. DISPLAY AND WARNING WIZARD

This terminal gives information's and outputs of the input terminals. The display and warning terminal consist of LED board, buzzers and exhaust fan, LCD display and monitor. LED board contains 12 led for indications of warning. For each sensor three led are used to indicate minor, major and critical fault. When LED is glowing, this indicates the leakage of LPG gas and increase in temperature. It is 1.2 V DC operated LED. When buzzer is blowing, this indicates the leakage of LPG gas and high temperature. It is 12 V DC operated buzzer. Exhaust fan is used to send out the LPG to space and then the concentration of LPG is reduced. When the gas sensor detects the leakage gas and sends instruction to the microcontroller than the exhaust fan starts to run and reduce the concentration of leakage gas.

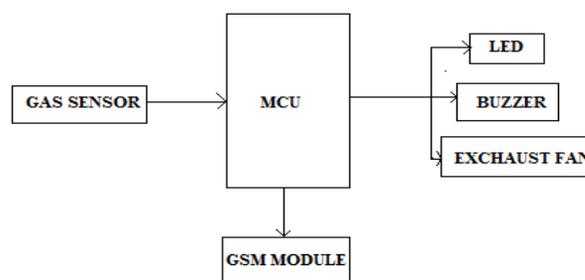


Fig.2. Working of exhaust fan

The LCD display is used to indicate the warning of leakage of gas as well as temperature readings also. We can also use graphical LCD instead of other alphanumeric LCD display. The monitor is used to the data recorded by DVR. We can also use the laptop as monitor with controlling the appliances.

V. EXECUTION OF SYSTEM

Accordingly programming structure when system start the MCU sends AT commands to the GSM MODULE which is basically a attention for GSM. If GSM replies OK than the system works according to the flowchart and sends warning messages to stored mobile number in microcontroller unit. The serial RTC and digital object counter also executed through the microcontroller unit. With the execution of the system serial RTC shows the real time on the display which is connected to the MCU. The digital object counter will be executed separately where the counting of persons coming in the home will displayed on seven segment display. In this system we allocated room numbering from A, S, D, F, G, H and J to control the lighting of appliances. The order is provided in such manner for flexible use of the system. The control keys of rooms are Z, X, C, V, B, N and M respectively. So to control the lighting and other appliance of room 'A' we have to open X-CTU and than just type 'A' and then appliances of room 'A' starts. If we want to off all the appliances of room 'A' we have to use keyword 'Z' in X-CTU. In same manner we can control the all appliances by using the control key in X-CTU software.

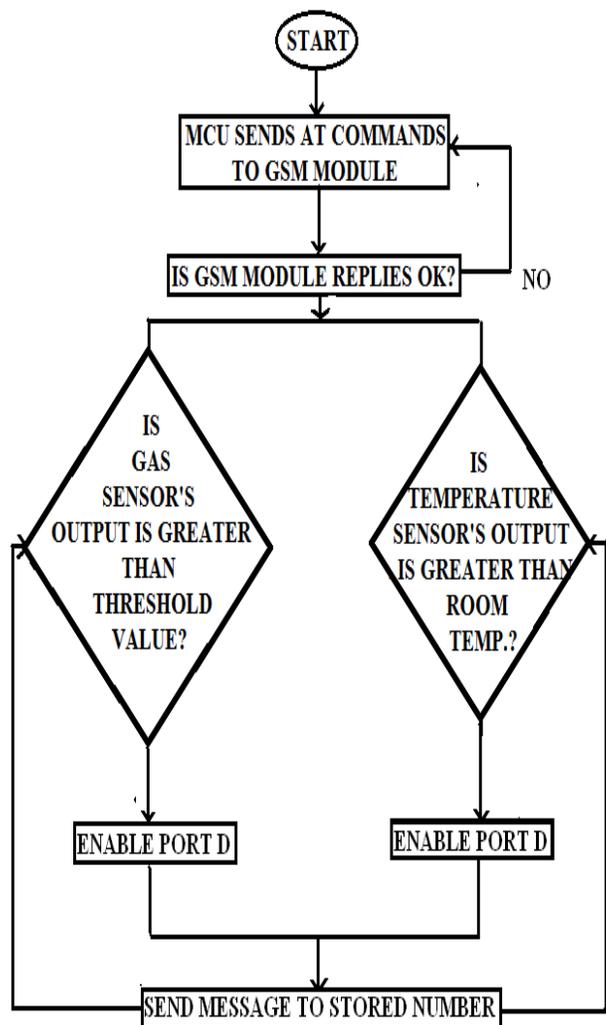


Fig.3. Flow chart of execution of Gas and Temperature sensor

VI. RESULTS

The first testing of the system was executed on 8.15AM and following results are obtained.

TABLE I. TESTING OF SYSTEM I

| S.No. | Parameter              | Warning status  |                         |                  |
|-------|------------------------|-----------------|-------------------------|------------------|
|       |                        | Physical status | Position of LED glowing | Status of buzzer |
| 1     | Gas sensor 1           | Gas leakage YES | 1                       | ON               |
| 2     | Gas sensor 2           | Gas leakage NO  | 1                       | OFF              |
| 3     | Temperature sensor 1   | 30.3°C.         | 2                       | OFF              |
| 4     | Temperature sensor 2   | 27.5°C          | 1                       | OFF              |
| 5     | Serial RTC             | 8.15AM          | -                       | -                |
| 6     | Digital Object Counter | 2               | -                       | -                |

The second testing of the system was executed on 1.45PM and following results are obtained.

TABLE II. TESTING OF SYSTEM II

| S.No. | Parameter    | Warning status  |                         |                  |
|-------|--------------|-----------------|-------------------------|------------------|
|       |              | Physical status | Position of LED glowing | Status of buzzer |
| 1     | Gas sensor 1 | Gas leakage NO  | 1                       | OFF              |

|   |                        |                |   |     |
|---|------------------------|----------------|---|-----|
| 2 | Gas sensor 2           | Gas leakage NO | 1 | OFF |
| 3 | Temperature sensor 1   | 32.3°C.        | 2 | OFF |
| 4 | Temperature sensor 2   | 35.9°C         | 3 | ON  |
| 5 | Serial RTC             | 01.45PM        | - | -   |
| 6 | Digital Object Counter | 5              | - | -   |

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VII. CONCLUSION

By implementing the idea of affordable low cost automation and monitoring system, a reliable and versatile embedded system has been developed which control and monitor the home and the system also sends an alert message to stored number through GSM module 900 The developed system is greatly helpful to avoid accidents if the resources are not handled properly.

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# Finite Element Simulation of Hot Rolling for an Aluminium 2024 Plate

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**Abstract-** Numerical simulation has become an important tool in the rolling industry. The use of two dimensional rolling model is quite common in Aluminum industries. In the present work A two dimensional elasto-plastic Finite Element model for hot rolling of an Aluminum plate has been developed. This model is used to study the behavior of the material under different values of coefficient of friction, roller diameter and initial thickness of the plate for attaining a specified final thickness of the rolled plate. The effect of coefficient of friction, initial thickness of plate and roller radius on maximum stress, equivalent plastic strain and reaction force has been studied. The current work has been carried out using the Finite Element software ABAQUS 6.10 (Explicit).

**Index Terms-** Rolling, simulation, FEM, Lean Manufacturing, von-mises stress, equivalent plastic strain.

## I. INTRODUCTION

In metalworking, rolling is a metal forming process in which the metal stock is passed through a pair of rolls. Rolling is classified according to the temperature of the metal rolled. When the temperature of the metal during rolling process is above its re-crystallization temperature, then the process is termed as hot rolling. The Finite Element Method is a numerical analysis procedure used to obtain approximate solutions to boundary value problems, which are found in many fields of engineering. Finite Element Method (FEM) is widely being used to solve problems on complicated non-linear metal deformation processes. It is the inability to solve many complex structural mechanics, heat transfer analysis, and fluid mechanics problems, that the Finite Element Method became an indispensable tool in the field of engineering mechanics.

Hwang Y.M. et al. (1999) proposed a mathematical model using the dual-stream function method under cylindrical coordinates to investigate the position of neutral point and the plastic deformation region at the roll gap during plate rolling. Lin Zone-Ching et al. (2000) simulated 3D sandwich flat strip with a thermo-elastic plastic coupled model under the assumption of an elastic roller using Aluminium-Copper flat strip. Jiang Z.Y. et al. (2001) used different friction shear models, mesh division and number of elements in the deformation zone and analyzed the influence of friction variation on rolling pressure, forward slip & spread by a three dimensional model. Kwak W.J. et al. (2002) investigated the effect of diverse process variables on some non dimensional parameters by a series of finite element process simulations, characterizing the thermo mechanical behavior of

the strip in strip rolling. Lee Y .et al. (2002) presented an integrated model for computing the thermo- mechanical parameters and metallurgical parameters to develop a “Thermo-Mechanical controlled process” technology in rod (or bar) rolling. Serajzadeh S. et al. (2002) proposed a mathematical model for predicting the temperature distribution & austenite micro structural changes during hot rolling. Esteban L. et al. (2007) studied the effect of different variables of the rolling operation on the lateral spread in the first pass of the finishing mill. Serajzadeh S. et al. (2008) predicted velocity & temperature distribution during hot rolling, employing a combined upper bound & finite element analysis. Zeng Jun et al. (2008) developed a general simulation model to study the dynamic process of roll plate bending using finite element method. Hambleton J.P. et al (2009) compared predictions of deformation and horizontal (drag) force resulting from three- and two-dimensional numerical simulation of a torque-free (towed) wheel operating on ductile material. Hojny Marcy et al. (2009) proposed a numerical FEM solver based on a coupled thermo mechanical model with changing density and mass conservation condition. Ould Ouali M. et al.(2009) used a micromechanical ductile fracture model, extended to take account thermal heating due to mechanical dissipation within the material to study a 3D-asymmetric rolling operation. Shahani A. R. et al. (2009) simulated the hot rolling process of AA5083 using thermo mechanical approach. Shahani A. R. et al. (2009) simulated the hot rolling process of AA5083 aluminium alloy using the finite element method. Wang M. et al. (2009) developed a 3D coupled thermo-mechanical FE model of the hot rolling process of a large ring of titanium alloy. Anjami Nassir et al. (2010) established a coupled thermo-mechanical and 3D rigid-plastic finite element model for hot rolling of large rings. Benasciutti D. et al. (2010) proposed a simplified numerical approach based on finite element to compute thermal stresses occurring in work roll of hot rolling mills. Chumachenko E. N. et al. (2010) discussed the finite-element modeling of rolling in passes based on the 2D method. Jiang Z.Y. et al. (2010) studied the effects of the flow stresses of the scale and steel, and the friction coefficients at the scale-steel and the roll scale interfaces on the final surface roughness. Kohboor B. et al. (2010) investigated the effect of rolling speed on strain aging phenomena in warm rolling of steel. Yue Chong-xiang et al. (2010) developed four 3-D finite element models to simulate the whole rod rolling process of GCr15 steel. Parvizi A. et al. (2011) presented an analytical solution for ring rolling process based on the slab method theory, in which the non uniformity of the normal and shear stresses across the section of deforming material throughout the plastic region was considered.

## II. FORMULATION OF PROBLEM

A two – dimensional elasto-plastic Finite Element model for hot rolling of a plate of Aluminium-2024 has been developed to study the behavior of the material for different values of coefficient of friction, roller diameter and initial thickness of the plate for obtaining a particular final height of the rolled plate.

There are numerous mathematical models for flat rolling process. In each, the equations of motion, thermal balance, material properties and roll deformation are used to calculate stress, strain, strain rate, velocity and temperature fields, the roll pressure distribution, roll separating forces and roll torques. The accuracy of these models depends on the quality of the assumptions made. In the conventional models, most researchers made an assumption that for homogeneous compression of a strip, considered to be made of an isotropic and homogeneous material, is incompressible in plastic state [7]. Further, plane strain conditions are assumed to exist and either a constant friction factor or Coulomb friction conditions apply at the roll-strip interface. Assumptions and simplifications vary broadly when finite element methods are employed. The same applies to the material models, the main models being used are elastic plastic models and rigid plastic models.

A mathematical model of the flat rolling process includes [2]:

- a) Equations of motion of the deformed metal,
- b) Heat balance of the roll/strip system,
- c) Equations of equilibrium of the work roll,
- d) Description of the frictional forces between the work roll and the metal,
- e) Description of the material properties.

As the strip enters the roll gap it is first deformed elastically. It speeds up; the relative velocity between the roll and the strip is such that friction draws the metal in. The criterion of plastic flow governs the manner in which the transformation from elastic to plastic material takes place. This conversion is what is known as the elastic-plastic interface. The strip proceeds through the roll gap and the plastic flow of material increases until the roll pressure is removed at exit. As the strip is unloaded and it returns, through the elastic state to the original, load free condition. It is observed that during rolling, the relative velocities of the roll and the strip change and as the strip is accelerating forward it reaches the roll surface velocity at the no-slip or neutral point. From then on, as further compression occurs, the strip speeds up and the direction of friction changes in such a way that it now retards motion. Exit velocity of the strip is often larger than that of the roll velocity and the difference between the two velocities is determined by the forward slip [1], [3].

In order to formulate the model several assumptions regarding material behavior must be made. The material is usually assumed to be, and to remain, isotropic and homogeneous; it is considered to be elastic-plastic even when gross plastic straining takes place, elastic deformations may be quite small in comparison to plastic strains. During forming the volume of the plastic region is taken as constant, and finally, a plane state of strain is assumed to exit.

## III. PARAMETERS STUDIED

The important parameters which were studied in the different cases of rolling in the study are Roll separating force, Mean effective plastic strain & Maximum stress (Von Mises equivalent stress).

**3.1. Mean effective plastic strain:** The mean effective plastic strain is defined as the maximum average effective (equivalent) plastic strain during the rod/bar rolling process. Calculation of mean effective plastic strain is extremely important for predicting and controlling the mechanical properties of the plate after rolling because all mathematical models of microstructure evolution requires thermo-mechanical variables such as mean effective plastic strain, mean effective plastic strain rate and temperature at each rolling stands. Temperature evolution due the mechanical energy converted to heat during the deformation process is also dependent on mean effective plastic strain and mean effective plastic strain rate. Furthermore, mean effective plastic strain rate is in turn a function of mean effective strain and the process time.

**3.2. VON MISES EQUIVALENT STRESS:** In a body that is subjected to a system of loads in three directions, a complex three dimensional system of stresses is developed. That is, at any point within the body there are stresses acting in three different directions and the direction and magnitude of the stresses changes from point to point. The Von Mises criterion combines these three stresses into an equivalent one, which is then compared with the yield stress of the material. This equivalent stress ( $\sigma'$ ) can be defined as:

For a 3-D case:

$$\sigma' = (\sigma_1 + \sigma_2 + \sigma_3 - \sigma_1\sigma_2 - \sigma_1\sigma_3 - \sigma_2\sigma_3)^{1/2} \quad (3.1)$$

For a 2-D case,  $\sigma_3 = 0$ :

$$\sigma' = (\sigma_1 + \sigma_2 - \sigma_1\sigma_2)^{1/2} \quad (3.2)$$

**3.3. ROLL separating force:** The roll separating force or simply the roll force is defined as the force with which the rollers pull each other apart. It is also equal to the force with which the rolls press against the metal. Calculation of roll force is important because calculation of torque and power in a rolling mill is based on calculation of roll force, which are then used in the design of spindle, motor power specification and bearing design. [3]

## IV. CASE FORMULATION

Thus, the problem has been formulated to study the effect of variation of coefficient of friction, initial height of the plate and the roller radius on rolling parameters namely the von Mises Equivalent Stress, Equivalent Plastic Strain and Reaction Force. Thus, the finite element simulation of hot rolling of an aluminum plate will be done at coefficient of friction 0.1, 0.2, 0.3, 0.4 & 0.5, initial height of the plate 100 mm and roller diameter 100 mm & 200 mm, with different percent of reduction, thereby giving as many as 30 cases of different combinations of coefficient

of friction, initial height of plate and roller radius. The effect of each case on the rolling parameters will be studied.[3], [7], [12]

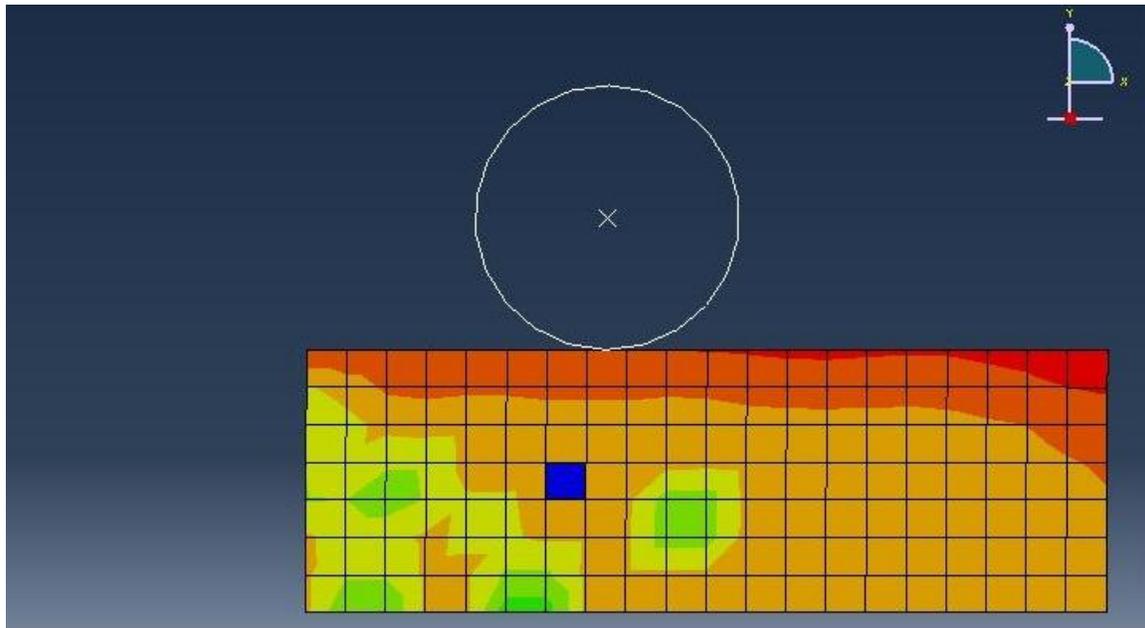


Fig. 4.1 Finite Element Simulation of Rolling of an Aluminium Plate

**4.1. MESHING:** The meshing of the model of the aluminium plate was done with C3D8R elements with hourglass control of ABAQUS 6.10 FE tool, which due to its shape, is also known as 4 node brick element. As this analysis was expected to have very large deformations, the adaptive meshing capability available in ABAQUS/Explicit was used with a frequency of 10 and 3 mesh sweeps per increment. The adaptive mesh control manager of ABAQUS reduces the amount of mesh distortion and maintains a high quality mesh throughout the analysis.[1]

**4.2 MATERIAL:** Alloy 2024 was introduced by Alcoa in 1931 as an alclad sheet. It was the first Al-Cu-Mg alloy to have a yield strength approaching 50,000-Kg/cm<sup>2</sup> and generally replaced 2017-T4 (Duralumin) as the predominant 2XXX series aircraft alloy. With its relatively good fatigue resistance, especially in thick plate forms, alloy 2024 continues to be specified

for many aerospace structural applications. It is considered as the "aircraft" alloy because of its strength. Good machinability but only fair corrosion resistance. Not recommended for brazing or soldering. Alloy 2024 is available in bar and alclad sheet and plate product forms in the annealed state and several tempers. [9],[10]

## V. RESULT AND DISCUSSION

**5.1. VON-MISES STRESS:** The effect of variation in Initial Height of the Aluminum plate on von Mises Equivalent Stress at different roller radius and different values of coefficients of friction is shown in the figure:-

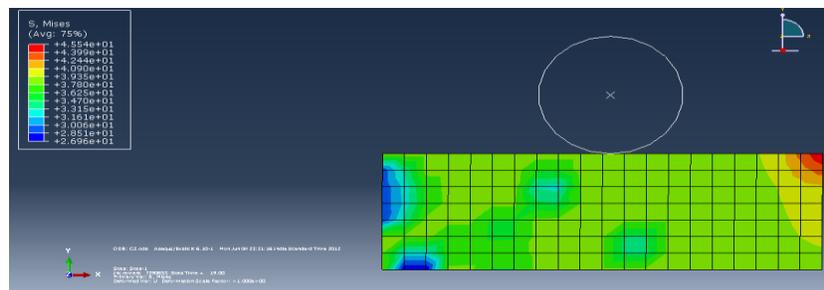
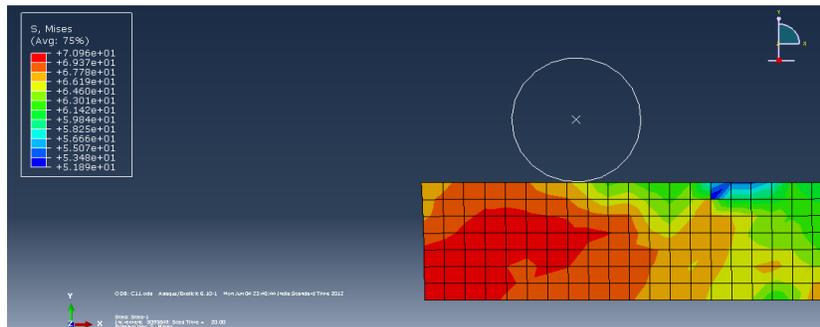
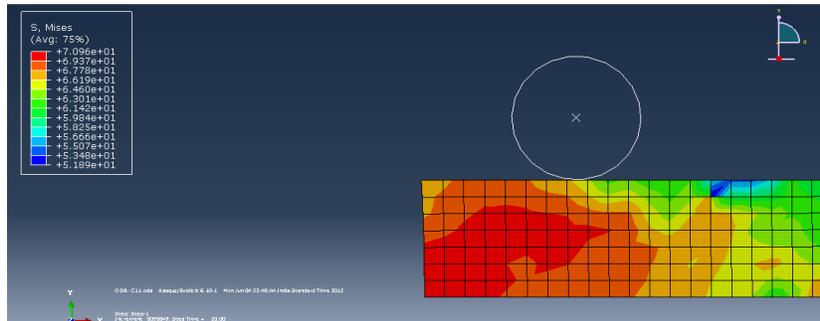


Fig 5.1 Effect At Roller Diameter 50 mm & reduction is 5%



**Fig 5.2: Effect At Roller Diameter 100 mm & reduction is 10%**



**Fig 5.3: Effect At Roller Diameter 50 mm & reduction is 15%**

Similarly doing the cases and result received which are as follows:

| ROLLER RADIUS | INITIAL HEIGHT | FRICTION | VON MISES STRESS(N/mm <sup>2</sup> ) | EQ. PLASTIC STRAIN | REACTION FORCE (N) | % REDUCTION |
|---------------|----------------|----------|--------------------------------------|--------------------|--------------------|-------------|
| 50            | 100            | 0.1      | 49.82                                | 0.04570            | 2631               | 5           |
| 50            | 100            | 0.2      | 45.51                                | 0.03474            | 2312               | 5           |
| 50            | 100            | 0.3      | 47.57                                | 0.03992            | 2335               | 5           |
| 50            | 100            | 0.4      | 44.24                                | 0.03143            | 2001               | 5           |
| 50            | 100            | 0.5      | 48.97                                | 0.04359            | 2385               | 5           |
| 100           | 100            | 0.1      | 70.32                                | 0.3998             | 2970               | 10          |
| 100           | 100            | 0.2      | 70.43                                | 0.1174             | 2788               | 10          |
| 100           | 100            | 0.3      | 54.94                                | 0.06539            | 3073               | 10          |
| 100           | 100            | 0.4      | 54.72                                | 0.05719            | 3140               | 10          |
| 100           | 100            | 0.5      | 59.51                                | 0.07056            | 2273               | 10          |
| 50            | 100            | 0.1      | 70.96                                | 0.7957             | 2919               | 15          |
| 50            | 100            | 0.2      | 70.97                                | 0.3120             | 2058               | 15          |
| 50            | 100            | 0.3      | 70.68                                | 0.1587             | 2368               | 15          |
| 50            | 100            | 0.4      | 70.81                                | 0.1211             | 2836               | 15          |
| 50            | 100            | 0.5      | 70.76                                | 0.09962            | 2993               | 15          |

Thus, we see that the effect of increase in coefficient of friction has a small effect on the von Mises Equivalent Stress at a particular initial height of the Aluminium plate. When the coefficient of friction is increased from 0.1 to 0.2 and to 0.5, the von Mises Stress increases linearly at a particular initial height of the plate, but the increase is much smaller as compared to that when the initial height of the Aluminium plate is increased. Thus, the effect of increase in initial height of the plate is more pronounced than increase in coefficient of friction. In the case of Equivalent Plastic Strain as well, the increase in coefficient of friction from 0.1 to 0.2 and to 0.5 results in a small linear increase in the mag-

nitude of Equivalent Plastic Strain at a particular initial height of the plate. However, the increase is much smaller as compared to the increase in Equivalent Plastic Strain with increase in the initial height of the plate. Therefore, the effect of increase in initial height of the Aluminium plate is more pronounced than the effect of increase in coefficient of friction. In the case of Reaction Force as well, the effect of increase in coefficient of friction is smaller as compared to the effect of increase in initial height of the Aluminium plate. Also, the increase in Reaction Force with increase in coefficient of friction is more pronounced at higher reduction. However the increase in Reaction Force with increase

in initial height of the plate is not as much as it is in the case of von Mises Equivalent Stress and Equivalent Plastic Strain.

## VI. DISCUSSION

In this study, we have analyzed the effect of variation in coefficient of friction, initial height of the plate and roller radius on the rolling parameters viz. Maximum Stress (von Mises Equivalent Stress), Equivalent Plastic Strain & Reaction Force using finite element simulation. Commercially available FE software ABAQUS 6.10 has been used in this study. The Aluminium plates of different initial thicknesses were meshed by using C3D4R elements ( 4 node brick elements). The material chosen for the simulation was Aluminium 2024.

- **Effect of Initial Height:** It was found that the effect of increase in coefficient of friction has a small effect on the Von Mises Equivalent Stress at a particular initial height of the Aluminium plate. When the coefficient of friction is increased from 0.1 to 0.2 and to 0.5, the Von Mises Stress increases linearly at a particular initial height of the plate, but not as much when the initial height of the Aluminium plate is increased. Thus, the effect of increase in initial height of the plate is more pronounced than increase in coefficient of friction. In the case of Equivalent Plastic Strain as well, the increase in coefficient of friction from 0.1 to 0.2 and 0.5 results in a small linear increase in the magnitude of Equivalent Plastic Strain at a particular initial height of the plate although the increase was much smaller as compared to the increase in Equivalent Plastic Strain with increase in the initial height of the plate. Therefore, the effect of increase in initial height of the Aluminium plate is more pronounced than the effect of increase in coefficient of friction. In the case of Reaction Force, the effect of increase in coefficient of friction is smaller as compared to the effect of increase in initial height of the Aluminium plate. Also, the increase in Reaction Force with increase in coefficient of friction is more pronounced at higher reduction. However the increase in Reaction Force with increase in initial height of the plate is not as much as it is in the case of von Mises Equivalent Stress and Equivalent Plastic Strain.

**Effect of Roller Radius:** The effect of increase in coefficient of friction is smaller than the effect of increase in Roller Radius on the von Mises Equivalent Stress. However, the increase in von Mises Stress with increase in Roller Radius is not as much as it is with increase in Initial Height of the plate. Thus, the effect of increase in Initial Height of the plate on von Mises Stress is more pronounced than increase in Roller Radius. The effect of increase in coefficient of friction on Equivalent Plastic Strain is much smaller than the effect of increase in Roller Radius. However, the increase in Equivalent Plastic Strain with increase in Roller Radius is not as much pronounced as it is with increase in Initial Height of the plate. Thus, the effect of increase in Initial Height of the plate on Equivalent Plastic Strain is more pronounced than increase in Roller Radius. In the case of Reaction Force as well, the effect of increase in coefficient of friction is smaller as compared to the effect of increase in Roller Radius.

However, the increase in Reaction Force with increase in Roller Radius is not as much as it is with increase in Initial Height of the plate. Therefore, the Initial Height of the plate has a greater effect on the Reaction Force as compared to the Roller Radius.

## VII. FUTURE WORKS

- The effect of friction, initial height of plate & roller radius can also be studied in cold rolling.
- This problem can also be analyzed from the viewpoint of Artificial Neural Network (ANN).
- Such a study can also be done on strips, sheets and bars of various shapes.

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# Hankow Reef, Bismarck Volcanic Arc, Papua New Guinea: Source of Yomba Island myth?

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**Abstract-** Hankow Reef off the coast of Madang Province, New Guinea has been linked to a large eruption at a former island known as ‘Yomba’ by legends told by people living in the Madang province. However some doubts have been made about the accuracy of their comments. I present evidence for a low-lying volcanic island that may have existed at Hankow Reef and its links to the Yomba stories.

**Index Terms-** Yomba, oral tradition, volcanic collapse, phreatomagmatic, Papua New Guinea

## 1. INTRODUCTION

Legends tell of an island that once sat between the Karkar and Long islands called Yomba that erupted causing a ‘time of darkness’ but then sunk beneath the waves. It has been a matter of debate for decades as to whether the oral traditions of the people of New Guinea are fanciful or contain elements of truth. It is noteworthy to make mention of Russell J Blong’s work on Long Island which had a major volcanic eruption 400 years ago as his work using oral tradition helped date the eruption of the volcano (Blong 1982). Much of this information is based on work by Mary R. Mennis (1981, 2005) who surveyed various settlements in the Madang area in the 1970’s.

## 2. REGIONAL SETTING

Hankow Reef, located between Karkar Island and Long Island (see Figure 1), forms part of a chain of volcanoes called the Bismarck Volcanic Arc that stretches for more than 1000 km. It forms the submerged summit of a large underwater seamount, the largest in the Bismarck Volcanic Arc. The Bismarck Volcanic Arc is an intra-oceanic subduction system forming at the southern margin of the Bismarck Sea (Woodhead et al 2009). Tectonics in the Eastern (New Britain) and Western parts of the volcanic arc differ. The Western part of the volcanic arc, where Hankow Reef is located, is forming through the convergence of the Australian and South Bismarck plates in a region of arc-continent collision (Woodhead et al 2009)

The Bismarck Volcanic Arc contains the majority of Papua New Guinea’s active volcanoes (Siebert et al 2010) most of which are located close to the coast of the island of New Guinea. The danger from tsunamis and pyroclastic density currents reaching the coast of New Guinea makes the area inherently at risk from a volcanic disaster.

## 3. SUMMARY OF THE YOMBA ISLAND STORY

In a comprehensive survey by Mary R. Mennis (1981, 2005) villagers in various settlements in the Madang area and sur-

rounding islands were asked to relate the story of Yomba Island. The general story is as follows:

Before Long Island erupted (~ 400 years ago) there was an island between Crown Island and Bagabag Island, people lived on the island and made pots. Some accounts mention an earthquake which may have signalled the onset of the eruption. At some point, a vent on Yomba Island erupted, producing ash fall and pumice fall, audible noises were also heard. People living on the island escaped in canoes and on coconuts. A ‘time of darkness’ similar to the one reported at Long Island (Blong 1982) is also frequently mentioned. Most accounts state that Yomba then collapsed producing a tsunami. In the aftermath of the event, Yomba Island was gone.

## A. PREVIOUS INTERPRETATIONS OF EVENTS

Many of the stories related to Mennis (1981, 2005) tell of a large catastrophic eruption destroying the island of Yomba, such as the one that destroyed Krakatau in Indonesia in 1883 (Self & Rampino 1981; Simkin & Fiske 1983). Mennis (2005) infers from satellite data that there is a crater at Yomba Island; however bathymetric data does not support this. Large eruptions often leave large pyroclastic deposits (Self 2006) but none have been found in the vicinity of Yomba Island (Mennis 2006).

Nunn & Pastorizo (2007) considered the Yomba Island stories to relate to a flank collapse of the island. Collapses on volcanoes can occur from weak or unstable flanks caused by oversteepening, tectonic and fault related activity (McGuire 1996) or through hydrothermal related processes (Reid et.al. 2001; Reid 2004). A collapse at steep-sided Ritter Island Volcano in the Dampier strait between Umboi and New Britain Island in 1888 destroyed the island and left a large avalanche scar on its western flank (Ray et.al. 2014). However, no large debris avalanches were found near Hankow Reef during bathymetric surveys in the area in 2004 (Mennis 2006). This suggests that the islands geology was significantly different than has been described previously.

## 4. A NEW INTERPRETATION

Many accounts collected state that people were living on the island, this means they most likely had ready access to the sea. Several descriptions of Yomba also note that it didn’t have one central volcano but a few volcanic constructs, perhaps more akin to a volcanic field rather than a typical oceanic stratovolcano. It appears that Simon Day’s comments in Mennis (2006) appears the most likely option, Yomba Island was low-lying, built up of small cones and pyroclastic fragments.

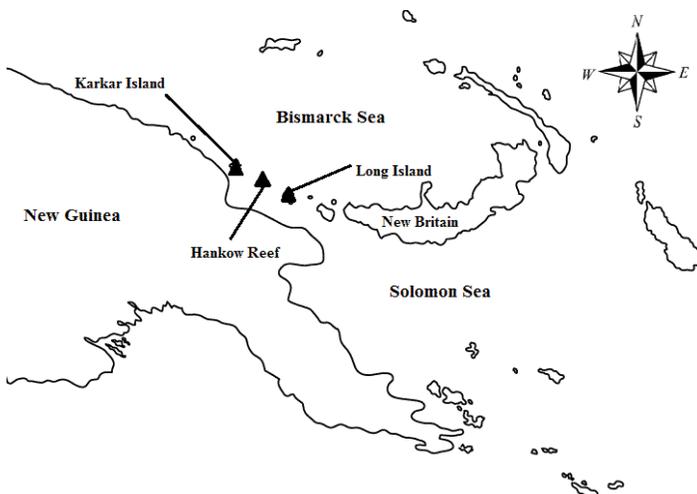


Figure 1. Map showing the location of Hankow Reef and surrounding islands.

#### A. SEQUENCE OF EVENTS

Yomba Island was most likely a low-lying island consisting of a couple of tuff rings/cones, probably less than 200 m high, sitting on a platform of pyroclastic deposits, much like the island of Mundua in the Witu islands, north of New Britain (Johnson & Blake 1972).

A violent eruption resulting from the interaction between water and magma (phreatomagmatic) may have destroyed major sections of the island leaving just a small platform of unconsolidated pyroclastic deposits. These platforms are very vulnerable to wave erosion as it consists of layers of weak fragments (Scarth 1994). Several cones produced by the same surtseyan activity thought to have formed Yomba have been quickly eroded (e.g. Cole et.al. 2001).

#### B. CONSTRAINING THE DATE OF THE ERUPTION

Many stories told by those interviewed place the date of the eruption just before the large eruption of Long Island (Mennis 2005). The eruption of Long Island took place sometime between 1640 and 1670 (Blong 1982). This may mean that the eruption of Yomba Island may have occurred only a few decades prior to the eruption of Long Island.

### 5. CONCLUSIONS

In the late 15th century or early 16th century a minor eruption took place on Yomba Island, causing islanders to flee the volcano. During the course of the eruption violent phreatomagmatic eruptions destroyed the volcanic structures on the island with the rest of the island collapsing in a series of small landslides, possibly producing small tsunamis, with the rest of the deposits being eroded by wave action.

Hankow Reef has been identified as a potentially active submarine volcano that is the source of the Yomba Island myth. More detailed work needs to be done both geologically and orally to determine fully the accuracy of the events described. The events at Yomba Island 400-500 years ago demonstrate the

volcanic hazards of the Bismarck Volcanic Arc, such as the generation of tsunamis, and more work should be undertaken on the islands to better quantify the risk of a major volcanic event in the region

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# The Effect of Structured Problem Solving Strategy on Performance in Physics among Students Who are Enrolled in the University of Rizal System

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**Abstract-** “Mathematics is the language of Physics”. This is the actual scenario of how Physics has to be taught by the teacher and be learned by the students through using formula, equations and analysis.

The study aimed to determine the effect of the structured problem solving strategy on performance in Physics among students who are enrolled in the University of Rizal System. There were 152 students taking up Physics I (General Physics) in the first semester of the SY 2013-2014 utilized in the study. The respondents were forty one (41) BT Drafting, forty (40) BT HRM, thirty nine (39) BT Electrical and thirty two (32) Biomedical Technician Course students. Two experimental and two controlled groups were given pretest and posttest during the mid-term period covering concepts on Momentum, Work, Power and Energy together with simple machine. Specifically, the study attempted to answer questions on how do performance of the students in Physics compared when grouped according to the course and which method is more effective in teaching Physics, conventional or structured problem solving process. Dependent t-test was used to determine the significant difference on the performance in pretest and posttest of the experimental and controlled groups with respect to their courses, likewise, F-value was used to determine the significant difference on the level of performance in both groups after exposures to two different strategies.

It was then concluded that the course or program is not to be considered as a factor in the performance of the students from the controlled group and experimental group. Furthermore, the use of structured problem solving technique is an effective tool in enhancing the learning of the students regardless of the program.

Therefore, it was recommended that studies of the same process be conducted to other programs of the college and university as well to enhance the analytical thinking of the students and to increase the teaching competencies of the teachers.

**Index Terms-** Structured Problem Solving, Conventional Computation, Physics 1 and Experimental

## I. INTRODUCTION

I understand the concepts. I just cannot do the problems”. These two statements are common among Physics students. Students complain that despite the length of time they spend in Physics, they still do not seem to do well on examinations especially on problem solving. They thought that Physics is a very difficult subject which requires special skills to understand.

Many students who have already acquired a reasonably good understanding of the concepts and principles still lack higher thinking skills to enable them to solve Physics problems.

According to Williams that the basic question in Physics instruction is how to stress the process as well as the product of problem solving. Physics instructions and teachers generally accept that problem solving leads to an understanding of Physics. Increasing the problem solving abilities of students continues to be a major goal of Physics instructors.[1]

Students mimic the actions of their professors in solving problems without comprehending the structure of what is being done. They leave the course with a bundle of facts but without developing a personal problem solving strategy.

Linn pointed out that even teachers have a hard time conveying an understanding of Physics and reasoning skills, students are only concerned with passing the tests and turning in correct homework and assignments.[2]

It is important to state exactly which skills should be learned and demonstrated in Physics courses. The most common approach or problem solving involves exhibiting illustrative examples of problem solutions and then providing students with practice in solving similar problems.

However, as cited by Wright that the pioneer in the field of structured problem solving was Polya. In Polya's book “How to Solve it” he outlined a four step strategy for problem solving. The steps are description, planning, implementation and checking. In the first step, the student lists the given and desired information, draws a diagram of the situation. The second step tells the student to select the basic relations pertinent for solving the problem. The third step asks the student to execute the plan by doing all the necessary calculations. The last step tells the student to check whether the final answer makes sense.[3]

Wood has shown that special instruction in problem solving procedures can lead to substantially improved performance and these skills can be transferred to other areas of study.[4]

Furthermore, according to Reif procedural knowledge on how to execute a problem solution and conceptual knowledge of laws and principles which provide meaning or context to the procedures are both necessary for a meaningful solution to any problem.[5]

In this study, the researcher attempted to prove that a structured problem solving if used as a part of comprehensive plan of Physics instruction can make a significant difference in the achievement of Physics students.

## II. OBJECTIVES OF THE STUDY

The study determined the effect of structured problem solving strategy on performance in Physics among students enrolled in the University of Rizal System.

Specifically, the study sought answers to the following sub-problems:

1. How does the performance of the students in Physics compare when grouped according to the course?
2. Which of the following methods is more effective in teaching Physics?
  - 2.1 conventional problem solving
  - 2.2 structured problem solving

Based on the problems which the study aimed to answer, the null hypotheses were tested:

1. There is no significant difference between the pre-test and post-test scores of the experimental and control with respect to the lessons in classes of different courses.
2. There is no significant difference on the effect of the conventional teaching strategy and the structured problem solving in the performance of the students in Physics with respect to their courses.

## III. METHODOLOGY

### Sampling Site

The study was conducted in University of Rizal System, Morong Campus. The campus is situated in the Eastern part of Rizal Province and comprises four colleges namely, College of Industrial Technology, College of Sciences, College of Education and the College of Engineering.

The College of Industrial Technology was the focus since the researcher belongs to the College as well as the students to be utilized in the following courses, BT-Electrical, BT-Drafting, BT-HRM and BioMed Technology.

### Population Frame and Sample Size

The total number of students that were utilized in the study was about 152 students all taking up Physics 1 (Gen. Physics) in the first semester of the SY 2013-2014. There will be forty-one (41) BT Drafting, forty (40) BT HRM, thirty nine (39) BT Electrical and thirty two (32) Biomed Technology students, respectively. Students were grouped accordingly, two (2) experimental group and two (2) controlled group were used for the study. Comparability test were used both in controlled and experimental group utilizing their grades in preliminary periods to establish and analyse the selection of the groupings.

Both pre-test and post-test were administered to the students grouped accordingly. The pre-test and post-test were 50 items composed of multiple choice type from the topics Work, Power and Energy. The test items were lifted from the standardized questions created by Dr. Christopher Bernido and Dr. Ma. Victoria Bernido from their book Learning Physics as One Nation written from the National Institute of Physics, University of the Philippines, Diliman, Quezon City under the sponsorship of CHED-PAFE

Teachers and Physics Educators who attended the seminar only have the copy of the test samples and books.

### Sampling Technique and Research Design

The true experimental method was used in this study to determine the effect of structured problem solving strategy on performance in Physics among students of the College of Industrial Technology in the University of Rizal System, Morong Campus.

Gay thinks that this method is the only method of research which can truly test hypothesis concerning cause and effect relationship. He says further that the experimental method represents the most valid approach to the solution of problems, both practical and theoretical [6]. Arvy, et.al. add that the experiment is generally regarded as the most sophisticated research method for testing hypothesis.[7]

To minimize biased associated with teacher factor, only one teacher will handle the class. Since intact Physics classes were used in the study. A quasi-experimental design was utilized and this involved 2 experimental groups and 2 control groups. Comparability of the students' grade in the preliminary grading has been used to determine the groupings for treatment. Students are categorized as heterogeneous as observed from their grade results. The number of respondents were identified using the systematic sampling and distributes equally to experimental and controlled group.

The Conduct of the Experiment

Two-experimental groups and two-controlled groups were given pre-test before the start of the mid-term period covering the concepts on Momentum, Work, Power, Energy and Simple Machine. Immediately, as the lesson progress, the structured problem solving technique was treated to the experimental groups and the conventional strategy of solving problem was used by the controlled groups.

After the activities were done, post-test were given to both groups to determine their performance. The scores in the pre-test and post-test were treated using the t-test.

Statistical Treatment

The test results were tabulated and analysed using different statistical treatment.

Dependent t-test was used to determine the significant difference in pre-test and post-test of experimental and control groups with respect to the courses.

F-value was used to determine the significant difference on the level of performance of experimental and controlled groups after exposure to conventional teaching and structured problem solving strategy on topics Momentum, Work, Power, Energy and Simple Machine.

IV. RESULTS AND DISCUSSIONS

The Significant Difference Between the Pre-Test and the Post-Test of the Experimental and Control Groups with Respect to the Different Courses

Table 1 presents the computed t-value on the significant difference between the pre-test and post-test of the experimental group with respect to the courses.

Table 1. Computed t-value on the Significant Difference Between the Pre-test and Post-test of the Experimental Group with Respect to Their Courses

| Courses     | Pre-test |      | Post-test |      | Mean Diff. | df | t <sub>c</sub> | t <sub>t</sub> | H <sub>o</sub> | VI |
|-------------|----------|------|-----------|------|------------|----|----------------|----------------|----------------|----|
|             | Mean     | SD   | Mean      | SD   |            |    |                |                |                |    |
| BT - HRM    | 2.60     | 1.25 | 5.53      | 1.67 | 2.93       | 29 | 7.42           | 2.045          | R              | S  |
| Biomed Tech | 1.97     | 1.14 | 5.47      | 1.23 | 3.50       | 29 | 13.16          | 2.045          | R              | S  |

R – Rejected; S - Significant

Table shows that with respect to the BT-HRM course, the computed t-value is 7.42 which is higher than the t-value of 2.045 using degree of freedom of 29 at 0.05 level of significance. The results show that there is significant difference between the pre-test and post-test of experimental group.

In Biomed Technology course, the computed t-value is 13.16 which is higher than the tabular t-value of 2.045 at 0.05 level of significance with 29 degrees of freedom. Therefore, the results show that there is significant difference between the pre-test and post-test of experimental group.

Moreover, the table revealed that there is significant difference between the pre-test and post-test results of experimental group with respect to their courses.

The results imply that structured problem solving techniques are effective tools in the improvement of the performance in Physics. The findings also show that the students in the experimental group benefitted from the experiment, hence the treatment is effective.

The results also affirm the suggestion of Bautista that supplementary materials and activities in teaching the subject ensured mastery on the part of the students.[8]

In addition, Wong affirmed the present study as cited by Castor that instructional materials in the classroom are the most effective way to catch up the interest and understanding of the pupils and help the teachers to teach better. He stressed that attractive and appropriate teaching aids stimulate action among pupils and help the teachers to teach better.[9]

Table 2 presents the computed t-value on the significant difference between the pre-test and post-test of control group with respect to two different courses.

Table 2. Computed t-value on the Significant Difference Between the Pre-test and Post-test of the Control Group with Respect to Their Courses

| Courses       | Pre-test |      | Post-test |      | Mean Diff. | df | t <sub>c</sub> | t <sub>t</sub> | H <sub>0</sub> | VI |
|---------------|----------|------|-----------|------|------------|----|----------------|----------------|----------------|----|
|               | Mean     | SD   | Mean      | SD   |            |    |                |                |                |    |
| BT Drafting   | 2.90     | 1.45 | 4.57      | 1.56 | 1.67       | 29 | 4.92           | 2.045          | R              | S  |
| BT Electrical | 2.17     | 1.16 | 4.30      | 1.24 | 2.13       | 29 | 7.55           | 2.045          | R              | S  |

R – Rejected; S – Significant

Table shows that with respect to BT Drafting, the computed t-value is 4.92 which is higher than the tabular t-value of 2.045 using degree of freedom of 29 at 0.05 level of significance. The results show that there is significant difference between the pre-test and post-test results of control group.

In BT Electrical, the computed t-value is 7.55 which is higher than the tabular t-value of 2.045 at 0.05 level of significance with 29 degrees of freedom. Therefore, the results show that there is significant difference between the pre-test and post-test result of the control group

Moreover, the table revealed that there is significant difference between the pre-test and post-test results of control group with respect to their courses.

The results further imply that the traditional method of teaching is also effective in improving the performance of students in Physics.

The result is affirmed by the study of Belen as cited by Espiritu where she expressed that there is no best method of teaching that can be used for general pattern, but the objective, the teacher, the learner, the specific subject matter, time limitation and the availability of tools and equipment are major factors in determining the best method or technique of teaching.[10]

Table 3 presents the computed t- value on the significant difference between the pre-test of the experimental and control groups with respect to their courses.

Table 3. Computed t-value on the Significant Difference Between the Pre-test of the Experimental and Control Group with Respect to the Different Topics in Physics

| Topics          | Control Group |      | Experimental Group |      | Mean Diff. | df | t <sub>c</sub> | t <sub>t</sub> | H <sub>0</sub> | VI |
|-----------------|---------------|------|--------------------|------|------------|----|----------------|----------------|----------------|----|
|                 | Mean          | SD   | Mean               | SD   |            |    |                |                |                |    |
| Momentum        | 2.90          | 1.45 | 2.60               | 1.25 | 0.3        | 58 | 0.84           | 2.02           | A              | NS |
| Work and Energy | 2.17          | 1.16 | 1.97               | 1.14 | 0.2        | 58 | 0.66           | 2.02           | A              | NS |
| Power           | 2.37          | 1.20 | 2.87               | 1.26 | 0.5        | 58 | 1.55           | 2.02           | A              | NS |
| Simple Machine  | 2.50          | 1.41 | 1.87               | 1.45 | 0.63       | 58 | 1.68           | 2.02           | A              | NS |

A – Accepted; NS – Not Significant

Table shows that with respect to BT-HRM on topics of Momentum the computed t-value is 0.84 that is lower than the tabular t-value of 2.02 using 58 degrees of freedom at 0.05 level of significance. The results show that there is no significant difference between the pre-test result of experimental and control groups.

In Biomed Technology, on Work and Energy topic, the computed t-value is 0.66 that is lower than the tabular t-value of 2.02 at 0.05 level of significance with a degree of freedom of 58.

Therefore, the results show that there is no significant difference between the pre-test result of experimental and control groups.

With respect to Power, the null hypothesis stating that there no significant difference between the pre-test result the experimental and control groups is accepted since the computed t-value 1.55 is lower than the tabular t-value of 2.02 at 0.05 level of significance with 58 degrees of freedom.

With lesson on Simple Machine, the computed t-value is 1.68 which is lower than the lower tabular t-value of 2.02 using 58 degrees of freedom at 0.05 level of significance. Thus, there is no significant difference between the pre-test results of the two groups.

Moreover, the table revealed that there is no significant difference between the pre-test results of experimental and control groups with respect to different lessons in Physics. The results imply that the two groups are equal in their performance in the different lessons in Physics at the beginning of the experiment.

Table 4 presents the computed t-value on the significant difference between the post-test of the experimental and control groups with respect to the different lessons in Physics.

The table shows that with respect to the Momentum, the computed t-value is 2.29 which is higher than the tabular t-value of 2.02 with 58 degrees of freedom at 0.05 level of significance between the post-test result of experimental and control groups.

Table 4. Computed t-value on the Significant Difference Between the Post-test of the Experimental and Control Group with Respect to the Different Topics in Physics

| Topics          | Control Group |      | Experimental Group |      | Mean Diff. | df | t <sub>c</sub> | t <sub>t</sub> | H <sub>0</sub> | VI |
|-----------------|---------------|------|--------------------|------|------------|----|----------------|----------------|----------------|----|
|                 | Mean          | SD   | Mean               | SD   |            |    |                |                |                |    |
| Momentum        | 4.57          | 1.56 | 5.53               | 1.67 | 0.96       | 58 | 2.29           | 2.02           | R              | S  |
| Work and Energy | 4.30          | 1.24 | 5.47               | 1.23 | 1.17       | 58 | 10.82          | 2.02           | R              | S  |
| Power           | 4.50          | 1.12 | 5.43               | 1.33 | 0.93       | 58 | 2.88           | 2.02           | R              | S  |
| Simple Machine  | 4.37          | 1.35 | 5.07               | 1.24 | 0.70       | 58 | 2.05           | 2.02           | R              | S  |

R – Rejected; S – Significant

In Work and Energy, the computed t-value is 10.82 which is higher than the tabular t-value of 2.02 at 0.05 level of significance with a degree of freedom of 58. Therefore, the results show that there is significant difference between the post-test results of experimental and control groups.

With respect to Power, the null hypothesis stating that there is significant difference between the post-test result of experimental and control groups is accepted since the computed t-value 2.88 is higher than the tabular t-value of 2.02 at 0.05 level of significance with 58 degrees of freedom.

With lesson on Simple Machine, the computed t-value is 2.05 which is higher than the tabular t-value of 2.02 with 58 degrees of freedom at 0.05 level of significance. Thus, there is significant difference between the post-test results of the two groups.

Furthermore, the table revealed that there is significant difference between the post-test results of experimental and control groups with respect to the different lessons in Physics.

The results indicate that in teaching Physics using structured problem solving techniques yield better performance than the students who are exposed to traditional method.

The findings is supported by Arcales, according to her, self-concept toward science significantly contributes to students mastery level, it is suggested that science teacher should use varied motivating activities to make the subject appealing to the students and learn to love equations and numbers.[11]

The Significant Difference on the Level of Performance of Experimental and Control Groups after Exposure to Conventional Problem Solving and Structured Problem Solving Technique with Respect to the Lessons in Terms of Different Courses

Table 5 presents the computed F-value on the significant difference on the level of performance of experimental and control groups after exposure to conventional teaching and structured problem solving techniques with respect to lessons in Physics in terms of different courses.

Table 5. Computed F-value on the Significant Difference on the Level of Performance of Experimental and Control Groups after Exposure to Conventional Teaching and Structured Problem Solving Techniques with Respect to Lessons in Physics in Terms of Different Courses

| Source of Variance             | Ss    | df | Ms    | F <sub>c</sub> | F <sub>t</sub> | H <sub>0</sub> | VI |
|--------------------------------|-------|----|-------|----------------|----------------|----------------|----|
| Rows (Courses)                 | 31    | 1  | 31    | 1.67           | 4.00           | A              | NS |
| Columns (Group Of Respondents) | 152   | 1  | 152   | 12.31          | 4.00           | R              | S  |
| Interaction (R x C)            | 9     | 1  | 9     | 0.49           | 4.00           | A              | NS |
| Within Groups                  | 10.37 | 56 | 18.52 |                |                |                |    |

A – Accepted; R – Rejected; NS – Not Significant; S - Significant

As shown on table 5, there is no significant difference on the interaction between the courses and the two groups of respondents since the computed F-value of 0.49 is lower than the tabular F-value of 4.00 at 0.05 level of significance along the interaction with 1/56, therefore the null hypothesis is accepted.

This implies that the courses or program is not being considered as a factor in the performance of the students from the control group and experimental group.

Significant Difference in the Pre-test and Post-test of the Experimental and Control Groups with respect to the Different Lessons in Physics according to the Courses

- In the pre-test and post-test of experimental group with respect to different lessons in Physics, the computed t-value are 7.42, 13.16, 9.29 and 10.91 respectively which are greater than the tabular t-value of 2.045 and 0.05 level of significance, therefore the null hypothesis is rejected.

- In the pre-test and post-test of control group with respect to the different lessons in Physics the computed t-values are 4.92, 7.55, 8.16 and 6.91 respectively which are greater than the tabular t-value of 2.045 and 0.05 level of significance, therefore the null hypothesis is rejected.
- In the pre-test of experimental and control groups with respect to the different lessons in Physics, the computed t-values are 0.84, 0.66, 1.55, 1.68 which are lower than the lower than the tabular t-value of 2.02 with 0.05 level of significance, therefore, the null hypothesis is accepted.
- In the post-test of experimental and control groups with respect to the lessons in Physics, the computed t-values are 2.29, 10.82, 2.88 and 2.05 which are higher than the tabular t-value of 2.02 with 0.05 level of significance, therefore the null hypothesis is rejected.

On the significant difference on the level of performance of Experimental and Control Group after exposure to Conventional Problem Solving and Structured Problem Solving with respect to the lessons in Physics in terms of different courses.

- The computed F-value of 0.49 is lower than the tabular F-value of 4.00 at 0.05 level of significance along the interaction within 1/56, thus accepting the null hypothesis.

Therefore, the use of structured problem solving techniques is an effective teaching tool in enhancing the learning of the students regardless of the course or program.

## V. CONCLUSIONS

Based on the findings, the following conclusions are drawn. The study implied that the courses or program is not to be considered as a factor in the performance of the students using experimental and controlled group treatment. The use of the structured problem solving technique is an effective teaching tool in enhancing the learning of the students regardless of the program.

## VI. RECOMMENDATIONS

The following recommendations are hereby offered. The same steps and procedures must be used to conduct the same study utilizing other programs of the college. The same research process must be conducted to other academic subjects such as mathematics and statistics in order to enhance the analytical thinking skills of the students. The use of other teaching tools and strategies must be used to conduct other study/research for the growth of the teachers and students in the teaching and learning process.

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# A Study on Customer loyalty Management in selected public sector banks

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**Abstract-** The purpose of this study is to find the influence of demographic variables and service quality dimensions. In order to investigate levels of satisfaction and loyalty of banking portfolio (products and services), a questionnaire was submitted to a random sample of NRI bank customers interviewed by trained student Volunteers outside the banks in a Coimbatore city in the south of India. The data were collected in one month during the time in which people usually go to Banks (from 10 a.m. to 12 p.m. and from 1 to 3 p.m.) 150 customers were contacted while leaving the bank. 30 questionnaires were received with required coverage details. The Statistical Package for the Social Science (SPSS) for Microsoft Windows 20.00 was used to complete the analysis of the collected data. Descriptive statistics, including means, standard deviations were implemented in order to investigate the demographic data, one-way analysis of variance (ANOVA) were used to determine whether any significant relationships exist among respondents. In addition, the .05 level of statistical significance was set at all statistical tests in the present study. The findings of the study were generalized as follows: Statistically significant differences were found In the end of the study implications and conclusion were provided.

**Index Terms-** bank, quality, loyalty, customer

## I. THEORETICAL BACKGROUND

The concept of customer loyalty is not at all a new concept in the market; it was since from so many centuries, In past ancient Roman Empire had often used the loyalty of their army even Napoleon Bonaparte, the most feared French commander of the early nineteenth century, achieved extraordinary results through the unrelenting loyalty of the soldiers under his command. Coming to the technical, civilized world of 21st century, marketers trying to capture market share with the help of a loyal customer base. Customer loyalty has been universally recognized as a valuable asset in competitive markets (Srivastva, Shervani & Fahey, 2000) Importance to creating a loyal customer arises from that it costs more to create a new customer than to retain an existing one. For example, the cost of creating a new customer is five

times more than that of retaining an existing customer (Reichheld, 1996). Research suggests that a loyal customer buys instead of being sold. He buys more than a new customer does as a firm introduces new products and upgrades existing products. It also costs less to serve loyal customers than new customers because the company knows a lot about them and how to get touch with them. In other words, marketing transactions are routinized and therefore less expensive because a non-routinized transaction is subject to bargaining with its resulting loss of efficiency (Darido and Uttal, 1989). Besides, a loyal customer is less price sensitive and refers the company's products to other people (Kotler, 1999).

## Conceptual framework of Customer Loyalty

In today's highly competitive environment, organizations should protect the long-term interest of the customers and hence should seek the ways through which the customer loyalty toward the organizations could be forged. Marketers opine that these long-term relationships with the customers would enhance their profitability (Dick and Basu, 1994; Garbarino and Johnson, 1999; Grossman, 1998), increased sales, lower costs and other tangible benefits (Terrill et al. 2000). The time has come for the firms to consider this customer loyalty as a source of competitive advantage (Bharatwaj et al. 1993). It has been established that the customers will not be impressed only by the core product attributes since other firms also provide similar offerings. The study of customer loyalty and business performance are fore grounded in the customer relationship management (Reichheld and Sasser, 1990; Sheth and Parvatiyar, 1995). The longer the customer stays with an organization, the more positive outcome he generates which include increase in the value of purchase, increase in the number of purchases and the customers' better understanding of organisation and vice-versa and, more positive word-of-mouth (Trubick and Smith, 2000). The current research endeavours put together the antecedents and components of service loyalty and try to create a comprehensive framework for the measurement of the SERVLOYAL. The following is the explanation of the variables under study

**Figure 1.1. Relationship among Service Quality, Service Satisfaction and Service Loyalty Constructs**

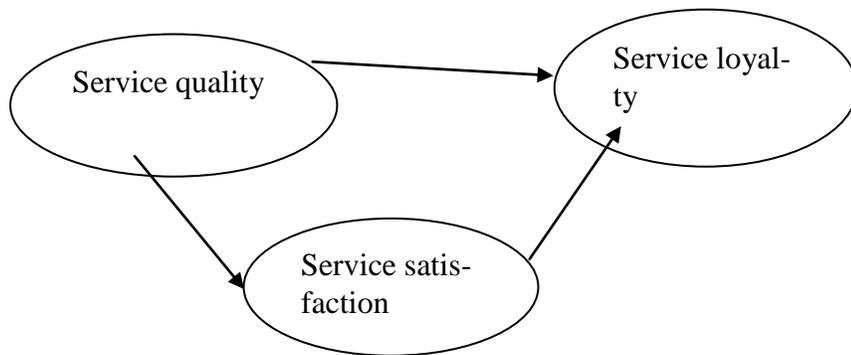


Figure 1.1 depicts the loyalty development model that is proposed and tested in this study. As described above, the major constructs in this model are, Service Loyalty, Service Satisfaction and Service Quality. According to the conceptual framework, the customers' decision to maintain relationship and invest further in the relationship is influenced by the extent to which Service Quality offered as that would directly influence Service Satisfaction, which in turn determines the Service Loyalty intentions.

## II. REVIEW OF RELEVANT LITERATURE

The aim of this study is to identify, describe and analyse factors that have an impact on customer loyalty. In line with this aim, the literature review is done to clarify the underlying concepts in customer loyalty and to unearth the factors that have been found to affect customer loyalty

Early studies of customer loyalty mainly focused on the behavioural aspects of customer loyalty. Typical behavioural measures of loyalty include proportion of purchase, purchase sequence and probability of purchase. This section contains the parsimonious list of empirical research conducted in this area at the international and national level and the reviews are presented in a chronological order.

Churchill (1942) was the first to collect panel data in order to determine customers' total buying behaviour, their brand loyalty and switching between brands. This pioneering work on loyalty set proper direction for further study in this arena. Brown (1952), who used behavioural approach, focused primarily on a sequence-of-purchase measurement. On the downside, Brown paid only a scant attention to the reasons for customer loyalty and hence the popularity of his postulate on loyalty gained very little momentum. However, this seminal work on loyalty provided the right platform for subsequent research efforts concerning loyalty. Cunningham (1956), in his study on loyalty formation sequence, introduced the concept of market share or proportion-of-purchase index as an indicator of loyalty. According to this, a family was typically considered loyal to a brand if it allocated more than 50 percent of its purchases within a product category to one brand and thus popularizing the concept of behavioural loyalty as the major form of loyalty. In 1978 Jacoby and Chestnut (1978, pp.33) counted over 50 definitions of brand loyalty, and the number has grown since then. According to them, brand loyalty as a concept emerged during times when brands and physical goods were the only focus of interest, but the research is relevant

also for analysing loyalty in relational and service settings. According to Dick and Basu (1994), customer loyalty can be viewed as strength of relationship between individual's relative attitude and repeat patronage rather than focusing on behavioural aspects alone. Their study also established that relationship between attitude and patronage is mediated by social norms and situational factors. Three different forms of loyalty antecedents, namely, cognitive, affective and conative loyalty were also identified through substantial revision of literature and redirection in loyalty measurement orientation. The conceptual framework developed by the researchers outlined four specific conditions related to loyalty viz. no loyalty, spurious loyalty, latent loyalty and true loyalty. Morgan and Hunt (1994) popularized the use of the concept of commitment in loyalty marketing in 90s and their definition of commitment as an enduring desire to maintain a valued relationship refers to a psychological state which results from customers liking or even loving, and therefore becoming emotionally attached to their service provider, resulting in enduring loyalty. They suggest that affective commitment is the most effective kind of commitment for developing and maintaining relationships and it has a positive effect on [1] intention to stay in the relationship, [2] desire to stay in a relationship, [3] performance and [4] willingness to invest in a relationship. In trying to figure out the implications of service loyalty to service providers, Javalgi and Moberg (1997) have analysed Dick and Basel Model of loyalty in depth through an empirical analysis. Their research in essence focused on the types and forms of loyalty viz. spurious, latent and no loyalty in various sectors and found out that loyalty is high for services that are highly customized and involved high level of judgment exercised by service providers. They have also emphasized that marketers with loyal customers cannot be satisfied but must always work at maintaining the loyalty they have attained with their customers by closely working with employees and sprucing up the method of service delivery.

### Objectives of the study

1. To study the influence of demographic variables and service quality dimensions

### Respondent Sample

In order to investigate levels of satisfaction and loyalty of banking portfolio (products and services), a questionnaire was submitted to a random sample of NRI bank customers interviewed by trained student Volunteers outside the banks in a Co-

imbatore city in the south of India. The data were collected in one month during the time in which people usually go to Banks (from 10 a.m. to 12 p.m. and from 1 to 3 p.m.)150 customers were contacted while leaving the bank. 30 questionnaires were received with required coverage details.

**Instrumentation**

The instruments of this study involved three parts: the first section of the instrument consisted of forced-choice questions about demographic characteristics: gender, marital status, age, Educational level, Years of transaction with the bank. The second section variables chosen for this study in order to measure Service quality in banks and third section for measuring service loyalty. The dimension 37 items are evaluated on a five-point Likert scale ranging from 1 to 5 ,using the anchors “5=Highly dissatisfied,4=dissatisfied,3=Neutral,2=Satisfied ,1= Highly satisfied”.

Cronbach,s alpha is a coefficient (a number between 0 and 1) that is used to rate the internal consistency (homogeneity) or the correlation of items in a test. If the test has a strong internal consistency most measurement experts agree that it should show only moderate correlation among items (0.70 to 0.90).The reliability coefficients for the variables chosen for the study should

have to be more than 0.70, to consider it as an acceptable value (Nunnally, 1978). In this study the Reliability analysis shows that all the factors have shown alpha value greater than 0.7, indicating the evidence of reliability and the overall reliability of the instrument is 0.92. So, the items constituting each variable under study have reasonable internal consistency and shows that all the dimensions of Service quality and customer loyalty have a positive reliability. The factors and dimensions included for analysis carry a good degree of reliability to support the objectives formulated. All dimensions have got significant relationship to make the real representation of the study. Hence it is concluded that the data collected in this study is highly reliable.

**Data analysis**

The Statistical Package for the Social Science (SPSS) for Microsoft Windows 16.0 was used to complete the analysis of the collected data. t-test, one-way analysis of variance (ANOVA) ,Regression were used to determine whether any significant relationships exist among respondents. In addition, the .05 level of statistical significance was set at all statistical tests in the present study.

**III. RESULT OF DATA ANALYSIS**

**Table: 1 Analysis to find out significant differences among the factors of Service Quality by gender of the respondents.**

As in all statistical tests, the basic criterion for statistical significance is a "2-tailed significance" less than0.05. Significance level of Reliability is 0.966, which is above 0.05 and, therefore, there is no statistically significant difference between Reliability by Gender of respondents,

| Factors        | Mean |        | Standard Deviation |        | t-value | Sig(2-tailed) |
|----------------|------|--------|--------------------|--------|---------|---------------|
|                | Male | Female | Male               | Female |         |               |
| Reliability    | 9.87 | 9.90   | 1.75               | 1.92   | -0.043  | 0.966         |
| Responsiveness | 5.58 | 5.33   | 0.87               | 0.98   | 0.711   | 0.483         |
| Tangibility    | 2.83 | 3.15   | 0.92               | 0.71   | -0.977  | 0.337         |
| Assurance      | 5.13 | 5.20   | 0.99               | 1.39   | -0.151  | 0.881         |
| Empathy        | 6.15 | 5.73   | 1.31               | 1.55   | 0.773   | 0.446         |
| Convenience    | 6.01 | 6.53   | 1.51               | 1.04   | -0.969  | 0.341         |

Significance level of Responsiveness is 0.483,which is above 0.05 and ,therefore there is no significant difference between Responsiveness by gender of the respondents,Significance level of Tangibility is 0.337,which is above 0.05 and ,therefore there is no significant difference between Tangibility by gender of the respondents,Significance level of Assurance is 0.881,which is above 0.05 and ,therefore there is no significant difference be-

tween Assurance by gender of the respondents,Significance level of Empathy is 0.446,which is above 0.05 and ,therefore there is no significant difference between Empathy by gender of the respondents,Significance level of Convenience is 0.341,which is above 0.05 and ,therefore there is no significant difference between Convenience by gender of the respondents

**Table: 2 Analysis to find out significant differences among the factors of Service Quality by Marital status of the respondents.**

As in all statistical tests, the basic criterion for statistical significance is a "2-tailed significance" less than0.05. Significance level of Reliability is 0.612, which is above 0.05 and, therefore, there is no statistically significant difference between Reliability by marital status of respondents,

|  | Mean    |           | Standard Deviation |           | t-value | Sig(2-tailed) |
|--|---------|-----------|--------------------|-----------|---------|---------------|
|  | Married | Unmarried | Married            | Unmarried |         |               |

|                |      |      |      |      |        |       |
|----------------|------|------|------|------|--------|-------|
| Factors        |      |      |      |      |        |       |
| Reliability    | 9.99 | 9.62 | 1.66 | 2.12 | 0.513  | 0.612 |
| Responsiveness | 5.38 | 5.78 | 0.90 | 0.88 | -1.11  | 0.276 |
| Tangibility    | 2.93 | 2.94 | 0.69 | 1.21 | -0.037 | 0.971 |
| Assurance      | 5.00 | 5.52 | 1.22 | 0.76 | -1.16  | 0.252 |
| Empathy        | 6.14 | 5.70 | 1.38 | 1.43 | 0.792  | 0.435 |
| Convenience    | 6.13 | 6.33 | 1.29 | 1.62 | -0.371 | 0.713 |

Significance level of Responsiveness is 0.276, which is above 0.05 and, therefore there is no significant difference between Responsiveness by marital status of the respondents, Significance level of Tangibility is 0.971, which is above 0.05 and, therefore there is no significant difference between Tangibility by marital status of the respondents, Significance level of Assurance is 0.252, which is above 0.05 and, therefore there is no significant

difference between Assurance by marital status of the respondents, Significance level of Empathy is 0.435, which is above 0.05 and, therefore there is no significant difference between Empathy by marital status of the respondents, Significance level of Convenience is 0.713, which is above 0.05 and, therefore there is no significant difference between Convenience by marital status of the respondents.

**Table: 3 Analysis to find out significant differences among the factors of Service Quality by Qualification of the respondents.**

As in all statistical tests, the basic criterion for statistical significance is a "2-tailed significance" less than 0.05. Significance level of Reliability is 0.08, which is above 0.05 and, therefore, there is no statistically significant difference between Reliability by Qualification of respondents,

| Factors        | Mean |        |      | Standard Deviation |        |      | F-value | Sig  |
|----------------|------|--------|------|--------------------|--------|------|---------|------|
|                | HSC  | Degree | PG   | HSC                | Degree | PG   |         |      |
| Reliability    | 10.7 | 10.21  | 8.82 | 1.29               | 1.72   | 1.79 | 2.72    | 0.08 |
| Responsiveness | 5.67 | 5.46   | 5.48 | 1.03               | 0.93   | 0.88 | 0.09    | 0.91 |
| Tangibility    | 3.10 | 3.09   | 2.56 | 0.22               | 0.95   | 0.85 | 0.29    | 0.29 |
| Assurance      | 4.93 | 5.06   | 5.44 | 1.06               | 1.33   | 0.71 | 0.65    | 0.65 |
| Empathy        | 5.93 | 6.12   | 5.83 | 1.85               | 1.35   | 1.32 | 0.89    | 0.89 |
| Convenience    | 6.07 | 6.27   | 6.11 | 2.36               | 1.17   | 1.21 | 0.94    | 0.94 |

Significance level of Responsiveness is 0.91, which is above 0.05 and, therefore there is no significant difference between Responsiveness by Qualification of the respondents, Significance level of Tangibility is 0.29, which is above 0.05 and, therefore there is no significant difference between Tangibility by Qualification of the respondents, Significance level of Assurance is 0.65, which is above 0.05 and, therefore there is no significant difference between Assurance by Qualification of the respondents, Significance level of Empathy is 0.89, which is above 0.05 and, therefore there is no significant difference between Empathy by Qualification of the respondents, Significance level of Convenience is 0.94, which is above 0.05 and, therefore there is no significant difference between Convenience by Qualification of the respondents.

service provided by the bank and they have complete trust in the bank. The quality of services provided by the bank can lead to a service satisfaction in the customer which in turn can lead to service loyalty.

**IV. CONCLUSION**

The key notation of success in the highly competitive current banking industry is not just winning customers but in retaining them. New customers will try bank offerings based on the perceived quality, and that result in satisfaction, the perceived value of bank will increase and thereby prompting repeat visit for further financial requirements. As per the study it is proved that the customers are satisfied with the service provided and the error free record keeping, the customers are satisfied by the exclusive

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# A Review on Oxygen Transfer Rate, Efficiency, Capacity and their Kinetic on Aeration System in Activated Sludge Process of Sewage Treatment Plant

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**Abstract-** The review is concerned with the transfer of oxygen from air to a wastewater subjected to biological aerobic treatment. Oxygen transfer from gaseous to the liquid phase, is a vital part of a number of wastewater treatment processes, such as activated sludge process which is totally depend on the availability of sufficient quantity of oxygen. This paper is a study of oxygen transfer rate, efficiency, capacity and their kinetics on aeration system. Apart from this the study shows how the sludge retention time and the oxygen uptake rate is depend on the temperature of wastewater of sewage treatment plant. The standard oxygen transfer rate is the decisive factor in the dimensioning of activated sludge process used in STP Plants. It depends on the required oxygen uptake rate by micro-organisms. This review discuss about the dependency of oxygen transfer rate on the temperature of wastewater.

**Index Terms-** Aeration systems, activated sludge process, mass transfer, Oxygen uptake rate (OUR), oxygen transfer rate, oxygen transfer efficiency, sludge retention time (SRT), wastewater temperature.

## I. INTRODUCTION

Aeration systems normally perform two functions in activated sludge wastewater treatment processes, namely, oxygen transfer and mixing. While oxygen transfer may be regarded as the primary function, mixing is also important to ensure a full utilization of the activated sludge reactor volume and a uniform dispersion of dissolved oxygen throughout the mixed liquor. The transfer rate of oxygen from air to waste water subjected to biologically treatment. the rate of oxygen transfer essential for specification of aerator to be utilize this process Fine bubble aeration is known for a higher oxygen transfer efficiency than surface aeration, but equipment costs as well as maintenance costs for surface aerators are lower often. An economic evaluation of both systems often results in fine bubble aeration, but depending on individual conditions also surface aeration is chosen due to economic benefits. Therefore oxygen transfer measurements for surface aerators are still important. Oxygen must be provided in biological wastewater treatment systems to satisfy several types of demands. One demand is that associated with the oxidation of organic or carbonaceous materials. Carbonaceous oxygen demand is associated with two cellular functions: cell synthesis and endogenous respiration. Cell synthesis carbonaceous oxygen

demand occurs when organic matter is first metabolized by the microorganisms contained in the mixed liquor. It is related to the oxygen required to oxidize a portion of the organic matter to provide the energy necessary for cell synthesis. Endogenous respiration carbonaceous oxygen demand occurs as the synthesized organisms are retained in the treatment system and it represents the essential life processes. The net result is that increasing amounts of oxygen are required as lower process organic loadings are used. Lower process organic loadings are characterized by operation at a longer solids retention time (SRT) and lower food-to-microorganism (F/M) loadings. The efficiency of oxygen transfer depends on many factors including the type, size and shape of diffusers and the tank geometry. In this paper, the effect of the depth of water in the tank and, the extension of coverage area of diffusers on each of oxygen transfer capacity (OC), efficiency (E) their size, shape, and materials of construction may vary considerably, diffused aeration devices are usually classified as either fine or coarse bubble referring to the relative diameter of the bubble produced. The demarcation between fine and coarse bubbles is not well defined. The standard oxygen transfer is the decisive factor in the dimensioning of activated sludge plants. It depends on the required oxygen uptake rate by micro-organism. The dependencies of the oxygen transfer rate and oxygen uptake rate on the waste water temperature range (5 – 30 °C) are discussed.

## II. MATERIAL AND METHOD

The process of oxygen transfer to gaseous to aqueous phase occurs in few steps. In the first step saturation of liquid surface between two phases ( $C_s$  saturation of concentration of liquid) this transfer rate will very fast which gaseous film is negligible. Passage of the oxygen molecules through the liquid interface film by molecular diffusion at very low mixing levels the rate of oxygen absorption is controlled, at higher turbulence levels interface film is broken up and rate of renewal of the film control absorption of the oxygen. Surface renewal rate is frequency at which the liquid with an oxygen concentration  $C_L$  (Oxygen concentration in bulk of the liquid phase) replace that from the interface with on the oxygen concentration equal to saturation concentration of liquid  $C_s$ . Oxygen transferred to bulk liquid by diffusion and by convection.

The basic equation of oxygen transfer rate is:

$$N = K_L A (C_s - C_L) \dots\dots\dots (1)$$

- Where,
- N = Mass oxygen transferred per unit time (lb O<sub>2</sub>/day),
  - K<sub>L</sub> = The liquid film coefficient (lb O<sub>2</sub>/day ft<sup>2</sup>),
  - A = Interfacial area in transfer (ft<sup>2</sup>),
  - C<sub>s</sub> = Saturation of concentration of liquid (Mg/l),
  - C<sub>L</sub> = Oxygen concentration in bulk of the liquid phase (Mg/l).

Equation no.(1) is usually rewritten in concentration units by dividing by volume of the system.

$$N/V = dt/dC_L = K_L (A/V) (C_s - C_L) = K_L a (C_s - C_L) \dots\dots (2)$$

- Where,
- a = A/V = interfacial area per volume (ft<sup>2</sup>/ft<sup>3</sup>)
  - K<sub>L</sub>a = the overall coefficient of oxygen transfer (lb/O<sub>2</sub> (day) (ft<sup>3</sup>))

In the determination of the mass transfer coefficient, the overall coefficient K<sub>L</sub>a is obtained without attempting to separate the factor K<sub>L</sub> and a. It is admittedly impossible to measure the interfacial area A.

**MASS TRANSFER COEFFICIENT AT UNSTEADY STATE IN AERATION TANK FOR ACTIVATED SLUDGE PROCESS**

In aeration of activated sludge water, oxygen utilization (respiration rate) at microorganism is taken into account, with reference equation no.(1)

$$dC_L/dt = K_L a (C_{sw} - C_L) - r \dots\dots\dots(3)$$

- Where,
- r = The rate of oxygen utilization of microorganisms,
  - C<sub>sw</sub> = Saturation concentration of oxygen in the waste water,
  - C<sub>L</sub> = The operating concentration of dissolved oxygen in the aerator wastewater.

The value of dC<sub>L</sub>/dt are obtained by plotting C<sub>L</sub> (measured by DO test) vs time and determining slope at selected time intervals fig.1

Equation no.(3) is rearranged to yield .

$$dC_L/dt = (K_L a C_{sw} - r) - K_L a C_L \dots\dots\dots (4)$$

**OXYGENATION CAPACITY (OC)**

In evaluation of an aerator the oxygen transferred is estimated under is estimated under standard conditions (SC), corresponding to a temperature of 20 °C and standard atmospheric pressure. Rate of oxygen transferred by the aerator is reported as its oxygenation capacity (OC), which is defined as the rate of oxygen transfer dC/dt at an initial oxygen concentration C<sub>L</sub> = 0 and standard conditions, From eq . (2)

$$OC (lbO_2/(hr)(unit volume )) = dC_L/dt = (K_L a)_{20c} (C_s - 0) = (K_L a)_{20c} C_s \dots\dots\dots (5)$$

**OXYGEN TRANSFER EFFICIENCY**

The fraction oxygen transferred to the water due to pass one meter cubic of air is expressed as oxygenation efficiency (E) of the diffuser system, which can be written as .

$$E = OC.H/I \dots\dots\dots (6)$$

- Where,
- H = The liquid depth in the tank in meters
  - I = the aeration intensity or volumetric air flux per unit area of the tank

**DEPENDENCY OF SLUDGE RETENTION TIME (SRT) ON THE WASTE WATER TEMPERTURE**

The sludge retention time is the mean retention of the micro-organism in the activated sludge process. It is states to be the decisive dimensioning parameter. SRT depends on the temperature of waste water and required treatment goals like carbon removal, nitrogen degradation etc. For nitrogen degradation the aerobic SRT is calculated as per the German standard:

$$SRT_{aer} = SF * 3.4 * 1.103^{(15-T)} \dots\dots\dots(7)$$

- Where,
- SF = safety factor = range from (1.45-1.80)
  - T = Temperature of wastewater.
  - SRT<sub>aer</sub> = aerobic sludge retention time

It is clear from the equation no.(7) that as water temperature increases the SRT decreases.

**DEPENDENCY OF OXYGEN UPTAKE RATE (OUR) ON THE WASTE WATER TEMPERTURE**

As per the German standard the oxygen uptake rate for the removal of carbon derives from the degradation of dissolved organic compounds in the waste water and endogenous respiration, i.e. hta basic consumption of the micro-organisms. Therefore the equation is:

$$OUR_{d,C} = B_{d,BOD} \frac{0.56 + 0.15 \left( \frac{SRT_{aer} * F_T}{(kg/d)} \right)}{1 + 0.17 * SRT_{aer} * F_T} \dots \dots \dots (8)$$

Where,

$F_T$  = Temperature factor  
 $OUR_{d,C}$  = oxygen uptake rate for the removal of carbon

The dependency of the waste water is calculated via the sludge retention time  $SRT_{aer}$  and the temperature factor  $F_T$ .

### III. CONCLUSION

The waste water temperature has a decisive on the biological processes of wastewater treatment and thus on SRT and OUR. It has been clear from above expression that as the temperature of wastewater increases there is decrease in absolute value of SRT and OUR, therefore the specific value of aeration tank volume will increases considerably. Also expressions above regarding the oxygen transfer rate, efficiency, capacity are very important factor in the dimensioning any activated sludge process plant.

### ACKNOWLEDGEMENT

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# A Timetable Prediction for Technical Educational System Using Genetic Algorithm – An Over View

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**Abstract-** In this paper we glance through the various approaches used by the researchers to develop an automatic timetable using Genetic algorithms. The optimized genetic algorithm can be used with the heuristic approach to design and develop the timetable of an institute. At stake during the process of development, the stakeholders are the professors and the students. The efficient utilization of the infrastructure is the main aim of the authors. The crossover, mutation and the fitness function is to be calculated for the implementation. In genetic algorithm every individual are characterized by a fitness function. After analysis if there is higher fitness then it means better solution and then after based on their fitness, parents are selected to reproduce offspring for a new generation where fitter individuals have more chance to reproduce. The objective of the work is to create a model used to generate the acceptable schedule using probabilistic operators.

**Index Terms-** Rule-Based agents, Genetic Algorithm, fitness function, Timetable Generator, Heuristic approach.

## I. INTRODUCTION

Planning timetable is one of the most complex and error prone application. There are still serious problems like generation of high cost time table are occurring while scheduling and these problems are repeating frequently. [6] Therefore there is a great requirement for an application distributing the course evenly and without collisions. The aim is here to develop a simple, easily understandable, efficient and portable application which could automatically generate good quality time table with in a second. [10] The outline of this paper is as follows: Active rules are described for the knowledge of intelligent agents (i.e. Constraints), GAs are described and their use in optimizing rule based agent is proposed, methods are apply to the problem of optimizing some results of this application are presented and finally, some conclusion and possible direction for future research are presented. A lecture timetable problem is concerned with finding the exact time allocation within limited time period of number of events (courses-lectures) and assigning to them number of resources (teachers, students and Lecture Halls) while satisfying some constraints. The constraints are classified into Hard Constraints and Soft constraints. Hard constraints are those that must be adhered to, while soft Constraints can be violated if necessary [2,3].

The advantage of GA is that they can explore the solution space in multiple directions at once [4].

Therefore, if one path turns out to be a dead end, they can easily eliminate it and continue work on more promising avenues, giving them a greater chance each run of finding the optimal solution

## II. STRUCTURE OF THE AUTOMATED TIME TABLE GENERATOR

The structure of time table generator consist Input Date Module, relation between the input data module, time interval, time slots module, applying active rules and GA module then extract the reports.

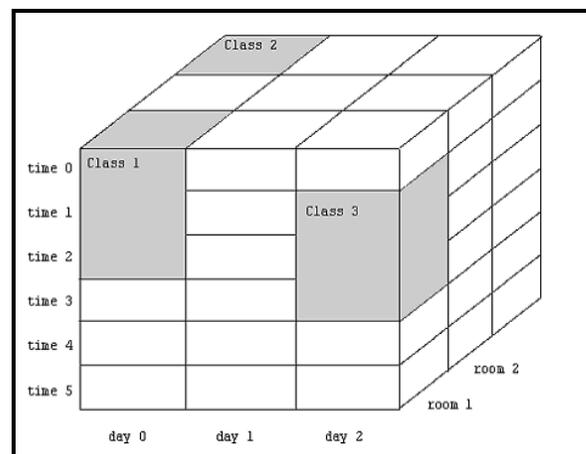


Figure 1: Time Table presented as 3 D Structure [1]

## III. GENETIC ALGORITHM [5]

Genetic algorithms are methods of solving problems based upon an abstraction of the process of Natural Selection. They attempt to mimic nature by evolving solutions to problems rather than designing them. Genetic algorithms work by analogy with Natural Selection as follows. First, a population pool of chromosomes is maintained. The chromosomes are strings of symbols or numbers. There is good precedence for this since humans are defined in DNA using a four-symbol alphabet. The chromosomes are also called the genotype (the coding of the solution), as opposed to the phenotype (the solution itself). In the Genetic algorithm, a pool of chromosomes is maintained, which are strings. These chromosomes must be evaluated for fitness. Poor solutions are purged and small changes are made to existing solutions and then allow "natural selection" to take its course,

evolving the gene pool so that steadily better solutions are discovered.

The basic outline of a Genetic Algorithm is as follows: [8]  
 Initialize pool randomly  
 For each generation  
 {  
   Select good solutions to breed new population  
   Create new solutions from parents  
   Evaluate new solutions for fitness  
   Replace old population with new ones  
 }

The randomly assigned initial pool is presumably pretty poor. However, successive generations improve, for a number of reasons:

1) **Selection:** During each successive generation, a proportion of the existing population is selected to breed a new generation. Individual solutions are selected through a fitness-based process, where fitter solutions (as measured by a fitness function) are typically more likely to be selected [12]

2) **Mutation:** It allow the algorithm to avoid local minima by preventing the population of chromosomes from becoming too similar to each other, thus slowing or even stopping evolution.[14]

```
for each gene in individual{
  if(P(Random) < Pm){
    gene = get random value from
    possible values list;
  }
}
```

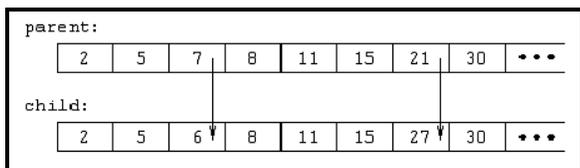


Figure 2: Mutation for Individual[1]

3) **Crossover:** It combines the genetic material from parents order to produce children, during breeding. Since only the good solutions are picked for breeding, during the selection procedure, the crossover operator mixes the genetic material, in order to produce children with even greater fitness.

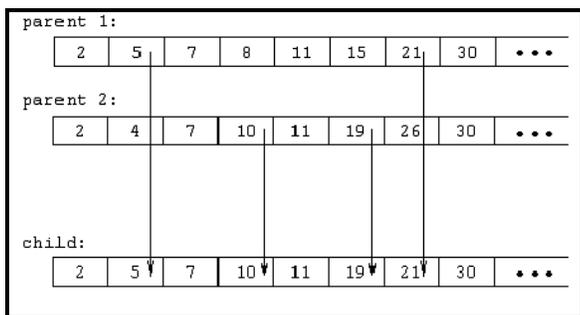


Figure 3: Crossover Individual[1]

For example, assume single point crossover at position 3 two binary chromosomes with values (000000, 111111) will produce (000111, 111000) as children. Moreover, there can be multiple point crossover.[8]

What propose here, is an “automatic” way of selecting the best action to execute upon an event occurring? The action is selected by a genetic algorithm. For the moment conditions are supported by active rules when an event has occurred the system can take several actions. For each of possible events, the system holds an ordered set of possible actions that can be taken when the event occurs. The first action is always selected, but a genetic algorithm running in parallel may dynamically change the order of the actions. [10]

Since the genetic algorithm controls the way the agents (constraints) respond to events, the reactive behavior of the agent is controlled by the genetic algorithm. But there can also be another "level" (the "rational" level) to control the agent, especially if a architecture is part of an agent built partially using another method and controlled partially by the constructs this method provides. Actions will be selected for execution using the traditional approach, but some others using the GA approach. This rational part of the agent can also control several parameters of the GA, restart it when needed, or schedule it to be run. This architecture can also be embedded in more complex systems. When an event/action language is necessary for the building of an agent type system, this method can be used for a subset of the events and the actions of the system. This simplifies the design and reduces testing and maintenance times when compared to a deterministic rule set with many conditions and checks. [5]

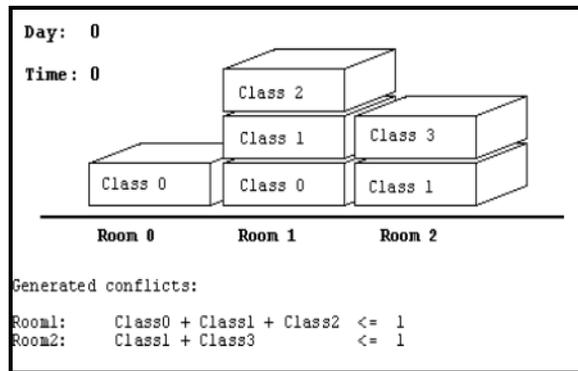


Figure 4: Generation of conflicts and bounds [1]

#### IV. CONCLUSION

The GA in timetabling framework has been shown to be successful on several real problems .It has been shown that the genetic algorithm perform better in finding areas of interest even in a complex, real-world scene. [13] This paper described how set of active rules can be used to express the knowledge of intelligent and how a genetic algorithm can be used to dynamically prioritize rules in the face of dynamically evolving environments. One could argue that the genetic algorithm can find a local optimum and then stop. This is always a danger with a genetic algorithm, but again it depends on the search space. In this time table generation approach, there

are many good solutions and the genetic algorithm will find one of them.

In extreme cases where there is only one good solution the genetic algorithm may fail, but again it can be restarted by the Active Rules with many chances to find a better solution. [8] One could also argue that this architecture is not powerful enough since it does not work based on an event/action language. However there is nothing to prevent this architecture from being a subset of a rich and powerful event/action language. In such a case it can be used to pick the rule to be fired when there are no other criteria available for rule selection. In other cases it maybe better to let the genetic algorithm pick the rule to be fired, instead of having many conditions which will complicate the active rule set and consequently increase design, test and maintenance times. The benefits of this approach are simplified design and reduced development and maintenance times of rule-based agents in the face of dynamically evolving environments. [11]

## V. FUTURE SCOPE

For Further work there is need to explore different types of genetic algorithms, like heuristic approach to develop the application. for example ones with overlapping populations such as steady state or incremental GAs. In such cases, a small replacement percentage, so that the GA could be used for driving the nodes at real time (once an initial good state has been reached) and not just training them. For plan to investigate other methods for finding the optimum rule set (for example, neural networks or other heuristic search methods like simulated annealing) and to formally compare the results with theoretical results obtained by a statistical analysis of the network. [11]

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# FPGA based hardware as a coprocessor

G.Prasad, N.Vasantha

**Abstract-** The process of hardware – software co-design of satellite data acquisition system is described. The hardware components are targeted to execute on a reconfigurable hardware coprocessor which communicates with a host computer that executes the software tasks. Control of the data flow between device interfaces, processing blocks and memories in a data acquisition system is complex in hardware implementation.. With growing computational needs, high design and NRE costs of ASICs, FPGA based co-processor has become a viable alternative. The main objective of our co-design methodology is the usage of hardware designing of algorithms, simulation and synthesis.

**Index Terms-** PCI Core, FIFO, DMA, Derandomization etc.

## I. INTRODUCTION

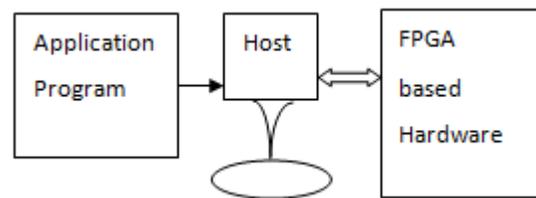
Over the past decade, high performance computing (HPC) applications demands have out spaced the conventional processors performance by demanding more processing power. As a result hardware acceleration became necessary to augment processors with application specific coprocessors. Typically, coprocessors, such as graphics co-processors, are application-specific. The computations they perform are predetermined. Coprocessors were initially designed to reduce the computational overload on the host processors, thus scaling-up the latter's performance. Due to right combination of performance, ease of use price along with significant power savings. FPGA is a good option for coprocessor design

With the advent of Field –programmable device technologies, reconfigurable coprocessors have become a viable alternative to quickly and inexpensively realizing quick implementations of wide classes of applications. In this paper the reconfigurable coprocessor board comprising of one Field Programmable Gate arrays (FPGA), First in First Out (FIFO) and PCI-X logic to interface with the host system was designed and is discussed. Using memory mapped addressing. The host computer can access the FIFO on the board through the PCI-X interface and send control words to the FPGA hardware. The functions to be implemented on the coprocessor board are selected from the software that is already written for and executing on the host computer.

Selection of these functions, which we will call hardware functions, is motivated by the desire to achieve overall speedup and is constrained primarily by the size of the FPGA. Hardware design and implementation is intensive in design time. Therefore proper choice of hardware functions is critical. Rapid prototyping and performance evaluation of the hardware functions is crucial to the successful and efficient use of coprocessor technologies.

In this paper we will describe an approach to the selection and rapid prototyping of coprocessor function. The design process starts with the existing software implementation of the algorithm. This software implementation is then profiled for time and critical portions of software where most of the CPU time is spend

are identified. This data is used to select the functions for migration to hardware. After having isolated the functions to be implemented on hardware, next an algorithmic behavioral specification for the hardware task is developed in HDL and is thoroughly verified and simulated for proper functionality. We will describe our co design through an example implemented in the data acquisition system.



User program Host Processor FPGA Coprocessor

Fig 1. FPGA Coprocessor

## II. QUARTUS SOFTWARE AND ALTERA HARDWARE DESCRIPTIVE LANGUAGE

The Altera Quartus II design software is a multiplatform design environment that easily adapts to specific needs in all phases of FPGA and CPLD design. Quartus II software delivers the highest productivity and performance for Altera FPGAs, CPLDs, and Hard Copy ASICs. Quartus II software delivers superior synthesis and placement and routing, resulting in compilation time advantages. Compilation time reduction features include, Multiprocessor support, Rapid Recompile, Incremental compilation. Quartus II Analysis and Synthesis, together with the Quartus II Fitter, incrementally compiles only the parts of your design that change between compilations. By compiling only changed partitions, incremental compilation reduces compilation time by up to 70 percent. For small engineering change orders (ECOs), the Rapid Recompile feature maximizes your productivity by reducing your compilation time by 65 percent on average, and improves design timing preservation.

AHDL is a proprietary digital Hardware Description Language (HDL) from Altera Corporation for programming their Complex Programmable Logic Devices (CPLD) and Field Programmable Gate Arrays (FPGA). This language has an Ada programming language-like syntax and similar operation to VHDL or Verilog. It is supported by Altera's Quartus and Max+ series of compilers. An advantage of AHDL is that all language constructs are synthesizable. AHDL is to Verilog much as assembly language is to a higher-level programming language: in AHDL, you have more control.

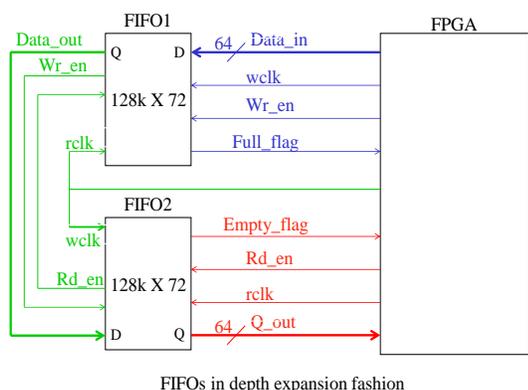
### III. ARCHITECTURE

This section gives an overview of the proposed architecture of the FPGA based hardware which will perform the function of the coprocessor

The architecture consists of three major blocks

1. FIFO Bank
2. A PCI-X core interface
3. 90nm FPGA.

A block diagram of the proposed architecture is shown in **Fig 2**. The entire system sits on a PCI card which can be fitted to a server. The system can be operated by issuing instructions to the FPGA through the PCI interface.



**Fig 2. FIFO Bank**

The term external FIFO refers to any device that you connect externally to a FPGA. There are several varieties of external FIFO devices. The choice of external FIFO and its type depends on the nature of the application. Designing with FIFO memories presents both advantages and disadvantages. External FIFO devices provide larger storage capacities than on-chip memories, and are still quite fast, although not as fast as on-chip memories. Typical external FIFO devices have capacities ranging from around 128 Kbytes to 10 Mbytes.

External FIFOs are typically very low latency and high throughput devices, slower than on-chip memory only because they connect to the FPGA over a shared, bidirectional bus. FIFO devices are less expensive per Mbyte than other high-capacity memory types such as SRAM. The primary advantages of external FIFO in an FPGA-based embedded system are cost and board real estate. They also consume less board space per Mbyte than SRAM and FPGA on-chip memory, which consumes none.

Depending on the available on chip memory the FPGA memory can be partitioned to fit in data corresponding to a fixed number of words. The on chip memory width is set up to match the width of the external FIFO which is the off chip memory. This number of words can be interfaced to the external onboard FIFO and depending on the size of the FIFO large volume of data can be stored. Thus by doing this framing accuracy as generated in the RAM is maintained. This is illustrated below as how it was implemented in an FPGA in the data acquisition hardware developed.

128k X 72 bit FIFOs are used in the depth expansion fashion, to create one 256k X 72 bit FIFO. Therefore, total 4 FIFOs are required to create 256k X 72 bit FIFO per data channel.

### IV. IP CORE PCI\_MT64 MEGACORE FUNCTION

The IP core provides an interface between the Altera pci\_mt64 MegaCore function and a 64-bit, 2-MByte FIFO module. It Supports 32- and 64-bit PCI master and target transactions, Supports chaining and non-chaining mode DMA, Uses the dual-port FIFO buffer function from the library of parameterized modules (LPM), This design shows how to connect the local-side signals of the Altera pci\_mt64 MegaCore function to local-side applications when the MegaCore function is used as a master or target on the PCI bus. The design consists of the following elements Master control logic, DMA engine, Data path FIFO buffer functions and FIFO interface as shown in Fig 1.

#### A. Master Control Logic

When the pci\_mt64 function is acts as a master, the master control logic interacts with the DMA engine to control the PCI master transactions. During a PCI master write, the data flows from the local master to the PCI bus. The master control logic Provides status of the PCI bus to the DMA engine, Interacts with the pci\_mt64 function to execute a PCI master write cycle, Transfers the data from the external FIFO-to-PCI FIFO buffer to the pci\_mt64 function.

#### B. DMA Engine

The DMA engine interfaces with the master control logic, the data path FIFO buffer s, and the FIFO interface to coordinate DMA transfers to and from the FIFO. The DMA engine consists of DMA control logic, DMA registers, DMA descriptor FIFO buffers.

#### C. DMA Control Logic

The DMA control logic Provides control signals to the master control logic to prompt it to request the PCI bus when needed, Triggers a new access to the external FIFO, Monitors the data path FIFO buffer's and the current FIFO access, Monitors the DMA registers in order to initiate a new transaction, Loads the address counter register (ACR) and byte counter register, (BCR) in the DMA registers when DMA is in chaining mode, Updates the interrupt status register (ISR) and control and status register (CSR) in the DMA registers (chaining and non-chaining mode).

#### D. DMA Registers

Setting up the DMA registers in the DMA engine initiates DMA transactions. These registers are memory-mapped to BAR0 of the pci\_mt64 function; they can be accessed with a target transaction to their memory-mapped addresses. The registers must be written by another master on the PCI bus. The DMA registers consists of Control and status register (CSR), Address counter register (ACR), Byte counter register (BCR), Interrupt status register (ISR), Local address counter.

#### E. DMA Descriptor FIFO Buffer

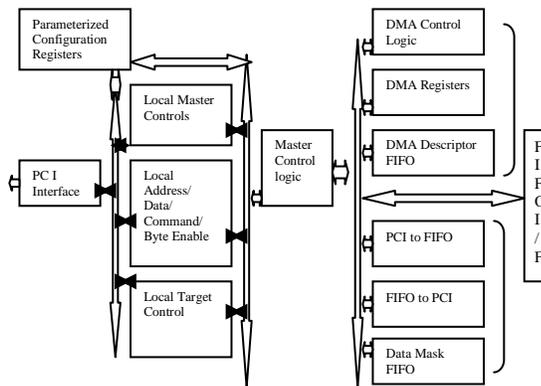
The DMA descriptor FIFO buffer provides the storage area for the series of byte count and PCI address pairs when the DMA is programmed to operate in chaining mode. The size of the descriptor FIFO buffer is 256 x 32, and it is capable of holding up to 128 DMA transactions in a chain. This FIFO buffer must be written with byte count and address pairs by another master/host on the PCI bus before starting the DMA in chaining mode. The

descriptor FIFO buffer is read by the DMA control logic to fetch the current byte count to the BCR and address to the ACR before executing the next DMA transaction in a chain.

**F. Data Path FIFO Buffers**

The data path FIFO buffers serve as the buffer space for the data flowing between the external FIFO and PCI bus. The FIFO buffers are needed to resolve the external FIFO's high data-access latency. The design implements the following FIFO buffer's PCI-to-internal FIFO buffer (128 x 64), Data mask FIFO buffer (128 x 8).

The PCI DMA core is interfaced with the host through the PCI bus, The PCI interface is responsible for accessing the configuration parameters to and from the system. The PCI core takes inputs for the functions from the host and stores them in the local configuration registers. Also Data from the external system will pass through the FIFO banks, through the PCI core to system memory. Data from the hard disk is read out by the core, stored in the onboard FIFOs and read out for interface to external devices.



**Fig 3. Block Diagram of PCI –Mt64 IP Core**

**V. FPGA 90NM STRATIX EP1S25F1020C5**

The Stratix FPGA is used to implement the following modules. Static configuration of on chip memory and PCI core, interface & control logic, and Dynamic Configuration logic. Stratix devices contain a two-dimensional row- and column-based architecture to implement custom logic [19]. A series of column and row interconnects of varying length and speed provides signal interconnects between logic array blocks (LABs), memory block structures, and DSP blocks. The logic array consists of LABs, with 10 logic elements (LEs) in each LAB. An LE is a small unit of logic providing efficient implementation of user logic functions. LABs are grouped into rows and columns across the device.

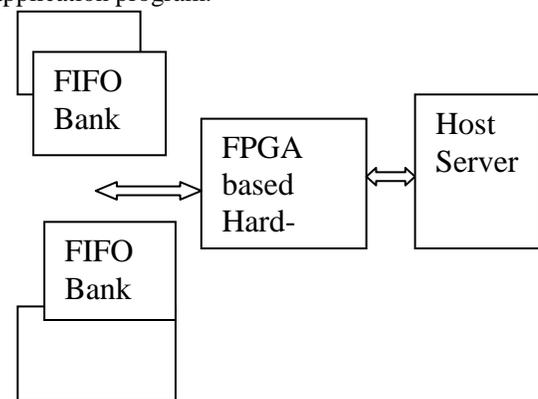
M512 RAM blocks are simple dual-port memory blocks with 512 bits plus parity (576 bits). These blocks provide dedicated simple dual-port or single-port memory up to 18-bits wide at up to 318 MHz. M512 blocks are grouped into columns across the device in between certain LABs. M4K RAM blocks are true dual-port memory blocks with 4K bits plus parity (4,608 bits). These blocks provide dedicated true dual-port, simple dual-port, or single-port memory up to 36-bits wide at up to 291 MHz. These blocks are grouped into columns across the device in between certain LABs. M-RAM blocks are true dual-port memory

blocks with 512K bits plus parity (589,824 bits). These blocks provide dedicated true dual-port, simple dual-port, or single-port memory up to 144-bits wide at up to 269 MHz. Several M-RAM blocks are located individually or in pairs within the device's logic array.

Digital signal processing (DSP) blocks can implement up to either eight full-precision 9 x 9-bit multipliers, four full-precision 18 x 18-bit multipliers, or one full-precision 36 x 36-bit multiplier with add or subtract features. These blocks also contain 18-bit input shift registers for digital signal processing applications, including FIR and infinite impulse response (IIR) filters. DSP blocks are grouped into two columns in each device. Each Stratix device I/O pin is fed by an I/O element (IOE) located at the end of LAB rows and columns around the periphery of the device. I/O pins support numerous single-ended and differential I/O standards. Each IOE contains a bidirectional I/O buffer and six registers for registering input, output, and output-enable signals. When used with dedicated clocks, these registers provide exceptional performance and interface support with external memory devices such as DDR SDRAM, FCRAM, ZBT, and QDR SRAM devices. High-speed serial interface channels support transfers at up to 840 Mbps using LVDS, LVPECL, 3.3-V PCML, or HyperTransport technology I/O standards.

**VI. DESIGN AND IMPLEMENTATION**

The FPGA hardware board sits on a PCI-X interface bus which can be fitted into a standard server class machine. The data acquisition hardware can be accessed by issuing instructions through the drivers to the PCI master core for selecting the required configuration. The FPGA based hardware interfaces with the on board FIFO bank for reading data from it and transfers the data to host through the PCI –X interface. Also communication from the host for configuring the hardware is also done through the PCI-X interface for selecting the required inputs as defined by the application program.



**Fig 4. Elements of FPGA Data Acquisition system Architecture.**

The hardware architecture is shown above. Various parameters are selectable like, type of sensor, resetting the device, volume of data to be acquired, chaining mode or non chaining mode, DMA Page size etc. needs to be given as input to the FPGA. By selecting the parameters through the application software the FPGA is loaded and only a portion of the logic space on

the FPGA is reconfigured. The configuration of the remaining portion of the FPGA is untouched and hence, the functions present in the untouched logic space may be accessed for execution is selected for execution.

DAQ application is a program used to control the FPGA based hardware. It is a program used to control the FPGA device and capture data from the hardware. The Steps to use Nrsa\_daq\_application are as follows:

Execute the application by issuing typing command Nrsa\_daq\_application in the command prompt

A list of menu options are seen, these options will

- Reset the device.
- Load parameters to the DAQ hardware
- Select the option "Set DMA Page Size",
- Select the option "Set DMA Transfer Size"
- Chaining/Non Chaining mode
- Derandomization on/ Derandomization off.
- Memory read/Memory write

The data acquisition hardware is first reset so that the registers corresponding to the DMA transfer are initialized to the start of value. The parameters for a particular satellite i.e. the frequency of operation, number of sensors, number of data acquisition cards on the server is given as input for the hardware to be configured to acquire the selected satellite. The page size is a customized field and can be modified as per our requirement. Default Page Size is 16KB. The transfer can be done only with a minimum of 1 MB. User can also set a required value. Whether the hardware is configured to handle small chunk or large chunk of data is decided by the Chaining/Non chaining mode selection. If the derandomization enable is set to ON then data is derandomized in hardware and is acquired. If this parameter is OFF than the derandomization is done in software. Selecting the Memory Read option the transfer takes place and the resulting data will be present in hex. out file.

By selecting the parameters the FPGA is loaded with the corresponding inputs and it is configured for data acquisition through the PCI interface. Now the FPGA processes these parameters as per the configuration logic and also does the processing like Derandomization there by achieving the real time speed. Thus the FPGA off loads the main processor by doing the derandomization process in hardware thus achieving real time speed which is not the case when the derandomization was done in software. Flow diagram of Derandomization in the software is shown Fig 5.

Data Flow

Fig5. Data Flow diagram of Software Derandomization

In software the satellite data is frame synchronized and acquired in real time. The further processing of Derandomization is carried out using an application program in near real time. Then the derandomized data is transferred to FIFO onboard memory for further transfer to host system. Thus there is latency in deriving the derandomized data by software method. In this method the host processor is involved in derandomization process of the raw data acquired.

Implementation in FPGA does the frame synchronization, derandomization in real time as shown in Fig6. The logic is realized using a 11bit shift register where the clock is connected to the global clock and reset to the global reset pin. The 11bit shift register is loaded with the control word on power on and the 12<sup>th</sup> bit is achieved by the exoring of the 8<sup>th</sup> and 10<sup>th</sup> bit. The output of the 10<sup>th</sup> bit is the derandomized serial pattern which is again added to the incoming satellite data to obtain the derandomized output data.

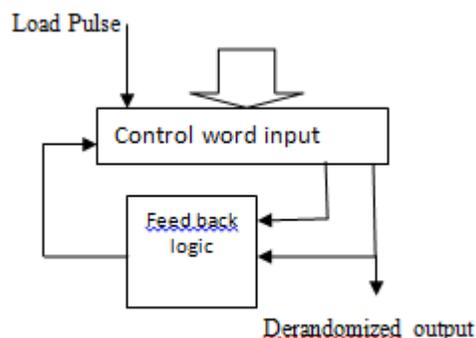


Fig 6. Block diagram of Derandomization principle.

HDL code for implementing Derandomization is given below.

```
data_sim_pn_shft_reg[0].clk=GLOBAL(channel_clk);
data_sim_pn_shft_reg[0].clrn = GLOBAL(nReset);
data_sim_pn_shft_reg[0].d=B"00001111011";
```

Real time Data Acquisition and Frame Synchronization done in Hardware

```

data_sim_pn_shft_reg[0].d=(data_sim_pn_shft_reg[8].q $
data_sim_pn_shft_reg[10].q);
data_sim_pn_shft_reg[10..1]=data_sim_pn_shft_reg[9..0];    --
pn sequence shift register enable.
pn_seq_op[0] = data_sim_pn_shft_reg[10];
pn_seq_op[1] = pn_seq_op[0];
    
```

Depending on the configuration selected the control word will change and also the load pulse of the control word will vary. This part of the logic space on the FPGA is reconfigured. The remaining portion of the FPGA is untouched and hence the functions present in the untouched logic space may be accessed for execution. The flow chart in Fig 7. shows the sequence of events that take place in the FPGA for implementing the derandomization process in real time in the FPGA.

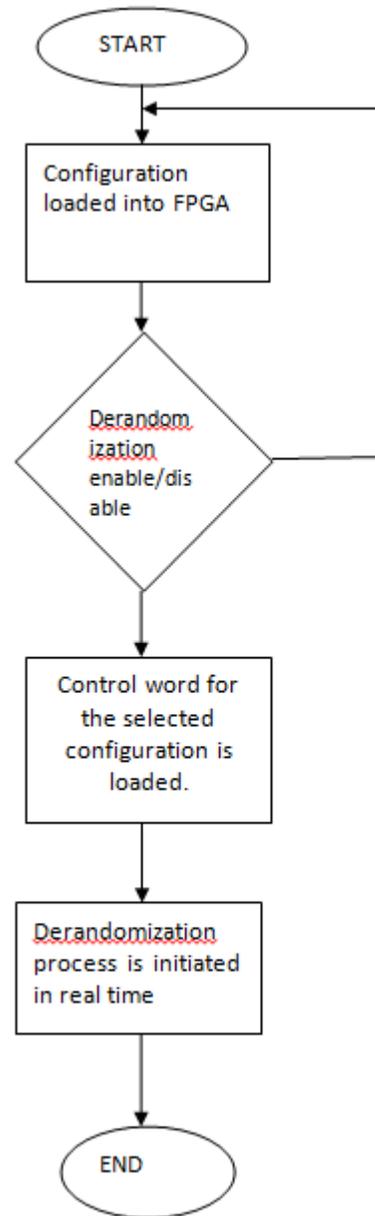


Fig 7. Flow chart of Hardware Derandomization.

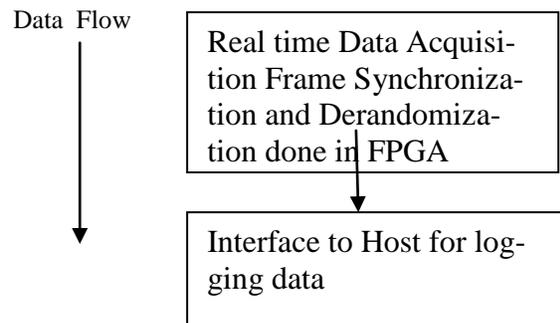
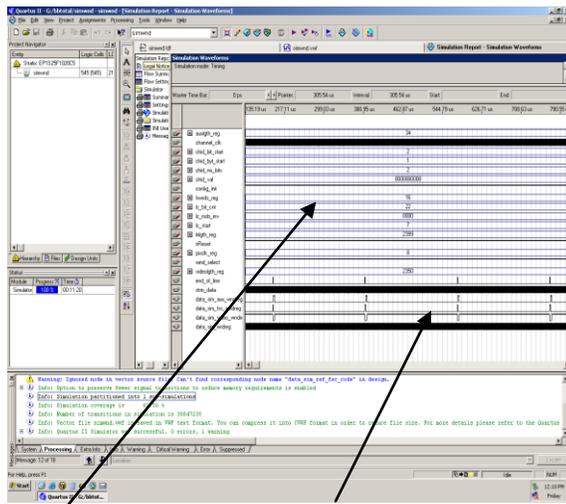


Fig8. Data Flow diagram of Hardware Derandomization

By implementing the Derandomization process in FPGA, the process takes place in real time, the computational overhead on the host processor is reduced, because the data to the host need not go through the derandomization process in software and thus total performance of the system is scaled up.

## VII. SIMULATION RESULT



**Configuration Parameters      Derandomized output**

**Fig 9. Configuration Parameters and Derandomized output.**

## VIII. CONCLUSION

In this paper we have presented an FPGA- based reconfigurable coprocessor. The proposed coprocessor was fully tested on Stratix FPGA based PCI –X card. Simulation results have been given. It is found to be very effective in implementing logic modules in FPGA. Further work includes the extension of co processor functions for decryption, decompression etc.

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# Correlation of Diabetic Nephropathy and HbA1C in Newly Diagnosed Type 2 Diabetic Patients of Western UP

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**Abstract-** Insulin resistance is characterized by a subnormal response to a given concentration of insulin and can be measured indirectly by a fasting insulin level. The prevalence of diabetes continues to grow worldwide, disease-related morbidity and mortality is emerging as major healthcare problems. Clearly, type 2 diabetes has a strong genetic component. Diabetic-nephropathy is the leading cause of end stage renal disease (ESRD) in US and a leading cause of diabetes mellitus related morbidity and mortality. Nephropathy complicates approximately 30% of type 2 diabetic patients. However no study has been performed that compared the HbA1c in type II diabetes mellitus with nephropathy to without nephropathy. Therefore aim of this study was to evaluate the glycosylated hemoglobin and their association with diabetic nephropathy in a western Uttar Pradesh. The body mass index (BMI) was calculated as weight (Kg) divided by height (m) squared. Venous blood was collected after 12 hours fasting into two test tubes; with no anticoagulant for serum creatinine, and with Ethylene Diamine Tetra Acetic Acid (EDTA) for HbA1c. we observed that Incidence of microalbuminuria increases with age as well as with increased duration of diabetes mellitus. Our study also evaluated relationship between diabetic retinopathy and nephropathy and found a significant correlation.

**Index Terms-** insulin resistance Hb A1c Microalbuminuria Nephropathy

## I. INTRODUCTION

Diabetes mellitus (Type- 2 diabetes), the common endocrine disorder, is characterized by persistent hyperglycaemia due to lack of insulin and/or insulin resistance<sup>1</sup>. Insulin resistance is characterized by a subnormal response to a given concentration of insulin and can be measured indirectly by a fasting insulin level<sup>2</sup>: higher levels of insulin correspond to higher degrees of insulin resistance. Factors that contribute to insulin resistance include obesity<sup>3</sup>, aging, and a sedentary lifestyle<sup>4</sup>. The prevalence of diabetes continues to grow worldwide, disease-related morbidity and mortality is emerging as major healthcare problems<sup>5</sup>. Clearly, type 2 diabetes has a strong genetic component<sup>6,7</sup> and is found more frequently in certain families and ethnic minority groups, such as Hispanics, African Americans, Pacific Islanders, and American Indians. Patients with Type- 2 diabetes may be

asymptomatic<sup>8</sup> and may have complications at the time of diagnosis. Diabetic-nephropathy is the leading cause of end stage renal disease (ESRD) in US<sup>9</sup> and a leading cause of diabetes mellitus related morbidity and mortality. Nephropathy complicates approximately 30% of type 2 diabetic patients<sup>10</sup>. The laboratory test for early detection of diabetic nephropathy is the measurement of microalbumin in urine (Microalbuminuria). Microalbuminuria predicts progression to diabetic nephropathy and cardiovascular diseases.<sup>11</sup> HbA1c is a measure of erythrocyte haemoglobin glycation, since erythrocytes have about 120 days life span, HbA1c reflects mean glycaemic value for the previous 3 months (weighted to the most recent months).<sup>12</sup> It provides no information about the immediate blood glucose concentration. Blood samples for HbA1c can be drawn whether or not the patient is fasting, as it does not reflect the patterns of glycaemia, the effects of food or exercise.<sup>13,14</sup> However no study has been performed that compared the HbA1c in type II diabetes mellitus with nephropathy to without nephropathy. Therefore aim of this study was to evaluate the glycosylated hemoglobin and their association with diabetic nephropathy in a western Uttar Pradesh.

## II. MATERIAL AND METHODS

This was a cross sectional study conducted at the L.L.R.M. Medical College, Meerut (western UP) during January 2014 to July 2014. One hundred known Type 2 diabetic patients (55 males and 45 females), with age range 30–70 were included in the study. Purposive non-probability sampling technique was used for data collection. Informed consent was obtained. A structured questionnaire regarding the demographic data such as age, sex, duration of diabetes, height and body weight were measured while wearing light weight clothing, but not shoes. Blood pressure, smoking habit, family history of diabetes, renal disease and hypertension was recorded for each patient.

### Inclusion Criteria:

1. Age > 30 years & < 60 years
2. Patient who gave written informed consent.
3. Mentally and physically fit up to a minimum level required to participate in study.

4. Patients with newly diagnosed type 2 diabetes mellitus (with in 1 month) according to WHO criteria and ADA recommendations for diabetes mellitus

**Exclusion criteria:**

1. Not interested/unable to provide informed consent.
2. Any substance abuse, mental illness or medical condition that in opinion of investigator would make it difficult for potential participant to participate in intervention.
3. Patient of known hypertension with or without treatment, ischemic heart disease, cardiomyopathy, valvular heart disease, heart failure, chronic pulmonary illness, severe anaemia, hemoglobinopathies.
4. Known case of diabetes mellitus type 1 and type 2 who are already diagnosed or on antidiabetic treatment.

Diabetic patients suffering from any other medical problems were excluded from the study. The body mass index (BMI) was calculated as weight (Kg) divided by height (m) squared. Venous blood was collected after 12 hours fasting into two test tubes; with no anticoagulant for serum creatinine, and with Ethylene Diamine Tetra Acetic Acid (EDTA) for HbA1c. Morning urine sample was collected in a container (without preservative) for analysis of creatinine and microalbumin. HbA1c was estimated by Boronate affinity chromatography (HPLC) which separates total glycated haemoglobin by binding to solid-phase dihydroxyborate using Nycocard immunoassay kit (USA). Serum creatinine was analysed by alkaline picrate, Jaffe’s Method (Erba Kit). Urinary creatinine was estimated by Jaffe’s Method (Erba kit). Urinary microalbumin was estimated by Sandwich Format Immunometric Assay method. Fasting & Post prandial plasma glucose (glucose-oxidase peroxidase method),

**III. DIAGNOSTIC CRITERIA**

**A) Criteria for the diagnosis of diabetes :**

1. FPG  $\geq 126$  mg/dl (7.0 mmol/l). (Fasting is defined as no caloric intake for at least 8 h.) OR
2. 2-h plasma glucose  $\geq 200$  mg/dl (11.1mmol/l) during an OGTT. The test should be performed as described by the World Health Organization, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water. OR
3. In a patient with classic symptoms of hyperglycemia or hyperglycaemic crisis, a random plasma glucose  $\geq 200$  mg/dl (11.1 mmol/l). OR
4. HbA1C  $\geq 6.5\%$ . The test should be performed in a laboratory using a method that is NGSP (National Glycohemoglobin Standardisation Program) certified and standardized to the DCCT (Diabetes Control & Complication Trial) assay.

**IV. DIABETIC NEPHROPATHY**

Presence of diabetic nephropathy has been assessed by measuring urinary excretion of albumin in a morning urine sample & GFR

**Measurement of Albuminuria:** Significant albuminuria is defined as urinary excretion of albumin  $\geq 30$ mg/dl albumin in 24 hr collection or  $\geq 30$  mcg/mg of creatinin in spot urine collection (morning urine sample).

**Microalbuminuria:** urinary excretion of 30-299 mg/dl albumin in 24 hr collection or 30-299 mcg/mg of creatinin in spot urine collection

**Macroalbuminuria:** urinary excretion of  $\geq 300$  mg/dl urinary albumin in 24 hr collection or  $\geq 300$ mcg/mg of creatinine in spot urine sample.

**Calculation of GFR:** calculated by MDRD(MODIFIED DIET FOR RENAL DISEASE) formula using software

**Statistical analysis:** Data were analysed for mean, percentage, standard deviation, Student\_t’ test, Fisher’s exact test, by using SPSS-16(Statistical Package for the Social Sciences) for Windows (SPSS, Chicago, IL). The t’-test and Fisher’s exact tests were applied to study quantitative and qualitative data, respectively with P’value  $< 0.05$  was considered statistically significant.

**V. OBSERVATION AND RESULTS**

**Table 1: Age and Sex wise distribution of cases**

| Age group (yrs) | Male |    | Female |    | Total |     |
|-----------------|------|----|--------|----|-------|-----|
|                 | No.  | %  | No.    | %  | No.   | %   |
| 30-39           | 03   | 03 | 03     | 03 | 06    | 06  |
| 40-49           | 21   | 21 | 16     | 16 | 37    | 37  |
| 50-60           | 41   | 41 | 16     | 16 | 57    | 57  |
| Total           | 55   | 55 | 45     | 45 | 100   | 100 |

Hundred newly diagnosed type 2 diabetes mellitus patients age between 30-60 years were selected for this cross sectional study. Out of which 55 (55%) were males and 45 (45%) females.

**Table-2: Frequency of Diabetic nephropathy**

|              | Microalbuminuria | Macroalbuminuria | Total     |
|--------------|------------------|------------------|-----------|
| Male         | 14               | 01               | 15        |
| Female       | 02               | 02               | 04        |
| <b>Total</b> | <b>16</b>        | <b>03</b>        | <b>19</b> |

Out of 100 patients of newly diagnosed type 2 DM ; 19 % patients were found to have diabetic nephropathy. Out of this 19 % cases, 16 cases ( 84.21%) were of microalbuminuria and 03 cases ( 18.75%) were of macroalbuminuria Out of 19 cases 15 were male and 04 were females.

**Table 3: Distribution of diabetic nephropathy according to sex**

| Sex    | Diabetic nephropathy |        | Total |
|--------|----------------------|--------|-------|
|        | Present              | Absent |       |
| Male   | 15                   | 50     | 65    |
| Female | 04                   | 31     | 35    |
| Total  | 19                   | 81     | 100   |

**P=0.1896 Relative risk = 2.019 95% CI =0.7254 to 5.621**

Table-3 showed that male and female populations were compared for frequency of Diabetic nephropathy applying Fisher's exact test but no significant difference was found (

p=0.1896) regarding the incidence of diabetic retinopathy between the two populations.

| PARAMETERS                     | WITH MICRO/MACRO ALBUMINURIA | WITHOUT MICRO/MACRO ALBUMINURIA | p VALUE ('t' -test) |
|--------------------------------|------------------------------|---------------------------------|---------------------|
| No. of Patients                | 19                           | 81                              | --                  |
| Fasting Plasma Glucose (mg/dl) | 211.52 ± 27.85               | 173.55 ± 27.24                  | <0.0001             |
| HbA1C (%)                      | 8.37 ± 0.83                  | 7.19 ± 0.58                     | < 0.0001            |
| Age ( year)                    | 53.78 ± 4.28                 | 49.20 ± 6.31                    | 0.0035              |
| BMI (kg/m <sup>2</sup> )       | 26.93 ± 2.31                 | 24.92 ± 2.45                    | 0.0015              |
| S. CREATININE (mg/dl)          | 1.76 ± 0.59                  | 1.12 ± 0.52                     | < 0.0001            |
| S. CHOLESTEROL (mg/dl)         | 199.13 ± 23.23               | 184.02 ± 19.56                  | 0.0043              |

Mean fasting plasma glucose levels of population with nephropathy were 211.52 ± 27.85 mg/dl and that of population without nephropathy was 173.55 ± 27.24 mg/dl .This shows that FPG is positively associated with the incidence of diabetic nephropathy in population as mean of FPG of population with nephropathy was higher as compare to population without nephropathy and correlation was found extremely significant (p<0.0001) Mean HbA1C of population with nephropathy was 8.37 + 0.83 %and that of population without nephropathy was 7.19 + 0.58 %.HbA1C is positively associated with the incidence of diabetic nephropathy in population as mean of HbA1C of population with nephropathy was higher as compare to population without nephropathy and correlation was found extremely significant (p<0.0001). Mean age of population with nephropathy was 53.78 ± 4.28 yrs and that of population without nephropathy was 49.20 ± 6.31 yrs.Age is positively associated with the incidence of diabetic nephropathy in population as mean of age of population with nephropathy was higher as compare to population without nephropathy and correlation was found very significant (p<0.0035)

Mean body mass index of population with nephropathy was 26.93 ± 2.31 kg/m<sup>2</sup> and that of population without nephropathy was 24.92 ± 2.45 kg/m<sup>2</sup> .BMI is positively associated with the incidence of diabetic nephropathy in population as mean of BMI of population with nephropathy was higher as compare to population without nephropathy and correlation was found very significant (p=0.0015) . Mean serum chloesterol of population with nephropathy was 199.13 ± 23.23mg/dl and that of population without nephropathy was 184.02 ± 19.56 mg/dl. serum cholesterol is found positively associated with the incidence of diabetic nephropathy in population as mean of serum cholesterol of population with nephropathy was higher as compare to population without nephropathy and correlation was found very significant (p=0.0043) Mean serum creatinine of population with nephropathy was 1.76 ± 0.59mg/dl and that of population without nephropathy was 1.12 ± 0.52mg/dl. Serum creatinine is found positively associated with the incidence of diabetic nephropathy in population as mean of serum creatinine of population with nephropathy was higher as compare to population without nephropathy and correlation was found extremely significant (p<0.0001)

## VI. DISCUSSION

Diabetes Mellitus is a multifactorial disease, associated with a number of microvascular (neuropathy and nephropathy) and macrovascular (ischemic heart disease, cerebrovascular disease and peripheral vascular diseases) complications. The gap between the onset of the disease and clinical diagnosis of diabetes leads to the development of these chronic complications, which are the leading causes of premature mortality among diabetic patients. In this study, which is one of the first studies in this regards in western U.P., we assessed the incidence of nephropathy and their correlation with various parameters like glycosylated haemoglobin (HbA1C), body mass index (BMI).Present study has also shown incidence of diabetic nephropathy 19% ( in form of microalbuminuria 16% as well as macroalbuminuria 03% in newly diagnosed diabetic patient which is lesser when compared to the study by Ghai et al<sup>15</sup>. **Unuigbe et al**<sup>16</sup> observed microalbuminuria in 50% and **Khan et al**<sup>17</sup> showed prevalence of 30%, of newly diabetic cases. Method of estimation of microalbuminuria as well as ethnical differences would have played a role in giving lower prevalence in the present study. The level of glyce-mic control seems to be the strongest factor influencing transition from normoalbuminuria to microalbuminuria. As reported in many studies our study also showed significant correlation between FBS, BMI ,s. creatinine, s. cholesterol and microalbuminuria. No sex preponderance has been seen in this study. Diabetic nephropathy can conveniently be categorized into different stages with respect to renal hemodynamic, systemic blood pressure, urinary findings, and susceptibility to therapeutic interventions. In the initial renal hyperperfusion stage, glomerular filtration is elevated with absent albuminuria. In the second stage (clinical latency) glomerular filtration will be high normal with absent albuminuria. Next stage is incipient nephropathy, wherein glomerular filtration will be normal with presence of microalbuminuria. It usually appears 5-15 years after the diagnosis of diabetes mellitus. In the subsequent stage, glomerular filtration decreases with appearance of macroproteinuria and clinical manifestations of nephropathy. Finally ends up in end stage renal disease with massive albuminuria and diminished glomerular filtration. Hence microalbuminuria may not be associated with abnormal serum creatinine, but can be an important warning signal

which if ignored can result in irreversible renal damage. Incidence of microalbuminuria increases with age as well as with increased duration of diabetes mellitus. Our study also evaluated relationship between diabetic retinopathy and nephropathy and found a significant correlation. **Anila Chandy et al<sup>21</sup>** from Christian Medical College and Hospital, Ludhiana, Punjab, and Nader Baharivand,<sup>22</sup> in Iran also found similar correlation between these two microvascular complications. This correlation can be explained by the common mechanism involved in tissue damage by all those factors.

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# Molecular Detection and Genomic Characterization of Torque teno sus virus 1 in Jiangnan Area of China

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**Abstract-** In this study, we detected Torque teno sus virus 1(TTSuV 1) in blood samples obtained from pigs in Jiangnan area of China, also characterized complete genomes of TTSuV 1. Genomes of TTSuV1 were obtained to examine the diversity and evolution of swine TTVs. The results suggest that JX TTSuV1 strain have a different sequence identity between 67.7% to 97.7% , and shared the highest identity (97.7%) with the Japan strain (AB076001).

**Index Terms-** Torque teno sus virus, Complete genome, Sequence analysis, Pig

## I. INTRODUCTION

Torque teno viruses (TTVs) are small, circular, non-enveloped viruses, which has been classified as a member of the discovered *Anelloviridae* family<sup>[i,ii]</sup>. TTVs were first found in a Japanese patient with posttransfusion hepatitis and then have also been found in other species including cats, dogs, pigs, cows and sheep<sup>[iii,iv]</sup>. There are two distinct genogroups have been identified as Torque teno sus virus 1(TTSuV1) and Torque teno sus virus 2 (TTSuV2) with wide spread in swine populations.

TTSuVs have been shown to be involved in co-infection with other disease such as porcine dermatitis and nephropathy syndrome(PDNS) and postweaning multisystemic wasting syndrome(PMWS). Data suggests that TTSuVs were associated with some pathological conditions of swine<sup>[v]</sup>.

The diversity and phylogeny of this virus has not been fully studied because of low number of swine TTSuV complete genome sequences. The transcriptional profiles and genomic organization of viruses are similar with high genetic divergence. The viral genome length varies from 2.0 kb to 3.9 kb depending on the host species<sup>[vi]</sup>. The genome of swine TTV is approximately 2.8 kb and our aim was to characterize complete genomes of TTSuV 1 and to examine the diversity and evolution of swine TTVs<sup>[vii]</sup>.

## II. MATERIALS AND METHODS

### Sample preparation

The sera samples obtained from farm in Jiangnan area of China were preserved in our lab under -80°C. Viral DNA was extracted using magnetic genomic DNA extraction kit(TianGen) and desolved under -20°C. The full-length genomes of TTSuV1 were amplified with proofreading DNA polymerase (TaKaRa LA Taq, TakaRa Bio Inc, Japan) using specific primers located in the UTR.

### Primer design

**Table1 TTSuV1 complete genome amplification primers**

| Primers | Sequences of primers  | Size |
|---------|---|------|
| Forward | 5'-<br>GGCGGACCTGATTGAA-<br>CTGATTGAA-<br>GACTGAAAACCGTT-3' | 2878 |
| Reverse | 5'-<br>GGCAGCAAAC-<br>GTGGTGCGAGCGAA-<br>GCGA-3'            | bp   |

The complete genome sequences of TTSuV1 was found from the GenBank and aligned using the software program DNASTar (DNASTAR, Inc. Madison, WI). A pair of primers to detect TTSuV1 was designed using the Primer Premier Software (version 5.0) based on conserved sequences of TTSuV1. Another pair of primers to amplification was also designed and this was showed in Table 1.

### Detection of TTSuV1

SN-PCR was used to detect TTSuV1. PCR reaction mixture contains 2.5µL template DNA, 12µL rTaq (TakaRa Bio Inc, Japan), 1µL of each primer (25µL), and ddH<sub>2</sub>O to a total volume of 25µL. The reaction was performed by preheating for 5 min at 95°C, followed by 35 cycles at 94°C for 30s, at 54°C (the second reaction is 52°C) for 30s, and at 72°C for 40s, and a final extension for 10min at 72°C. PCR product (5µL) was analyzed using electrophoresis on a 1% (w/v) agarose gel and visualized with JS-650D equipment (PeiQing, China). Then agarose gel recycling was carried on to obtain the target strip and the product of recycling was also detected using electrophoresis. The genomic DNA was analyzed by agarose gel electrophoresis and PCR amplification was carried out for further comparison.

### PCR amplification

Positive sera samples detected by PCR were selected for amplification of complete genomes of TTSuV1. Complete genomes of TTSuV1 was amplified by PCR using specific primers showed as Table 1 and LA Taq DNA polymerase (TakaRa Bio Inc, Japan) according to TaKaRa LA Taq instructions. The amplification primers were amplified according to sequence in Genbank(Accession number: AB076001). Reaction system containing 10×LA buffer, dNTP Mixture 2.5Mm, LA rTaq, 1.25 U, primer 10 pmol/µL, DNA template 2.5µL was diluted with double-distilled water(DDW) in total volume of 25µL. The amplification

procedure was as followed: 5min at 95°C, 30s at 94°C, 30s at 59°C, 3min at 72°C, followed by 35 cycles of 30 s at 94°C and a final extension for 10min at 72°C. The amplified positive products were purified with a TaKaRa MiniBEST Agrose Gel DNA Extraction Kit (Ver.4.0) and cloned into the pMD18-T Vector. The cloned products were then sequenced using an ABI 377 DNA sequencer (ABI, USA).

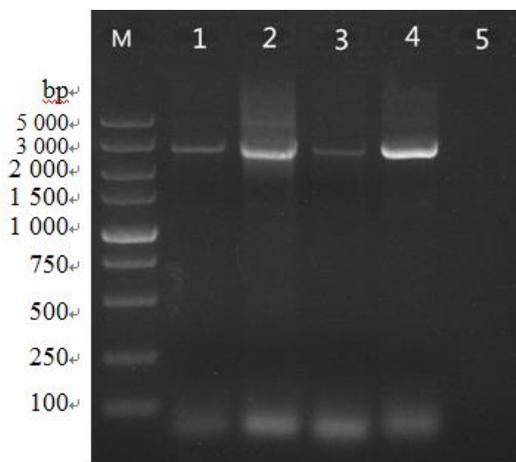
**Sequence analysis**

Complete genomic sequences of TTSuVs strains were obtained from GenBank database. Phylogenetic analyses were performed using the neighbor joining method in MEGA 5.1. Phylogenetic tree was also constructed based on the ORF1 sequences of strains.

**III. RESULTS AND DISCUSSION**

**PCR amplification**

TTSuV was detected in pigs from all the different districts using SN-PCR. The positive product of TTSuV1 was choosed to be amplified. The amplified PCR products, positive stripes of amplification, were observed to be 2878bp of TTSuV1 using agarose gel electrophoresis. The results were shown as Fig.1.



**Fig1. PCR amplification of Tc TSuV1 complete genome. M: DL 5 000 Marker; 1~4 : Production of PCR Amplification ; 5:Negative control: M: DL 2000 DNA Maker.**

**Sequence analysis**

TTSuV1 amplified from swine sera were sequenced and characterized together with several already known genomic sequences. The sequencing results were analyzed in comparison using Chroms and DNASTAR biological software. Complete genome sequence with 2893bp length of TTSuV1 was obtained and made homology analysis together with 9 strains from China and 5 strains from Spain, America, Canada, Japan and Brazil. The map of homology comparison of the TTSuV1 complete genome was obtained using using Lasergene software was shown in Fig.2.

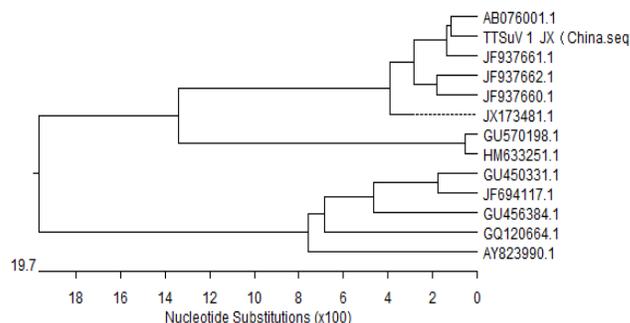
|    |      |      |      |      |      |      |      |      |      |      |      |      |    |
|----|------|------|------|------|------|------|------|------|------|------|------|------|----|
| 1  | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   | 13   |    |
| 1  | 68.2 | 95.5 | 69.4 | 69.7 | 69.7 | 76.4 | 78.9 | 68.4 | 94.6 | 95.0 | 95.6 | 95.1 | 1  |
| 2  | 40.9 | 68.7 | 86.2 | 85.5 | 86.2 | 69.4 | 71.0 | 83.3 | 67.8 | 67.8 | 67.4 | 68.3 | 2  |
| 3  | 4.6  | 40.0 | 69.3 | 69.6 | 69.6 | 75.9 | 78.5 | 68.1 | 94.6 | 97.6 | 94.8 | 97.7 | 3  |
| 4  | 39.3 | 14.8 | 39.5 | 87.2 | 88.4 | 68.4 | 71.0 | 84.4 | 68.3 | 68.4 | 68.3 | 68.8 | 4  |
| 5  | 38.9 | 15.6 | 39.1 | 14.1 | 91.8 | 68.0 | 70.6 | 94.6 | 69.0 | 69.0 | 69.2 | 69.2 | 5  |
| 6  | 39.0 | 14.7 | 39.1 | 12.7 | 8.7  | 68.5 | 71.0 | 88.9 | 68.6 | 68.7 | 68.8 | 69.0 | 6  |
| 7  | 25.5 | 37.2 | 26.3 | 38.1 | 38.7 | 38.0 | 96.6 | 70.5 | 76.6 | 75.4 | 76.8 | 75.9 | 7  |
| 8  | 24.8 | 36.1 | 25.4 | 36.7 | 37.4 | 36.8 | 1.0  | 69.9 | 78.6 | 77.9 | 78.7 | 78.3 | 8  |
| 9  | 38.7 | 17.5 | 39.3 | 15.4 | 3.5  | 9.9  | 36.8 | 36.2 | 68.0 | 67.3 | 68.2 | 67.7 | 9  |
| 10 | 5.7  | 41.6 | 5.6  | 41.3 | 40.1 | 40.9 | 25.5 | 25.3 | 39.7 | 94.8 | 96.5 | 94.4 | 10 |
| 11 | 5.2  | 41.6 | 2.5  | 41.1 | 40.2 | 40.7 | 27.0 | 26.2 | 40.8 | 5.4  | 94.6 | 97.2 | 11 |
| 12 | 4.5  | 42.2 | 5.4  | 41.3 | 39.8 | 40.4 | 25.2 | 25.1 | 39.2 | 3.6  | 5.6  | 94.6 | 12 |
| 13 | 5.1  | 40.8 | 2.3  | 40.3 | 39.8 | 40.1 | 26.3 | 25.7 | 40.1 | 5.8  | 2.8  | 5.5  | 13 |
| 1  | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   | 13   |    |

**Fig 2. Homology comparison of theTTSuV1 isolated complete genome.**The upper-left triangle date represent divergence of complete genomic nucleotide sequence, but the upper-right triangle date represent identity of the complete genomic nucleotide sequence of TTSuV 1.

According to homology analysis, nucleic acid sequence homology was 67.7%~97.7% between the TTSuV1 in this study and TTSuVs from GenBank. The TTSuV1 sequences in this study showed a sequence similarity of 97.7% to strain AB076001 from Japan and 97.2% to strain GU937661 from Fujian in Chia. Sequence similarity of TTSuV1 was low compared with strain AY823990 from Brazil and JF694117 from Sichuan in Chian. Conserved region of TTSuV1 was located in 1nt~706nt and 2 276nt~2 893nt. ORF1was in 534nt ~2 498nt. ORF2 was in 430nt~651nt and ORF3 was in 430nt~647nt and 2 078nt~2 498nt.

**Phylogenetic Analysis**

The sequences from the PCR products of TTSuV1 positive samples were used for diversity and phylogenetic studies according to the complete genetic sequences of TTSuV1 from NCBI. The TTSuV1 sequences in this study showed a low sequence similarity of 50% to TTSuV2. The identity ranged from 90 to 98% compared with TTSuV1 sequences originated from other places of the world. This TTSuV1 sequences had a higher sequence divergence with these chosen strains between 66.7-97.7%. The phylogenetic tree with two main clades was showed in Fig.3.



**Fig 3. Phylogenetic tree derived from the 16S rRNA gene sequences showing relationships of TTSuV1 to all described species.** Numbers at nodes indicate bootstrap values(percentage of 1000 replicates). Bar value estimated nucleotide substitutions per site.

Reports from many parts of the world suggest that TTSuV1 is widespread among pig populations<sup>[viii,ix]</sup>. In recent years,

TTSuVs and PCV2 have high rate in co-infection with subclinical symptoms but not result in associated diseases<sup>[x,xi]</sup>. The results of Blast comparative analysis suggested that TTSuV 1 in this study has 79%~98% of nucleotide similarity with complete genome sequences of TTSuV 1 from NCBI. The coverage rate of HM633252、HM633242 and JX535325 was 100% comparative with TTSuV 1 in this study. AB076001 from Japan has highest genetic relationship with TTSuV1, so we can make it as reference in study of epidemic disease.

#### IV. CONCLUSIONS

In conclusion, this study is the first in assessing the presence of TTSuV1 in domestic pigs in Jiangnan area of China. In this limited study we have suggested that, like in other places of the world, TTSuV1 is widespread among domestic pigs in China.

#### ACKNOWLEDGEMENTS

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# A study on intrusion detection system against DDOS attack in MANET

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**Abstract-** Mobile ad-hoc network (MANET) is one of the most important fields for development of wireless network. A mobile ad hoc network is an autonomous collection of mobile devices like laptops, mobiles, sensors, etc. MANET is an emerging technology and have great strength to be applied in critical situations in military battlefields and commercial applications such as building traffic system, MANET is infrastructure less, with no any centralized controller exist. So one of the major challenges wireless mobile ad-hoc networks face today is security, because no central controller exists. There are many security attacks in MANET and DDOS (Distributed denial of service) is one important attack in MANET.

**Index Terms-** Security, Mobile ad-hoc network, Intrusion detection system, DDOS

## I. INTRODUCTION

MANET is an autonomous system in which nodes are connected by wireless links and send data to each other. Mobile ad-hoc network (MANET) is one of the most promising fields for research and development of wireless network. As the popularity of mobile device and wireless networks significantly increased over the past years, wireless ad-hoc networks has now become one of the most vibrant and active field of communication and networks. A mobile ad hoc network is an autonomous collection of mobile devices (laptops, smart phones, sensors, etc.) that communicate with each other over wireless links and cooperate in a distributed manner in order to provide the necessary network functionality in the absence of a fixed infrastructure. This type of network, operating as a stand-alone network or with one or multiple points of attachment to cellular networks or the Internet, paves the way for numerous new and exciting applications. there is no any centralized system so routing is done by node itself.



## Figure1.2. MANET Architecture

The main task of the intrusion detection system (IDS) is to discover the intrusion from the network packet data or system audit data. One of the major problems that the IDS might face is that the packet data or system audit data could be overwhelming. Some of the features of audit data may be redundant or contribute little to the detection process. So the reduction in the size of data set is needed. To perform the reduction, two methods of feature selection, namely, markov blanket discovery and genetic algorithm are proposed. The Intrusion Detection System is distributed in nature so each node of a mobile ad hoc network equipped with an IDS.

## II. PROBLEM STATEMENT

Lot of security vulnerabilities in a wireless environment, such as MANET, has been identified and a set of countermeasures were also proposed. However, only a few of them provide a guaranty which is an orthogonal to security critical challenge. ONE OF the serious attacks to be considered in adhoc network is DDoS attack. A DDoS attack is a large scale, coordinated attack on the availability of services at a victim system or network resource. The DDoS attack is launched by sending huge amount of packets to the target node through the co-ordination of large amount of hosts which are distributed all over in the network. At the victim side this large traffic consumes the bandwidth and not allows any other important packet reached to the victim.

Due to its mobility and self routing capability nature, there are many weaknesses in its security. THE presence of a DDOS increases the packet loss in the network considerably AND LEADS TO SECURITY ISSUES IN THE NETWORK. DDoS attack is a natural development from the SYN Flood. The idea behind this attack is focusing Internet connection bandwidth of many machines upon one or a few machines. This way it is possible to use a large array of smaller (or "weaker"), widely distributed computers to create the big flood effect.

Usually, the assailant installs his remote attack program on weakly protected computers using Trojan horses and intrusion methods, and then orchestrates the attack from all the different computers at once. This creates a brute force flood of malicious "nonsense" Internet traffic to swamp and consume the target server's or its network connection bandwidth. This malicious packet flood competes with, and overwhelms, the network's valid traffic so that "good packets" have a low likelihood of surviving the flood. The network's servers become cut off from the rest of the Internet, and their service is denied.

### III. LITERATURE SURVEY

#### A. Types of attack in MANET

Attacks in MANETs can be divided into two main categories, namely passive attacks and active attacks.

**Passive Attacks:** Passive attacks are those where the attacker does not disturb the operation of the routing protocol but attempts to seek some valuable information through traffic analysis. This in turn can lead to the disclosure of critical information about the network or nodes such as the network topology, the location of nodes or the identity of important nodes.

**Active Attacks:** In active attacks, intruders launch intrusive activities such as modifying, injecting, forging, fabricating or dropping data or routing packets, resulting in various disruptions to the network. Some of these attacks are caused by a single activity of an intruder and others can be caused by a sequence of activities by colluding intruders. Active attacks (as compared to passive attacks) disturb the operations of the network and can be so severe that they can bring down the entire network or degrade the network performance significantly, as in the case of denial of service attacks. Therefore, in this paper we have focused on active network layer attacks.

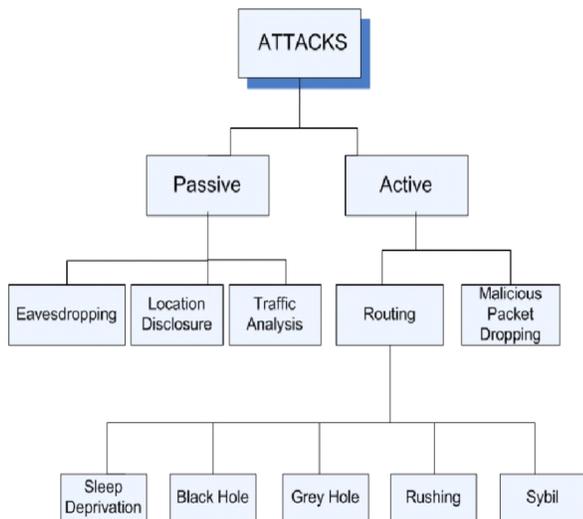


Figure 3.1 Classification of attacks in MANETs

#### 3.1 Wormhole

The wormhole attack is one of the most powerful presented here since it involves the cooperation between two malicious nodes that participate in the network. One attacker, e.g. node A, captures routing traffic at one point of the network and tunnels them to another point in the network, to node B, for example, that shares a private communication link with A. Node B then selectively injects tunneled traffic back into the network. The connectivity of the nodes that have established routes over the wormhole link is completely under the control of the two colluding attackers. The solution to the wormhole attack is packet leashes.

#### 3.2 Blackmail

This attack is relevant against routing protocols that use mechanisms for the identification of malicious nodes and propagate messages that try to blacklist the offender. An attacker may

fabricate such reporting messages and try to isolate legitimate nodes from the network. The security property of non-repudiation can prove to be useful in such cases since it binds a node to the messages it generated.

#### 3.3 Routing Table Poisoning

Routing protocols maintain tables that hold information regarding routes of the network. In poisoning attacks the malicious nodes generate and send fabricated signaling traffic, or modify legitimate messages from other nodes, in order to create false entries in the tables of the participating nodes [6]. For example, an attacker can send routing updates that do not correspond to actual changes in the topology of the ad hoc network. Routing table poisoning attacks can result in the selection of non optimal routes, the creation of routing loops, bottlenecks, and even partitioning certain parts of the network.

#### 3.4 Replay

A replay attack is performed when attacker listening the conversation or transaction between two nodes and put important message like password or authentication message from conversation and use this in future to make attack on the legitimate user pretending as real sender.

#### 3.5 Location Disclosure

Location disclosure is an attack that targets the privacy requirements of an ad hoc network. Through the use of traffic analysis techniques or with simpler probing and monitoring approaches, an attacker is able to discover the location of a node, or even the structure of the entire network.

#### 3.6 Black Hole

In a black hole attack a malicious node injects false route replies to the route requests it receives, advertising itself as having the shortest path to a destination. These fake replies can be fabricated to divert network traffic through the malicious node for eavesdropping, or simply to attract all traffic to it in order to perform a denial of service attack by dropping the received packets.

#### 3.7 Denial of Service

Denial of service attacks aim at the complete disruption of the routing function and therefore the entire operation of the ad hoc network. Specific instances of denial of service attacks include the routing table overflow and the sleep deprivation torture. In a routing table overflow attack the malicious node floods the network with bogus route creation packets in order to consume the resources of the participating nodes and disrupt the establishment of legitimate routes. The sleep deprivation torture attack aims at the consumption of batteries of a specific node by constantly keeping it engaged in routing decisions.

#### 3.8 Distributed Denial of Service

A DDoS attack is a form of DoS attack but difference is that DoS attack is performed by only one node and DDoS is performed by the combination of many nodes. All nodes simultaneously attack on the victim node or network by sending them huge packets, this will totally consume the victim bandwidth and this

will not allow victim to receive the important data from the network.

### 3.9 Rushing Attack

Rushing attack is that results in denial-of-service when used against all previous on-demand ad hoc network routing protocols. For example, DSR, AODV, and secure protocols based on them, such as Ariadne, ARAN, and SAODV, are unable to discover routes longer than two hops when subject to this attack. develop Rushing Attack Prevention (RAP), a generic defense against the rushing attack for on-demand protocols that can be applied to any existing on-demand routing protocol to allow that protocol to resist the rushing attack.

### 3.10 Masquerade

It is an intruder who gain the privilege of any one system as an authenticate user by stolen user password, through finding security gaps in programs, or through bypassing the authentication mechanism.

### 3.11 Passive Listening and traffic analysis

The intruder could passively gather exposed routing information. Such an attack cannot effect the operation of routing protocol, but it is a breach of user trust to routing the protocol. Thus, sensitive routing information should be protected. However, the confidentiality of user data is not the responsibility of routing protocol.

## IV. INTRUSION DETECTION SYSTEM

To solve the security issues we need an Intrusion detection system, which can be categorized into two models:

1. Signature-based intrusion detection [1]
2. anomaly-based intrusion detection.

In Signature-based intrusion detection there are some previously detected patron or signature are stored into the data base of the IDS if any disturbance is found in the network by IDS it matches it with the previously saved signature and if it is matched than IDS found attack. But if there is an attack and its signature is not in IDS database then IDS cannot be able to detect attack. For this periodically updating of database is compulsory.

### Disadvantage

System is that if there is an attack and its signature is not in IDS database then IDS cannot detect that attack.

To solve this problem anomaly based IDS is invented, in which firstly the IDS makes the normal profile of the network and put this normal profile as a base profile compare it with the monitored network profile. Anomaly based IDS are based on tracking unknown unique behavior pattern of detrimental activity

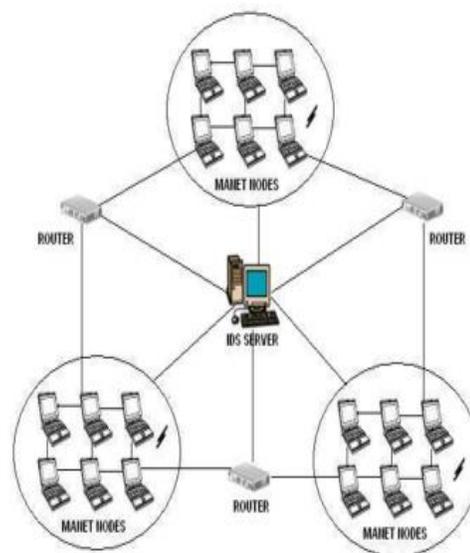


Figure 4.1 Intrusion detection system

### Advantages

1. Doesn't require prior information of the node
2. Helps to reduce the "limitations problem".
3. Conducts a thorough screening of what comes through.

## V. CONCLUSION

In this paper, an introduction to mobile ad hoc networks is provided along with its various vulnerabilities. We firstly survey various attacks and problems Different types of attacks called Active and Passive are discussed. After that a survey is conducted regarding intrusion detection techniques which can find out misbehaving links in reliable manner like Security is a very important in MANET. A variety of attacks have been discussed in this paper. An Intrusion Detection System uses various techniques for detecting attacks like DDoS attack on the wireless mobile adhoc network. The benefit of this IDS technique is that it can be able to detect attack without prior knowledge of attack. Intrusion detection on attack is easy in wireless network as compare to wired network. One of the serious attacks to be considered in ad hoc network is DDoS attack. The Security research area is still open as many of the provided solutions are designed keeping a limited size scenario and limited kind of attacks and vulnerabilities. Intrusion detection systems can effectively identify malicious activities and help to offer adequate protection. Therefore, an IDS has become an unavoidable and important component to provide defense-in-depth security mechanisms for MANETs.

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# Rare case of intragastric primary malignant melanoma

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**Abstract-** Malignant melanoma is the leading cause of death due to skin disease. Malignant melanoma is known to metastasize to different organs of the human body with an unusual predilection for the gastrointestinal tract. Gastrointestinal invasion is a rare condition and is often associated with the invasion of other visceral organs.

**Index Terms-** Gastric melanoma, Metastasis,

## I. INTRODUCTION

Primary intestinal melanoma is difficult to differentiate from metastatic melanoma, especially given that the primary cutaneous lesion has the potential to regress and disappear. In addition, melanoma by itself is a great mimicker of other neoplastic conditions and may create a major diagnostic challenge when presenting at an intrabdominal location. The mean survival time of these patients is consistently less than one year. The exact clinical incidence of gastrointestinal melanoma cannot be determined from any large series, but the stomach, after the small bowel, is the second most common site involved. Tumour thickness is the single most important prognostic factor.

## CASE STUDY

- ❖ 60 yrs old female patient came with the complaints of low grade fever – 1yr  
Shortness of breath – 1yr  
Loss of appetite – 3months  
Loss of weight – 3 months  
Generalised weakness – 3 months  
Abdominal distension – 20 days  
Edema of feet – 20 days
- ❖ No h/o fever ,cough ,chest pain ,vomiting,loose motions,oliguria,bleeding manifestations at present.
- ❖ Past history : no h/o similar complaints in the past
- ❖ Operated for haemorrhoids 2 yrs back
- ❖ Family history: not significant
- ❖ Personal history : mixed diet , decreased appetite , bowel & bladder regular
- ❖ General examination:
  - ❖ 60 yrs old female pt concious, coherent
  - ❖ no pallor ,icterus, cyanosis,clubbing
  - ❖ edema feet (+), lymphadenopathy (+)
  - ❖ vitals stable
- ❖ GIT Examination:

Upper GIT – Normal

Lower GIT:

Abdomen is uniformly distended

No Organomegaly

Liver span –

Ascites present, shifting dullness (+)

❖ CVS Examination:

Cardiomegaly

raised JVP

➤ Investigations:

Hb: 13 gms, WBC: 7200, Platelets –adequate

Liver function test: Total Bilirubin- 0.9, Total Proteins – 7.2

PT INR – 1.1

Ascitic fluid: Proteins – 3.6 , Cell count – 280, Adenosine deaminase(ADA) – 12, No malignant cells

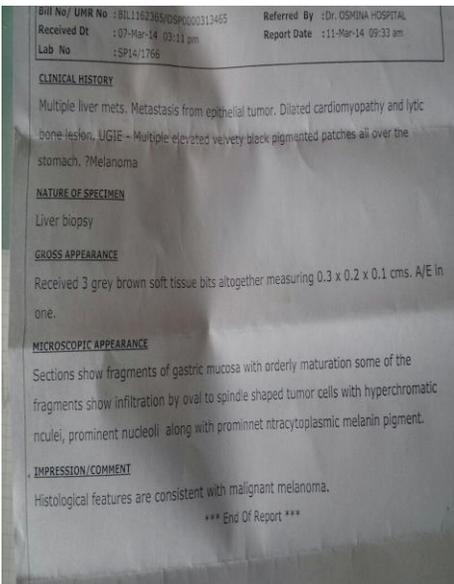
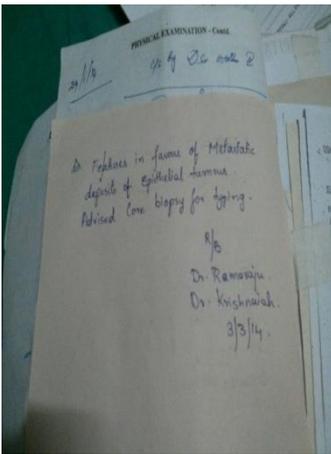
Ultrasonography Abdomen – Cirrhosis of liver with multiple tiny hypo echoic nodules

2D Echocardiography – Global hypokinesia of LV, all chambers dilated, LV & RV dysfunction.

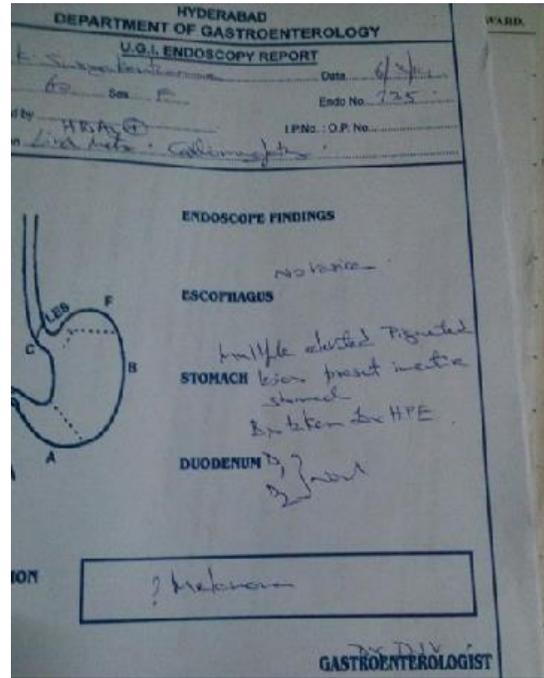
- CT Chest & Abdomen – Cardiomegaly, mediastinal pleural collection +, multiple hyper intense lesions in both lungs basal segments and Lt upper lobe.  
ill defined lesions in Lt lobe of liver
- CECT Abdomen – multiple non enhancing hypodense lesions both lobes of liver, pre rectal lymphadenopathy +, irregular lytic lesions in lumbar vertebra
- FNAC(Fine needle aspiration cytology) of Liver – Metastatic deposits of Epithelial tumour
- Upper GI endoscopy(UGIE) – multiple elevated pigmented lesions present in entire stomach ( ? Melanoma)
- Histopathology examination(HPE) of tissue – histological features are consistent with Malignant Melanoma



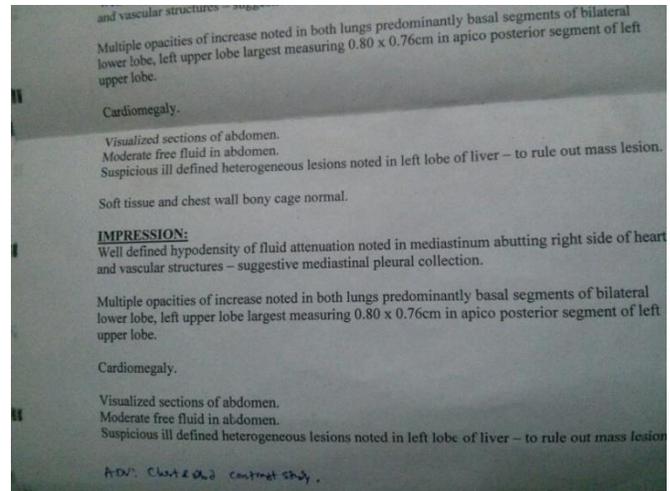
Biopsy specimen



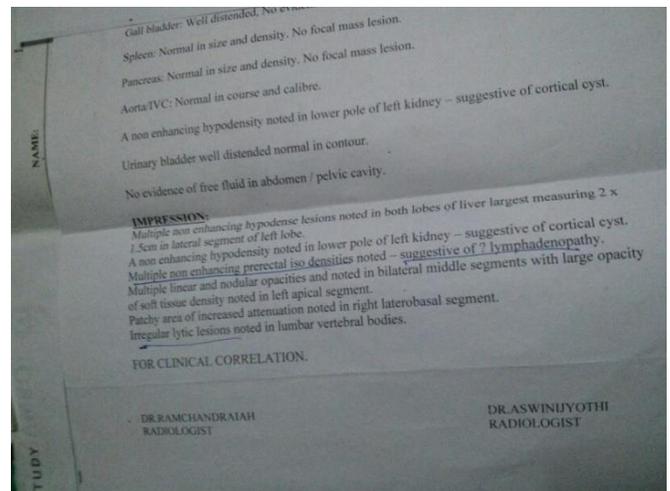
Biopsy report



UGIE



CT CHEST AND ABDOMEN



CECT ABDOMEN REPORT.

## II. DISCUSSION

Melanoma accounts for 1-3% of all malignant tumours. Except cutaneous, other less common melanomas include, among others, those in gastrointestinal tract. However, their primary or secondary nature is often difficult to establish. Referring to stomach, scattered cases of primary melanoma have been reported in literature.

Autopsy frequently reveals gastrointestinal involvement in patients that have died from melanoma, however little evidence emerges in antemortem diagnosis and, even then, usually only in connection with emergency situations such as obstructions, bleeding or perforation. The frequently asymptomatic character of gastrointestinal melanoma explains why it largely eludes detection. Symptoms include mainly gastrointestinal bleeding, abdominal pain, anorexia, nausea and vomiting, weight loss, progressive dysplasia, obstruction, and occasionally acute perforation. Melena in a melanoma patient seems to be a primary symptom for gastrointestinal metastasis, even in the absence of other symptoms. In our case our patient never experienced melena. In the majority of the cases reported, the gastric involvement was a manifestation of terminal metastasis. It has been reported that almost all the areas of the human body can be affected by melanoma metastases.

Many of the previous reports on the gastric spread were based on the radiological features of the metastases. Recently, however, endoscopy has been shown to be a more reliable diagnostic tool. It permits exact morphological evaluation and direct biopsy for pathological diagnosis. Moreover, by endoscopic follow-up it is possible to monitor the course of metastases and to evaluate the results of treatment. The endoscopic classification of the gastric metastases comprises three main morphological types. Firstly there are melanotic nodules, often ulcerated at the tip, which are the most frequently observed endoscopic feature. Secondly are submucosal tumor masses, melanotic or not, which are elevated and ulcerated at the apex. This is the typical aspect of "bull's eye" lesions.

The third morphological type is mass lesions, with varying incidence of necrosis and melanosis. Additionally, gastric metastases may appear even as a simple ulcer. Concerning the anatomical site of the gastric metastases, the majority of them are reported to occur in the body and the fundus, most often at the greater curvature with lesser curvature lesions being uncommon. In our patient, the endoscopic picture of the gastric lesion showed it to be melanotic at her gastric fundus and the first part of her duodenum. The pathological evaluation could confirm the metastatic nature of the melanoma lesion. GIT metastases can appear in various morphological forms, and therefore immunohistochemistry is often useful in distinguishing between a malignant melanoma and other malignancies.

Although surgical treatment has been attempted in some mel-

noma patients with gastrointestinal metastases, surgery seems to be of limited practical value and should be performed only in carefully selected patients and in patients with complications. The poor general condition of our patient by the time of the diagnosis, complicated with other organ (liver, bone and lungs) metastases, did not allow any surgical treatment.

Metastatic melanoma in various areas, from an unknown primary lesion, is well documented in the literature. The stomach, after the small bowel, is the second most common site involved. The primary origin of a melanoma in the stomach is extremely unlikely and can be accepted only if the absence of any other primary lesion is confirmed. Endoscopy has been shown to be the most reliable form of examination for the diagnosis of gastric metastases. In addition, gastric invasion is most often associated with the invasion of other organs and the mean survival time of patients presenting with a gastric metastasis is consistently less than one year. Therefore, every metastatic malignant melanoma case should undergo endoscopic examination for gastrointestinal metastases.

Current findings for our patient were assessed to indicate a malignant melanoma with metastasis to her stomach, liver, lungs and bones. Stomach metastasis due to a malignant melanoma is very rare, and such metastases are hardly ever reported among gastric metastases. This case is the first gastric and duodenal metastases observed in our clinic due to malignant melanoma. Our patient was referred to our oncology clinic after the diagnosis, for chemotherapy.

Malignant melanoma is reported to metastasize to all organs of the human body. Although it is common for it to metastasize to the gastrointestinal tract (GIT), a melanoma located primarily in the gastric mucosa is an uncommon tumor. Gastrointestinal metastases are rarely diagnosed before death, using radiological and endoscopic techniques. Also, GIT metastases can appear in various morphological forms, and therefore immunohistochemistry is often useful in distinguishing between a malignant melanoma and other malignancies.

The median survival time for melanoma patients presenting with gastrointestinal invasion is less than one year. The prolonged survival time reported in a few patients with gastrointestinal metastases is associated with aggressive surgical treatment, adjuvant chemotherapy and immunotherapy. The high mortality rate observed in these patients is associated with multiple metastases to other organs, such as lungs, liver, pancreas, spleen, endocrine glands, and brain.

Criteria for the diagnosis of primary gastric melanoma include the absence of concurrent lesions and the lack of a history of melanoma or atypical melanocytic lesion removal from the skin or other organs. Disease-free survival of at least 12 months after curative surgical excision of the involved organ has been proposed as a criterion for the distinction of a primary lesion from a metastatic lesion, as 50% of patients with stage IV melanoma of

the skin or visceral disease from an unknown primary lesion die 12 months after diagnosis.

The clinical manifestations of primary gastric melanoma are similar to those of other gastric tumors, with weight loss, upper gastrointestinal bleeding, and anemia as the most common symptoms. Most patients are asymptomatic until the tumor becomes advanced. Computed tomography scan of the abdomen, upper endoscopy, and subsequent biopsy are the main diagnostic modalities. On upper endoscopy, a mass-like lesion with black pigmentation may be seen. Immunohistochemical stains with S100 protein, Melan-A, and HMB-45 antibodies have increased the diagnostic sensitivity of biopsy and cytology and play a key role in the diagnosis of these lesions. Chemotherapy options include interferon, interleukin-12, and other agents. Prognosis is extremely poor due to the frequent delay in diagnosis, the inherently more aggressive nature of the tumor, and earlier dissemination due to the rich lymphatic and vascular supply of the gastrointestinal mucosa.

### Conclusion

Malignant melanoma most commonly develops in the skin. The vast majority of gastrointestinal melanomas are metastases from a cutaneous primary tumor. In rare instances, primary malignant melanoma can arise from mucosa of the gastrointestinal tract, particularly from the esophagus, anorectum, and small bowel. Fewer than 15 cases of primary gastric melanoma have been documented in the literature.

There has been speculation in the past as to whether primary melanoma can occur in the stomach, as benign melanocytes are absent in the normal gastric wall. However, melanosis of the stomach has been well documented in the case of anal and esophageal melanoma. Thus, it is possible that primary gastric melanoma can occur in unusual circumstances

### Acknowledgment

Material from the chapter by Walter J. Urba, Carl V Washington, Hari Nadiminti from 18<sup>th</sup> edition, Harrison's principles of internal medicine.

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# Spectrum of microorganisms isolated from mobile phones of general surgeons

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**Abstract-** Mobile phones have been the source of communication within the hospital. Mobile phones can act as an important source of microorganism capable of causing nosocomial infections, however in surgeons mobile they can be more devastating by acting as an important source of surgical site infections.

**Index Terms-** cell phone infection, mobile phone bacteria, mobile phone infections, Nosocomial Infection, surgeon's mobile phone, surgical site infection

## I. INTRODUCTION

Colonized micro-organisms in the devices of health care personnel may be transmitted to patient even if patients do not have direct contact with mobile phones. Nosocomial infection may be caused in patients with weak immune system but micro-organisms may not cause any harm in patients with strong immune system<sup>[1]</sup>.

Risk of infection involved in using mobile phones in the operation theatre has not yet been determined there are no cleaning guidelines available that meet hospital standards. However, mobile phones are used routinely all day long but not cleaned properly as health care workers may/ do not wash their hands as often as they should<sup>[2]</sup>

## OBJECTIVE-

Hence the present study was undertaken with objectives to screen mobile phones of general surgeons for the presence of micro-organisms, to isolate and identify the micro-organisms with the help of standard laboratory techniques

**Methods:** Swabs were taken from mobile phones surfaces, inoculated in Blood agar and MacConkey agar and thioglycollate medium, and incubated aerobically. Growth was identified as per standard microbiological procedures. Antibiotic susceptibility was determined for *S.aureus*

## II. MATERIALS & METHODS

All general surgeons of all age group including surgery residents and consultants and of both genders who were ready for consent were included in this study. This study was carried out from 1st August 2014 to 30th September 2014 at Hi-tech medical college and hospital, Bhubaneswar.

Sterile cotton swab moistened with sterile normal saline was used to collect the specimen. Swab was rotated on the sides, back and over the keypad of mobiles and on screen of a touchscreen phone.<sup>[3]</sup>

The swab were immediately sent to microbiology department after collection, where they were

Inoculated and streaked onto blood agar, MacConkey's agar, Sabouraud's dextrose agar. Plates were incubated aerobically at 37°C for 24 hrs. Isolated organisms were processed according to colony morphology, gram stain. Organisms were identified according to standard protocol<sup>[4]</sup>.

## III. RESULTS

A total of 40 mobile phone swabs of resident doctors were analyzed for presence of microorganisms. It was revealed that of the 40 mobile phones, 26 (65%) were contaminated with microorganisms (Table 1).

26 micro-organisms were isolated from 40 mobile phones as shown in Table 2. Among 26 isolates, Coagulase negative Staphylococci 17 (69.23%) was dominant organism followed by Diphtheroids 7 (26.92%), *Aspergillus niger* 1 (3.84%), MRSA 1 (3.84%)

**Table 1. Microbial contamination of mobile phones of general Surgeons**

| Mobile Phones    | Doctors |
|------------------|---------|
| Contaminated     | 26      |
| Non-Contaminated | 14      |
| Total            | 40      |

**Table 2. Organisms isolated from mobile phones of general surgeons**

| Organism                         | No of surgeons |
|----------------------------------|----------------|
| Coagulase Negative Staphylococci | 17 (69.23%)    |
| Diphtheroids                     | 7 (26.92%),    |
| M.R.S.A                          | 1 (3.84%)      |
| <i>Aspergillus niger</i>         | 1 (3.84%)      |
| Total                            | 26             |

## IV. DIS-

## CUSSION

The present study was conducted at Hi-tech medical college and Hospital. A total of 40 mobile phone swabs of general surgeons were analyzed for the presence of micro-organisms. It was revealed that of the 40 mobile phones, 26 (65%) were con-

taminated with micro-organisms. It is similar to studies conducted by Killic I. H. *et al.* and Datta P. *et al.* who found contamination of mobile phones 61.3% and 72% respectively. [1,2] While studies conducted by Karabay *et al.*, Ulger F. *et al.*, Tambekar D. H. *et al.* found higher rate of mobile contamination than our study i.e. 90.98%, 94.5%, 95% respectively [4-6]. Isolation of Coagulase negative Staphylococci was predominant in our study (**Table 2**) i.e. 69.23% which is comparable with study of Karabay O *et al.*, Killic I. H. *et al.* and Ulger F. *et al.* who found Coagulase negative Staphylococci isolation 68.4%, 60% and 58.96% respectively [1,4,5].

## V. CONCLUSIONS

This study emphasizes that mobile phones act as a carriers & may play an important role in spreading of nosocomial infection. Surgeons are often exposed to pathogenic microorganisms during hospital work & they may carry these micro-organisms on their mobile phones and act as a source of infection to others. Restricting mobiles in health care set up is a debatable issue as use of mobile is unavoidable in emergencies. Hence regular surveillance and development of effective preventive strategies such as regular decontamination of mobile phones with alcohol disinfectant to reduce the burden and use of antimicrobial additive materials are required. We could easily avoid spreading bacterial infections by using regular cleaning agents and rearranging our environment. In conclusion, it can be said that hand hygiene is greatly overlooked and under-emphasized in health care settings as many preach but few follow it.

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# A Study on Serum Iron, TIBC and Nutritional Status in III Trimester Pregnancy

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**Abstract-** A high proportion of women in both industrialized and developing countries become anaemic during pregnancy. Estimates from the World Health Organization (WHO) report that from 35% to 75% of pregnant women in developing countries and 18% of women from industrialized countries are anaemic<sup>(2)</sup>. Many of these women were already anaemic at the time of conception, with an estimated prevalence of anaemia of 43% in non pregnant women in developing countries and of 12% in women in wealthier regions<sup>(2)</sup>. The prevalence of iron deficiency is far greater than the prevalence of anaemia and iron deficiency. In pregnancy, anaemia has a significant impact on the health status of both mother and fetus. Nutritional anaemia is the most widespread nutritional disorder in the world affecting 30 percent world population. It is more common among the expectant mothers. According to Agarwal, maternal anaemia resulted in 12 to 28 percent of fetal loss, 30 percent of perinatal and 7 to 10 percent of neonatal deaths<sup>(2)</sup>. The remaining births have about 50% chance resulting in a low birth weight.

In the present study on iron nutritional status in third trimester pregnant women mostly primigravida has shown that haemoglobina, serum iron levels and related parameters are affected indications Of occurrence of iron deficiency anaemia.. The serum iron level serves as an index of state of iron metabolism. Identification and correction of iron deficiency, and resulting anaemia in pregnancy is the most important safe guard against maternal and fetal morbidity and mortality and good maternal nutrition is a key factor influencing the health of both mother and child. Poor maternal health / nutrition during pregnancy, is one of the several factors that have been associated with intra uterine growth retardation (IUGR) and consequent low birth weight.

**Index Terms-** Haemoglobin, serum iron, serum total iron binding capacity (TIBC), serum unsaturated iron binding capacity (UIBC), serum transferrin saturation (Tf %), serum transferrin, serum total protein and serum albumin levels.

## I. INTRODUCTION

Maternal nutrition and health is considered as most important regulator of human fetal growth. Pregnancy is the period of dynamic change for a mother requiring a lot of care. A woman's normal nutritional requirements increases during pregnancy in order to meet the needs of the growing fetus and maternal tissues associated with pregnancy. Proper dietary balance is

necessary to ensure sufficient energy intake for adequate growth of fetus with out drawing on mother's own tissues to maintain her pregnancy.

Surveys in different parts of India indicate that about 50 to 60% of women belonging to low socioeconomic group are anaemic in the last trimester of pregnancy<sup>(7)</sup>. The major etiological factors being iron and folic acid deficiencies. It is well known that anaemia per se is associated with high incidence of premature births, postpartum haemorrhage, puerperal sepsis and thromboembolic phenomena in the mother. Iron requirement during pregnancy is considerable and is most limited to the second half of the pregnancy specially to the last 12 weeks<sup>(4)</sup>. The maternal plasma iron concentration often decreases during pregnancy and the plasma iron binding capacity increases during pregnancy. One of the most significant changes is that of blood volume expansion by a mean of 50%. Plasma volume increases disproportionately compared with red cell mass, resulting in the physiological decrease in hematocrit. During this time, iron requirement for mother and fetus average nearly 1000mg<sup>(9)</sup>. The amount of iron absorbed from diet together with that mobilized from stores is usually insufficient to meet the demands imposed by pregnancy. The net effect is a state of physiological anaemia that occurs during pregnancy. Current knowledge indicates that iron deficiency anaemia in pregnancy is a risk factor for preterm delivery and subsequent low birth weight, and possibly for inferior neonatal health.

The over all prevalence of iron deficiency in non-pregnant women of reproductive age in the United States 9% -11%, is higher than at other ages apart from infancy<sup>(5)</sup>. Risk is also increased with parity nearly three fold higher for women with 2-3 children and nearly four fold greater for women with 4 or more children thus complicating pregnancy<sup>(5)</sup>.

In the absence of exogenous iron supplement the haemoglobin concentration and the haematocrit fall appreciably. Thus pregnancy poses a physiological iron deficiency state. If detected early and proper treatment is instituted anaemia improves promptly. If however the anaemia progresses to a severe degree and if uncared for, the mother is likely to develop complications. The fetal prognosis is adversely affected by prematurity with its hazards.

## II. MATERIALS AND METHODS

The present study is conducted in the Department of Biochemistry and Department of Obstetrics and Gynecology, S.V.S.

Medical College and Hospital, Mahabubnagar. A total of 40 pregnant women were studied. among these 20 were cases and 20 were controls. Each subject was selected as per inclusion criteria. Pregnant women in their third trimester without any previous antenatal checkup and subjects with no iron folic acid supplementation were included. Pregnant women with any complications were excluded from the study. The biochemical parameters of cases were compared with those of normal female (control group) persons.

**Collection of Blood Samples:**

About 6ml of blood is collected under aseptic condition. About 1ml dispensed into clean dry bottle with EDTA for estimation of blood hemoglobin, the rest of blood is allowed to clot and serum is obtained, with precautions to avoid hemolysis. With that sample Serum iron, Total iron binding capacity, Serum total protein, Serum albumin Serum transferrin saturation, unsaturated iron binding capacity (UIBC) and serum transferrin are calculated from serum iron and TIBC. All investigations were done on same day of sample collection using semi auto analyzer.

Haemoglobin is estimated by cyanmethemoglobin Method, determination of iron binding capacity by Ferrozine method. Transferrin saturation is calculated based on the following formula<sup>(8)</sup>:  $\text{Transferrin saturation (\%)} = \frac{100 \times \text{Serum Iron}}{\text{TIBC}}$

Serum transferrin is calculated based on the following equation<sup>(8)</sup>:  $\text{Tf (gm/L)} = 0.007 \times \text{TIBC (\mu\text{g/dL})}$  or  $\text{Tf (mg/dL)} = 0.7 \times \text{TIBC, (\mu\text{g/dL})}$

Serum total proteins by Biuret method and determination of albumin by Bomocresol Green Method.

**III. RESULTS**

The present study included a total number of 40 subjects comprising of 20 cases and 20 controls. The following table shows the comparative statistical analysis of the laboratory parameters used in assessing the iron status and also in serum total protein and serum albumin that are used as markers for nutritional assessment in the present study of pregnant women during the last trimester.

**COMPARATIVE STATISTICAL ANALYSIS OF ALL BIOCHEMICAL PARAMETERS in controls and cases**

|                           |         | Controls | Cases |
|---------------------------|---------|----------|-------|
| <b>Hemoglobin (gm/dL)</b> | Mean    | 12.92    | 9.49  |
|                           | S.D.    | 0.64     | 1.22  |
|                           | S.E     | 0.31     |       |
|                           | t-test  | 11.05    |       |
|                           | p-value | < 0.001  |       |
| <b>Serum Iron (μg/dL)</b> | Mean    | 91.85    | 48.85 |
|                           | S.D.    | 7.19     | 12.61 |
|                           | S.E     | 3.24     |       |
|                           | t-test  | 13.23    |       |
|                           | p-value | < 0.001  |       |
| <b>Serum TIBC (μg/dL)</b> | Mean    | 317.65   | 426.1 |
|                           | S.D.    | 17.66    | 19.64 |
|                           | S.E     | 5.91     |       |
|                           | t-test  | 18.35    |       |

|                                     |         |         |        |
|-------------------------------------|---------|---------|--------|
|                                     | p-value | < 0.001 |        |
| <b>Serum UIBC (μg/dL)</b>           | Mean    | 222.85  | 377.2  |
|                                     | S.D.    | 25.26   | 14.80  |
|                                     | S.E     | 6.54    |        |
|                                     | t-test  | 23.57   |        |
|                                     | p-value | < 0.001 |        |
| <b>Serum Tf Saturation %</b>        | Mean    | 29.15   | 11.40  |
|                                     | S.D.    | 3.75    | 2.64   |
|                                     | S.E     | 4.13    |        |
|                                     | t-test  | 18.36   |        |
|                                     | p-value | < 0.001 |        |
| <b>Serum Transferrin (mg/dL)</b>    | Mean    | 222.34  | 298.27 |
|                                     | S.D.    | 12.36   | 13.75  |
|                                     | S.E     | 0.13    |        |
|                                     | t-test  | 4.90    |        |
|                                     | p-value | < 0.001 |        |
| <b>Serum Total Proteins (gm/dL)</b> | Mean    | 7.26    | 6.62   |
|                                     | S.D.    | 0.31    | 0.49   |
|                                     | S.E     | 0.13    |        |
|                                     | t-test  | 4.90    |        |
|                                     | p-value | < 0.001 |        |
| <b>Serum Albumin (gm/dL)</b>        | Mean    | 4.19    | 3.59   |
|                                     | S.D.    | 0.25    | 0.32   |
|                                     | S.E     | 0.93    |        |
|                                     | t-test  | 6.50    |        |
|                                     | p-value | < 0.001 |        |

S.D: Standard Deviation.

S.E: Standard Error of the mean.

**Statistical Analysis:** Mean and standard deviation (S.D.) of all variables were calculated and compared with those of controls. Statistical significance was assessed by applying the student's t-test, p-value <0.01 were considered significant.

**IV. DISCUSSION**

Pregnancy is anabolic state that is orchestrated via hormones which facilitates the availability of nutrients to highly specialized maternal tissue characteristic of reproduction and their transfer to the developing fetus. In developing countries like India the maternal nutritional status and outcome of pregnancy can be aggravated by under nutrition contributing to micro nutrient deficiencies (especially iron). Nutritional anaemia is most wide spread nutritional disorder observed in pregnant women. Anaemia is a major contributor to maternal mortality, the case fatality rate vary from less than 1% to more than 50% depending on the available obstetric care and severity of anaemia, cardiac failure being an important cause of maternal mortality. In India anaemia is responsible for 17% of maternal deaths and case fatality rate of pregnancy anaemia approaches 6 to 17%. Anaemia has far reaching health implications, such as increased maternal mortality and morbidity, intra uterine growth retardation, low birth weight, increased neonatal mortality and depressed immunocompetence. The present study is aimed at assessing iron and nutritional status in third trimester pregnant women attending antenatal OP at our S.V.S hospital.

In the present study 60% of cases (12) showed a decreased haemoglobin level and this decrease was found at cut off value of <10gm% which is considered as anaemia (defined by Federation of Obstetrics and Gynaecological Society of India). The serum iron was found to be decreased in 17 cases (85%). TIBC of serum was increased in 19 cases (95%). The serum Transferrin levels were in the reference range, but the protein is less saturated with iron (mean 11.4%). The iron need is not uniformly distributed throughout pregnancy but it is mostly limited to the second half of pregnancy. The amount of iron absorbed from the diet and that mobilized from the stores are inadequate to meet the demand. This sets a physiological iron deficiency state during pregnancy.

Many women enter pregnancy without sufficient iron stores resulting from heavy menstrual periods, previous pregnancies, breast feeding, or poor nutrition. It is difficult to meet the increased requirement for iron through diet, and anaemia often develops unless iron supplements are given. Several studies done in India have shown that the high phytate content in cereals interfere with iron absorption. Measures like addition of vitamins C to the diet may promote iron absorption and prevent iron deficiency anaemia. If supplemental iron is not added to the diet, iron deficiency anaemia will result. Hence iron supplements are strongly recommended as the principal strategy to overcome iron deficiency.

**Nutritional status:** The deposition of protein is not linear throughout pregnancy. Early during pregnancy the protein requirement for fetal development is minimal, where as the requirement for maternal volume expansion and tissue growth may be substantial. Late in pregnancy, the fetus may account for a major increase in protein needs. Poor maternal health / nutrition during pregnancy, is one of the several factors that have been associated with intra uterine growth retardation (IUGR) and consequent low birth weight. Nutritional status assessment provides scope for dietary improvement and potential need for supplementation of specific nutrient for individual pregnant women.

In the present study the nutritional status is quantitated by assessing the serum total proteins and albumin. The serum total protein concentration in cases was found to be lowered in 6 cases (30%) the rest of 14 cases (70%) showed a normal level. The serum albumin concentration was lowered in 6 cases (30%) the rest of 14 cases (70%) showed a normal levels. These changes indicate that protein nutritional status is only moderately decreased.

## V. CONCLUSION

From the results of the present study it can be summarised that iron deficiency status in pregnancy as highly prevalent and commonest cause for anaemia during pregnancy is iron deficiency. The present study also indicates even when protein nutritional is adequate in most of the cases iron deficiency can occurs, as iron sources, factors responsible for absorption, also play important role in maintaining iron nutritional status.

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# Network Intrusion detection on CPU GPU System

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**Abstract-** With the great increase in the usage of computer networks, the risk of having these network to be under attacks have been increased. Number of techniques have been created and designed to help in detecting and/or preventing such attacks. One common technique is the use of Intrusion Detection Systems (IDS). Today, number of open sources and commercial IDS are available to match enterprises requirements. However, the performance of these systems is still the main concern. This paper examines perceptions of intrusion detection architecture implementation, resulting from the use of graphics processor. It discusses recent research activities, developments and problems of operating systems security. Some exploratory evidence is presented that shows capabilities of using graphical processors and intrusion detection systems. The focus is on how knowledge experienced throughout the graphics processor inclusion has played out in the design of intrusion detection architecture.

**Index Terms-** Network analysis, Intrusion detection, GPU, CUDA, Parallel computing.

## I. INTRODUCTION

A Network Intrusion detection System (NIDS) is an intrusion detection system that tries to detect malicious activity such as service attacks, port scans or even attempts to break into computers by monitoring network traffic. A network intrusion detection system reads all incoming packets and tries to find suspicious patterns known as signatures or rules. For instance, if it is observed that a particular TCP connection requests connection to a large number of ports, then it can be assumed that there is someone who is trying to conduct a port scan of all/most of the computers of the network. A network intrusion detection system is not limited to inspecting the incoming network traffic only. Patterns and outgoing intrusion can also be found from the outgoing or local traffic as well. Some attacks might also come from the inside of the monitored network, as in trusted host attack. At the heart of every modern network intrusion detection system there is a string matching algorithm. The network intrusion detection system uses the string matching algorithm to compare the payload of the network packet and/or flow against the pattern entries of the intrusion detection rules, which are a part of every network having a network intrusion detection system[1].

Intrusion detection is the process of monitoring the events occurring in system and analyzing them for signs of intrusions. These intrusions are the results of attackers accessing systems from the Internet, authorized users of the systems who attempt to gain additional unauthorized privileges, and authorized users who misuse the privileges given to them. Intrusion detection is a security technology that attempts to identify and isolate intrusions against computer systems. Intrusion detection is an im-

portant component of a security system, and it complements other security technologies.

## II. NEED FOR INTRUSION DETECTION SYSTEM

The underlying reasons for using intrusion detection systems are relatively straightforward

- identifying attacks that firewall legitimately allow.
- Identifying attempts such as port scan or ping sweep.
- Notice insider hacking.
- Provide additional checks for holes/ports opened through firewalls, intentionally or unintentionally.

### A. Uses of intrusion detection system:

*The following are the basic needs that a intrusion detection system can fulfill,*

- **Controlling the administrator activities:**

Network intrusion detection systems can act as an additional control tool which can check unauthorized configuration changes by the hosts that have been granted administrative privileges.

- **Protection against viruses:**

There has been an alarming increase in the number of viruses and worms that now invade the internet and affect numerous computers every day. Worm epidemics has demonstrated the danger of underestimating the dangers of malicious programs.

- **Detecting unknown devices:**

A network intrusion detection system can help in identifying the address of unknown/external hosts within the protected network segments. It can also detect increased traffic and special kind of activities from specific workstations which were not involved in such kind of activities before. Such activities can be a hint to malicious activities from the hosts and the network administrator must be informed about this.

- **Analyzing the information follows:**

Situations where the communication specialists have no trustworthy information on the protocols used in the protected network segments. A intrusion detection system can control all the protocols and services used in the corporate network, as well as the frequency of their use.

- **Analyzing data from the network equipment:**

Log files from routers and other network equipment can serve as an additional source of information on the various attacks that a data network can be prone to. A network intrusion detection system can be configured to do this work. The task of collecting such log file information and analyzing logged securi-

ty events can be delegated to the intrusion detection system, which in this case, serves as a Syslog server. It can centralize such tasks of collecting log-file information and detect attacks and misuse of the network[2].

### III. STRING MATCHING ALGORITHM

At the heart of every modern network intrusion detection system there is a string matching algorithm. The network intrusion detection system uses the string matching algorithm to compare the payload of the network packet and/or follow against the pattern entries of the intrusion detection rules, which are a part of every network having a network intrusion detection system. String matching needs significant memory and time requirements. In fact, the performance of all network intrusion detection systems depends almost entirely on the performance of the string matching algorithm[4]. String matching generally consists of finding a substring (called a pattern) within another string (called the text). The pattern is generally denoted as,

$$x = x[0..m - 1]$$

whose length is  $m$  and the text is generally denoted as,

$$y = y[0..n - 1]$$

whose length is  $n$ . Both the strings- pattern and text- are built over a finite set of characters which is called the alphabet and denoted by  $\Sigma$ . whose size is denoted by  $\sigma$ . While searching the pattern within the text, at one time, we consider a subset of the text generally with the help of a window whose size is equal to  $m$ . Then the window is aligned with the pattern and they are matched for equality- either from the right or from the left- this specific work is known as an attempt. If they completely match, then either the algorithm ends or it continues to find any more occurrences of pattern in text. If they do not match, then the window is shifted to a new position. This is known as sliding window mechanism.

#### A. Boyer-Moore Algorithm :

This is an algorithm that searches for the location of the first occurrence of pattern in text. During the search operation, the characters of pattern are matched starting from the last character of pattern. The first and simpler pre-computation step done by the Boyer-Moore algorithm is the creation of the bad character shift table. This table is essentially an array indexed by all characters in the alphabet storing integers that represent how far the algorithm may shift upon a mismatch. At all characters indices not in the keyword a value equal to the keyword's length is stored since if a character in the input is encountered that does not appear in the keyword we can shift entirely past it[3]. All table positions of characters present in the keyword store the distance from the right most character in the keyword. Therefore, if the character  $a$  started the keyword and did not appear anywhere else in the keyword then the bad character shift table's (call it  $bctable$ ) value at position  $a$   $bctable[a]$  would be  $m - 1$ . When the character does exist in the keyword this bad character shift allows the algorithm to immediately realign the keyword's right most appearance of the character that was mismatched to the character that cause the mismatch in the input.

The first notable difference of this algorithm is that it starts matching the characters from right to the left instead from left to

right as in most string matching algorithms. When there is a mismatch, the window needs to be shifted and this algorithm uses two pre-computed functions corresponding to the good-suffix shift and the bad-character shift. Suppose, while the character comparison, we get to a point when the characters in the pattern and the text do not match, that is,  $\neq$ . Also, in this condition, we have already matched some of the trailing characters of the pattern with that of the text, that is,  $.$  In this case, we employ the good-suffix shifting. We align the segment of the text with the right most occurrence in the pattern under the condition that it is preceded by a character different from the character at which the mismatch had occurred, that is, different from  $.$  This type of shifting is known as the good-suffix shift because there exists a suffix of the pattern which has already matched with the text. After the shifting, instead of starting the character comparisons from the extreme right of the pattern, we can start the comparison from suffix.

Under the bad-character shift, we align the character with the right most occurrence in  $.$  In some cases, does not occur anywhere in  $.$  In these cases, the window is just shifted by one position, that is, the window is shifted from  $to$   $.$  The bad character shift can sometimes be negative, that is, the window can get shifted to the left instead to the right. So the Boyer-Moore algorithm uses the maximum of the bad-character and the good-suffix shift.

### IV. STRUCTURE OF IDS

#### ➤ Design :

The IDS developed is based on signature-network. An IDS comprises of Management console and Sensors. Management console is the management and reporting console. Sensors are agents that monitor hosts or networks on a real time basis. Our IDS has a database of attack signatures. The attack signatures are patterns of different types of previously detected attacks.

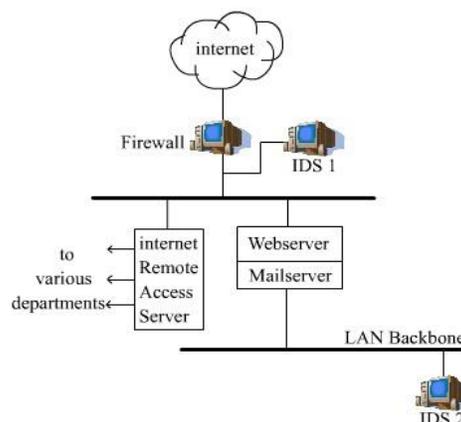


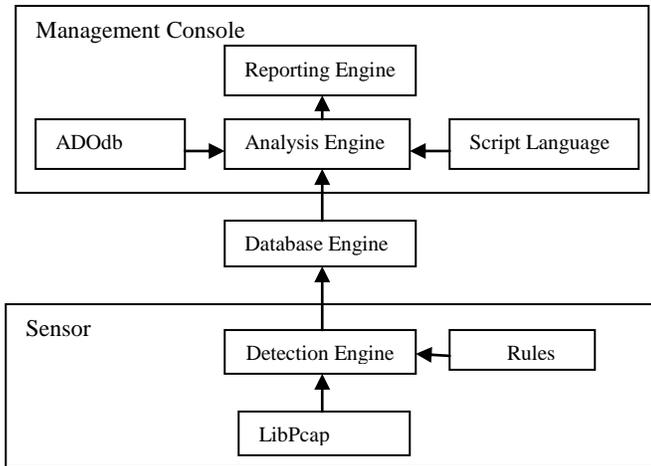
Figure 1: Schematic diagram of IDS placements

The snort sensors are placed in a key position to monitor all internet based traffic in and out of the organization. IDS-1 is a popular placement of IDS which detects attacks that successfully penetrate the firewall. By placing intrusion detection systems

(IDS-2) throughout a corporate network, attacks by insiders will be detected [4].

➤ *Framework of IDS :*

As mentioned in figure software packages are integrated to form the following Intrusion Detection System framework.



**Figure 2: Framework of IDS**

a) *Packages :*

- Snort - Detection Engine

Snort fills an important "ecological niche" in the realm of network security: a cross platform, lightweight network intrusion detection tool that can be deployed to monitor small TCP/IP networks and detect a wide variety of suspicious network traffic as well as outright attacks.

- libPcap- Packet Capturing Library

libPcap is an architecture for packet capture and network analysis for the Linux platforms. It includes a kernel-level packet filter, a low-level dynamic link library ,and a high-level and system-independent library .

- PHP- Web Based General-Purpose Scripting Language

PHP stands for Hypertext Pre-processors. PHP's strongest feature is its database interfacing capability. Connecting a database to the Internet has never been so easy. It supports many of the most popular database servers on the market, including MySQL, Oracle, Sybase, Generic ODBC, and PostgreSQL, to name a few.

- ADOdb- Database Abstraction Library

ADODB stands for Active Data Objects Data Base. PHP is a wonderful language for building dynamic web pages. Unfortunately, PHP's database access functions are not standardized. Every database extension uses a different and incompatible API[5].

- Apache-Web server

Apache is the name of the software that allows you to run a web service on a server. Apache is very popular and provides

access to most web sites on the internet. A recent survey of Web Servers around the world placed Apache Powered sites at over 50 percent of the total.

- ACID-PHP-Based Analysis

Analysis Console engine for Intrusion Detection (ACID), is a PHP-based analysis engine to search and process a database of security incidents generated by security-related software such as IDSs and firewalls.

## V. OVERVIEW OF GPU AND CUDA

### A. *Graphical Processing Units :*

The constant global demand for high-definition graphics in 3D games and real time visualization for applications have lead to massive investments in developing Graphic Processing Units (GPU) for harnessing computational power in an extremely efficient parallel processing computational model. The GPUs have grown almost exponentially in processing power and memory bandwidth [6].

### B. *CUDA:*

CUDA is a parallel computing architecture that enables programmers to use both CPU and GPU processors to cooperate in a single program, using a computing paradigm known as heterogeneous computing. Software developers are able to program general purpose functions or routines to be run on the GPU by simply use "\C for CUDA" while the rest of the program is still executed in the CPU.CUDA is the parallel computing architecture developed by NVIDIA which allows developers to use 'C for CUDA' language to code parts or functions of a general purpose program. The main three key abstractions that are available to the programmer as the C extensions are: a hierarchy of thread groups, shared memories and thread barrier synchronization.

## VI. PACKET

A packet as a unit of data is routed between an origin and a destination on the Internet or any other network. The entire file downloads, Web page retrievals, email, all these Internet communications always occur in the form of packets. When any file is sent from one place to another, the Transmission Control Protocol (TCP) layer of TCP/IP divides the file into chunks of an efficient size for routing. Each of these packets is separately numbered and includes the Internet address of the destination. Basically as series of digital numbers, it conveys the following:

- The source IP address and port numbers;
- The destination IP address and port numbers;

Each packet header contains the proper protocols, the originating address, the destination, and the packet number. Routers in the network look at the destination address in the header and compare it to their lookup table to find out where to send the packet. For the purposes of this work, the adoption of this nature of protocol was used.

### A. *Packet Capturing :*

The first phase of any network intrusion detection system is packet capturing. All data in the network are transmitted in the form of a packet, which comprises of a packet header, packet

data. The packet header consists of several Open Systems Interconnection (OSI) layer information, checksums, fragmentation flags and offsets, source and destination IP addresses, source and destination port numbers, etc.; the packet data consists of the payload. The raw packets thus captured are processed to extract the source and destination addresses, source and destination ports, protocol information, and the packet payload all of which are essential for detecting intrusions. The information that is extracted is stored for comparison and reassembling the packet later.

**B. Transferring packets :**

The simplest approach is to transfer each packet to the GPU separately. However, there is an overhead associated with a data transfer operation to the GPU and many small transfers to the GPU result into a performance decreasing. Therefore the following approach is designed to achieve better performance for packets transferring. Packets obtained by CPU are collected in a buffer for some time. When CPU decides that it's time to process packets it transfers a batch of packets to the GPU for processing[7].

**VII. ARCHITECTURE**

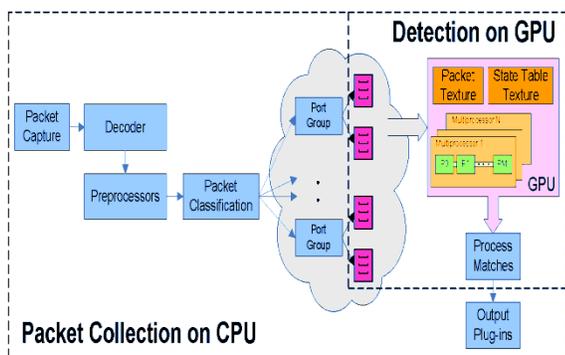


Fig 3: Architecture of Packet Processing on GPU

The overall architecture is shown here where we separate the architecture of our system in three different tasks: the transfer of the packets to the GPU, the pattern matching processing on the GPU, and finally the transfer of the results back to the CPU.

**A. Transferring Packets to GPU :**

The first thing to consider is how the packets will be transferred from the network interface to the memory space of the GPU. The simplest approach would be to transfer each packet directly to the GPU for processing. However, there is overhead associated with a transfer in the form of batching which require many small transfers into a larger one ,so it is much better to transfer directly.

We use a separate buffer for temporarily storing the packets of each group. After a packet has been classified to a specific group, it is copied to the corresponding buffer. Whenever the buffer gets full, all packets are transferred to the GPU in one Operation.

**B. String Searching and Pattern Matching on the GPU :**

Once the packets have been transferred to the GPU, the next step is to perform the pattern matching operation. In a NIDS the main component is the string matching algorithm. The objective of the algorithm is to search for a string (also called a pattern), or multiple strings. Pattern matching algorithms will search through a text for each known pattern individually, which means they will loop through the whole text as many times as the total number of patterns. example of single pattern algorithms is Boyer-Moore(BM) .

**C. Transferring the Results to the CPU :**

Every time a thread matches a pattern inside a packet, it reports it by appending it in an array that has been previously allocated in the device memory. The reports for each packet will be written in a separate row of the array, After the pattern matching execution has finished, the array that contains the matching pairs is copied to the host memory.

**➤ Cat Karat Packet Builder :**

Cat Karat Builder is a handy, easy IP4,IP6,IP4/IP,TCP,UDP,ICMP,IGM,ARP etc packet generation tool that allows to build custom packet for firewall or target testing and has integrated scripting ability for automated testing. This packet builder enables the user to specify the entire contents of the packet from the GUI. In addition to building packets ,it also supports saving packets to packet files and sending packets to network .It can be used at all kind of network areas like traffic generator, packet generator or protocol simulator.

**EXECUTION:**

For optimizing the code, the best way to transfer data into the GPU is to perform one large memory transfer requiring to only access memory once. This is quite important as for every network packet the information has to be copied over. Saving processing time is our number one objective.

The last step that needs to be done before launching the GPU kernel is to specify memory space where the kernel is to store the output of the algorithm it will be running. This memory space is reserved and GPU memory address pointer stored on the CPU side, and then sent to the GPU as a kernel parameter. This has to be done because the kernel does not have an actual output back to the calling function. We have to manually retrieve the data that now has been placed in the reserved memory space on the GPU from our CPU function that started the kernel in the first place. To save memory transfer bandwidth, the output of the algorithm is purely the ID of the pattern that was found and the location of the input text where it was located.

The final operations on the output are carried out by the CPU.

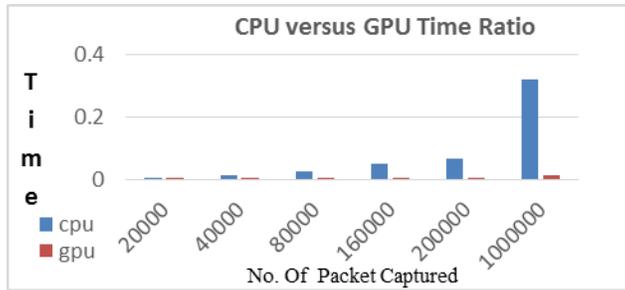
**ANALYSIS:**

**a) CPU versus GPU Time Ratio :**

The analysis is done using string searching and pattern matching algorithm in which every character gets check with the stored database information. A packets have an header and data information sections, each sections have their own fields and analyzing each field is very time consuming task so that part of

work is assigned to the GPU that increases the performance with much better speedup.

Following graph and table shows the comparison status of time Complexity required for CPU and GPU with different scenarios of Packets capturing and analysis



**Table 1: CPU versus GPU Time Ratio**

| No | Packets | CPU Time | GPU Time | Speedup  |
|----|---------|----------|----------|----------|
| 1  | 20000   | 0.007159 | 0.000366 | 19.56011 |
| 2  | 40000   | 0.01263  | 0.000674 | 18.73887 |
| 3  | 80000   | 0.028274 | 0.001266 | 22.33333 |
| 4  | 160000  | 0.052642 | 0.002446 | 21.52167 |
| 5  | 200000  | 0.066887 | 0.003039 | 22.00954 |
| 6  | 1000000 | 0.321635 | 0.014848 | 21.66184 |

### VIII. CONCLUSION

According to the analysis of the results obtained from application, we can conclude that :

- a) The Intruder hosts are identified by detecting malicious packets successfully.
- b) String searching and matching algorithm that is boyer moore works efficiently on GPU than CPU.
- b) Transferring Complex part of work to the GPU resulting in much more speedup.

### IX. FUTURE SCOPE

In future, extensive complex analysis could be carried out using the less complex algorithm, in order to gain more better performance in network security system.

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# Designing of Controller for DVR to Reduce Harmonics in DFIG Wind Turbine

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**Abstract-** This work presents a control strategy of a dynamic voltage restorer (DVR) to improve the doubly fed induction generator (DFIG) based wind turbine in case of fault. The application of a dynamic voltage restorer (DVR) connected to a doubly fed induction generator (DFIG) based wind-turbine-driven is investigated. Voltage in faulty line can be compensated using DVR, while nominal operation of DFIG wind turbine is continued as demanded in actual grid codes.

A dynamic voltage restorer based on the dq0 algorithm is discussed. The proposed control scheme is very effective to detect any disturbance or fault in distribution systems. Simulation results for a 1.5 MW wind turbine using Matlab/Simulink are presented to verify the effectiveness of the proposed scheme.

**Index Terms-** Doubly fed induction generator (DFIG), dynamic voltage restorer (DVR), Voltage Sag, Reactive Power Compensation, dq0 transformation..

## I. INTRODUCTION

WIND energy is gaining popularity all over the world as it is environment-friendly renewable energy source. It has advantage over other renewable energy sources like solar energy, as cost per kilowatt-hour (kWh) is high in later. The contribution of these renewable energy systems to the power system has been increased rapidly. DFIG based wind turbine offer several advantage over Fixed speed induction generator (FSIG)[1]-[4]. Advantages are variable-speed operation, independent control of active [6] and reactive power[5], and its partially rated power converter. It has low converter costs and reduced power losses [6],[7]. Fig. 1 shows the schematic diagram of a DFIG-based wind turbine.

Simple induction generators with rated power converters and the DFIG with partial rating power converters (slip power rating) are the widely preferred topologies for the variable speed operation. DFIG based wind turbine is the most popular option due to varying nature of the wind speeds., Total energy output is 20%–30% higher in case of DFIG-based wind turbine due to variable speed operation, so the cost per kWh energy is reduced

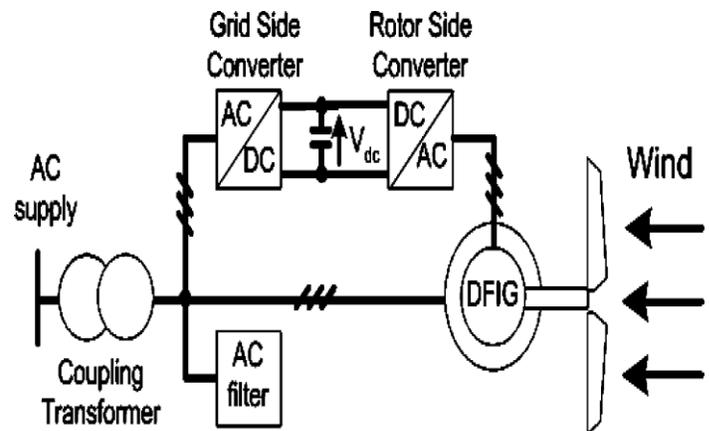


Fig. 1. Schematic diagram of a DFIG-based wind generation system

Fault ride-through capability is the most demanding requirement for doubly fed induction generators (DFIGs) based wind farms. Transmission system must be remain connected when a voltage dip occurs in the grid [8],[9].

A DFIG is a wound-rotor induction generator, where grid and stator are directly connected, and the Rotor windings are fed through a partially rated variable frequency ac/dc/ac converter (VSC), which handles around 24% of the machine rated power while the range of the speed variation is 33% around the synchronous speed [10]. The VSC consists of a rotor-side converter (RSC) and a grid-side converter (GSC) connected back-to-back by a dc-link capacitor. Effective operation in both sub- and super-synchronous speed modes is ensured by controlling rotor current injection using fully controlled bi-directional PWM converters [10]. control of both active and reactive powers using the vector control is already discussed [3], [11]. Generally the direction of this power flow through the rotor circuit is dependent on the wind speed. Below the synchronous speed, active power flows from the grid to the rotor side and at the time rotor side converter (RSC) acts as inverter while the grid side converter (GSC) acts as a rectifier but above the synchronous speed rotor side converter (RSC) acts as the rectifier, and grid side converter (GSC) acts as the inverter. Other proposed solutions for fault ride-through of a DFIG based wind farms include a series dynamic resistance in the rotor in [12] or in the stator in [13] or using a series grid side converter (GSC) topology as in [14].

Any disturbances in grid voltage has severe effect on DFIGs, as described in [6] and [7] for balanced and unbalanced voltage sag, and requires an extra protection for the rotor side

converter. When a voltage sag occurs, sudden change in stator voltage cause unexpected variation in stator flux. As rotor keeps rotating and a high slip occurs, and an overvoltage and overcurrent in the rotor circuit occurs. Higher overcurrents and overvoltages is produced because of asymmetrical faults .as there is negative sequence component in the stator voltage and the slip of this negative sequence component is very high [15].Wind farms connected to transmission system have to stay connected whenever a voltage sag occurs in the grid, [9].Objective is that disconnection of the DFIG during grid voltage sag is avoided. Various crowbar topologies can be selected, as it is explained in [2]-[4].Crowbar is a resistive network connected to the rotor circuit, in case of rotor overcurrents and disable the rotor side converter (RSC) as described in [15].Machine draws a high short circuit current whenever the crowbar is activated, and power network draws large amount of reactive power, which is not acceptable according to actual grid code requirements. So, various other methods for protection have to be investigated for fault ride-through of a DFIG.

### II. DFIG MODEL

The actual behavior of the DFIG is investigated with dynamic equation which is considered for more realistic observation. The dynamic behavior of the DFIG in synchronous reference frame can be represented by the Park equations where the rotor quantities are referred to the stator side. The stator and rotor voltages in synchronous reference frame are expressed as follows:

$$\left. \begin{aligned} V_{ds} &= R_s i_{ds} + \frac{d\phi_{qs}}{dt} - \omega_s \phi_{qs} \\ V_{qs} &= R_s i_{qs} + \frac{d\phi_{ds}}{dt} + \omega_s \phi_{ds} \\ V_{dr} &= R_r i_{dr} + \frac{d\phi_{qr}}{dt} - (\omega_s - \omega_r) \phi_{qr} \\ V_{qr} &= R_r i_{qr} + \frac{d\phi_{dr}}{dt} + (\omega_s - \omega_r) \phi_{dr} \end{aligned} \right\} (1)$$

The flux linkage equations of the stator and rotor can be related to their currents and are expressed as follows:

$$\left. \begin{aligned} \phi_{ds} &= L_s i_{ds} + L_m i_{dr} \\ \phi_{qs} &= L_s i_{qs} + L_m i_{qr} \\ \phi_{dr} &= L_r i_{dr} + L_m i_{ds} \\ \phi_{qr} &= L_r i_{qr} + L_m i_{qs} \end{aligned} \right\} (2)$$

Equations (1) to (2) are the set of differential equations which represent a fourth order model for describing the dynamic behavior of DFIG.

### III. DYNAMIC VOLTAGE RESTORER (DVR)

Dynamic Voltage Restorer (DVR) is a series connected solid state device which injects voltage into the system and regulate the load-side voltage. It is normally installed in between the supply and the feeder in a distribution system. In the event of a disturbance it boost up the load-side voltage and avoid any power disruption to that load . There are various control schemes and circuit topologies that can be used to implement a DVR. DVR is used to compensate voltage sags and swells, as well as it can compensate line voltage harmonics, reduce transients in voltage and fault current limitations. DVR consists of an injection / booster transformer, a harmonic filter, a voltage source converter (VSC), DC charging circuit and a control and protection system as shown in Figure 2.The DVR injects active power into the distribution line in sag correction techniques during the compensation period . Hence, for long duration sags the capacity of the DC link or energy storage unit become a limiting factor in the disturbance compensation process.

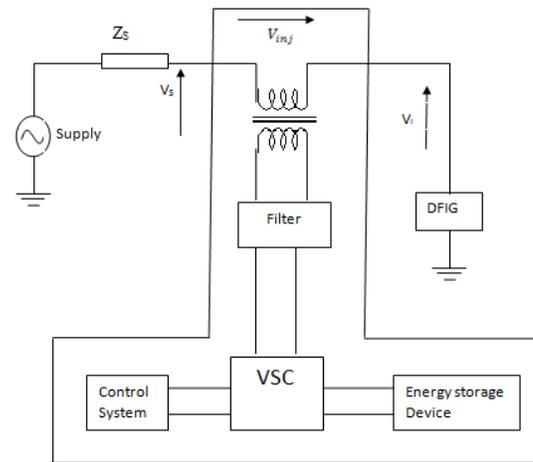
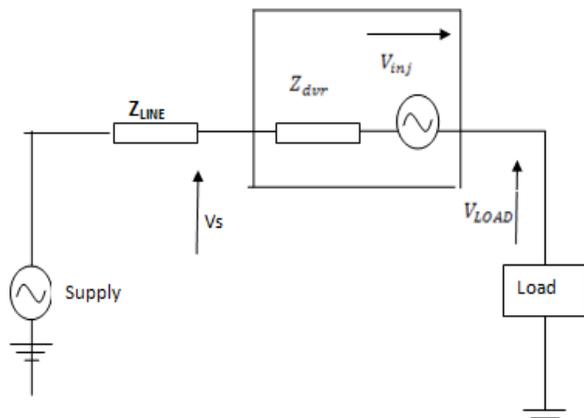


Figure 2.Dynamic Voltage Restorer (DVR) schematic diagram

#### A .Equivalent Circuit Of DVR:

The DVR does not depend upon the type of fault or any event that happens in the system, but the whole system must be in connection with the grid, i.e. the line breaker does not trip. By compensating the positive economical design can be achieve .Because of infinite impedance for this component. the zero sequence part of a disturbance will not pass through the step down transformer. The equivalent circuit of the DVR is shown in Fig. 3.



**Figure 3 Equivalent circuit of DVR**

When the source voltage drops or increases, the desired load voltage magnitude  $V_L$  can be maintained by injecting a series voltage  $V_{inj}$  through the injection transformer and this is done by DVR. The series injected voltage of the DVR can be written as:

$$V_{inj} = V_L + V_S$$

Where,  $V_L$  is the magnitude of desired load voltage.  $V_S$  is the source voltage during sags / swells condition.

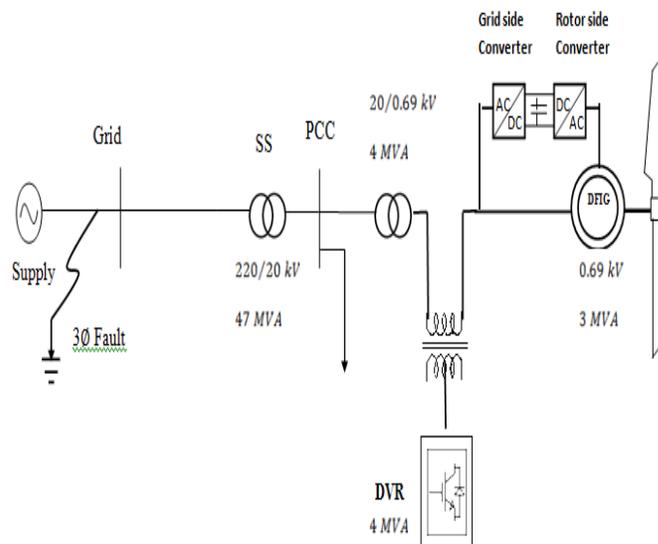
The load current  $I_L$  is given by:

$$I_L = \frac{P_L \pm j * Q_L}{V_L}$$

$P_L$  is active power and  $Q_L$  is reactive power

#### IV. PROPOSED METHOD

Figure-4 shows the configuration of the proposed DVR design using single line diagram, where the outputs of a three-phase half-bridge inverter are connected to the utility supply via wye-open connected series transformer.



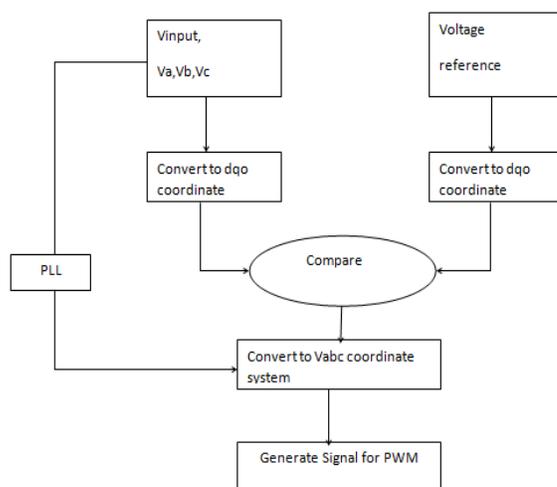
SS – Substation

PCC – Point of common coupling

**Figure 4.:** Single Line diagram of test system with DVR

In case of voltage sag/swell, with the aid of dqo transformation based control scheme, the inverter output can be steered in phase with the ac source while the load is maintained constant. Filtering scheme is provided in the proposed method, output of inverter is installed with capacitors and inductors. Task of the filter is to keep the harmonic voltage content generated by the voltage source inverter to the permissible level

The dqo method gives the sag depth and phase shift information with start and end times. The quantities are expressed as the instantaneous space vectors. Firstly convert the voltage from a-b-c reference frame to d-q-o reference. For simplicity zero phase sequence components is ignored.



**Figure 5:** Flow chart of feed forward control technique for DVR based on dqo transformation

Figure-5 illustrates a flow chart of the feed forward dqo transformation for voltage sags/swells detection. The detection is

carried out in each of the three phases. The control is based on the comparison of a voltage reference and the measured terminal voltage ( $V_a, V_b, V_c$ ).

The error signal is used as a modulation signal that allows generating a commutation pattern for the power switches (IGBT's) constituting the voltage source converter. The commutation pattern is generated by means of the sinusoidal pulse width modulation technique (SPWM); voltages are controlled through the modulation.

The block diagram of the phase locked loop (PLL) is illustrated in Figure-5. The PLL circuit is used to generate a unit sinusoidal wave in phase with mains voltage.

Simulink diagram of control system is shown in Figure-6. PI controller is used and whose output is fed to PWM generator.

The controller may also be used to shift the inverter into rectifier mode to charge the capacitors in the DC energy link in the absence of voltage sags/swells. The dqo transformation or Park's transformation is used to control of DVR.

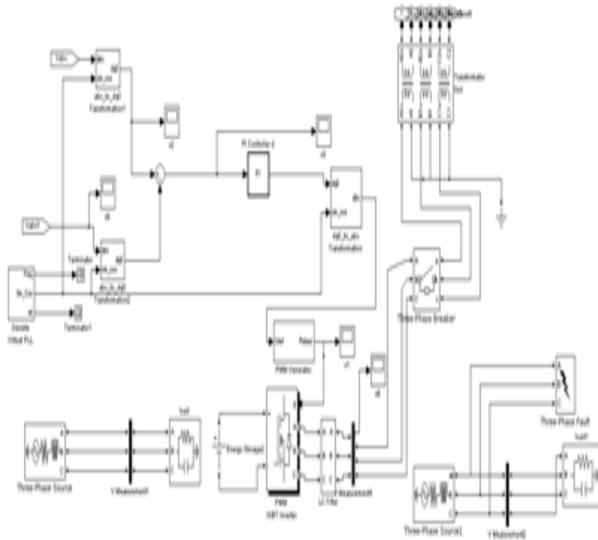


Figure 6 Simulink diagram of control system

V. SIMULATION RESULT AND DISCUSSION

The Performance of DVR in voltage sag mitigation using the proposed controller, a simple distribution network is simulated using MATLAB/SIMULINK. It is assumed that the voltage magnitude of the load bus is maintained at 1 p.u during the voltage sags condition. The results of the most important simulations are represented in Figures. The first simulation of three phase voltage sag is simulated and a three-phase voltage at the utility grid, voltage across DC link in DFIG, Active Power and Reactive power generation of DFIG with 3-Ø fault without DVR is shown in Figure 6.1 (a) -6.1 (d) respectively and three-phase voltage at the utility grid, voltage across DC link in DFIG, Active Power and Reactive power generation of DFIG with 3-Ø fault, with DVR is shown in Figure 6.2 (a) -6.2 (d) respectively. Voltage sag initiated at 0.3s and it is kept until 0.4s, with total voltage sag duration of 0.1s. As a result of DVR, the load voltage is kept at 1 pu.

The parameters of the DVR system are as follows (Table-5.1):

TABLE 5.1 SYSTEM DATA

|                                |       |
|--------------------------------|-------|
| Supply Voltage                 | 480 V |
| System Frequency               | 60 Hz |
| Series transformer turns ratio | 1:2   |
| DC link Voltage                | 500V  |
| Filter Inductance              | 0.5H  |
| Filter capacitance             | 0.5F  |

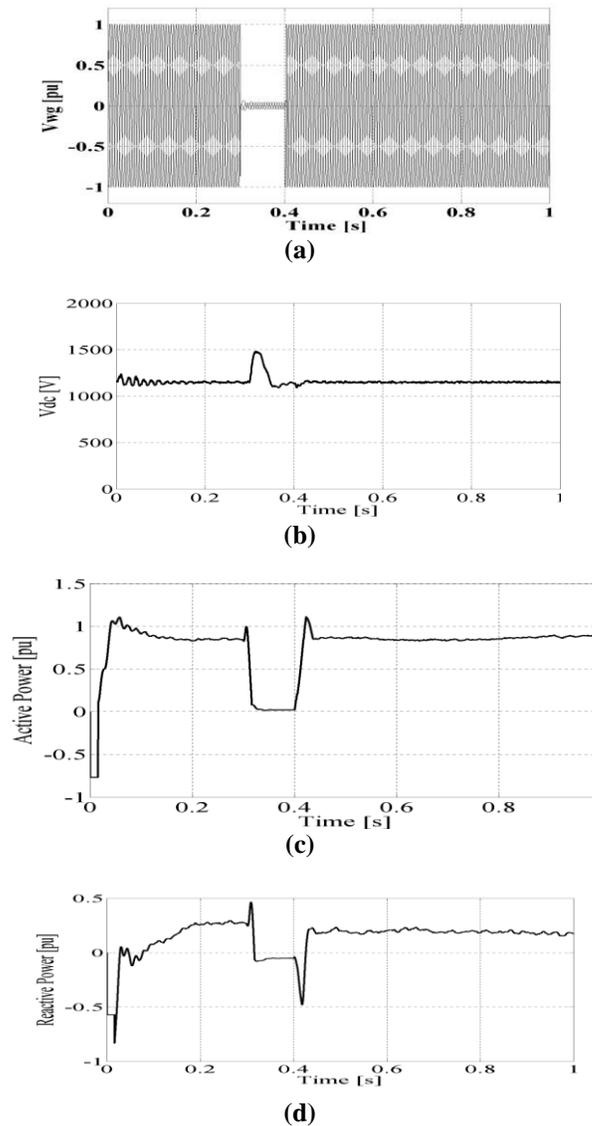
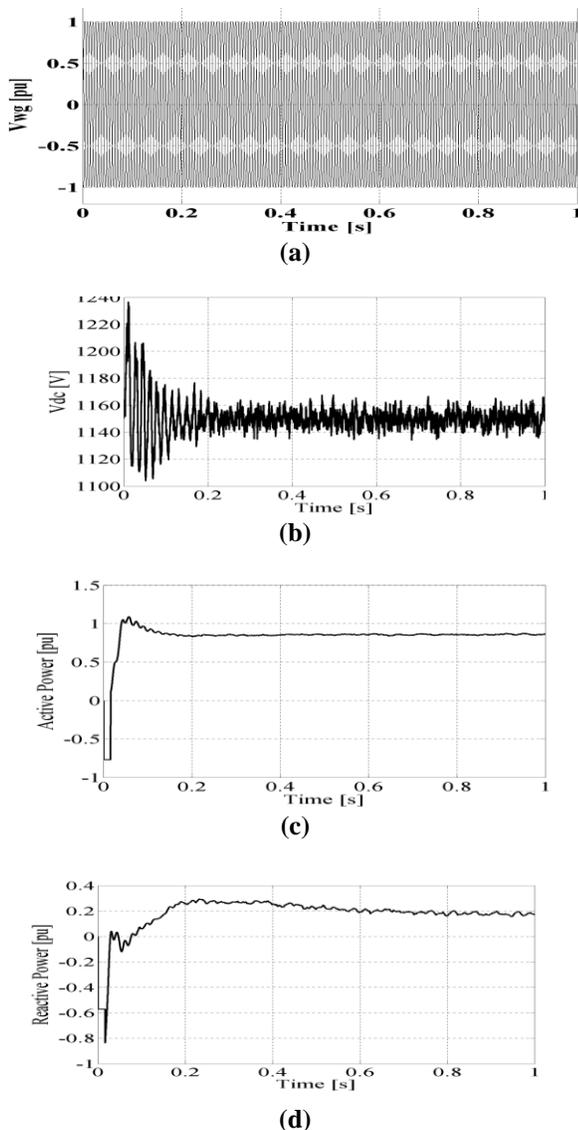


Figure 6.1: (a) Three-Phase voltage at Load (b) Voltage across DC link in DFIG (c) Active Power of DFIG (d) Reactive Power of DFIG with three phase fault without DVR



**Figure 6.2: (a) Three-Phase voltage at Load (b) Voltage across DC link in DFIG (c) Active Power of DFIG (d) Reactive Power of DFIG with three phase fault with DVR**

## VI. CONCLUSION

The modeling and simulation of a DVR using MATLAB/SIMULINK has been presented. A control system based on dqo technique which is a scaled error of the between source side of the DVR and its reference for sags/swell correction has been presented. The simulation shows that the DVR performance is satisfactory in mitigating voltage sags/swells.

The main advantage of this DVR is low cost and its control is simple. It can mitigate long duration voltage sags/swells efficiently. This paper has presented the power quality problems such as voltage dips, swells, distortions and harmonics. Compensation techniques of custom power electronic devices DVR was presented. The design and applications of DVR for voltage sags and comprehensive results were presented. A PWM-based control scheme was implemented.

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# A Comparison of Fentanyl, Esmolol and their Combination for Attenuation of Hemodynamic Response to Laryngoscopy and Tracheal Intubation

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**Abstract- Background:** Laryngoscopy and endotracheal intubation has become an integral part of anesthetic management and critical care of the patient. It has been practiced since its description by Rowbotham and Magill in 1921. Direct laryngoscopy and endotracheal intubation is invariably associated with hemodynamic changes, due to reflex sympathetic discharge caused by epipharyngeal and laryngopharyngeal stimulation.<sup>41</sup> This increase in the sympatho adrenal activity results in hypertension, tachycardia and arrhythmias. Intravenous fentanyl and intravenous esmolol have emerged to be very popular agents used to obtund the hemodynamic stress response to laryngoscopy and endotracheal intubation. The potential benefit and safety of combination therapy of low dose fentanyl and esmolol have been suggested by previous investigations. By modulating both nociceptive input and blunting peripheral adrenergic effects, a combination of intravenous fentanyl and esmolol may prove to be more efficacious than either agent alone

**Methods:** Hundred adults (18–65 yrs), ASA risk I and II, of either sex undergoing elective surgical procedures under general anesthesia were included in this prospective, randomized study. Subjects were divided into four groups of 25 each to receive Normal saline, Fentanyl 4 minutes before induction, Esmolol 2 minutes before induction or Fentanyl and Inj. Esmolol. Pulse rate, Systolic and Diastolic blood pressures were recorded at following stages: Baseline values before premedication, Before induction, On laryngoscopy and intubation, 1 min after intubation, 2 min after intubation, 3 min after intubation, 4 min after intubation, 5 min after intubation. Data analysis was carried out using Statistical Package for Social Science (SPSS, VI 0.5) package. Results were analysed by Anova test.

**Results:** Combination of intravenous fentanyl 2mcg/kg and intravenous esmolol 2 mg/kg is more effective in the attenuation of hemodynamic responses to laryngoscopy and endotracheal intubation than intravenous fentanyl 2mcg/kg or intravenous esmolol 2mg/kg alone.

**Index Terms-** Laryngoscopy, Endotracheal intubation, Esmolol, Fentanyl

invariably associated with hemodynamic changes, due to reflex sympathetic discharge caused by epipharyngeal and laryngopharyngeal stimulation. This increase in the sympatho adrenal activity results in hypertension, tachycardia and arrhythmias.

The rise in the pulse rate and blood pressure is usually transient, variable and unpredictable. Usually, these changes are well tolerated by healthy individuals. However, these transitory changes may be hazardous in patients with hypertension, myocardial insufficiency and cerebrovascular diseases. Left ventricular failure, pulmonary edema, myocardial ischemia, cerebrovascular accidents may occur in such patients.

Various methods have been used in order to blunt this pressor response. Such as - Deepening the plane of anesthesia, Curtailing the duration of laryngoscopy to less than 15 seconds, Lidocaine sprays or gargles prior to intubation, Use of intravenous lidocaine, Use of ACE inhibitors e.g. captopril, enalapril prior to intubation, Vasodilators e.g. hydralazine, nitroglycerine, Calcium channel blockers like nifedipine, Beta blockers like labetalol, esmolol, Opioids like fentanyl, sufentanyl, alfentanyl, Alpha -2 agonists like clonidine, dexmedetomidine, Use of gabapentin and magnesium sulphate. None of the methods have gained universal acceptance.

**ESMOLOL** is an ultra short acting, beta -1 selective adrenergic blocker. It has a rapid onset and short duration of action.

**FENTANYL** is a synthetic opioid agonist ( $\mu$ , receptor), popularly used as an IV analgesic and a component of balanced anesthesia. It is a phenyl piperidine derivative of the 4-aminopiperidine series. It is about one hundred times more potent than morphine as an analgesic.

Intravenous fentanyl and intravenous esmolol have emerged to be very popular agents used to obtund the hemodynamic stress response to laryngoscopy and endotracheal intubation. The potential benefit and safety of combination therapy of low dose fentanyl and esmolol have been suggested by previous investigations.

By modulating both nociceptive input and blunting peripheral adrenergic effects, a combination of intravenous fentanyl and esmolol may prove to be more efficacious than either agent alone.

## I. INTRODUCTION

Laryngoscopy and endotracheal intubation has become an integral part of anesthetic management and critical care of the patient. Direct laryngoscopy and endotracheal intubation is

## II. METHODS

This prospective, randomized and placebo controlled clinical study was designed to include 100 adult patients (18–65 yr) of either sex, ASA risk I and II, undergoing elective surgical proce-

dures under general anesthesia were included in this prospective, randomized study. The patients with baseline heart rate < 60 bpm, history of asthma/ reactive airway disease, history of cardiac disease and hypertension, on treatment with adrenergic augmenting or depleting drugs, PR interval > 0.24 seconds on ECG, 2<sup>nd</sup> and/or 3<sup>rd</sup> degree heart block, history of drug addiction/chronic narcotic use, anticipated difficult airway, requiring more than one attempt at intubation were excluded from the study.

Subjects were divided into four groups of 25 each to receive Normal saline, Fentanyl 4 minutes before induction, Esmolol 2 minutes before induction or Fentanyl and Inj. Esmolol. Pulse rate, Systolic and Diastolic blood pressures were recorded at following stages: Baseline values before premedication, Before induction, On laryngoscopy and intubation, 1 min after intubation, 2 min after intubation, 3 min after intubation, 4 min after intubation, 5 min after intubation.

The study protocol was approved from the institutional ethical committee and written informed consent was obtained from all the patients. All the medications were provided by hospital pharmacy, were identical.

Patients were randomly allocated into 4 groups -

**Group C:** received Inj. Normal saline 10ml IV 4 minutes before induction

**Group F:** received Inj. Fentanyl 2mcg/kg IV 4 minutes before induction.

**Group E:** received Inj. Esmolol 2mg/kg IV 2 minutes before induction.

**Group FE:** received Inj. Fentanyl 2mcg/kg IV 4 minutes and Inj. Esmolol 2mg/kg IV 2 minutes before induction.

All patients were pre oxygenated with 100% oxygen for three minutes, The respective study drug was injected. Patients were then induced with Inj. Sodium Thiopental 5mg - 7mg/kg IV and Inj. Suxamethonium 2mg/kg IV to facilitate laryngoscopy and intubation. Patient was intubated with appropriate size endotracheal tube, one minute after induction and connected to anesthesia machine.

Variables to be monitored were heart rate, systolic blood pressure, diastolic blood pressure and mean arterial blood pressure.

Patient characteristic data were analysed with one-way anova for continuous variables Data analysis was carried out using Statistical Package for Social Science (SPSS, VI 0.5) package. Results were analysed by Anova test.  $P < 0.05$  was considered significant.

### III. RESULTS

#### (1) PATIENT DEMOGRAPHICS:

**Table 1: Demographic data**

| GROUPS   | AGE (in years) | GENDER |        | WEIGHT(in kgs) |
|----------|----------------|--------|--------|----------------|
|          |                | MALE   | FEMALE |                |
| GROUP C  | 31.92 ± 8.87   | 12     | 13     | 60.12 ± 6.41   |
| GROUP F  | 31.56 ± 7.71   | 13     | 12     | 59.24 ± 8.10   |
| GROUP E  | 34.16 ± 11.16  | 12     | 13     | 58.16 ± 6.94   |
| GROUP FE | 33.08 ± 9.52   | 13     | 12     | 58.68 ± 6.61   |

There was no statistically significant difference between four groups ( $P = 0.786$ )

#### (2) HEART RATE :

The heart rate was measured at baseline, before induction, during laryngoscopy and endotracheal intubation and 1, 2, 3, 4 and 5 minutes after intubation (Table 2)

**Table 2: Changes in Heart Rate**

| HEART RATE (bpm) |      | Baseline Value | Before Induction | On laryngo-scopy and ETI | 1 min after ETI | 2 min after ETI | 3 min after ETI | 4 min after ETI | 5 min after ETI |
|------------------|------|----------------|------------------|--------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| GROUP C          | MEAN | 82.08          | 92.92            | 103.08                   | 112.92          | 110.32          | 104.28          | 99.60           | 92.92           |
|                  | ±SD  | 10.33          | 8.34             | 10.40                    | 11.17           | 11.33           | 8.45            | 7.03            | 8.18            |
| GROUP F          | MEAN | 81.44          | 87.08            | 95.64                    | 105.24          | 101.08          | 96.08           | 91.88           | 88.56           |
|                  | ±SD  | 8.93           | 8.80             | 10.06                    | 11.61           | 11.60           | 10.39           | 8.93            | 8.81            |
| GROUP E          | MEAN | 83.44          | 75.40            | 90.64                    | 102.20          | 99.64           | 96.80           | 96.24           | 93.04           |
|                  | ±SD  | 8.99           | 9.24             | 10.09                    | 11.06           | 10.43           | 9.03            | 8.53            | 8.44            |
| GROUP FE         | MEAN | 83.48          | 68.92            | 76.60                    | 85.12           | 82.68           | 80.84           | 78.48           | 77.52           |
|                  | ±SD  | 7.63           | 6.28             | 6.23                     | 7.66            | 7.50            | 7.67            | 7.14            | 7.21            |
| P Value          |      | 0.813          | <0.001           | <0.001                   | <0.001          | <0.001          | <0.001          | <0.001          | <0.001          |

Base line Heart Rate of all the groups are comparable to each other and there is no statistical difference between them (p value > 0.05). P value <0.001 (using ANOVA) - highly significant.

**(3) SYSTOLIC BLOOD PRESSURE :**

The systolic blood pressure was measured at baseline, before induction, during laryngoscopy and endotracheal intubation and 1, 2, 3, 4 and 5 minutes after intubation. (Table 3)

**Table 3: Changes in Systolic Blood Pressure**

| Systolic blood pressure(mm of Hg) |      | Baseline Value | Before Induction | On laryngo-scopy and ETI | 1 min after ETI | 2 min after ETI | 3 min after ETI | 4 min after ETI | 5 min after ETI |
|-----------------------------------|------|----------------|------------------|--------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| GROUP C                           | MEAN | 122.92         | 125.56           | 143.72                   | 157.84          | 153.00          | 141.28          | 136.08          | 132.68          |
|                                   | ±SD  | 8.46           | 7.01             | 8.31                     | 7.74            | 7.85            | 8.20            | 7.65            | 6.93 I          |

|          |      |        |        |        |        |        |        |        |        |
|----------|------|--------|--------|--------|--------|--------|--------|--------|--------|
| GROUP F  | MEAN | 125.08 | 120.08 | 138.00 | 147.76 | 141.44 | 132.56 | 123.52 | 113.28 |
|          | ±SD  | 10.13  | 10.87  | 9.00   | 7.68   | 7.08   | 8.26   | 8.40   | 7.39   |
| GROUP E  | MEAN | 124.24 | 119.80 | 137.68 | 152.00 | 143.04 | 136.52 | 130.20 | 121.88 |
|          | ±SD  | 4.81   | 6.38   | 5.87   | 5.12   | 5.37   | 6.16   | 5.63   | 7.04   |
| GROUP FE | MEAN | 127.68 | 115.92 | 125.88 | 136.96 | 130.28 | 124.80 | 118.60 | 111.08 |
|          | ±SD  | 8.07   | 7.16   | 7.66   | 8.96   | 8.75   | 8.06   | 7.75   | 7.17   |
| P Value  |      | 0.210  | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |

Base line Systolic Blood Pressure of all the groups are comparable to each other and there is no statistical difference between them (p value > 0.05). P value <0.001 (using ANOVA) - highly significant.

#### **4.) DIASTOLIC BLOOD PRESSURE:**

The diastolic blood pressure was measured at baseline, before induction, during laryngoscopy and endotracheal intubation and 1, 2, 3, 4 and 5 minutes after intubation. (Table 4).

**Table 4: Changes in Diastolic Blood Pressure**

| Diastolic blood pressure (mm of Hg) |      | Baseline Value | Before Induction | On laryngoscopy and ETI | 1 min after ETI | 2 min after ETI | 3 min after ETI | 4 min after ETI | 5 min after ETI |
|-------------------------------------|------|----------------|------------------|-------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| GROUP C                             | MEAN | 79.36          | 32.95            | 91.24                   | 101.20          | 96.80           | 92.72           | 89.60           | 87.23           |
|                                     | ±SD  | 4.50           | 4.89             | 3.61                    | 4.07            | 4.61            | 4.35            | 4.43            | 4.40            |
| GROUP F                             | MEAN | 75.40          | 73.36            | 81.16                   | 88.20           | 82.36           | 79.16           | 74.44           | 70.44           |
|                                     | ±SD  | 5.87           | 6.55             | 5.60                    | 4.67            | 4.20            | 4.05            | 4.46            | 5.41            |
| GROUP E                             | MEAN | 76.64          | 82.04            | 86.16                   | 97.40           | 90.76           | 87.00           | 84.16           | 79.88           |
|                                     | ±SD  | 4.74           | 5.23             | 3.93                    | 3.67            | 4.42            | 3.33            | 3.60            | 5.03            |
| GROUP FE                            | MEAN | 78.40          | 69.28            | 79.16                   | 86.40           | 81.12           | 73.52           | 68.56           | 64.48           |
|                                     | ±SD  | 6.48           | 5.96             | 7.06                    | 6.99            | 6.53            | 6.69            | 5.41            | 5.16            |
| P Value                             |      | 0.054          | <0.001           | <0.001                  | <0.001          | <0.001          | <0.001          | <0.001          | <0.001          |

Base line Diastolic Blood Pressure of all the groups are comparable to each other and there is no statistical difference between them (p value > 0.05). P value <0.001 (using ANOVA) - highly significant.

#### IV. DISCUSSION

A hemodynamic response of increased heart rate and blood pressure to laryngoscopy and intubation has been well recognized for over 60 years now. Stimulation of mechanoreceptors in the pharyngeal wall, epiglottis, and vocal cords is thought to be the cause for this hemodynamic response. Various narcotic drugs like morphine, fentanyl, alfentanil, sufentanil and remifentanyl have been used. However, **FENTANYL** has been found to be more effective than the other narcotics in preventing the stress response and also seemed to provide a more stable hemodynamic profile prior to laryngoscopy and tracheal intubation. Fentanyl has been used in various doses varying from 2 to 15 mcg/kg for blunting the stress response and doses greater than or equal to 5 mcg/kg has been reported to be most effective. However, such doses of fentanyl may cause excessive sedation, apnea and chest wall rigidity pre operatively, and nausea, vomiting and prolonged respiratory depression post operatively especially in surgeries with a duration of less than two hours.

**ESMOLOL HYDROCHLORIDE**, an ultra short-acting, cardio selective beta blocker, avoids the above complications, but is found to have variable effectiveness in the recommended doses. In majority of previous studies, esmolol was administered by infusion prior to induction and was found to protect patients from hypertension and tachycardia. But in emergency cases, the preparation and administration of an infusion is time consuming and cumbersome. In such cases, it would be very helpful if esmolol could be administered as a single bolus rather than an infusion prior to intubation.

In various studies conducted before, a bolus dose of 2mg/kg IV Esmolol injected prior to induction has been found to be effective in attenuating cardiovascular response to laryngoscopy and intubation and the optimal time of administration was suggested to be three minutes before laryngoscopy and intubation. Some of the investigators suggested that a modulation of the nociceptive input by fentanyl and blockade of adrenergic receptors by esmolol would enable their combination to provide effective blunting of the response to intubation while minimizing the undesirable effects of larger doses of either agent alone. So, the present study was conducted to compare the efficacy of intravenous fentanyl, intravenous esmolol and their combination in the attenuation of hemodynamic stress responses to laryngoscopy and endotracheal intubation.

A significant attenuation of the heart rate, systolic blood pressure, diastolic blood pressure were observed in groups F, E and FE when compared to the control group C. Group FE however showed the maximum attenuation of heart rate, systolic blood pressure, diastolic blood pressure as compared to the other groups (p<0.001).

The following observations were made:

1. There was a significant increase in the heart rate during laryngoscopy and post endotracheal intubation in all the groups. The increase was highly significant in group C when compared to the other groups. The heart rate returned to pre induction values only in group FE. The combination of fentanyl and esmolol

significantly attenuated the rise in heart rate compared to fentanyl and esmolol alone.

2. There was a significant increase in systolic blood pressure during laryngoscopy and post endotracheal intubation in all the groups. The increase was highly significant in group C when compared to the other groups. The systolic blood pressure returned pre induction values within 5 minutes post intubation in groups F, E and FE. The combination of fentanyl and esmolol produced a more significant attenuation of rise in systolic blood pressure compared to fentanyl and esmolol alone.

3. A significant increase in diastolic blood pressure was observed on laryngoscopy and post endotracheal intubation in all the groups. The increase was highly significant in group C when compared to the other groups. The diastolic blood pressure returned to pre induction values within 5 minutes post intubation in groups F and FE. The combination of fentanyl and esmolol produced a more significant attenuation of rise in diastolic blood pressure compared to fentanyl and esmolol alone.

4. A significant increase in the mean arterial blood pressure was observed on laryngoscopy and post endotracheal intubation in all the groups, with mean arterial blood pressure returning to pre induction values within 5 minutes post intubation in groups F and FE. The combination of fentanyl and esmolol significantly attenuated the rise in mean arterial blood pressure compared to fentanyl and esmolol alone.

Therefore, from the present study it is concluded that **the combination of intravenous fentanyl 2mcg/kg and intravenous esmolol 2 mg/kg is more effective in the attenuation of hemodynamic responses to laryngoscopy and endotracheal intubation than intravenous fentanyl 2mcg/kg or intravenous esmolol 2mg/kg alone.**

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# The sequential surgical path to the first laparoscopic resection with Mini- laparotomy anastomosis for pancreatico-duodenectomy (Whipple's) in Sri Lanka

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**Abstract-** OBJECTIVE To map out the path way from open pancreatico duodenectomy to complete laparoscopic resection detailing the situations which necessitated conversion to the open surgery at different stages of the procedure.

## SUMMARY BACKGROUND DATA

Laparoscopic assisted pancreatico-duodenectomy is an achievable alternative to open surgery which necessitates a steep, stepwise learning curve. The usefulness and progression to laparoscopic resection with hand assisted or hybrid adaptations has been reviewed<sup>1</sup>

## METHOD

Open pancreatico duodenectomy was modified to complete laparoscopic surgery via a series of hybrid surgeries converting to open surgery at varying stages of the procedure. The Adaptation made and the stage at which conversion to open surgery was noted with the resultant success and complications

## RESULTS

Twenty eight patients underwent surgery over two years. In 10 patients laparoscopic mobilization was possible until exposure of the portal vein .It was progressed to supraduodenal dissection in 11 patients and division of stomach and pancreas in 3. Complete resection was achieved in 4 patients. One patient developed pneumonia on the seventh post-operative day and succumbed eight days later. Other patients were discharged eight to ten days following surgery. Postoperative complications were minimal in all patients and none had anastomotic leaks or prolonged ileus. All pathological specimens revealed clear resection margins.

## CONCLUSION

Laparoscopic pancreaticob duodenectomy poses a steep and challenging learning curve. Conversion to open surgery at varying stages of the procedure provides the confidence and improvement of the skills until successful completion.

## I. INTRODUCTION

Pancreatico-duodenectomy is the surgical treatment of choice for carcinoma of the peri ampullary region and head of pancreas. The open procedure is associated with considerable morbidity and occasional mortality. The long incision, continuous handling and prolonged use of retractors can result in post operative respiratory inadequacy due to severe pain and ileus. There is often significant blood loss. Laparoscopic assisted pancreatico-

duodenectomy is an achievable alternative minimizing post-operative complications, thus facilitating early feeding, mobilization and discharge from hospital. .(1,2,4,6).

Laparoscopic laparoscopic pancreatico-duodenectomy necessitates a steep, stepwise learning curve and literature indicates the need of further studies to recommend its routine use.(4,5,6,7,8)

We describe the sequential progression adopted by us detailing the situations that necessitated conversion to open surgery at differing stages of the procedure until successful completion.

Patients were clinically evaluated for associated co- morbidities and optimized as required. Procedures were carried out under general anaesthesia supplemented by epidural analgesia. Patients were positioned head up (30degrees) and a left sided tilt of 20 degrees.

Abducting the legs to 60 degrees enabled positioning of the surgeon closer to the surgical field.

The laparoscopic screen was placed over the right shoulder. And was adjusted to provide a clearer vision.

We used five ports. Pneumoperitoneum was created by insufflation of CO2 at a pressure of 14 mmHg. The gastro-colic ligament was divided to enter the lesser sac. Colon was mobilized from the mid transverse colon to caecum. The duodenum was identified and 'kocherized' and the inferior vena cava was exposed until the left renal vein crossed the abdominal aorta. Duodenal mobilization was continued until division of the ligament of Treitz

Subsequently the portal vein was exposed to the neck of pancreas. Dissection continued until the common bile duct and common hepatic artery were exposed.. This was followed by clipping and division of the gastro-duodenal artery. Stomach was transected using staplers and the pancreas was divided in front of the portal vein. The jejunum was transected using staplers.

The gall bladder was separated from the liver bed and division of the common hepatic duct completed the resection.

A mid line laparotomy of not exceeding 10 cm was adequate to retrieve the specimen and perform the anastomoses - pancreaticojejunostomy, hepatico-jejunostomy and gastro-jejunostomy

Twenty eight patients underwent surgery over two years. In 10 patients laparoscopic mobilization was possible until exposure of the portal vein .It was progressed to supraduodenal dissection in 11 patients and division of stomach and pancreas in 3. Complete resection was achieved in 4 patients. Blood loss never exceeded 500ml during all laparoscopic procedures of varying extent.(Table 1)

The meticulous fluid balance, monitoring and vigilance reduced complications due to altered physiology owing to pneumoperitoneum, position, abdominal compartment syndrome with aorto-caval compression leading to impediment of perfusion to organs, possibility of gas embolism. (9) The respiratory and cardiovascular parameters were stable throughout the procedures.

Following extubation, all patients were cared for in the ICU. Pain relief was provided using the epidural catheter for the first day. Subsequently the patients were comfortable with diclofenac sodium suppositories (100mg) twice a day. The requirement for opioid analgesics was minimal. All patients were mobilized after twenty four hours.

Patients were given oral sips forty eight hours after surgery, semisolids on the fifth post-operative day and a normal diet two days later.

One patient developed pneumonia on the seventh post-operative day and succumbed eight days later. Other patients were discharged eight to ten days following surgery.

Postoperative complications were minimal in all patients and none had anastomotic leaks or prolonged ileus.

All pathological specimens revealed clear resection margins.

## II. DISCUSSION

Laparoscopic pancreaticoduodenectomy poses a steep and challenging learning curve for a surgeon. The usefulness and progression to laparoscopic pancreaticoduodenectomy with necessity for hand assisted or hybrid adaptations was reviewed by Gagner and Palermo in 2009.

Adaptation to a sequential learning curve requiring conversion to open surgery at varying stages of the procedure due to lack of progress or risk of bleeding was practised for the safety of the patient. Prior experience of the open technique is a necessity.

Following a laparoscopic dissection to any stage of the resection, the subsequent laparotomy for progression required a mid-line incision less than 10cm in length. Our intent is to complete the hepatico jejunostomy laparoscopically in the future that would facilitate the pancreatico gastrostomy and gastro-jejunosotomy using a smaller incision.

All the patients were stable intra and post operatively enabling extubation at the end of procedure. Analgesic requirements, period of ICU and hospital stay, were much less than following open surgery. Oral intake was earlier than with the open procedure and the patients were considerably more comfortable.

## III. CONCLUSIONS

Sequential surgical progression towards laparoscopic pancreaticoduodenectomy by us is described with the intent of encouraging a technique primarily to minimize patient discomfort, blood loss and enable early feeding, mobilization and discharge; thus reducing institutional costs. Our experience reveals that this technique is achievable and outcomes are more favourable to patients compared to open pancreaticoduodenectomy.

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# Tetraploid induction approach induced by colchicine of *Prunella vulgaris* for. *albiflora* Nakai

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**Abstract-** This study was conducted to find out the effective induction method of tetraploid plants to obtain potential data for cultivating superior varieties by colchicine treatment. The seed germination was decreased by the higher concentration of colchicine treatment and longer soaking time. A total of 907 individuals were germinated in 16 treated plots except control (untreated plot) and 28 tetraploids were induced which was about 3.1% of the number of seed germinated. The plant regeneration rate by colchicine treatment on explant of *Prunella vulgaris* for. *albiflora* Nakai under in vitro culture was decreased with the higher concentration of colchicine. While a total of 312 individuals were regenerated in all treatments, the explant was soaked in more than 0.05% for over 1 hour, tetraploid could be obtained. In particular, for the soaking treatment in 0.05% for 6 hours and 12 hours, 37 tetraploids were induced, which was about 57.8% of the number of plant regenerated. In accordance with the observation on doubling of DNA contents in leaf in order to identify polyploid, the peak DNA content of G<sub>1</sub> phase was 101.3 for diploid and 197.2 for tetraploid. The result confirmed the doubling of DNA content. Furthermore, the number of chloroplasts per guard cell depending on polyploid was around 10 in diploid and 19.3 in tetraploid, which was around 1.9 times as much as diploid.

**Index Terms-** Colchicine, DNA content, morphological characteristic, number of chloroplasts, tetraploid,

## I. INTRODUCTION

As one of allied species of *Prunella vulgaris* var. *lilacina*, '*Prunella vulgaris* for. *albiflora* Nakai' belonging to *Prunella vulgaris* var. *lilacina* family is a perennial plant which bear the white colored flower. Therefore, its scarcity is recognized compared to *Prunella vulgaris* var. *lilacina* that producing purple flowers. In Korea, it is mainly used for medicine and nectar source but supply is limited compared to demand and the method of cultivation is very primitive and there is little full-fledged research for the improvement of varieties and cultivation methods.

The artificial induction of tetraploid plants is generally being made a lot by varying concentration, treatment time and treatment method etc. Colchicine is known to be the inhibition of the formation of spindle fibers by combining tubulin in the process of somatic cell division of plants and induces polyploidization of chromosome by interfering with the formation of microtubules and anodal movement of chromosome in the middle stage of cell division (Hadlaczký et al., 1983).

In general, organs or stems of tetraploid plants become larger (Cockerham and Galletta, 1976; Lapins, 1975) and stems get thicker and longer and leaves and flowers get larger as well. In addition to polyploidization, particularly, the component content of secondary metabolite such as sugars in candy cane, vitamin C in fruit of tomatoes and apples, nicotine in tobacco leaves etc. are changed and characteristics such as virus-free resistance (Hahn, 1969), freezing resistance of mulberry (Park, 1994) etc. are improved in some cases.

Generally, methods to identify polyploidy were regarded as the observation of pollen grains (Bamberg and Hanneman, 1991), number of chloroplast (Chaudhari and Barrow, 1975; Dudley, 1958; Bae et al, 2001), stomatal cells (Borrino and Powell, 1987), marker genes such as 'seed maker' or 'embryo maker' (Bingham, 1969; Verdenius, 1973; Nonda and Chase, 1966), characteristics of the plant (Gaines and Aase, 1926; Hougas and Peloquin, 1957) but the analysis method by the amount of intracellular DNA and chromosome observation known as the most accurate methods were mainly used (Galbraith et al, 1983; Miyoshi and Asakura, 1996; Sari et al, 1999). However, the disadvantages of the method by chromosome when usually used that some technical problems and efforts were accompanied and a large amount of materials cannot be examined. Currently, therefore, polyploidy is determined by simply measuring DNA content with flow cytometry that can analyze a large amount of materials accurately.

In order to obtain basic data for cultivating superior varieties of '*Prunella vulgaris* for. *albiflora* Nakai', this study were conducted to examine the appropriate materials and appropriate concentrations, soaking time, etc. and to find out the effective induction method of tetraploid plants by colchicine treatment.

## II. MATERIALS AND METHODS

### *Tetraploid cultivation and colchicine treatment*

Seeds of '*Prunella vulgaris* for. *albiflora* Nakai' were grown in 2013 and explants of cultured plants were grown after in vitro sterilization that were used as experimental materials. For treatment, 20 ml of 0.01, 0.05, 0.1 and 0.5% colchicine solution were applied in Petridish on which 50 seeds were soaked and left for 1, 3, 6 and 12 hours under the low temperature condition (5°C). Each treatment was repeated 3 times. After soaking, each seed was washed 3~4 times with sterile water and then, it was sown in bed soil for gardening and sprouted in the constant temperature room of 25°C. Germination was investigated when cotyledons emerged and leaves were collected when more than 6 foliage leaves emerged to check the presence or absence of poly-

ploidy. Also, in order to treat explants of cultured plants, 40 ml of 0.01, 0.05 and 0.1% colchicine solution was put in a beaker of 10 ml and then the nodes of '*Prunella vulgaris* for. *albiflora* Nakai' were cut to a length of about 1cm and soaked for 1, 6 and 12 hours. After soaking, each explant was washed with sterile water 3~4 times and then 5 explants were placed in MS medium and each treatment was repeated 9 times. Culture was made at  $25\pm 1^\circ\text{C}$  and illuminated for 16 hours by luminosity of  $40 \mu\text{mol. m}^{-2}. \text{s}^{-1}$ .

#### **DNA content analysis using cytometry**

The plant leaf of each treatment plot was cut to a size of about  $0.5 \times 0.5$  cm and then, HR-A solution (Patec Inc., Germany) was added and then the tissue was crushed to extract DNA. HR-B solution (Patec, Germany) was added to this solution for staining and then, doubling of DNA content was checked by using Flow cytometry (Patec PA-1, Germany) and polyploidy was determined through this result.

#### **Investigation of the number of chloroplasts in guard cells**

In order to observe chloroplasts, it was stained by separating the back side of leaves collected in the middle part of the plant to cut the back side epidermis and then, immersed it in iodine-potassium solution (1%(w/v) iodine, 2%(w/v) potassium iodide) for 2~3 hours and stained back side epidermis was examined through a microscope. To count the number of chloroplasts in guard cells, 30 cells were investigated in leaves of three objects per repetition and then the average was calculated.

### **III. RESULTS AND DISCUSSION**

#### **Seed soaking treatment of colchicine**

Seed germination rate and polyploid induction rate were investigated by different concentration and soaking duration of colchicine in *Prunella vulgaris* for. *albiflora* Nakai seeds and the results were shown in Table 1. The germination rate of seeds were tended to decrease when the higher the concentration of colchicine and the longer the soaking duration. In particular, in the case of 12-hour soaking treatment, the germination rate was found to be significantly suppressed to the range of 6-14.7% in the concentration plot of more than 0.05%. Total 907 individuals showed 37.8% of germination rate that were germinated in 16 colchicine treated plots except for control (untreated plot). In order to check polyploidy, GAIN value of flow cytometry was fixed to 520.0 and then the DNA content of leaves was investigated. The result revealed that DNA content peak of  $G_1$  phase was doubled to 101.3 in diploid (control plot), 197.2 in tetraploid.  $M_1$  plants of tetraploid in which DNA content was observed doubled and as a result, 28 tetraploid plants with 3.1% content could be obtained (Fig 1).

In order to increase the efficiency of tetraploid induction, seeds were treated with colchicine. Results showed that the induction efficiency of tetraploid plants could be observed higher in the longer duration of soaking time compare to soaking concentration. Also, when colchicine was treated for 6 hours or 12 hours regardless of the high and low concentrations of colchicine, there were differences in the tetraploid induction efficiency but tetraploid plants were induced in all concentration plots. In particular, 5 and 7 tetraploid plants were obtained when treated

for 6 hours at concentrations of 1% and 0.05, respectively, showing the highest induction of tetraploid plants.

From the above results, colchicine concentrations (ranges from 0.05~1%) and treatment duration 6 hours were considered to be suitable concentration and soaking time of colchicine seed treatment for tetraploid plant induction of *Prunella vulgaris* for. *albiflora* Nakai. *Prunella vulgaris* for. *albiflora* Nakai identified as tetraploid was transplanted in pots filled with bed soil for gardening and cultivated for 2 months and then, the growth of the aerial part was investigated. The results are shown in Table 2 and Fig 2. It was prevailed that the plant length of tetraploid plants was longer about 1.3 cm than that of diploid plants while the leaf length of diploid plants was longer. There were no differences in leaf width and petiole length between diploid and tetraploid plants while leaf number of tetraploid was found to be more by about 4 leaves (Table 2). Generally, in the case of tetraploid plants, stems are known to get thicker and leaves and flowers are also larger due to the expansion of organs or tissues (Cockerham & Galletta, 1976; Kim *et al.*, 2003) but *Prunella vulgaris* for. *albiflora* Nakai showed no significant difference except for significantly long plant length and leaf length. These results are considered to result from morphological differences in the early stage of growth.

Looking at the morphological characteristics of tetraploid plants shown after colchicine treatment, several forms of tetraploid plants could be observed such as small or large plants compared to diploid plants. In particular, a lot of egg-shaped tetraploid objects could be seen compared to diploid with lanceolate leaves. In addition, diploid plants have the soft and thin leaf tissue and leaf color is also green while tetraploid plants showed the characteristics of thicker mesophyll tissue and dark green leaf color compared to diploid plants (Fig 2). The number of chloroplasts of guard cells of diploid and tetraploid of *Prunella vulgaris* for. *albiflora* Nakai is shown in Fig 3. As for the number of chloroplasts per guard cell, diploid plants have 10 chloroplasts and tetraploid plants 19.3 and tetraploid was found to have about two times more chloroplasts than diploid. These results were very similar to the results that the number of chloroplasts in guard cells according to polyploidy of potatoes significantly increases, 12.2 in haploid, 18.4 in triploid and 20.2 in tetraploid as polyploidy is increased (Cho *et al.*, 1994) and even for tobacco, the number of chloroplasts in guard cells also increases as polyploidy increases (Bae *et al.*, 2001).

#### **In vitro cultured explant soaking treatment of colchicine**

The effects of soaking treatment concentration and time duration of colchicine on polyploid induction of *Prunella vulgaris* for. *albiflora* Nakai explants being cultured in vitro and plant regeneration are shown in Table 3 and Fig 4. 405 explants of *Prunella vulgaris* for. *albiflora* Nakai were treated with colchicine and as a result, 312 individuals were regenerated at all concentrations, showing 77.0% of regeneration rate and the number of regenerated plants showed a tendency of lowering at the high concentration of colchicine and the longer period of time. In order to check polyploidy, the DNA content of regenerated 312 individuals was investigated after fixing GAIN value of flow cytometry to 490.0 and as a result, DNA content peak of  $G_1$  phase was found to be 100.4 in diploid and 201.1 in tetraploid, showing that DNA content is doubled (Fig 4). The DNA content of regenerated 312 individuals was analyzed and as a result, tet-

raploid plants were obtained from a total of 68 objects, showing the high induction rate of 21.8%. Tetraploid plants were induced in all treatment plots except for colchicine 0.01% at 1 hour soaking treatment plot. However, in the case of plots treated for 6 and 12 hours at the concentration of 0.05%, and the induced 18, 19 tetraploid plants showed the highest results respectively. These results were very similar to the results that the tetraploid plants induction using in vitro culture of *Hypericum perforatum*, the highest induction rate was shown when immersed with colchicine 0.05% for 12 hours (Kwon *et al.*, 2013).

The above results showed that induction of tetraploid plants using in vitro culture was found to be about 7.0 times higher than the tetraploid induction rate of 3.1% obtained during seed treatment. So, it is more effective to treat colchicine in explants of in vitro culture showing vigorous cell division than directly treat it in seeds and may be used as a way of efficient induction of tetraploid plants. The characteristics of tetraploid plants after colchicine treatment observed that leaf area gets wider and the form of the petiole gets thicker and shorter compared to diploid. It was observed that diploid carried the weak and thin leaf tissue and leaves were also light green while tetraploid plants showed the characteristics of thicker mesophyll tissue than diploid and leaf color of dark green (Fig 5).

#### IV. CONCLUSION

The efficiency of tetraploid induction depends on the duration of colchicine treatment. The more duration of colchicine treatment, the more efficacies will be observed. Morphological and physiological alterations were observed after colchicine treatment such as egg-shaped tetraploid objects, thick mesophyll tissue. The number of chloroplasts in guard cells was increased as doubled in tetraploid plants compare to diploid plants. The results revealed that the induction rate of invitro cultured tetraploid plants showed higher than the seed treatment method. However, further investigation will be required to find out the induction methods more specifically and precisely.

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**Tables and Figures:**

**Table 1. Effect of colchicine on chromosome doubling and germination in *Prunella vulgaris* for. *albiflora* Nakai.**

| Conc. (%) | Soaking time(hrs) | No. of seeds treated | No. of seeds germinated | % of germination   | No. of tetraploids |
|-----------|-------------------|----------------------|-------------------------|--------------------|--------------------|
| Control   |                   | 50                   | 43.6                    | 87.3a <sup>z</sup> | -                  |
| 0.01      | 1                 | 50                   | 35                      | 70.0ab             | -                  |
| 0.05      |                   | 50                   | 30.3                    | 60.7bc             | -                  |
| 0.1       |                   | 50                   | 28                      | 56.0bcd            | -                  |
| 0.5       |                   | 50                   | 20.3                    | 40.7def            | 1                  |
| 0.01      |                   | 50                   | 31.6                    | 63.3bc             | -                  |
| 0.05      | 3                 | 50                   | 26.6                    | 53.3bcd            | -                  |
| 0.1       |                   | 50                   | 20.6                    | 41.3def            | 2                  |
| 0.5       |                   | 50                   | 15.6                    | 31.3efg            | 2                  |
| 0.01      |                   | 50                   | 23.3                    | 46.7cde            | 1                  |
| 0.05      | 6                 | 50                   | 19.6                    | 39.3def            | 7                  |
| 0.1       |                   | 50                   | 11.6                    | 23.3fgh            | 5                  |
| 0.5       |                   | 50                   | 9.3                     | 18.7gh             | 2                  |
| 0.01      |                   | 50                   | 15                      | 30.0efg            | 3                  |
| 0.05      | 12                | 50                   | 7.3                     | 14.7gh             | 2                  |
| 0.1       |                   | 50                   | 4.6                     | 9.3h               | 2                  |
| 0.5       |                   | 50                   | 3                       | 6.0h               | 1                  |

<sup>z</sup>Mean separation within columns by Duncan's multiple range test (p=0.05).

**Table 2. Comparison of growth characteristics in diploid and tetraploid of *Prunella vulgaris* for. *albiflora* Nakai.**

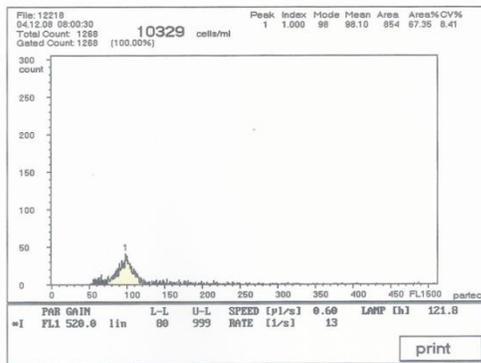
| Ploidy     | Plant height (cm)     | Leaf length (cm) | Leaf width (cm) | No. of leaves | Petiole length (cm) |
|------------|-----------------------|------------------|-----------------|---------------|---------------------|
| Diploid    | 3.0±0.4b <sup>z</sup> | 3.1±0.2a         | 2.2±0.2a        | 13.5±1.0b     | 2.7±0.1b            |
| Tetraploid | 4.3±0.6a              | 2.3±0.3b         | 2.2±0.3a        | 17.3±1.3a     | 2.7±0.5b            |

<sup>z</sup>Mean separation within columns by Duncan's multiple range test (p=0.05).

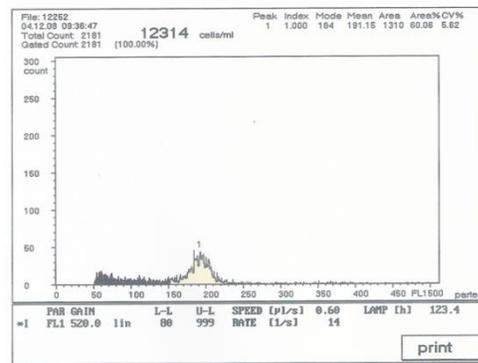
**Table 3. Effect of colchicine on chromosome doubling and plant regeneration in *Hypericum patulum* Thunberg.**

| Conc. (%) | Soaking time(hrs) | No. of explants treated | No. of explants regenerated | % of regeneration  | No. of tetraploids |
|-----------|-------------------|-------------------------|-----------------------------|--------------------|--------------------|
| 0.01      |                   | 45                      | 44                          | 97.8a <sup>z</sup> | 0                  |
| 0.05      | 1                 | 45                      | 42                          | 93.3a              | 2                  |
| 0.1       |                   | 45                      | 37                          | 82.2ab             | 3                  |
| 0.01      |                   | 45                      | 41                          | 91.1a              | 6                  |
| 0.05      | 6                 | 45                      | 36                          | 80.0ab             | 18                 |
| 0.1       |                   | 45                      | 28                          | 62.2bc             | 11                 |
| 0.01      |                   | 45                      | 39                          | 86.7ab             | 5                  |
| 0.05      | 12                | 45                      | 28                          | 62.2bc             | 19                 |
| 0.1       |                   | 45                      | 17                          | 37.8c              | 4                  |

<sup>z</sup>Mean separation within columns by Duncan's multiple range test (p=0.05).



Diploid



Tetraploid

**Fig. 1. Comparison of DNA contents in diploid and tetraploid of *Prunella vulgaris* for. *albiflora* Nakai. Flow histograms showing DNA measurements of nuclei from leaves.**



Diploid

Tetraploid

Fig. 2. Comparison of morphologic characteristics in diploid and tetraploid of *Prunella vulgaris* for. *albiflora* Nakai.

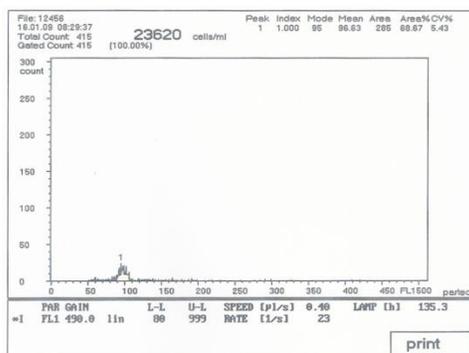


Diploid

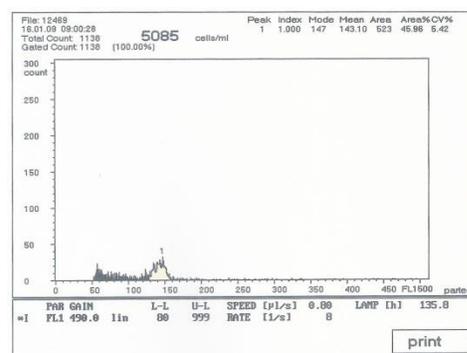


Tetraploid

Fig. 3. Comparison of number of chloroplasts per guard cell in diploid and tetraploid of *Prunella vulgaris* for. *albiflora* Nakai.

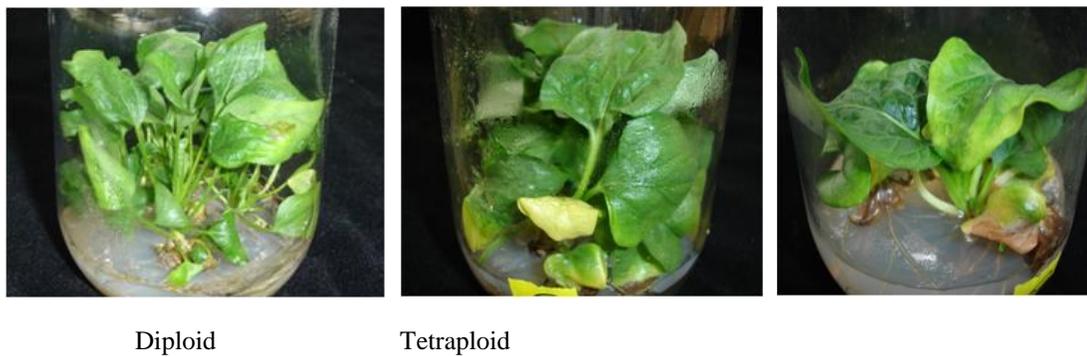


Diploid



Tetraploid

Fig. 4. Comparison of DNA contents in diploid and tetraploid of *Prunella vulgaris* for. *albiflora* Nakai. Flow histograms showing DNA measurements of nuclei from leaves.



**Fig. 5. Comparison of morphologic characteristics in diploid and tetraploid of *Prunella vulgaris* for. *albiflora* Nakai. cultured in vitro.**

# DYNAMICS OF INDIA'S TEA PRODUCTION: AN ECONOMETRIC ANALYSIS

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**Abstract-** Aggregate annual production of made tea in India is empirically analyzed in this study using time series analysis techniques. Important factors affecting tea production are identified and modeled using Vector Autoregressive (VAR) model taking two variables at a time of which one is production, the variable of interest.

**Index Terms-** Production, Prices, VAR, Cointegration, Integration, Transmission, Intervention

## I. INTRODUCTION

World tea production reached 4527 million Kilograms in 2012 and China that holds the largest market share dominates the market. India was the market leader at the international level with regard to production and consumption of tea till 2005. At present, India is the second largest producer of tea in the world and produces around 1112 million kilograms of tea accounting for 24.56% of tea produced worldwide. The tea industry accounts for the employment of more than 2 million people in India. It occupies an important role in the Indian economy not only due to its capacity to earn foreign exchange, but also because it impacts the livelihoods of scores of people employed directly and indirectly by the industry.

Since 1990s, the Indian tea industry has been experiencing a decline in prices in the auction market due to falling demand which has been primarily attributed to poor quality. Although the annual production has been increasing, the productivity and yield have not shown any improvement. The problem has been further worsened by a poor export performance which has been attributed to high production costs, poor quality and increasing global competition from emergence of new growers like Vietnam, Indonesia and Kenya. All this have led to the revenue from the tea industry falling by leaps and bounds. The other issue that has been plaguing the Indian tea industry is the existence of high percentage of ageing tea bushes. The economic age of tea bushes that is required for good yield of crops is 5 to 40 years. A continuous stand of tea plants for more than 50 years exhausts the soil of its mineral supply, thereby reducing plant growth and hence profitable yields.

Owing to the above mentioned factors and the nuances involved in the tea manufacture, it is a unanimously accepted view of agricultural economists that tea warrants extensive research. Studies that enhance the clarity on different factors affecting tea production are extremely desirable considering the problems tea industry has faced over the years.

## II. FEATURES OF THE INDIAN TEA INDUSTRY

The birth of Indian tea industry was marked by the discovery of indigenous teas plant in Assam in 1823 by Robert Bush. This received momentum when the East India Company in 1833 lost the tea trading monopoly in China. In 1835, a scientific deputation was sent to Assam to report on prospects of the tea industry and the team saw tea plants in many parts in the hills between Assam and Burma. In 1836, C.A. Bruce was made the Superintendent of Tea Forests. Among others, he formed the Bengal Tea Company at Calcutta with the objective of purchasing the produce from the East India Company's tea plantations in India. A similar Company was also established in the same year in London with the same objectives. In 1839 the first consignment of tea from India (eight chests) was shipped to London and it was auctioned at a price ranging from six to thirty four shillings per pound. In 1840, two thirds of experimental teas were handed over to new company. In 1852, the first tea company in India paid its final dividends. The second limited company in 1859 was formed in Assam called Jorhat Company. During 1862-67, tea cultivation started in Chittagong and Chotta Nagpur. Ultimately tea cultivation was commissioned in many districts in India wherever there was some hope of a success. Within a few months, India along with Sri Lanka dominated the world tea trade/market.

The essential features of the tea industry include (i) Farming and Manufacturing, (ii) Geographical Locations, (iii) Marketing, (iv) Exports, (v) Internal Consumption, (vi) Import, (vii) Labour.

### III. OBJECTIVES OF THE STUDY

The study intends to analyze two important aspects of tea industry namely production and price. The broad objectives of the study include:

- Identifying factors affecting tea production in India
- Modeling of Annual tea production with the identified factors

### IV. LITERATURE REVIEW

There are a number of studies on modeling of tea production in Pakistan and other parts of Southeast Asia most of which consider climate related factors predominantly while some have even considered soil related factors for modeling. Chatterjee (2005) conducted a study on the domestic production, domestic consumption and exports of Indian tea and examined their inter linkages. The study examines possible reasons for stagnating export volumes of Indian tea industry by analyzing the inter linkages between production, consumption and exports of tea and also developing export function. The production function takes only the acreage and price as important variables in the model. The three models developed for supply, demand and export are analyzed together using the SUR (Seemingly Unrelated Regression) technique and the correlation between the disturbances of the three equations are estimated using generalized least squares method. The results of the study indicate that India did not experience a fall in tea exports in the USSR period due to favorable terms of trade with the USSR, while in the post USSR period, competition increased and hence Indian tea exports declined. It also highlights that tea in India is a necessity good as income elasticity is low.

Thomas & Ahmad (1970) conducted a study on the factors affecting tea production in Pakistan. The total domestic absorption of tea in Pakistan is regressed with time as the independent variable and it has been found that there is a steady increase in absorption at the expense of declining exports. Acreage has been on the rise but tea production does not show an increasing trend. The short run fluctuations in tea production has been analyzed taking into account factors like rainfall, temperature, Lang's factor (rainfall/temperature) and number of rainy days in a year. The results indicate that the quantity of rainfall is not closely related to production. On the other hand, rainfall has significant correlation with production in the not-so-cool months. The Lang's factor is found to be conceptually weak and the number of rainy days is found to have significant correlation with tea production both on a month-to-month and annual basis.

Gupta & Dey (2010) conducted a study on the development of productivity measurement model for tea industry. This study has made an attempt to address the issue of declining production and unsatisfactory productivity performance of the Indian tea industry. It proposes a relatively simple productivity measurement model suited to tea industry. Productivity accounting model is used and suitably given the form so as to fit to a tea industry. The performance of the model is assessed by applying it to tea industry in Assam and it has been found that the model is comprehensive and satisfies all the six criteria of measurement theory such as validity, comparability, completeness, timelines, inclusiveness and cost-effectiveness. The model also identifies areas of poor resource (labour, material and energy) utilization responsible for total productivity decline in the tea industry.

Baten, Kamil & Haque (2009) conducted a study on modeling technical inefficiencies effects in a stochastic production function for panel data. The inefficiency effects are assumed to be independently distributed as truncations of normal distributions with constant variances but with means which are linear functions of observable variables. Panel data is used in this study to estimate the production frontier and the technical inefficiency effects of tea production using a Stochastic Frontier Analysis (SFA) methodology. The study observes that Stochastic Frontier Translog Production Function is more preferable compared to Stochastic Frontier Cobb-Douglas Production Function. The findings suggest that 49% technical inefficiency exists in tea yield. The null hypotheses, that inefficiency effects are not stochastic or do not depend on the labor-specific variables and time of observations, is rejected for these data. This study also reveals that there is a negative relationship between size and yield.

Krishnadas (2010) conducted a study on production and export performance of major Indian spices. The objectives of the study are to analyze the growth in area, productivity and production of major spices in India, to analyze the instability in production of major Indian spices, to examine the growth in exports and direction of trade of major spices from India and to examine the factors influencing changes in production and export of major spices. The following analytical techniques are employed viz. Compound growth rate analysis for computing the growth rate on area, production, yield and exports; Instability analysis to compute the extent of variability in area, production, productivity and export of major spices using coefficient of variation; Markov chain analysis to analyze the trade directions of Indian spice exports and Multiple Linear Regression to identify the factors influencing the production of major spices.

Akhlas, Ahmad, Siyar & Khanum (2003) conducted a study on qualitative assessment of fresh tea produced in Pakistan growing under different agro ecological conditions and fertilizer treatments. The objective is to evaluate the effect of plucking season, altitude and agronomic practices upon quality of tea using trials initiated in 1998 at Shinkiyari (1000 m) and Battal (1500 m) on mature tea bushes.

Analysis of variance technique is used which shows that increasing nitrogen treatments and different seasons have a significant influence on Epigallocatechin (EGC), Epicatechin (EPC) and Caffeine level of tea leaves at both localities. The results show that tea produced in Pakistan contains constituents in premium concentration highly desirable for Black tea processing.

Dutta (2011) conducted a study on impact of age and management factors on tea yield and modeling the influence of leaf area index on yield variations. The study attempts to analyze the effects of age, pruning and fertilizer application on tea yield and to derive a relation between yield and tea leaf area index (LAI). The study is motivated by the fact that tea yield has stagnated in Northeast India. For the purpose at hand, statistical analysis is applied to the data set collected at the section level of a tea estate from 1999-2007. Tea yield has been found to be correlated with age, NPK applications, pruning and also leaf area index. Age shows a significant negative effect. Clear negative effects of N applications could be observed. A significant positive effect of pruning could also be observed. Stepwise regression confirms that LAI could play an important role in predicting tea yield.

Hicks (2009) conducted a study on the current status and future development of global tea production and tea products to identify the critical challenges faced by the tea industry globally. It examines the current situation and medium term prospects for production, consumption and trade of tea and its impact on the world tea market. The following factors are taken to be affecting global tea production: weather conditions, planted areas, population, age of tea bushes, labor, capital, price of inputs and yield risk. The factors taken to be affecting global consumption are income of the country, quality of the products and substitutes and complements available, etc.

From the review of this exhaustive literature on tea production, it can be seen that although tea production has been dealt with by many researchers, there seems to be dearth of research work related to this in India. Considering the importance of tea industry in India, in terms of income, foreign exchange earnings and being a significant employment provider, it seems essential to identify factors that significantly impact tea production and model them with the objective of providing good forecast.

## V. LITERATURE REVIEW

There are a number of studies on modeling of tea production in Pakistan and other parts of Southeast Asia most of which consider climate related factors predominantly while some have even considered soil related factors for modeling. Chatterjee (2005) conducted a study on the domestic production, domestic consumption and exports of Indian tea and examined their inter linkages. The study examines possible reasons for stagnating export volumes of Indian tea industry by analyzing the inter linkages between production, consumption and exports of tea and also developing export function. The production function takes only the acreage and price as important variables in the model. The three models developed for supply, demand and export are analyzed together using the SUR (Seemingly Unrelated Regression) technique and the correlation

## VI. DATA AND METHODOLOGY

Yearly data for the period (1991-2011) was used for production and other factors that were identified from literature and assumed to be affecting it. In some cases, for the purpose of getting a stable model, the data has been subjected to log transformation which has been explained in the next section on results and analysis. The factors that were assumed to be a priori affecting production are Area under cultivation of Tea, Domestic Consumption, Price, Rainfall, Temperature, Age of Tea Bushes, Labour, Area under plucking, GDP at Market prices, Revenue through Cess and Number of Suppliers.

The methods used in time series analysis for modeling production and other variables are ARIMA (Auto Regressive Integrated Moving Average) model for the univariate case and VAR (Vector Auto Regressive) model for the multivariate case. A complete description of these methods is beyond the scope of this chapter but concise descriptions of facts pertaining to the model that have direct connotation to our modeling work are presented here.

A VAR model describes the evolution of a set of  $k$  variables (called *endogenous variables*) over the same sample period ( $t = 1 \dots T$ ) as a linear function of only their past values. The variables are collected in a  $k \times 1$  vector  $y_t$ , which has as the  $i^{\text{th}}$  element,  $y_{i,t}$ , the time  $t$  observation of the  $i^{\text{th}}$  variable. For example, if the  $i^{\text{th}}$  variable is GDP, then  $y_{i,t}$  is the value of GDP at time  $t$ .

A  $p$ -th order VAR, denoted **VAR** ( $p$ ), is

$$y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \dots + A_p y_{t-p} + e_t,$$

Where the  $l$ -periods back observation  $y_{t-l}$  is called the  $l$ -th *lag* of  $y$ ,  $c$  is a  $k \times 1$  vector of constants (intercepts),  $A_i$  is a time-invariant  $k \times k$  matrix and  $e_t$  is a  $k \times 1$  vector of error terms satisfying

1.  $E(e_t) = 0$  — every error term has mean zero;
2.  $E(e_t e_t') = \Omega$  — the contemporaneous covariance matrix of error terms is  $\Omega$  (a  $k \times k$  positive-semi definite matrix);

3.  $E(e_t e'_{t-k}) = 0$  For any non-zero  $k$  — there is no correlation across time; in particular, no serial correlation in individual error terms.

The order of VAR model is identified based on various criteria such as AIC, SC, HQ and FPE. Finally after the model has been estimated, it is used for understanding the dynamics of other variables on the variable of interest by looking at the coefficients and also based on causality studies. Also the estimated model will be used for forecasting future values of all the variables. A ‘Structural VAR’ is a depiction of the underlying “structural”, economic relationships between the variables under consideration. Two features of the structural form that make it the preferred candidate to represent the underlying relations include residuals being uncorrelated and presence of contemporaneous impact between variables.

A. *Univariate Modeling*

First the univariate case is taken and modeling is done to study the dynamics of annual production of made tea in India. This throws light on the presence or absence of trends, seasonality, cyclicity and irregular components if any in the series. The importance of univariate modeling cannot be underpinned as it helps in understanding if the series is stationary or differencing is required and if the production is expected to show an increasing or decreasing trend in future. Then in the subsequent stages of analysis, when other variables are considered for modeling, it will clearly highlight the impact that these variables have on the production of made tea.

The variable under consideration for modeling is the production of made tea in India (in Kg) which is the sum of the quantities of CTC, Orthodox, Darjeeling and Green teas produced in India. The unit of the variable is Million Kgs and the period for which data are used is from 1991 to 2011.

The time series plot of production is first analyzed to see if there are any discontinuities or outliers in the data for the period under consideration and to account for the same if any.

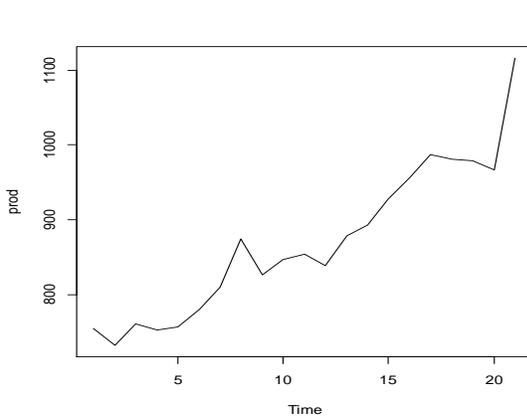


Figure 2.1: Time Series Plot of Production

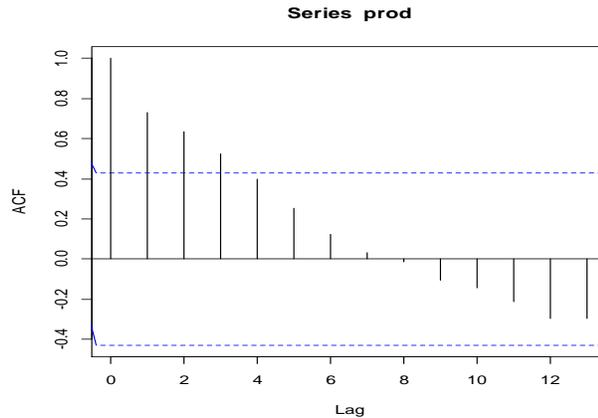


Figure 2.2: ACF of production

From the plot in figure 2.1 we infer that the production of made tea seems to have an increasing trend on the whole with some sharp peaks in the years 1998 and mid 1999. It was in the year 1999, that the Indian tea industry suffered a serious crisis triggered by a big fall in the auction prices and export prices and eventually led to a lot of tea estates closing down. This can be naively related to the upsurge in the production that we see from the plot. The increase in production was not balanced by an increase in domestic consumption of tea in India. The export performance was also not attractive owing to increased competition from the new players in the international market and deteriorating quality of Indian made tea. These factors would have led to a decline in prices and eventually led to crisis.

As far as the modeling is concerned, there seems to be an increasing trend and hence it can be naively concluded that differencing may be required which is again confirmed from the ACF (Auto Covariance Function) plot shown in figure 2.2 that shows a slow decline in ACF. But owing to less number of data points, one cannot go by ACF plot. Hence unit root tests are carried out to confirm this. ADF and PP tests had p values of 0.4349 and 0.05178 for the raw series which are high (if we want 95% significance) and hence this confirms the presence of unit roots in the lag polynomial and need for differencing. Then the same tests were performed for the differenced series. PP test had p value of less than 0.01 thereby confirming that once differencing may be sufficient.

Now, the time series plot, ACF and PACF of the differenced series as shown in figures 2.3, 2.4 and 2.5 are analyzed to see if more differencing is required. The time series plot of the differenced series in figure 2.3 shows that some volatility is present in the data which might be because of the presence of limited number of data points. The ACF and PACF plots in figures 2.4 and 2.5 also seem to be fine with all the values at different lags within the confidence boundaries (dotted lines).

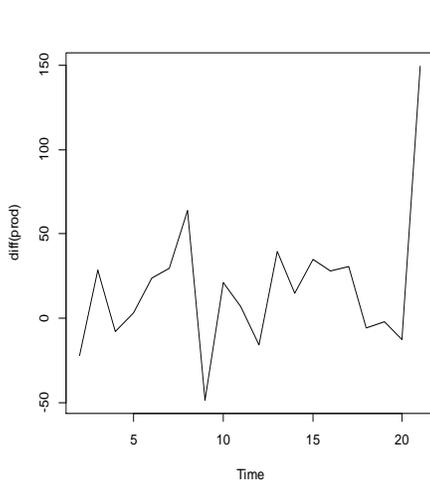


Figure 2.3: Plot of differenced

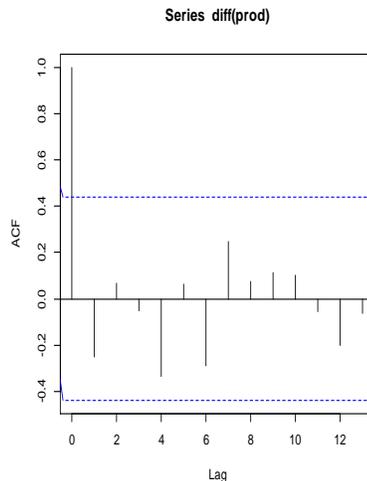


Figure 2.4: ACF of differenced Production series

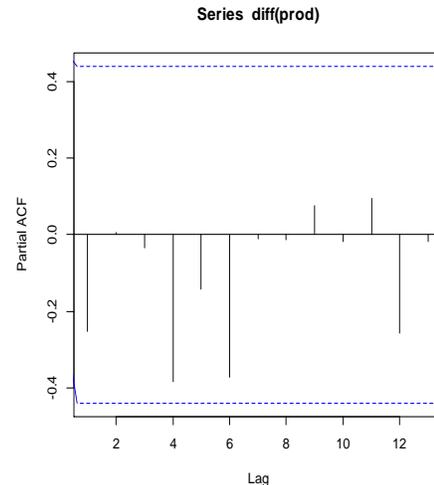


Figure 2.5: PACF of differenced Production series

Now the emphasis is on building a suitable model for production keeping in mind that a first order differencing is required. AIC (Akaike Information Criterion) is the tool that is used to select the model with proper order. The model with least AIC is the one that is preferred. The final selected model is as follows:

ARIMA (0, 1, 0) model is selected and the equation is as follows:

$$DX_t = \varepsilon_t, \text{ where } DX_t = X_t - X_{t-1}$$

AIC of the model is 209.331 and that happens to be the least of all other models tried.

Once modeling is done, it is customary to check if the residuals are white noise failing which modeling will still remain incomplete. The differenced series plot in figure 2.3 looks stationary. Also as pointed out before, ACF and PACF plots also look alright. Box-Pierce, Ljung Box and Kolmogorov Smirnov tests are carried out to check if the residuals of the model are white noise. The p values of the three tests are 0.9948, 0.9788 and 0.8059 respectively which are high thereby implying that the residuals are indeed white noise. The next and most important task is prediction of future values of production. But the model is a simple random walk and hence the best estimate of production in 2012 is the value in 2011 itself.

With the univariate case in the backdrop, more variables are considered to study their impact on the production of made tea.

### B. Bivariate Modeling

Variables considered for Modeling Production: Area under cultivation of Tea, Domestic Consumption, Price, Rainfall, Temperature, Age of Tea Bushes, Labour, Area under plucking, GDP at Market prices, Revenue through Cess, Number of Suppliers and Bearing area, Domestic Average Coffee Price and Relative auction price of tea.

All variables are integrated of different order and hence VAR is used for modeling as opposed to Cointegration.

In this study, since yearly data from 1991 to 2011 is used for modeling, all variables that were assumed to be affecting production could not be taken in a single run (owing to less number of data points) and hence Structural VAR with production (variable of interest) as the second variable is carried out and the results of models with production on the left hand side and other variables on the right hand side are shown and delineated.

### C. Production and Consumption

Production denotes the supply and Consumption, the demand in the context of made tea. The objective is to model both the variables and see if there is any impact of consumption on production. In general from theory of economics, it is known that there is an inverse relationship between price and demand and direct relationship between price and supply. Also if the demand is high, producers will produce more as gains are high. But there is a complexity involved in interpreting the relationship as the methodology that is going to be adopted here is VAR (Vector Auto Regressive) modeling. In this method, there could be as many lags as the order of the model and consumption could affect production differently in different lags. Hence the complexity involved actually lies in interpreting how consumption affects production at different lags. The results of the modeling are as follows:

Period of Study: 1991-2011

The variables are Log transformed to make the VAR model stable.

First the raw time series plots of production and consumption are analyzed to see if there are any discontinuities and outliers in the data. The production and consumption plots are shown in figures 2.1 and 2.5 respectively.

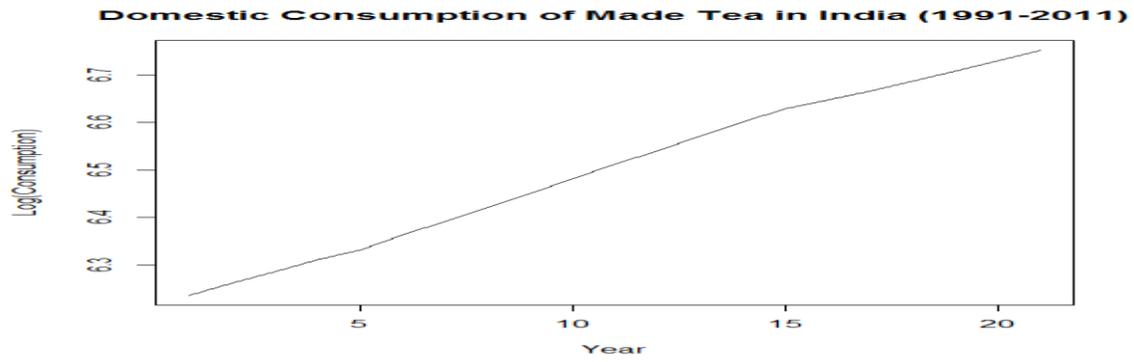


Figure 2.6: Time series plot of Consumption

From the plot, it can be inferred that both production and consumption show an increasing trend and that consumption has much lesser volatility or deviations. The optimal order of the model is found to be one based on AIC, HQ, SBC and FPE. The final model with only significant terms is shown below:

$$\text{Prod}_t = 0.6129 * \text{Cons}_{t-1} + 2.7840 + \varepsilon_t$$

(0.0358)      (0.2325)

From the first order model, the following can be inferred:

When the consumption at time (t-1) increases by one unit, production at time (t) will increase by 0.6129 units. There seems to be a direct relationship between production and consumption with the rate of increase or decrease in production lesser than that in consumption. The fact that there is a direct relationship between production and consumption is understandable as producers will produce more when they see an increase in demand. But unlike other commodities, tea production cannot be increased without planting more tea crops or in other words, increasing the area under cultivation of tea. Moreover, it will take 5 years for the tea crops to mature after which tea crops can be used for production of made tea. But the model says that when consumption at time (t-1) increases, production at time (t) will increase. This is because many tea companies don't operate at the maximum capacity and many factories buy only tea leaves from tea growers to the extent of what is required. Hence it's always possible to increase production up to a certain level when an increase in demand is seen. But the issue here is as pointed out earlier, the rate of increase or decrease in production is lesser than that in consumption.

Now the model is plotted to see how well it matches the actual data.

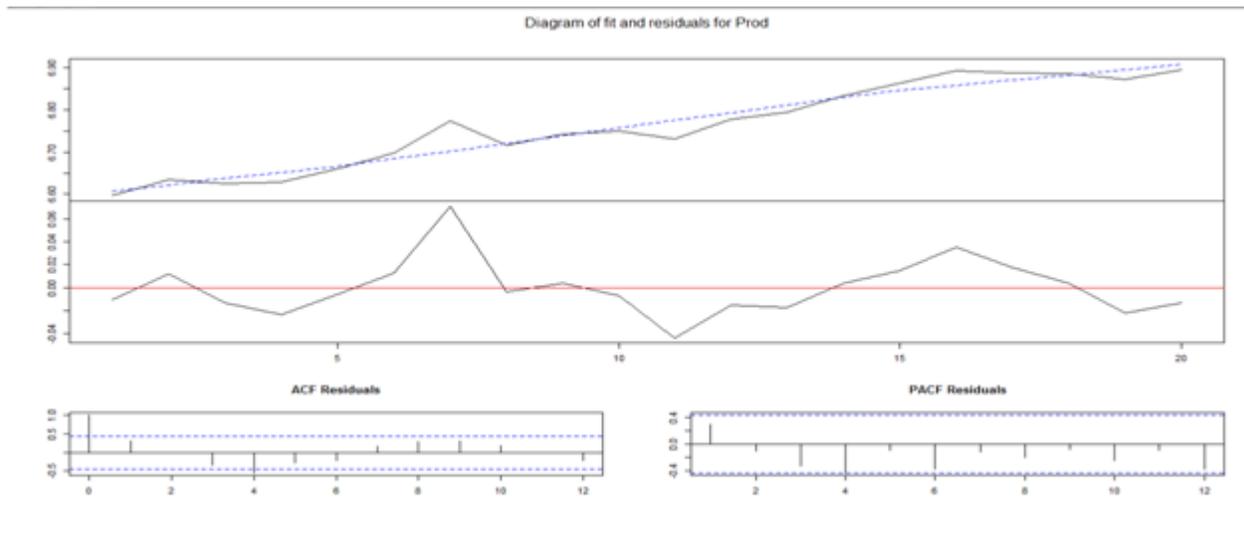


Figure 2.7: Diagram of fit and residuals for Production

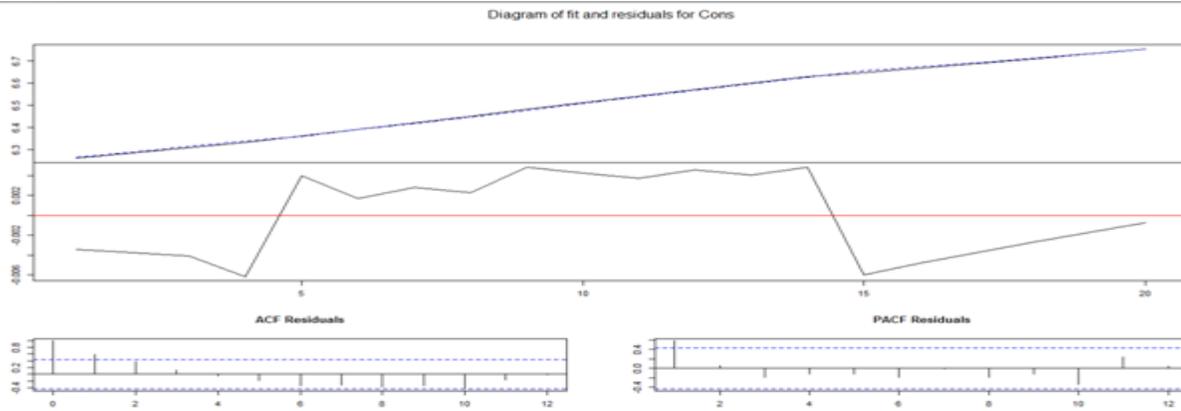


Figure 2.8: Diagram of fit and residuals for Consumption

The ACF and PACF plots of residuals corresponding to production and consumption in figures 2.7 and 2.8 look fine with ACF declining fast in both plots and PACF lying within the confidence limits in both cases. This is a clear sign of the stationary residuals. Next from the modeling perspective, it is customary to check if the residuals are white noise. The multivariate JB test was carried out to check if the residuals were normal. P value was found to be 0.0479 thereby proving that residuals were non-normal. Portmanteau test was used to check if the residuals were white noise. It checks if the PACF of the residuals is zero. The residuals were indeed found to be white noise with a p value of 0.4084.

The next step is to check for the causality between the variables. This is by far the most important aspect in VAR. It is a much stronger version of the relationship that is found in regression. There was no instantaneous causality between production and consumption but consumption was found to be granger causing production which was also clear from the model. On the other hand, production was not found to granger cause consumption which again was obvious from the model as production did not even affect consumption. Next we look at the impulse response plots to see how a unit shock in consumption affects production based on structural VAR.

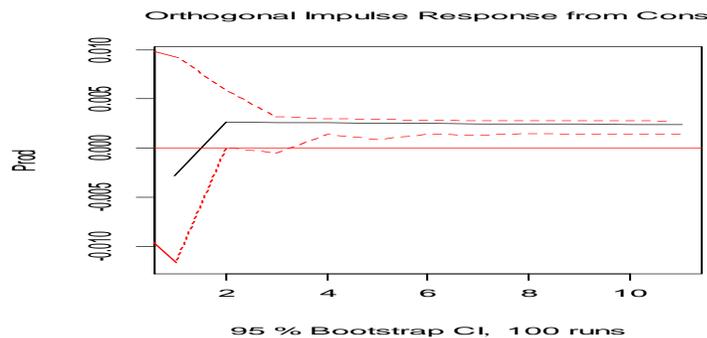


Figure 2.9: Orthogonal IRF from Consumption to Production

The IRF plot in figure 2.9 shows that a unit shock in consumption at lags 2 and 3 will have significant effect on current production. This shows that consumption two to three years before has a strong impact on the current level of production and hence Tea Board of India must frame policies to stimulate the demand for tea by improving its quality and promoting its generic brand. Next we look at the prediction plot and the FEVD (Forecast error variance decomposition) plot.

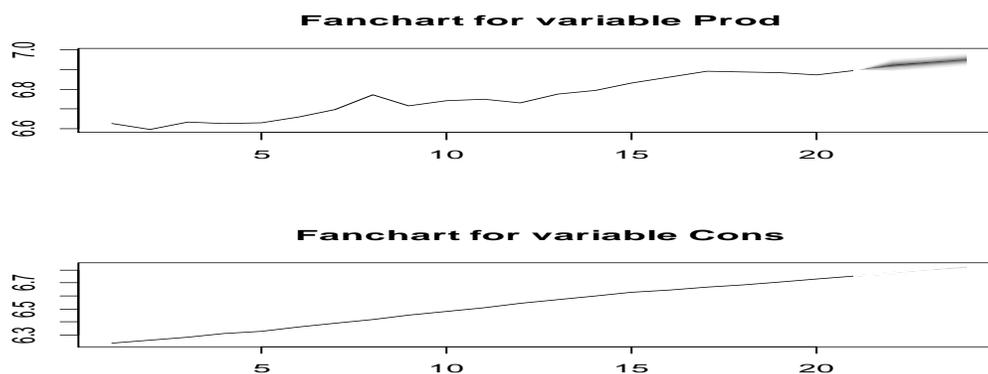


Figure 2.10: Prediction Chart for Production and Consumption

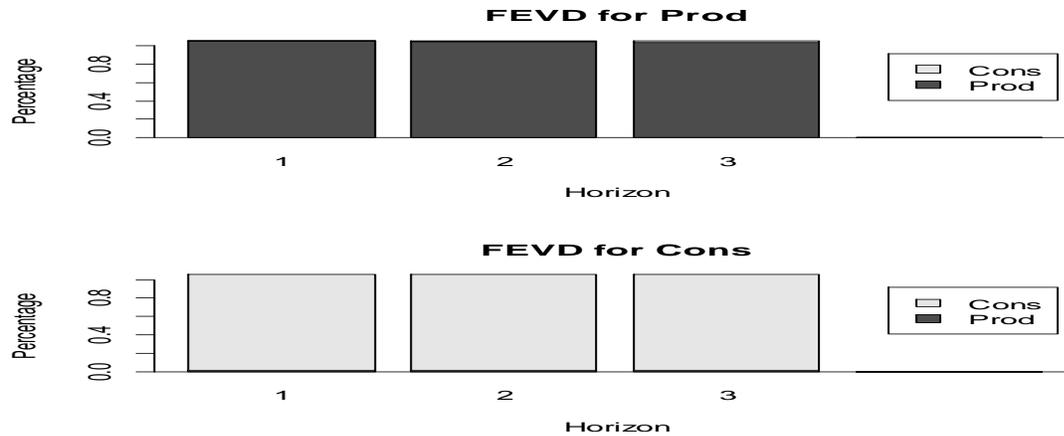


Figure 2.11: FEVD plots for Production and Consumption

The Fanchart (prediction plot) in figure 2.10 shows that both production and consumption will increase in the future. The FEVD plot in figure 2.11 shows that consumption does not play any part in contributing to the forecast of production in future. On the other hand, when consumption is forecasted, a very small percentage of error variance is contributed by production in all the three lags in future. But the percentage contributed is infinitesimally small and hence can be neglected as production does not cause or affect consumption.

#### D. Production and Number of Suppliers

Number of suppliers denotes the number of tea estates in India. The period of study was from 1991 to 2006 as data on number of suppliers was available only till 2006. Here in order to aid the modeling process, tea production was in terms of 1000 Kg and actual value of number of suppliers was taken. First we begin by visualizing the plot of number of suppliers to see how it changes across time.

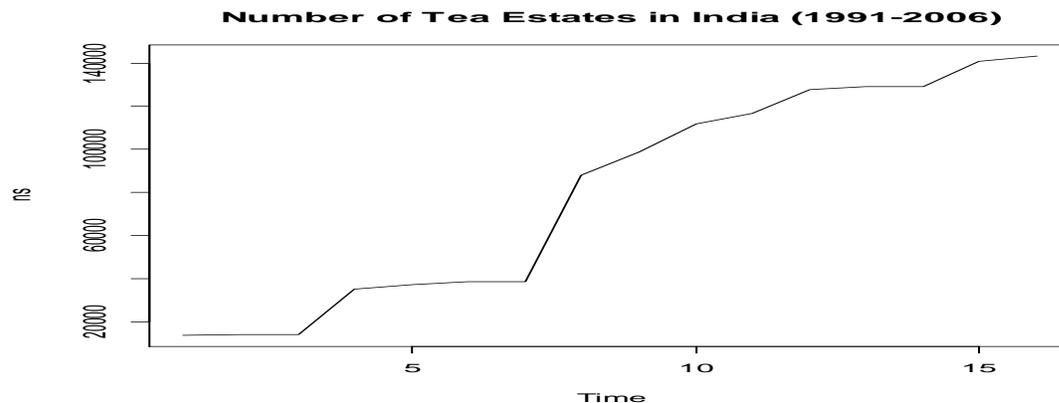


Figure 2.12: Time series plot of Number of Tea Estates in India

It can be seen from the time series plot in figure 2.12 that number of suppliers increase over time and hence presence of an increasing trend is clearly visible. We already saw an increasing trend in the production plot. Hence we can expect a direct correlation between the two variables. But only after modeling is done it can be understood as to how production is affected by number of suppliers at different lags.

The optimal order of the model was found to be four based on the all the four selection criteria viz. AIC, HQ, SC and FPE. The final VAR (4) model with only significant coefficients is shown below:

$$Prod_t = 0.8117*Prod_{t-1} - 2.34*N_{t-1} + 0.8375*Prod_{t-2} + 0.9325*N_{t-2} + 1.2197*N_{t-3} - 0.5796*Prod_{t-4} + \epsilon_{1t}$$

Where,  $Prod_t$  – Production of tea at time t

$N_t$  – Number of Suppliers at time t

The model says that Production at time t will increase by 0.9325 units with a one unit increase in Number of suppliers at time (t-2) and by 1.2197 units with a one unit increase in Number of suppliers at time (t-3). This is understandable as we expect the production to go up with an increase in number of tea estates in India. But the complexity lies in interpreting the negative coefficient of Number of suppliers at time (t-1), which means that as the number of suppliers at time (t-1) increases, the production at time t will reduce. This is the reason why time series analysis is so useful. It helps in understanding how other variables affect the variable of interest at different lags. Here, the equation cannot be looked at separately but in its entirety. What it says is that production at time t depends on number of suppliers at times (t-1), (t-2) and (t-3) in different ways and production at times (t-1), (t-2) and (t-4) in different ways. The increase

or decrease in production can be ascertained only by calculating the production at time  $t$  and comparing it with that at time  $(t-1)$ . Also the most important aspect that has to be kept in mind is that the above relationship between production and number of suppliers holds good only when there are no changes in other important variables like rainfall, temperature, consumption etc. But there will be changes in these variables over the year and let's say if rainfall is erratic in a particular year or consumption of tea comes down, the existing tea producers or tea estates will not produce as much as they would have in the previous year thereby leading to a drop in total production despite new tea estates coming up and contributing to some tea production.

To understand the exact relationship between production at time  $t$  and number of suppliers at time  $(t-1)$ , both these variables were regressed and the following model was obtained.

$$Prod_t = 7.427e+05 + 1.188 * N_{t-1} + \epsilon_t$$

Both the coefficients were found to be significant and the ANOVA of coefficient of  $N_{t-1}$  was also significantly different from zero. This shows that when only these two variables are taken, a positive relationship is found. On the other hand in the presence of other lags, the coefficient of  $N_{t-1}$  is negative thereby implying that the model in its entirety must be interpreted and not separately. Next, the model is plotted to see how well it approximates the actual values.

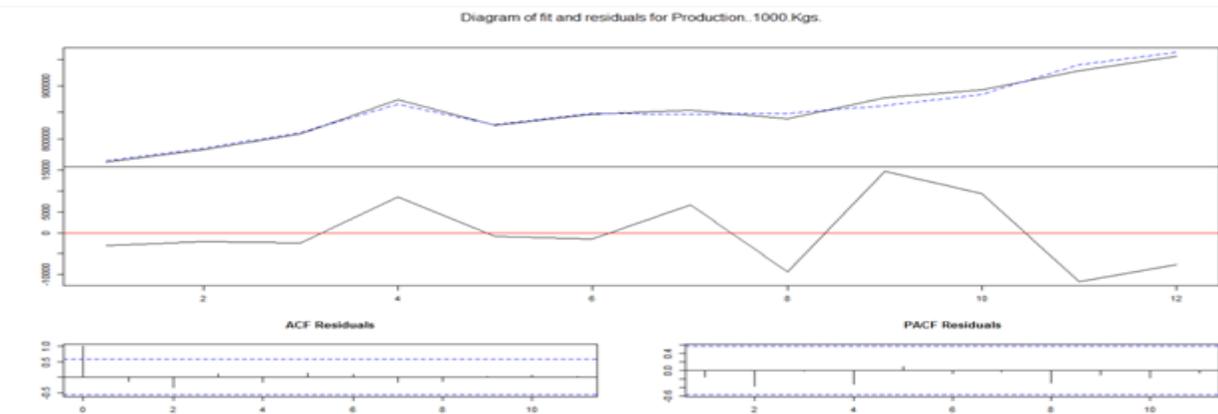


Figure 2.13: Diagram of fit and residuals for Production

The diagram of fit in figure 2.13 looks extremely good with most of the points predicted by the model also matching the actual values. The ACF and PACF plots also look fine. The residuals were tested for normality and white noise using Jarque Bera test and Portman-teau test respectively and they were found to be both normal and white noise with p values being 0.8364 and 0.4265 respectively.

The causality results indicate that number of suppliers granger causes production but the converse is not true which is understandable as supply depends on number of suppliers but a person who wants to enter the market would not look at supply but at other factors like demand, scope for profit making, entry barriers etc. Next we plot the impulse response function of number of suppliers on production as production is our variable of interest.

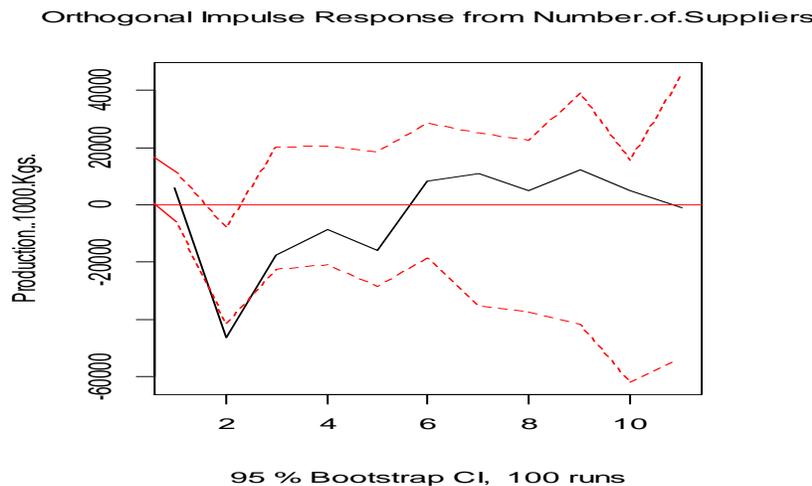


Figure 2.14: IRF plot of Number of Suppliers on Production

The upper limit of 95% Confidence interval cuts the 0 axis implying that the impact of a unit shock in number of suppliers on production is significant. Unit shock in number of suppliers at lag 2 seems to be having a significant impact on current production. This might be because of the significant exit barriers in tea manufacturing. Once an estate is started and tea bushes are grown which in-

involves significant investment, the producers have to wait for 5 years for the bushes to become mature. It's not possible to remove investments from the estate before the gestation period. Hence a well planned decision will have to be made before investing in an estate or starting a new one.

Finally, we look at the prediction plot to see how production changes in future and FEVD plot to see how much of variance in the forecast of production is contributed by number of suppliers.

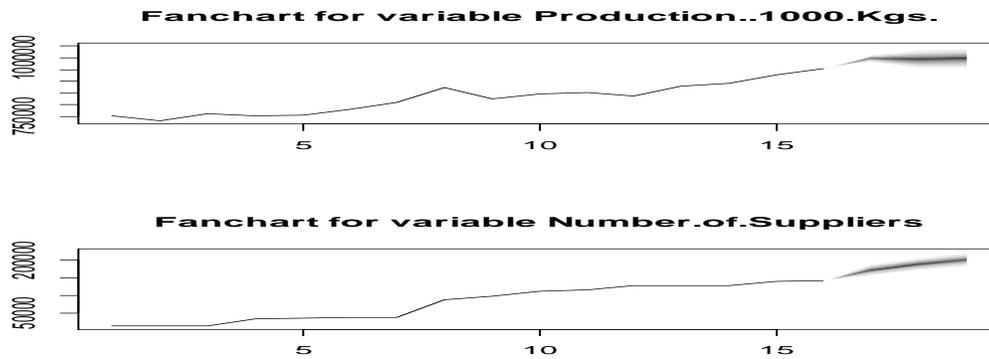


Figure 2.15: Prediction plots of Production and Number of Suppliers

The prediction plot shows that production remains more or less constant in the next three years while number of suppliers increases.

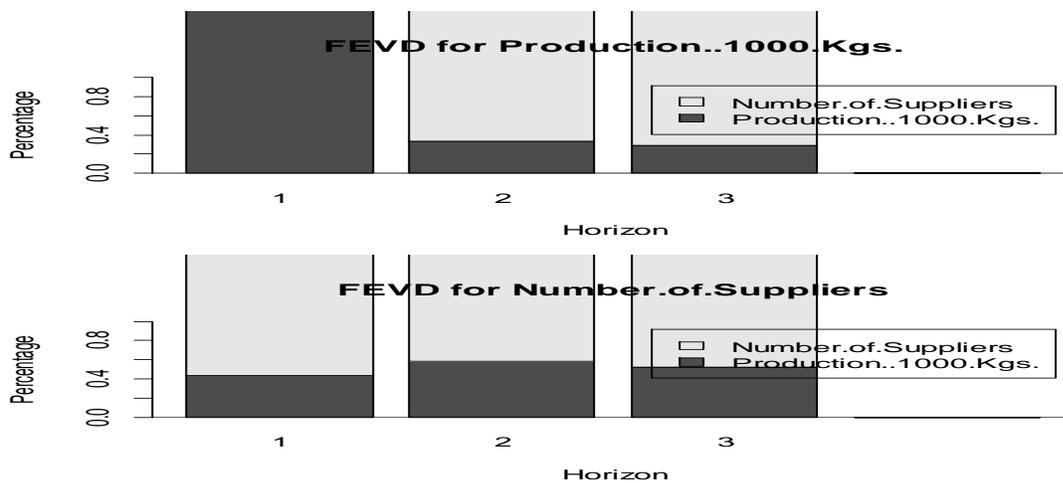


Figure 2.16: FEVD plots of Production and Number of Suppliers

FEVD plot for production shows that in lags 2 and 3, number of suppliers significantly contributes to variance in forecast error of production.

*E. Production and Labour*

Production in 1000 Kg is modeled with Average number of laborers employed in tea sector for the period (1991-2005). Yearly data was used for modeling the variables. The analysis is started by first visualizing the labor plot and seeing how labor varies across time.

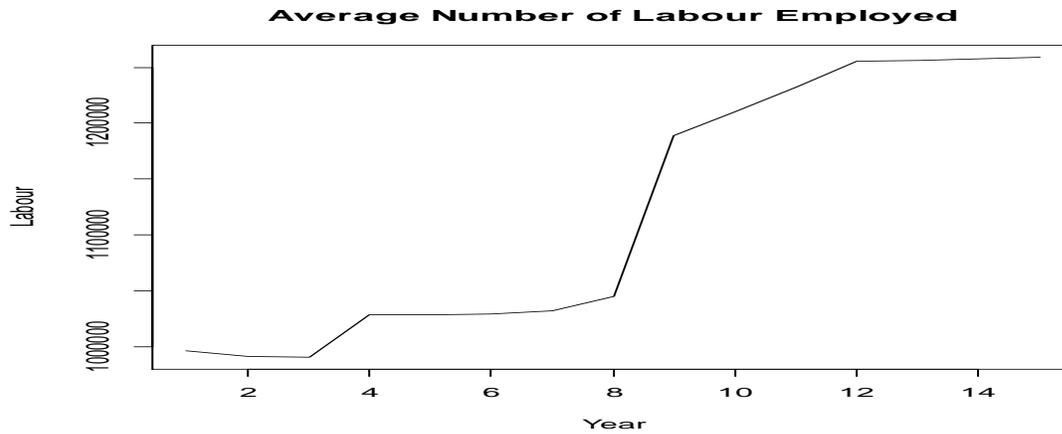


Figure 2.17: Time series plot of Labor

The labor plot shows an increasing trend with some fluctuations. The optimal order of the model was found to be 4 based on AIC, HQ and SC. The final model is as shown below:

$$\text{Prod}_t = 3.507 e^{-1} * \text{Labor}_{t-2} + 4.520 e^5 + \epsilon_{1t}$$

The final model says that production at time t will increase by 0.3507 units with a unit increase in labor at time (t-2). Labor is a very important input for production and we expect a direct relationship between supply and its inputs. For this reason, the model is understandable.

Unit root tests were conducted and found that production was I (2) and labor was I(3). Hence cointegration cannot be performed. The residuals were checked for normality and white noise using multivariate Jarque Bera test and Portmanteau test and they were found to be both normal and white noise with p values being 0.2821 and 0.4312 respectively. The causality results indicate the presence of instantaneous causality between production and labour. Also production is found to be granger cause labour. The IRF plot of labour on production is shown in figures 2.18:

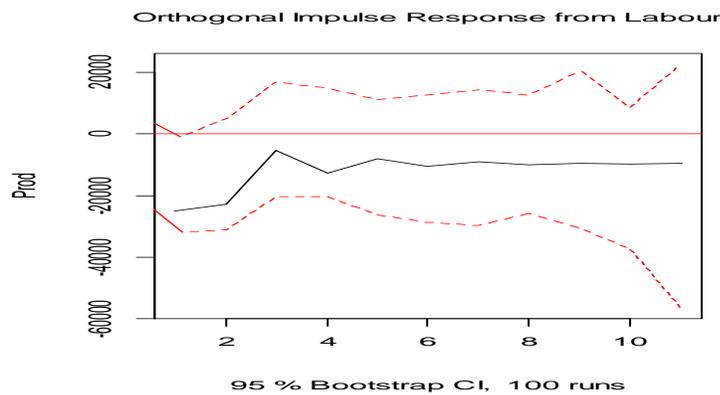


Figure 2.18: IRF plot of Labour on Production

In figure 2.18, the 95% bootstrap confidence intervals do not touch the 0 axis implying that a unit shock in labor does not have any significant impact on current level of production.

Finally, the prediction plot and FEVD plot are visualized to see how production changes in future according to the model.

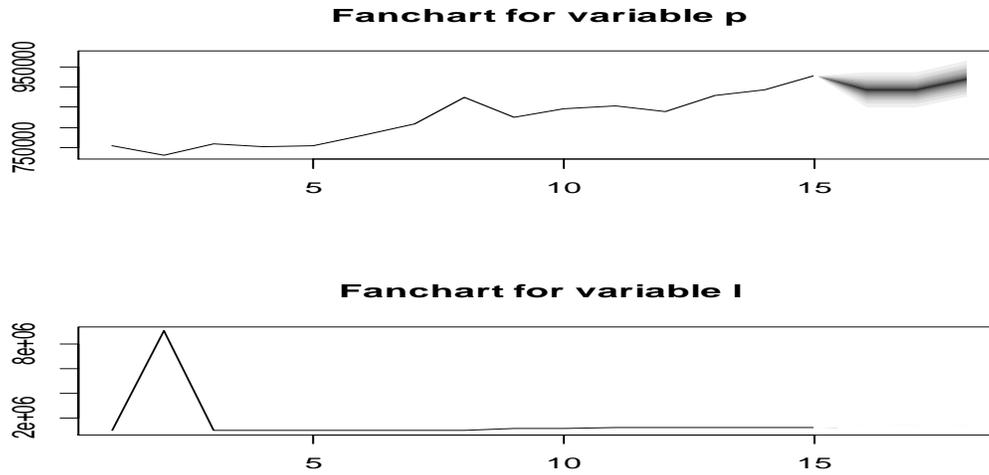


Figure 2.19: Prediction Plots of Production and Labor  
 Production decreases and then increases in the next three years according to the model.

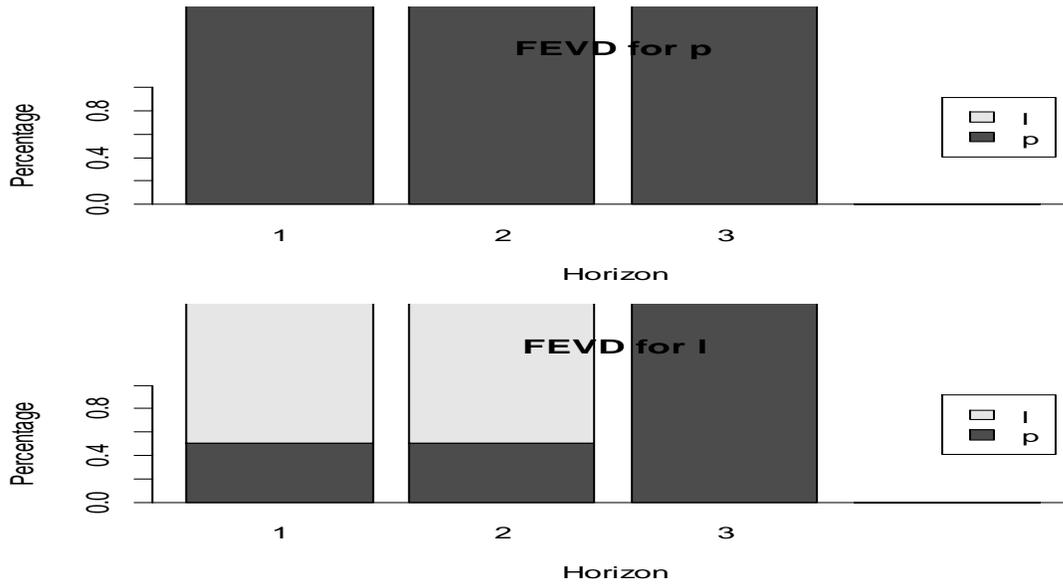


Figure 2.20: FEVD plots of Production and Labor  
 Labor doesn't contribute to variance of forecast error in production while production contributes to variance in forecast error in labor in the next two years.

*F. Production and Price*

Monthly data from 1991 to 2005 was used to model production in 1000 Kg and auction price. We expect a positive relationship between production and price as producers will produce more when they see a price increase.

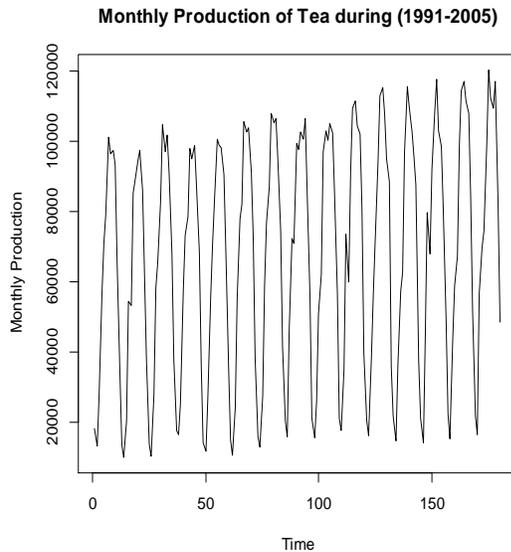


Figure 2.21: Monthly Production plot

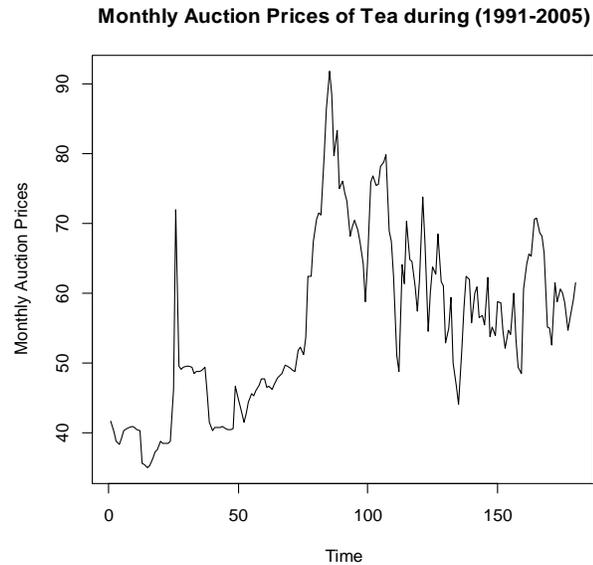


Figure 2.22: Monthly Auction Prices plot

The production plot shows that seasonality is present with increases in June, July and August of every year. Price plot indicates the presence of volatility.

The optimal order of the model was found to be 4 using all the four criteria – AIC, HQ, SC and FPE. The final VAR (4) model is as shown below:

$$Prod_t = 1.009*Prod_{t-1} - 2.431 e^{-1}*Prod_{t-2} + 5.986 e^2*Price_{t-2} - 4.071 e^2*Price_{t-3} - 3.305 e^{-1}*Prod_{t-4} + 2.769 e^4 + \epsilon_{1t}$$

The final model says that production at time t increases with increase in auction price at time (t-2) and decreases with increase in price at time (t-3). The fact that there is a positive relationship between production at time t and price at time (t-2) is understandable as producers will produce more when they see increasing prices. But production increase is not because of increasing the area. In the short run acreage cannot be changed. What can be done is replanting, replacement planting, extensions (extending further to existing land for possible investments in future), etc. But even these will have an effect on total production only after the gestation period of 5 years when the crops become mature. But production per unit area or yield can be increased by adoption of improved cultural practices like manuring, intensive cultivation via proper use of fertilizers and pesticides, timely pruning of tea bushes and adopting good plucking style. Hence production can be increased or decreased by producers in this way based on price signals. But there is a negative relationship between production at time t and price at time (t-3) which might be because of other factors like poor rainfall or other factors which are beyond the control of producers. Also the model has to be understood in its entirety.

The residuals were checked for normality and white noise and they were found to be white noise and non-normal with p values for Jarque Bera test and Portmanteau test being  $2.2*10^{-16}$  and 0.3297 respectively. Causality results suggest the presence of instantaneous causality between production and prices implying that production at time t is caused by price at time t and vice versa. Also prices were found to be granger causing production. The IRF plot is shown in figure 2.23.

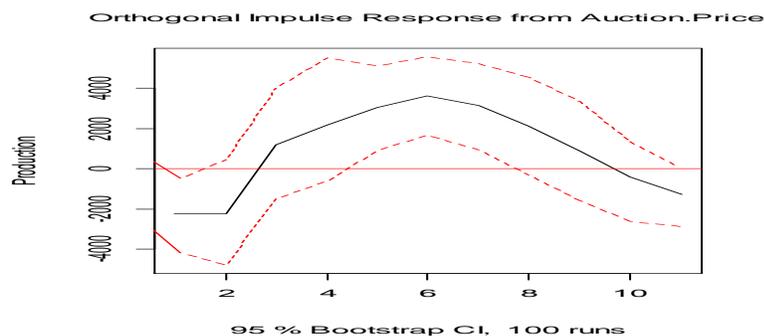


Figure 2.23: IRF plot of Price on Production

The IRF plot of price on production in figure 2.23 shows that unit shocks in price at lags 5, 6 and 7 seem to have significant impact on current level of production. Hence it's very essentially to reduce the volatility in prices and keep them stable.

Finally, the prediction and FEVD plots are visualized to see how production and price change in future.

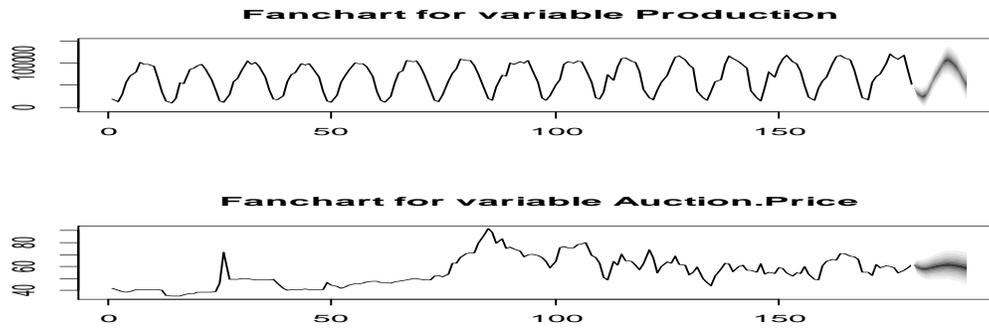


Figure 2.24: Prediction plots of Production and Price

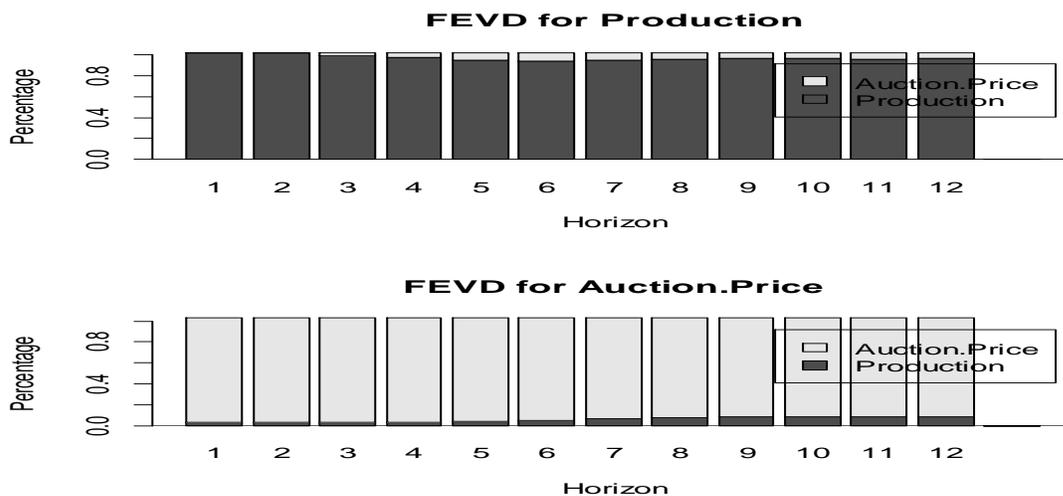


Figure 2.25: FEVD plots of Production and Price

The FEVD plots show that the contribution of price to variance of forecast error in production is small and same is true with price as well. Twelve months ahead forecasts are shown in fanchart.

### G. Production and Age of Tea bushes

Age of tea bushes is one of the most important factors affecting tea production as only mature tea bushes in the age category of 5-50 years contribute to yield. If the age of tea bushes crosses 50 years, its yield capacity will come down and hence will have to be uprooted for planting new crops.

In the modeling process, We have taken the proportion of area of tea bushes in the age group of above 50 years to the total area to be the 2<sup>nd</sup> variable and production (in 10<sup>8</sup> units) to be the 1<sup>st</sup> variable which is our variable of interest. Yearly data from 1991 to 2004 was used to model the two variables.

First the raw time series plots are visualized to see how the variable behaves.

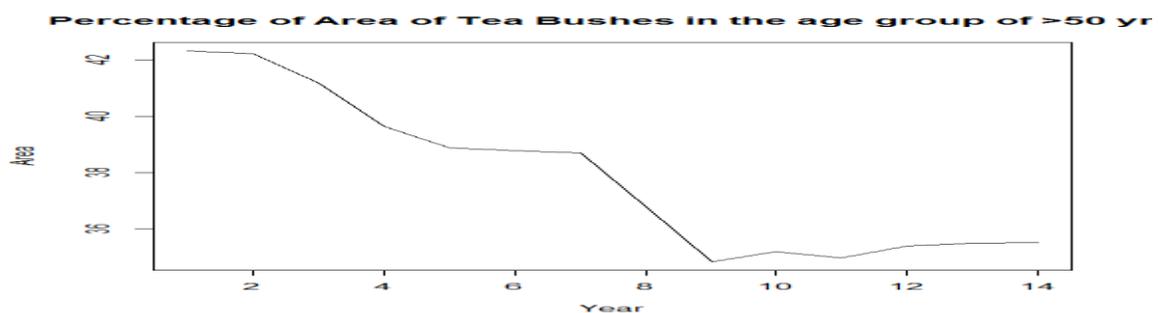


Figure 2.26: Time series plot of Percentage of Area of tea bushes of age > 50 yrs

The plot of 2<sup>nd</sup> variable in figure 2.26 shows a decline over time and production plot shows an increase as seen already and hence one can naively expect a negative relationship.

The optimal order of the model was found to be one according to all the four criteria – AIC, HQ, SC and FPE. The final VAR (1) model is as shown below:

$$Prod_t = -0.165 * Area_{t-1} + 14.43271 + \varepsilon_{1t}$$

The second part shows how production affects area but we are not interested in that as our variable of interest is production and moreover area in the age group of > 50 years is not dependent on supply but on price. When the prices increase, producers would want to produce more and hence invest for the future which is done by uprooting old tea bushes and planting new seedlings.

The final model says that production at time t reduces when the proportion of area in the age group of above 50 years to the total area increases which is true as we saw earlier.

The residuals of the final model were found to be both normal and white noise using Jarque Bera test and Portmanteau test whose p values were 0.4499 and 0.1215 respectively. The causality results are not positive. The IRF plot of area on production is shown in figure 2.27.

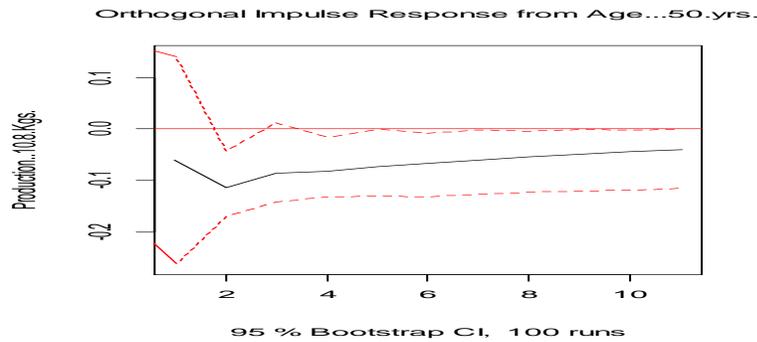


Figure 2.27: IRF plot of Proportion of Area on Production

The IRF plot in figure 2.27 shows that unit shocks in percentage of area of tea bushes in the age group of above 50 years to the total area at lags 2 and 4 have significant impact on current level of production. This indicates that age of tea bushes is a very important factor that affects tea production.

Finally, the prediction and FEVD plots are visualized to see how the variables change in future.

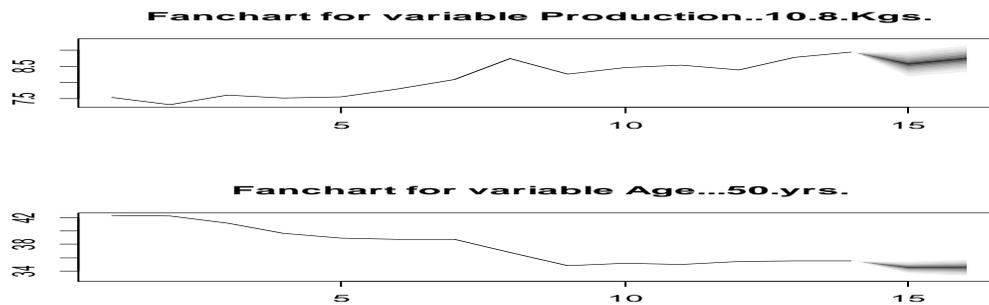


Figure 2.28: Prediction plots of Production and Percentage area of tea bushes of age > 50 yrs

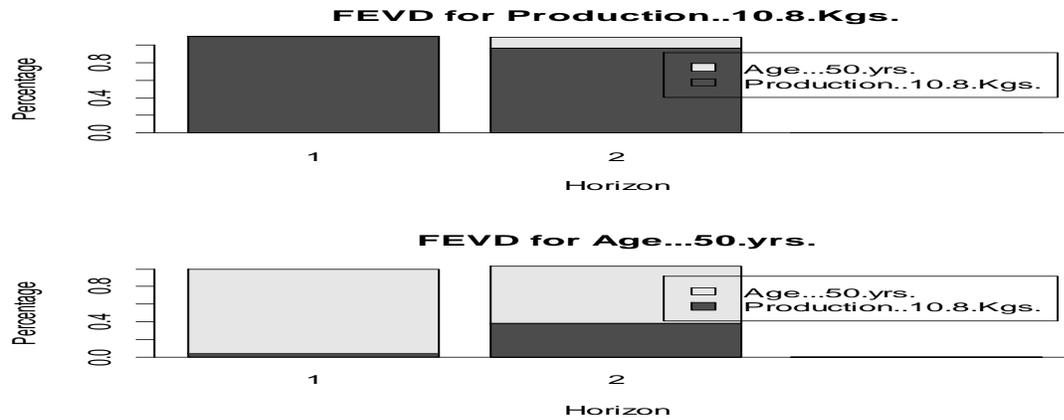


Figure 2.29: FEVD plots of Production and Percentage area of tea bushes of age > 50 yrs

Production seems to decrease and then increase in the next two years. The FEVD plot shows that the proportion of area contributes about 10-20% of variance in forecast error of production which is understandable as proportion of area causes production.

*H. Production, Rainfall and Temperature*

The monthly plot on production showed the presence of seasonality which means that in some months in a year, production would be high, while it will be low in other months. Since data on soil temperature was not available, production and rainfall were modeled for three different seasons viz. Monsoon (June-September), Post Monsoon (October-December) and Pre Monsoon (March-May). Yearly data for the period (1991-2006) was used for this purpose.

In Monsoon period, production did not show any correlation with rainfall and hence no stable model could be developed.

*I. Production and Rainfall in the Post Monsoon Period*

Production (in 1000 Kg) and Rainfall (in mm) were modeled in the post monsoon period using VAR. First the time series plots are visualized to understand the behavior of both the variables.

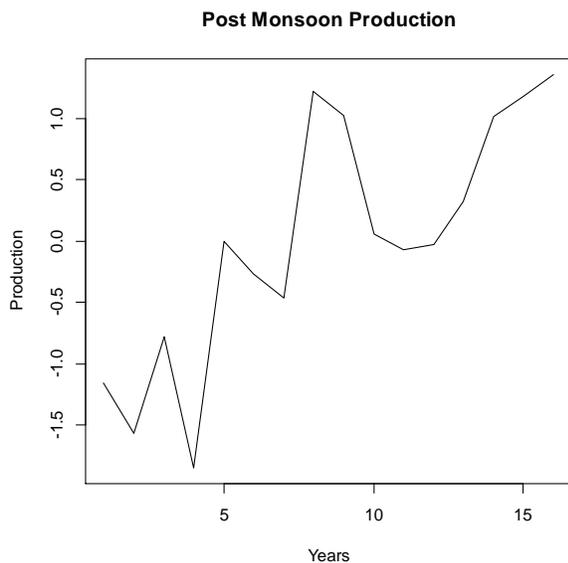


Figure 2.30: Time series plot of Production in Post Monsoon period

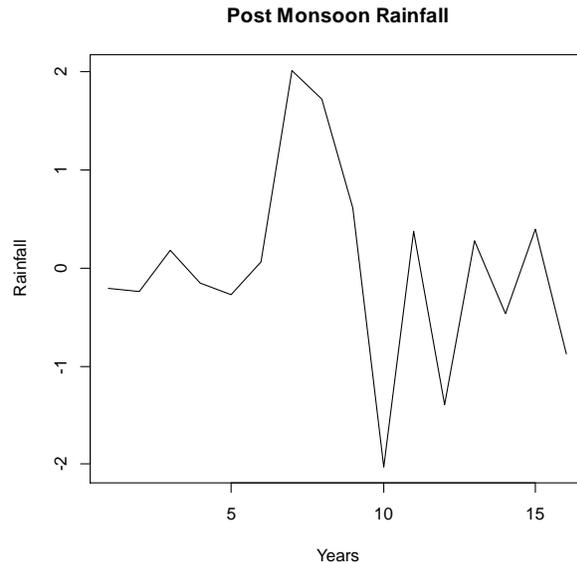


Figure 2.31: Time series plot of Rainfall in post Monsoon period

Production shows an increasing trend while rainfall doesn't show any trend. The optimal order of the model was found to be 2 based on the following criteria – AIC, HQ, SC and FPE. The final VAR (4) model is as shown below:

$$Prod_t = 334.00157 * Rainfall_{t-1} + 0.83878 * Prod_{t-2} + \epsilon_{1t}$$

The final model says that production at time  $t$  depends only on production at lag 2 and rainfall at lag 1. The coefficient corresponding to rainfall at lag 1 is positive implying that as rainfall at time  $(t-1)$  increases, production at time  $t$  increases which is understandable as we expect a positive relationship between production and rainfall.

The residuals of the final model were found to be both normal and white noise with  $p$  values of Jarque Bera test and Portmanteau test being 0.6716 and 0.2312 respectively. Causality results were not found to be positive. The IRF plot of rainfall on production is shown in figure 2.32.

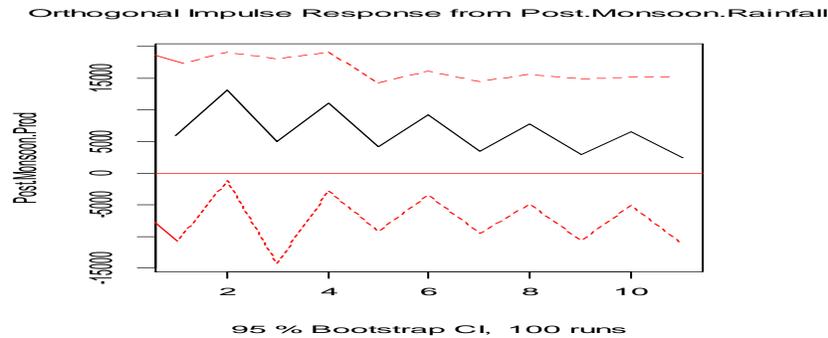


Figure 2.32: IRF plot of Rainfall on Production

Since the 95% bootstrap confidence intervals don't touch the 0 axis, the impact of unit shock in rainfall on production is not significant.

Finally we look at the prediction and FEVD plots to see how the variables behave in future.

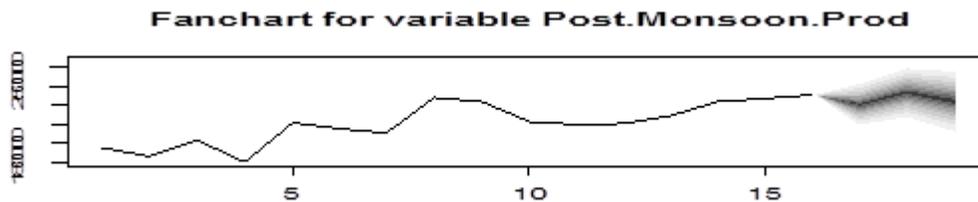


Figure 2.33: Prediction plot of Production

The prediction plot shows that production decreases initially and then increases in the next three years.

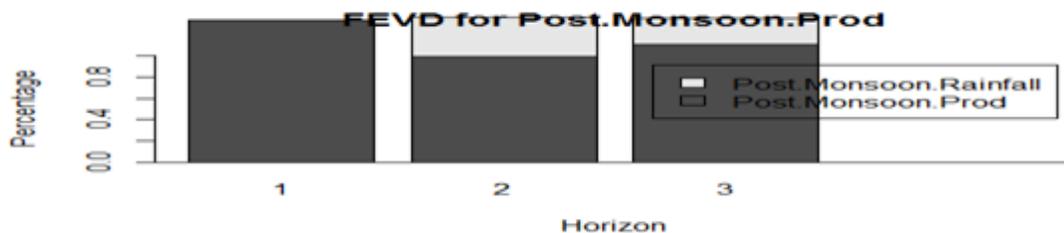


Figure 2.34: FEVD plot of Production

The FEVD plot shows that rainfall contributes about 20% to the variance of forecast error in production at lag 2 and about 10% at lag 3. This is understandable as rainfall at lag 1 affects production and hence its forecast will depend on rainfall.

Note that we are just interested in the final model and understanding the dynamics between variables and prediction is not the objective. This is because production should be forecasted using a model that contains all significant factors or variables as only then an accurate forecast could be obtained. But in all the discussed pair wise cases, we would just like to test how the independent variable considered affects production's forecast and error variance.

#### J. Production and Rainfall in the Pre Monsoon Period

Production (in 1000 Kg) and Rainfall (in mm) were modeled in the pre monsoon period using VAR. The final result of the model could not explain the dynamics and relationship between production and rainfall, as neither production nor rainfall depended on the other variable.

The final model was of the form given below:

$$Prod_t = Constant$$

Rainfall<sub>t</sub> = Constant

We, thereby conclude that there is no significant correlation between production and rainfall in the pre monsoon period and hence rainfall does not affect production in this period.

*K. Production and Coffee Prices*

Aggregate annual tea production (in Million Kg) is modeled with domestic average price of Robusta Coffee (in Rs/Kg) using VAR. Coffee is a substitute for tea and hence we expect an inverse relationship between supply of tea and coffee prices. The data period is from 1994 to 2011. The time series plots of domestic coffee prices and production are shown in figures 2.35 and 2.36 respectively.

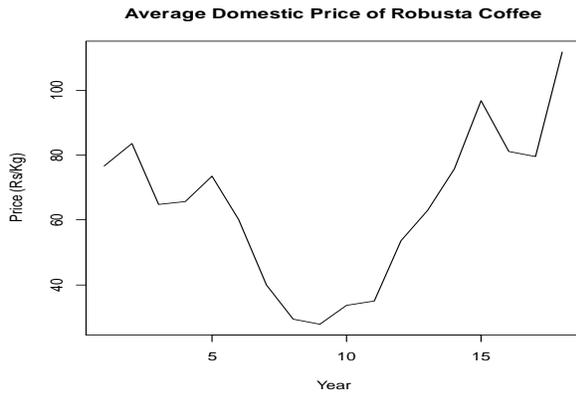


Figure 2.35: Time series plot of Domestic Coffee Prices

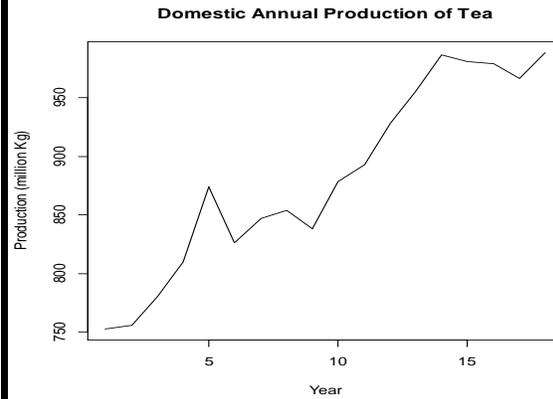


Figure 2.36: Time series plot of Domestic Production of Tea

Production as before shows an increasing trend while coffee prices initially decreases and then increases. The optimal order of the model was found to be 4 based on AIC, HQ, SC and FPE. The final VAR (4) model with only significant coefficients is as follows:

$$Prod_t = 552.75147 + 1.18016*Price_{t-1} + 0.45119*Prod_{t-4} - 1.67427*Price_{t-4} + \epsilon_{1t}$$

Price<sub>t</sub> – Domestic Coffee Price at time t

The final structural VAR model says that a unit increase in coffee prices at lag 1 will increase tea production by 1.18 units while a unit increase in coffee prices at lag 4 will decrease tea production by 1.67 units. Economics tells us that there is an inverse relationship between supply of particular goods and price of substitutes. Given this a positive coefficient for price at lag 1 does not concur with the known fact. But as mentioned before the coefficients should not be looked at separately but the model should be interpreted in its entirety. When coffee price at lag 1 was regressed with production, a negative coefficient of 0.67 is obtained which concurs with theory. Hence the final VAR model says that in presence of price and supply at lag 4, there seems to be a positive relationship between supply and price at lag 1.

The residuals of the final model were found to be both normal and white noise with p values of Jarque Bera test and Portmanteau test being 0.7006 and 0.2521 respectively. There seems to be instantaneous causality between tea production and coffee prices although granger causality fails. The IRF plot of coffee prices on tea production is shown in figure 2.37.

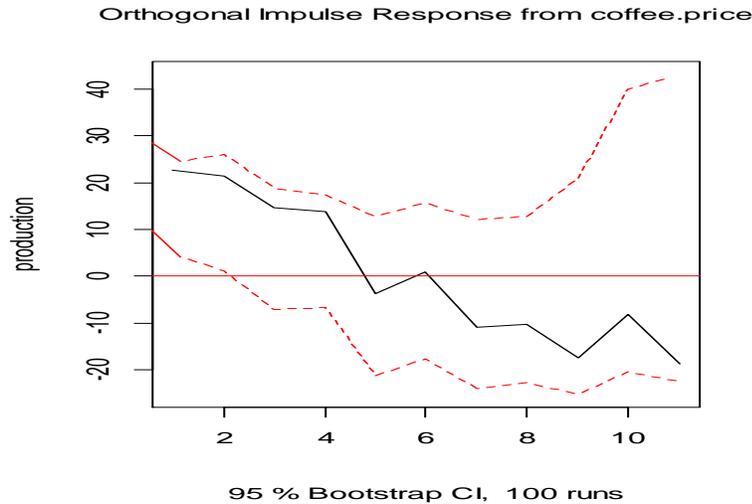


Figure 2.37: IRF plot of Coffee Prices on Tea Production

The plot says that a unit shock in domestic coffee price at lag 2 has a significant impact on current tea production. Finally we look at the prediction and FEVD plots to see how production changes in future because of coffee prices.

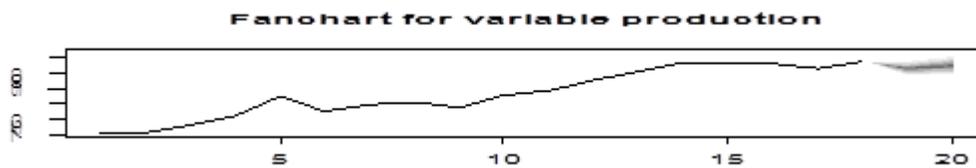


Figure 2.38: Prediction plot of Production

Tea production according to the structural VAR model shows a decline in the next two years.



Figure 2.39: FEVD plot of Production

Coffee price does not contribute to the variance of error forecast of production. This is a little surprising as coffee prices affect tea production according to the model.

Finally, it is of utmost importance to mention all variables that were not found to be affecting production. They include rainfall in monsoon and pre monsoon period, area under plucking, GDP, revenue through cess, bearing area and relative auction price of tea. Area under plucking is actually an important variable but may be because of lack of sufficient data points, stable model wouldn't have resulted. The same can be said about revenue through cess, as well. Also there seems to be not much correlation between tea production and relative price of tea which is the ratio of actual to expected tea price. This again can be attributed to lack of sufficient data points.

## VII. DATA AND METHODOLOGY

Tea industry in the past five years has experienced increase in auction prices owing to strong demand from local and overseas buyers. On the other hand, annual production has not shown any significant increase. This study focuses on modeling of production and auc-

tion prices of tea in India. Market integration and price transmission between selected auction and retail markets of tea in India are analyzed. Price transmission between domestic and international auction markets of tea is examined empirically. The broad objectives of the study as mentioned in chapter one are:

- Identifying factors affecting tea production in India
- Modeling of Annual tea production with the identified factors
- Finding reasons for why or how some factors, if any, did not show any effect on production

These major objectives were dealt with separately in subsequent chapters. Factors affecting annual tea production were identified and modeled in chapter two. Possible reasons for some factors not showing correlation with production were discussed. The following variables were assumed to be affecting aggregate tea production in India from literature - Area under cultivation of Tea, Domestic Consumption, Price, Rainfall, Temperature, Age of Tea Bushes, Labour, Area under plucking, GDP at Market prices, Revenue through Cess and Number of Suppliers. A pair wise analysis was done using VAR as the methodology and the findings that emerged from empirical analysis are as follows:

- VAR (1) model was developed between production and consumption in which production depended on consumption at lag 1 with a positive coefficient while consumption depended only on its own lag. Consumption was found to be granger causing production with the IRF plot showing that the impact on production caused due to a unit shock in consumption is felt for a very long period.
- VAR (4) model was developed between production and number of suppliers in which production depended on number of suppliers at lags 1, 2 and 3 and on its own lags. The dynamics was found to be complex with the coefficient corresponding to number of suppliers at lag 1 being negative and the other two coefficients being positive. Here, the number of suppliers denotes the number of tea estates in India and hence we expect the production to rise with increase in number of suppliers. We also proved that there is a positive relationship between production at time t and number of suppliers at time (t-1) and hence VAR model will have to be interpreted in its entirety. Number of suppliers was found to be granger causing production with the IRF plot showing that the impact on production due to a unit shock in number of suppliers will be significant and also will be felt for a long period.
- VAR (4) model was developed between production and average number of labor employed in the tea industry in which production depended on labor at lag 2 with a positive coefficient and labor depended on production at lags 2 and 3 with both being positive coefficients. The causality results are not positive while IRF plots show that unit shocks in either variable will have significant impacts on the other variable for many lags.
- When production was modeled with auction prices using yearly data, no correlation was found between them. When they were modeled with monthly data from 1991 to 2005, VAR (4) model was developed in which production depended on price at lags 2 and 3 with the coefficient corresponding to price at lag 2 being positive and the coefficient corresponding to price at lag 3 being negative while price depended on production at lag 4 with the corresponding coefficient being negative. Instantaneous causality was found to be present between production and price and price was found to be granger causing production. The IRF plot of price on production showed that the impact on production due to a unit shock in price would be felt for about eight months. The same was found to be true in the case of IRF plot of production on price.
- VAR (1) model was developed between production and proportion of area of tea bushes in the age group of above 50 years to the total area in which production depended on the second variable at lag 1 with the coefficient being negative. The causality results were not positive while the IRF plot of the second variable on production showed that the impact due to a shock in the second variable on production is slightly significant.
- VAR (4) model was developed between production and rainfall in the post monsoon period (October-December) in which production depended on rainfall at lag 1 with the corresponding coefficient being positive implying that production would increase with increase in rainfall. Causality results were not positive and IRF of rainfall on production was also not significant.

The variables that were initially assumed to affect production but did not show any correlation with it were rainfall in monsoon and pre monsoon period, area under plucking, GDP and revenue through cess. One reason for this could be because of lack of sufficient data points. Tea cess is a tax levied by the central government. Revenue through cess (in crores) is the total amount that government of India through Tea Board got by imposing cess on tea. It will be included in the auction prices of tea sold through public auctions. Revenue from cess can increase either due to an increase in total quantity produced or due to an increase in cess levied per kg of tea. The analysis showed that this did not have any correlation with the total supply of tea in India. Again this could be because of the same reason mentioned above.

## VIII. LIMITATIONS

In production modeling, bivariate analysis has been carried out which is devoid of partial relationships. This is because of lack of sufficient data points. Bivariate models can only help in understanding the marginal effect of other variables on the variable of interest.

## ACKNOWLEDGMENT

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# Investigations on Hybrid Learning in Anfis in Microarray Gene Expression Classification

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**Abstract-** This paper discusses the performance of proposed learning method of Hybrid Back Propagation Neuro fuzzy Method (BPN) and Runge-Kutta Learning Method(RKLM). The proposed learning method is evaluated in the application of cancer classification. First, a classifier is trained with a part of samples in the cancer data set. Then one uses the trained classifier to predict the samples in the rest of the dataset to evaluate the effectiveness of the classifier. The analysis of the cancer classification using Hybrid Adaptive Neuro Fuzzy Inference System (ANFIS) is explained in this paper.

**Index Terms-** Learning Method, Microarray Gene Expression, BPN, ANFIS, RKLM.

## I. INTRODUCTION

In current years, DNA microarray technology has been established as an extremely powerful tool for the expression of genes. Analyzing the great amount of gene expression data from

microarray chips it is understood that it can perform a very essential role in disease diagnosis, particularly in cancer diagnosis. It also offers an opportunity and a challenge for present machine learning research.

## II. MICROARRAY GENE EXPRESSION

Cells are the main basic units of all organisms on earth, except for viruses, e.g., yeast has only one cell, while any of the mammals, hold tons of cells. Within a cell, there is a nucleus, and inside a nucleus, there are quite a number of divided long segments called chromosomes which is prepared by Deoxyribonucleic Acid (DNA). The basic units of DNA are nucleotides which consist of sugar phosphate backbone and four bases Adenine (A), Cytosine(C), Guanine (G), and Thymine (T). A pairs with T [3], while C pairs with G. DNA codes the inherited information through particular order of these base pairs on a double-stranded helix for reproduction of organisms (see Figure 1).

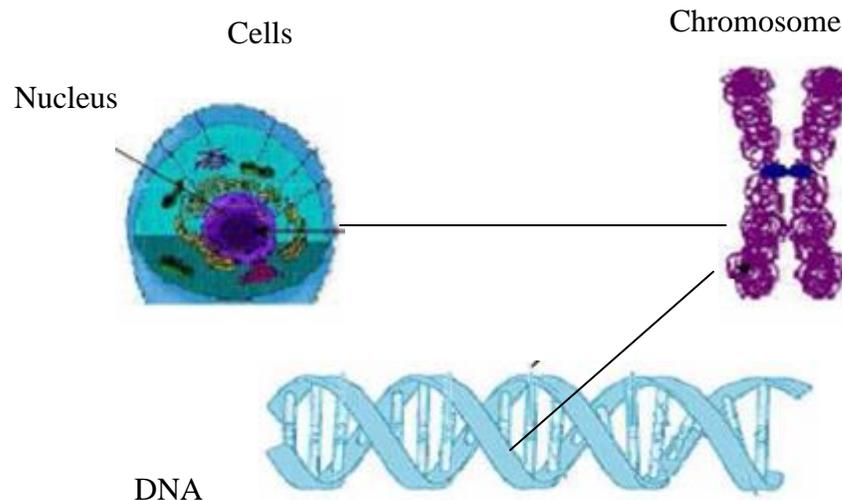


Figure.1 An overview of the relationship among cell, nucleus, chromosome, gene and DNA.

DNA has coding and non-coding segments, and the coding segments are called genes. The technique from genes to proteins includes two steps: First, DNA is recorded into messenger ribonucleic acid, via mRNA or RNA in short. Second, the mRNA transforms into proteins. Basically all cells in the related organism have similar genes, but these genes can be expressed in more than one way at different times and under different situations. The majority of molecular biology investigations focused on mRNA level due to the information that all most important differences in cell state or type are connected with changes in the mRNA levels of many genes [5].

### III. CANCER GENE EXPRESSION CLASSIFICATION

Zhenyu Wang [16] proposed Neuro-fuzzy modeling for microarray cancer gene expression data. It is easy and very successful technique that applies to accurate cancer classification using expressions of only very few genes. The cancer classification is proposed by Niyue Tan [11]. The cancer type and phase are often extremely important to the assignment of the suitable treatments. It is identified that mutations in genes can lead to cancer. Standard cells can develop into malignant cancer cells through a series of mutations in genes that manage the cell cycle and genome integrity, to name only a few [7]. These mutations are missing in normal cells, and this attempt expects the expression levels of these genes, and genes regulated by these genes, to be different in usual and cancerous cells. By observing these differences, it is now achievable to classify cells as cancerous or usual by measuring the expression levels of a variety of genes present in the cells.

Initially, plan the microarray experiments according to a biological problem that need to be learnt. Normally, microarray experiments can be separated into two categories. One focuses on time series information which contains the gene expression data of a variety of genes under a range of research. An additional type of microarray experiment consists of gene expression data of a variety of genes taken from various tissue samples or under different experimental conditions, such as nutrition, temperature, chemical environment and etc.

The gene expression profiles from particular microarray experiments have been newly utilized for cancer classification. This advance promises to give an improved therapeutic measurement to cancer patients by diagnosing cancer variety with enhanced accuracy [13]. However, the feature of data produced by this new technology is more than one can manually investigate.

### IV. GENE RANKING USING T-SCORE

To find out how the gene importance ranking scheme influences the classification result, T-Score (TS) ranking scheme was used [17]. In the datasets, the combinations were tested within the top 100 genes selected by the ranking scheme. Compute the importance ranking of each gene using a feature ranking measure, one of which is described below.

T-Test: The t-score (TS) of gene  $i$  is defined as follows:

$$TS_i = \max \left\{ \frac{\bar{x}_{ik} - \bar{x}_i}{m_k s_i}, k = 1, 2, \dots, K \right\} \quad [53] \quad (4.1)$$

where

$$\bar{x}_{ik} = \sum_{j \in C_k} \bar{x}_{ij} / n_k \quad [54] \quad (4.2)$$

$$\bar{x}_i = \sum_{j=1}^n x_{ij} / n \quad [56] \quad (4.3)$$

$$s_i^2 = \frac{1}{n-K} \sum_k \sum_{j \in C_k} (x_{ij} - \bar{x}_{ik})^2 \quad [58] \quad (4.4)$$

$$m_k = \sqrt{\frac{1}{n_k} - \frac{1}{n}} \quad [60] \quad (4.5)$$

There are  $k$  classes.  $\max\{y_k, k = 1, 2, \dots, K\}$  is the maximum of all  $y_k$ .  $C_k$  refers to class  $k$  that includes  $n_k$  samples,  $x_{ij}$  is the expression value of gene  $i$  in sample  $j$ ,  $\bar{x}_{ik}$  is the mean expression value in class  $k$  for gene  $i$ ,  $n$  is the total number of samples,  $\bar{x}_i$  is the general mean expression value for gene  $i$  and  $s_i$  is the joint within-class standard deviation for gene  $i$ . In fact, the TS used here is a t-statistic between the centroid of a specific class and the overall centroid of all the classes. Another possible model for TS could be a t-statistic between the centroid of a specific class and the centroid of all the other classes.

### V. GENE SELECTION

The amount of features (usually in the range of 2000-30000) is greatly bigger than the amount of samples (usually in the range of 40-200). When such data is offered, various standard data analysis and machine learning methods are either unsuitable or become computationally infeasible [12]. A large amount of genes are not related to the presentation of the classification. Taking such genes into account during classification enlarge the dimension of the classification difficulty, poses computational complexity, and introduces unnecessary noise in the procedure. A main goal for diagnostic research is to develop diagnostic procedures based on inexpensive microarrays that have sufficient probes to discover diseases. Thus, it is crucial to identify whether a small amount of genes can be sufficient for good classification. This necessitates selection of several genes that are extremely related to particular classes for classification, which are called informative genes. This procedure is called gene selection, or feature selection in machine learning in common [8]. Some modern research has exposed that a small amount of genes are enough for accurate diagnosis of the major cancers, even though the amount of genes vary greatly among different diseases.

Therefore, the microarray cancer classification problems are classified as the combinational optimization problem with two major objectives: diminishing the amount of selected genes and maximizing the classification accuracy.

The difficulty of feature selection lies in a thorough treatment in pattern recognition and machine learning. The gene expression datasets are difficult to contain a huge amount of genes. Moreover, these datasets hold only a small amount of samples, so the discovery of irrelevant genes can suffer from statistical instabilities.

### VI. FINDING THE MINIMUM GENE SUBSET

After selecting some top genes in the importance ranking list, it attempts to classify the dataset with only one gene. This work input each selected gene into our classifier. If no good accuracy is obtained, go on classifying the dataset with all the possible 2-gene combinations within the selected genes. If still no

good accuracy is obtained, then repeat this procedure with all the 3-gene combinations and so on, until obtain a good accuracy. This work used the following three learning methods in ANFIS classifier to test gene combinations.

- i. BPN
- ii. Hybrid (BPN and LSE)
- iii. Hybrid (BPN and RKLM)

For Back propagation, Hybrid BPN and Least Square Estimator (LSE) and Hybrid BPN and RKLM carried out 5-fold Cross-Validation (CV) in the training dataset to tune their parameters.

## VII. THE CANCER CLASSIFICATION PROBLEM

Cancer classification is central to cancer treatment. Further subdivision of morphologically similar tumors can be made at molecular level; traditionally cancer classification relied on specific biological insights, rather than on systematic and unbiased approaches. Cancer classification can be divided into two challenges: class detection and class prediction. Class detection refers to defining previously unrecognized tumor subtypes. Class prediction refers to the assignment of particular tumor samples to already-defined classes. To develop a more systematic approach to cancer classification based on the simultaneous expression monitoring of hundreds of genes using DNA microarrays as test cases [14,15].

The gene expression data from cancer samples, namely the cancer gene expression data allow comparison of gene expression levels between normal and cancer cells, so that further analysis work could be performed to find out the 'Internal pattern' which may serve as a classification technique.

Classification difficulty has been expansively studied by researchers in the area of statistics, machine learning and databases. Numerous classification algorithms have been developed in the history, such as the decision tree methods, the linear discrimination analysis, the Bayesian network and etc., [9]. For the last few years, researchers have started paying concentration to the cancer classification using machine learning. Studies have shown that gene expression changes are related with different types of cancers.

Most planned cancer classification techniques are from the statistical and machine learning areas, ranging from the old adjacent neighbor analysis, to the fresh approach. There is no single classifier that is greater over the rest. Some of the techniques only works well on binary-class problems and not extensible to multi-class problems, while others are more general and flexible [2]. One thing to note for most of those planned algorithms on gene classification is that the authors are only concerned with the precision of the classification and do not give much attention to the running time.

Cancer classification using gene expression data stands out from the additional preceding classification data due to its unique nature and application field. Through this study it is hoped to achieve some insight into the problem of cancer classification in aid of further increasing more efficient and capable classification algorithms.

### 7.1 Training and testing of data

The proposed approach computes the feature ranking score from a statistical analysis of weight vectors of multiple linear trained on subsamples of the original training data. Then the proposed method is tested on four gene expression datasets for cancer classification. The results show that the proposed feature selection method selects better gene subsets than the standard method and improves the classification accuracy. A Gene Oncology-based similarity assessment indicates that the selected subsets are functionally diverse, further validating proposed gene selection method. This investigation also suggests that, for gene expression-based cancer classification, average test error from multiple partitions of training and test sets can be recommended as a reference of performance quality.

### A. Terminologies and Problem Statement

This chapter defines and introduces some terminologies and notations that will be used throughout the section for the problem of cancer classification using gene expression data, termed cancer classification, for briefness [10].

Let  $X_1, X_2, \dots, X_m$  be random variables for genes  $G_1, G_2, \dots, G_m$  respectively, where  $X_i$  has domain  $\text{dom}(X_i)$  which is the range of expression values for gene  $G_i$ . Let  $C$  be the random variable for the class labels, and  $\text{dom}(C) = \{1, \dots, K\}$ , where  $K$  denotes the total number of classes. Let  $t = \{t.X_1, t.X_2, \dots, t.X_m\}$  denotes a size  $m$  tuple of expression values for  $m$  genes. Let  $T = \{(t_1, c_1), (t_2, c_2), \dots, (t_n, c_n)\}$  denoting a training set of  $n$  tuples, where  $i = \{1, 2, \dots, n\}$ ,  $c_i \in \text{dom}(C)$  is the class label of tuple  $t_i$ . Let the test set be  $S = \{t_1, t_2, \dots, t_l\}$  where  $l$  is the size of the test set.

A Classifier is a function class with two arguments,  $T$  and  $S$ , where  $T$  denotes the training samples and  $S$  is a testing sample. Function class returns a class prediction for sample  $s$ . The classification accuracy is defined as the number of correct predictions made by the classifier on a set of testing tuples using the function Class trained on the training tuples.

### B. Main problem in cancer classification

Given a training set  $T = \{(t_1, c_1), (t_2, c_2), \dots, (t_n, c_n)\}$ , where  $t_i$ 's are independent  $m$ -dimensional random data tuples of gene expression values,  $m$  is the total number of genes,  $t_i = (t_i.X_1, t_i.X_2, \dots, t_i.X_m)$ ,  $m > n$  and  $c_i \in \text{dom}(C)$  is the class label of the  $i^{\text{th}}$  tuple. Given a test set  $S = \{s_1, s_2, \dots, s_l\}$ . Each  $s_i$  is a gene expression data tuple of length  $m$ . Each  $s_i$  is in the form of  $\{s_i.X_1, s_i.X_2, \dots, s_i.X_m\}$ , where  $x_j$  is the expression value of gene  $j$ . Find a classification function class, which gives maximal classification accuracy on  $S$ .

The gathering of well-distributed, sufficient and accurately calculated input data is the basic condition to achieve an exact model [1]. Selection of the ANFIS inputs is the major important task of designing the classifier, since even the greatest classifier will carry out poorly if the inputs are not chosen sufficiently well. It is tricky for ANFIS to handle high dimensional problems, as this leads to a huge amount of input nodes, rules and hence resultant parameters.

VIII. EXPERIMENTAL RESULTS

The experiment was done using MATLAB 7 [4] under windows environment. There are various classifiers are studied in the literature but in this research only ANFIS is considered for classification, because the proposed learning model applied only with ANFIS classifier. Results that are achieved by using ANFIS classifier are encouraging. It analyzes the classification performance of the cancer using proposed learning methods in ANFIS classifier. In this assessment, the classification performance, together with the training error rate is considered as the primary comparison measures. From the result it is seen that the performance of ANFIS with RKLM gives the best in estimation.

The work, reported in this research, indicates that ANFIS structure is a good candidate for classification purposes. Additionally, it is a smart performance of the RKLM approach with on-line operation and with ANFIS

A. Datasets

There are many different benchmark microarray datasets, reported in published cancer gene expression studies, including leukemia cancer dataset, colon cancer dataset, lymphoma dataset, breast cancer dataset and ovarian cancer dataset [6]. In this research, the proposed learning models are tested on three datasets: leukemia cancer dataset, lymphoma cancer dataset and Small Round Blue Cell Tumour (SRBCT) cancer dataset.

The aim of testing on several different datasets is not only to show that proposed models are better or worse, but also to find out when new models performs better and why, what are the reasons causing the unsatisfying results, and how to solve the problems.

B. Accuracy, Error rate and Execution Time for Proposed Hybrid ANFIS

The average accuracy and the execution time is shown in the below tables and figures.

Table 1: Average accuracy

| [62] Dataset  | [63] No. of gene selected | [64] Average Accuracy (%) |                                     |                                 |
|---------------|---------------------------|---------------------------|-------------------------------------|---------------------------------|
|               |                           | [65] BPN                  | [66] Hybrid [67] (BPN and LSE) [68] | [69] Hybrid [70] (BPN and RKLM) |
| [71] Leukemia | [72] 2                    | [73] 89                   | [74] 93                             | [75] 97                         |
|               | [76] 3                    | [77] 89                   | [78] 95                             | [79] 98                         |
| [80] Lymphoma | [81] 2                    | [82] 92                   | [83] 93                             | [84] 96                         |
|               | [85] 3                    | [86] 93                   | [87] 93                             | [88] 96                         |
| [89] SRBCT    | [90] 2                    | [91] 93                   | [92] 95                             | [93] 97                         |
|               | [94] 3                    | [95] 95                   | [96] 96                             | [97] 97                         |

Table 1 shows the average accuracy for ANFIS classifier with proposed Hybrid BPN and RKLM learning. Then the proposed learning model Hybrid BPN and RKLM is higher when compared with other two learning methods in ANFIS.

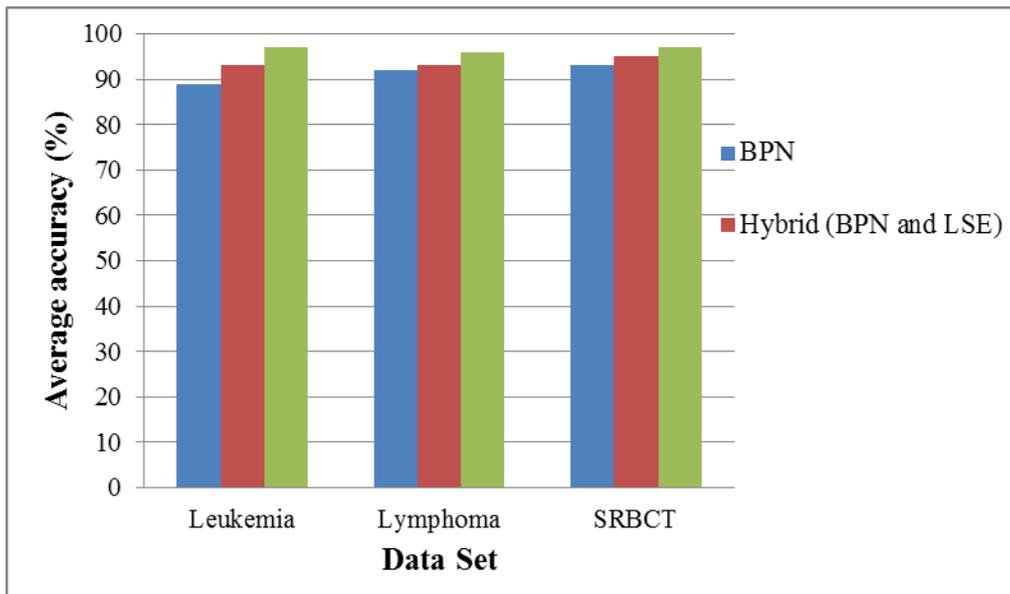
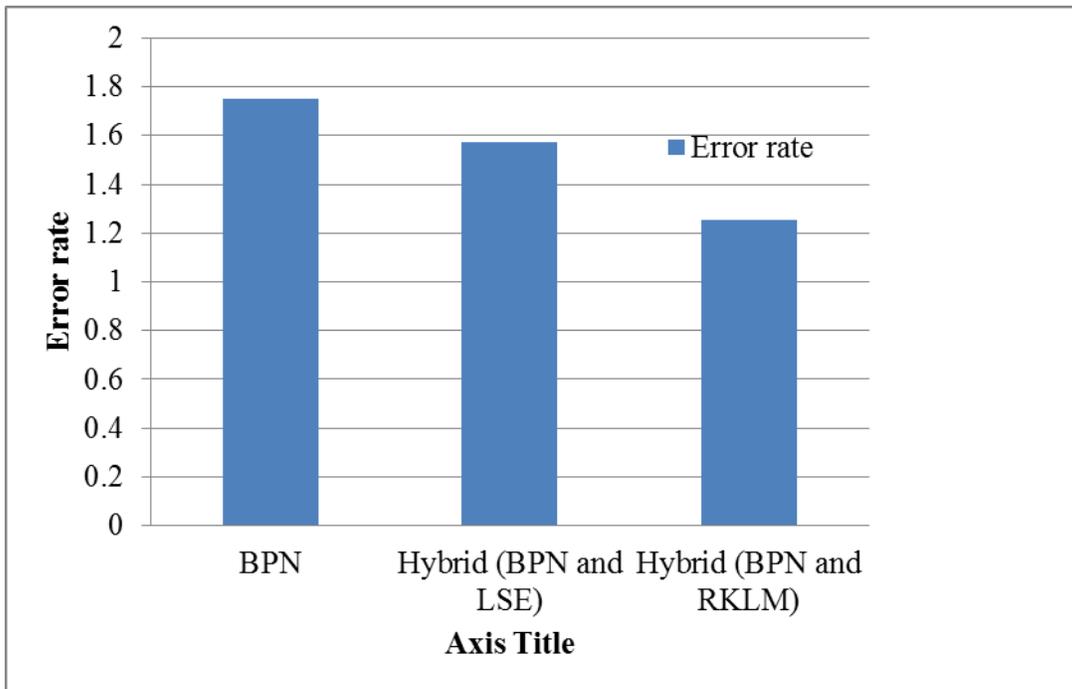


Figure 2: Average accuracy for 2-gene combination

Figure 2 shows the average accuracy for 2-gene combinations for leukemia, lymphoma and SRBCT datasets and proposed learning model. The proposed learning method of Hybrid BPN and RKLM has high accuracy when compared with other learning methods.

**Table.2: Average error rate for 2-gene combinations**

|                            |                 |
|----------------------------|-----------------|
| [98] <b>Hybrid Methods</b> | [99] Error rate |
| [100]BPN                   | [101]1.750      |
| [102]Hybrid (BPN and LSE)  | [103]1.573      |
| [104]Hybrid (BPN and RKLM) | [105]1.251      |

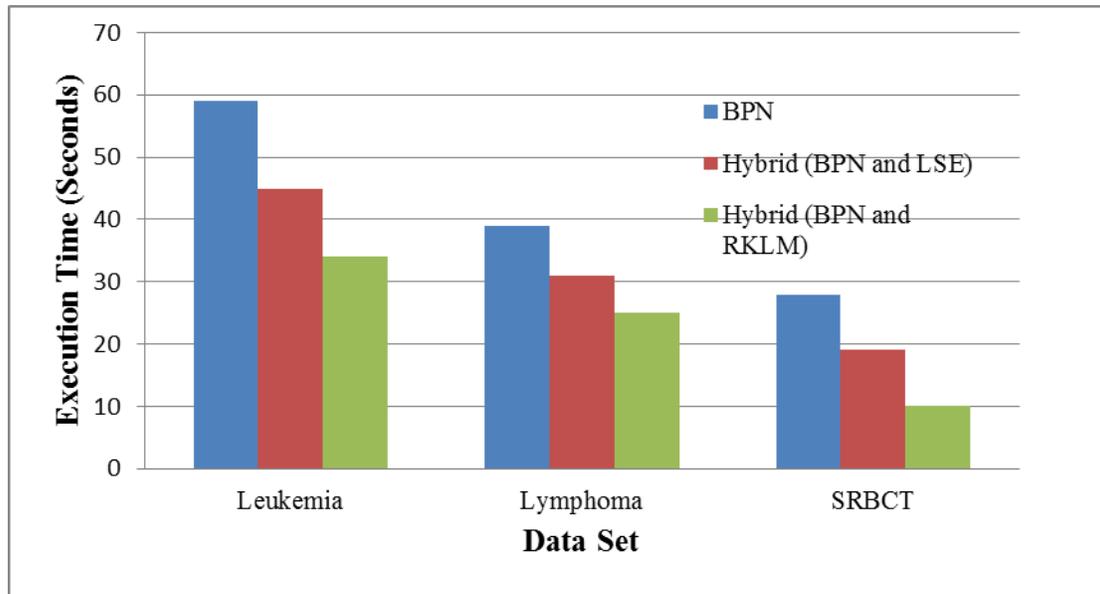


**Figure 3: Error rate for 2-gene combinations**

Table 2 and figure 3 show the error rate of the various learning model applied in ANFIS classifier. The proposed Hybrid learning of BPN and RKLM has less error rate when compared to other two standard learning methods.

**Table 3: Execution time**

| [106]Dataset  | [107]No. of gene selected | [108]Execution Time (Seconds) |                                |                                 |
|---------------|---------------------------|-------------------------------|--------------------------------|---------------------------------|
|               |                           | [109]BPN                      | [110]Hybrid [111](BPN and LSE) | [112]Hybrid [113](BPN and RKLM) |
| [114]Leukemia | [115]2                    | [116]59                       | [117]45                        | [118]34                         |
|               | [119]3                    | [120]75                       | [121]70                        | [122]41                         |
| [123]Lymphoma | [124]2                    | [125]39                       | [126]31                        | [127]25                         |
|               | [128]3                    | [129]53                       | [130]57                        | [131]26                         |
| [132]SRBCT    | [133]2                    | [134]28                       | [135]19                        | [136]10                         |
|               | [137]3                    | [138]43                       | [139]35                        | [140]12                         |



**Figure 4 Execution time for the ANFIS methods**

Figure 4 shows the execution time for proposed method of Hybrid BPN and RKLM. Hybrid BPN and RKLM have less execution when compared with ANFIS methods.

#### IX. CONCLUSION

Systematic and unbiased approach to cancer classification is of great importance to cancer treatment and drug discovery. Previous cancer classification methods were all clinical based and were limited in their diagnostic ability. It has been known that gene expressions contain the keys to the fundamental problems of cancer diagnosis, cancer treatment and drug discovery. The gene expression data classification using ANFIS may use list of datasets like Leukemia, Lymphoma and SRBCT for the proposed method. Thus the above table and chart show the proposed learning method of Hybrid BPN and RKLM have high accuracy with less time when compared with the other ANFIS methods.

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# Automatic Washer Fault Detection using Pattern Recognition

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**Abstract-** In last few years industries are facing a major problem in field of testing their final finished produce especially in the field of automobiles. Efficiency of the vehicles is affected when the parts are not tested properly. Hence the selection and rejection of this automobile part for the further implementation of automotive is needed. We are presenting our research paper on developing intelligence in machine so as to make machine to do accurate analysis and on the basis of this analysis machine is able to take accurate and correct decision regarding sorting of defective and non defective washers. Neural network technique which is part of pattern recognition is used to implement artificial intelligence in the machine. These technique is synthesized using MATLAB. hence we are providing the most promising solution for fast and accurate sorting technique for washers.

## I. INTRODUCTION

Petrol is one of the non renewable resource which is required in our day to day life and is becoming extinct. There are various reasons why petrol is becoming extinct one of which is improper manufacturing of some parts of vehicles engine which can cause loss of petrol either by increasing its consumption or by leaking. also companies which are manufacturing automotive parts(washer) face a lot of problems and bear losses of about 20

This project is used to find the three dimensional faults in an object by simply adjusting the position of the camera and conveyor belt design. Two cameras can be used to get the three dimensional image of the object. To get the rear image of the object transparent layer is made in the conveyor belt design. In order to process multiple objects in a single device set up upcoming technology known as artificial neural network is used which takes the decision automatically according to the real time image and standard image. In automobile industries-motor current signature analysis has been successfully used in induction machines for broken rotor bars fault diagnosis. The method however does not always achieve good results when the load torque is not constant.

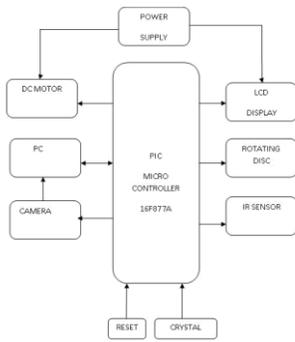
## II. AUTOMATIC FAULT DETECTION

In the science and engineering of automobile parts manufacturing, the testing and fault detection plays major role. In the past few years, the fault detection is carried out by comparing the real time image of automobile jobs with the standard image of that object already stored. However, it consumes more time because it compares multiple images, recently

some new transformations are used to detect fault without comparison. Hence the proposed system is analysis of the image and identifying the fault using the image processing technique combined with matlab. Moreover the analysis of these images is going to be done in three-dimension. The images of the automobile parts carried out in the conveyor is captured as video and it is converted into snaps using matlab some adaptive techniques and some transformations are being used to analyze the real time image of the automobile parts. If any fault is identified the fault will be displayed in output screen of the matlab. The fault is taken out in terms of values from pc, using this value the pushing element separates the faulted piece from the process. The block diagram of the proposed system is shown below.

## III. SYSTEM ARCHITECTURE

In system block diagram shown above microcontroller is used for controlling operations. It controls operation of DC motor which in turn rotates the disc on which object is placed. High resolution camera is used to capture the images and these images are provided to pc which uses MATLAB and compares the image captured by camera with the standard image and therefore detects fault using image processing. The decision whether or not the washer is defective is taken using neural networks which is part of pattern recognition. When object is placed on the disc it is sensed by IR sensor and image is captured. LCD display is used for displaying the number of defective washers, number of tested washers and number of non defective washers.



**Fig. 1. System Block Diagram.**

**IV. METHODOLOGY**

This design is being assigned two methodologies namely hardware methodology and software methodology. Hardware methodology consist of conveyer bet with glass disc and software methodology consists flow of our testing procedure

**A. Hardware Methodology: Belt conveyor with Glass Disc**

The belt conveyor is an endless belt moving over two end pulleys at fixed positions and used for transporting material horizontally or at an incline up or down. The main components of a belt conveyor are:

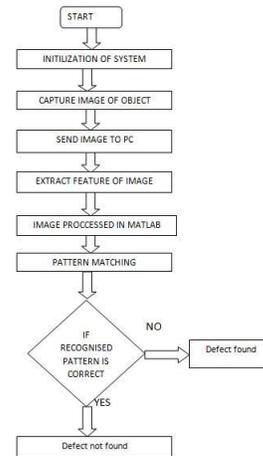
- The belt that forms the moving and supporting surface on which the conveyed material rides. It is the tractive element. The belt should be selected considering the material to be transported.
- The idlers, which form the supports for the carrying and return stands of the belt.
- The pulleys that support and move the belt and controls its tension.
- The drive that imparts power to one or more pulleys to move the belt and its loads.
- The structure that supports and maintains the alignments of the idlers and pulleys and support the driving machinery.

**[3]. Software Methodology**

Software methodology includes flow of testing procedure as shown in figure below.

1. Start
2. Initialization of system
3. Capture image of object
4. Send captured image to pc
5. Extract feature of image
6. Image processing of object is done using matlab
7. Mat lab recognize image of object and matches it with the predefined dimensions of objects image and take decision whether the object is faulty or not
8. If the pattern is matched defect is not found

9. If pattern not correct then defect is found and process is repeated for another washer
10. End .



**Fig. 2. Software Methodology flowchart**

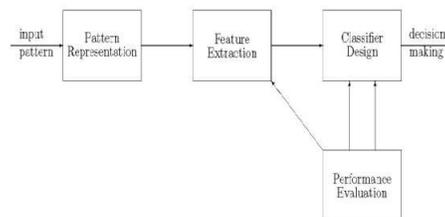
**V. PATTERN RECOGNITION AND CLASSIFICATION**

Pattern recognition is one of the most difficult problems in image processing especially in very noisy conditions. Arsenault et al. in 1988 have developed a technique to improve the performance of ANN in pattern recognition and classification. The superior performance is achieved by introducing an in-variant into the network by changing the interconnection between layers of the network, or by means of some pre-processing of the input data.

PATTERNS RECOGNITION MODELS

| Approach                 | Representation            | Recognition function           | Typical criterion    |
|--------------------------|---------------------------|--------------------------------|----------------------|
| Template matching        | Samples, pixels, curves   | Correlation, distance measures | Classification error |
| Statistical              | Features                  | Discriminant function          | Classification error |
| Stochastic or structural | Primitives                | Rules, grammar                 | Acceptance error     |
| Neural networks          | Samples, pixels, features | Network function               | Mean square error    |

**Fig. 3. Pattern recognition model.**

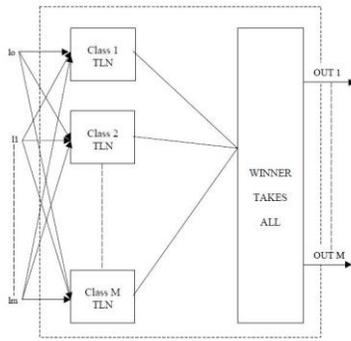


**Fig. 4. Pattern recognition block digram.**

**A. Proposed neural network architecture**

Based on the above, a novel neural architecture of a multisensor classification problem, have been proposed. This neural have been proposed. The first hidden layer consists of a committee of neurons, the first-level committee, to check the constraints on data. The results of such checks are managed by the output neuron of the subnet, which resembles a vote taking unit (VTU). The output neurons of the sensorrelated subnets resemble the members of a second-level-committee, each member of which is an expert in the analysis of the data from a single sensor element. Again, the output unit of the TLN is regarded as the VTU of this committee, combining the judgements provided by the sensor-related committees.

architecture geometry is shown in Fig. 5. In this neural architecture, for each class, a TLN with two hidden levels



**Fig. 5. Winer-takes algorithm**

**VI. SIMULATION RESULTS**



**Fig. 6. Original Image.**



**Fig. 7. Fault Detected image**

**VII. CONCLUSION**

Thus the image processing in MATLAB and pattern recognition gives more accurate method of detecting fault in the automobile part(washer) than manual checking and testing. The program is suited for any job that is coming on the real time so it is less time consuming .If there is no fault detected the output will be zero so that the objects moves to the other side of the conveyor if the fault is detected which is a value. This value is sent to the microcontroller through RS232 AND MAX 232, which controls the pushing ele-

ment and thus the object is rejected from the conveyor if it has a fault in it. Thus the washer is tested and fault is diagnosed using image processing techniques such as image processing and neural network which is part of pattern recognition.

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# Impact of Social Support in Relation to Self-Esteem and Aggression among Adolescents

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**Abstract-** The term social support can be talked in terms of relationships that how much and to what level can it fit in relationships. The social support includes the help and assistance that one need from friends, family at any time of need, crisis so as to inculcate the positive self image. It not only improves the quality of life but also helps during adverse times. The self esteem means self image that buffers and improves upon one's beliefs. It is a personality trait which remains stable and is permanent in nature. Self-esteem includes various beliefs about self such as ones appraisal of own physical characteristics, i.e. appearance, the emotions that one carry and the positive self attitude and behavior. The term aggression is a kind of response that one gives to other which is unpleasant in nature. In psychology, the term aggression denotes any unpleasant stimulus that harms the physical and psychological characteristics in the environment. The aggression can be verbal, physical, anger and hostility. The aim of the current investigation was to study the impact of social support on self esteem and aggression. For this purpose, the perceived social support scale (Zimet, Dahlem, Zimet & Farley, 1988), Self-Esteem scale (Rosenberg, 1965) and Aggression scale (Buss & Perry, 1992) were administered to the sample of 100 students in the age range of 18-23 years. The sample was taken from different colleges of Chandigarh. The inter-correlation matrix was calculated. The results have shown and proved the hypotheses that there is a positive relationship between social support and self esteem ( $r = 0.19$ ) significant at 0.05 level and a negative correlation between social support and aggression ( $r = 0.22$ ).

**Index Terms-** Social support, Self-esteem, Aggression, Adolescents.

## I. INTRODUCTION

Social support is a kind of help and assistance that one gets from other people when one is there to care for you and that one is a part of the social circle where one lives and grows. The support and assistance can be in many ways like help in emotional way for example nurturance from closed ones, advice in form of the information, support in terms of finance, sense of belongingness and also on top of everything that is a personal support and advice. The term social support can be therefore measured or valued as a source of assistance that is available and when one is helped being the part of the social group. The support that one can get includes the family, friends, neighbors, pets, organizations, coworkers etc. According to Towey (2013) social

support is a part of one's relationships with others. It means having someone including family, friends in times of the different kinds of crisis and to enhance a sense of belongingness and to enhance the inner positive self image. The social support enhances and influences the quality of life and safeguards against any adverse life events. The forms of social support can be of different kinds:

Emotional refers to the actions and events when one is cared for.

Instrumental support includes the financial help when one gets such as in terms of money and housekeeping.

Informational support means to give a piece of advice and information of any kind.

Social support is linked with the characteristics of one as how one has developed the networking and how it helps the people to cope up from different problems or events in their life. It also enhances the psychological well being. House (1981) distinguishes between different kinds of support, like giving love, developing trust, empathy, caring etc. The social support also includes how and when the close friends, family members, neighbors help you at the time of crisis. The appraisal support includes the support for feedback, information for self evaluation, feedback purposes and also in terms of social comparison.

Berkman et al. (2000) defines the term social relationship that it has been related with the effects on the health education and health behavior. There is no theoretical framework that provides the connection between social relationships and health. The attributes that are closely linked with health and social relationships are social integration, social network and social support. The term social integration refers to the various characteristics or connections that exist in the social world. Social network includes the social relationships that one is connected to around oneself. Social support is an important component and functions of social relationships. Glanz et al. (2002) defines social networks as the association between the support that people provide and functions that they provide to serve than providing support.

The term self esteem describes as the person's overall sense of self worth and the personal value (Cherry, 2014). It is a kind of personality trait which remains stable, permanent and for longer duration. Self esteem involves the self belief, emotions and also the behavior. It also includes the physical characteristics like appraisal of one's own looks or appearance.

Braden (1969) describes the attributes of self esteem. Self esteem is an important need for the normal and healthy development of an individual. It increases based on the individuals beliefs and awareness of their own self. It develops through the feelings, individual thoughts and their actions.

Science Daily (2014) defines aggression as a part of social and behavioral sciences and it refers to the behavior that causes physical and psychological harm and pain. The aggression can be in the form of physical, verbal, anger and hostility but the behavior will actually be considered as an aggressive even if it does not harm or gives pain to anyone.

Gabby (2013) defines aggressive behavior is that which causes the emotional or physical harm to others or even if the person is threatened by any stimulus. The aggressive behavior can take the form from being verbally aggressive to doing harm to the person's personal property. The people who are aggressive generally have the tendencies to be irritable, impulsive, restless etc. The aggressive behavior is mostly seem to be intentional in nature as it is done with some purpose to harm others, violating the existing norms of the society, or relationship disputes by causing an end to the relationship. The study has also shown that the emotional problems are seem to the common cause of having an aggressive behavior.

The aggression can also take the form of occasional outbursts and are commonly found in the present time. The aggressive behavior has taken its form as a frequent occurrence in any age range and at any time. The aggressive behavior is a behavior that is uncontrollable, occurs mainly from misunderstanding with the appropriate behavior. Therefore it can also come mainly from the conflict that occurs at times by not being able to prioritize the things or situations. The aggressive behavior at times can be very immediate or the purpose to take the revenge. It can be passive nature as well with an intuition to provoke others.

The aggression in adolescents could be because of the negative experiences in life or because of the chronic mental illness. Some people suffering from the depression, anxiety or post traumatic stress disorder or any other chronic illness or any illness for long time does show aggressive behavior because of their conditions. Aggression can also take its seat because of the frustration due to one or the other reason. The aggression can also occur when someone close to you stops caring. Therefore, there could be many reasons for such kind of behavior and if not controlled at right time can lead to various co-morbid conditions.

Therefore the studies have proved statistically that there is a positive relationship between the social support that a person gets through various sources and that in turn influences the self esteem. The studies have also shown a negative relationship that exists between the social support and aggression. This concludes that a social support can in one hand develops the positive sense of self esteem but also increases the aggression level. This is seen mainly among the adolescents who have a more support of the friends than any other kind of social support.

## II. RATIONALE OF THE STUDY

Adolescence is a period of great joy, excitement and optimism during which the delights of autonomy, intimacy and the future is seen and possibilities are created for happiness, success and psychological growth throughout the life. Adolescence is an age bubbling with energy and it is in this transition phase that youth's energies have to be channelized towards positivity to enhance and inculcate the positive skills that will help them to lead a well functioning adult life.

Social support is an important attribute during college time. The peers play an important role and peers are looked upon as the right source at the adolescent's age. The importance of support from peers rises in adolescents.

The present study mainly focuses on the social support and to see its impact on self esteem and aggression among adolescents. The research says that the social support does increase the self esteem. Also, social support mainly from friends and peer groups increases and facilitates the level of aggression. The adolescents show the aggression tendencies if encouraged, motivated and influenced by the peer groups.

## III. OBJECTIVES

On the basis of aforementioned literature, following objectives have been proposed for the present investigation:

1. To study the relationship between social support and self esteem among college going students.
2. To investigate the correlation between social support and aggression among college going students.

## IV. HYPOTHESES

The purpose of the study was to investigate the role of social support on self esteem and aggression. Based on the research, following hypotheses were proposed:

1. It is expected that social support would be positively related with self-esteem.
2. It is hypothesized that social support will be negatively related with aggression.

## V. METHODS

The sample consisted of 100 students. The data was collected from the different colleges of Chandigarh. The age range was 18-21 years of B.A., B.SC. & B.Com. The students in the sample were selected on random basis.

## VI. TESTS AND TOOLS

1. Perceived Social Support scale (Zimet, Dahlem, Zimet & Farley, 1988). This scale consists of 12 items. Each item can be scored from point 1-7, where 1 denotes very strongly disagree, 2 as strongly disagree, 3 mildly disagree, 4 as neutral, 5 if mild agree, 6 as strongly agree and 7 very strongly agree. The scale is divided into further sub variables like family as Fam, friends as Fri and significant others as SO. The scale can be used on any kind of sample.
2. Self-Esteem scale (Rosenberg, 1965). The scale consists of 10 items. The item can be scored from strongly Agree to Strongly Disagree. The score for strongly agree (SA) = 3, Agree (A) = 2, Disagree (D) = 1 and strongly disagree (SD) = 0. There are 5 items which are reverse scored where SA = 0, A = 1, D = 2, SD = 3. The scores are then totaled and higher the score, higher the self esteem.

3. Aggression scale (Buss & Perry, 1992). The scale consists of 29 items. The scale is further divided into sub variables like physical aggression (PA), verbal aggression (VA), anger (A) and hostility (H). The two items in the scale are reverse scored. The every time in the scale is denoted with the sub variables and the total of each sub factor is done and then the total aggression score is calculated from the sum of the each factor score.

VII. RESULTS & DISCUSSION

| Variables           | Social support | Family | Friends | Significant others | Self-Esteem | Aggression | Physical aggression | Verbal aggression | Anger  | Hostility |
|---------------------|----------------|--------|---------|--------------------|-------------|------------|---------------------|-------------------|--------|-----------|
| Social support      |                | 0.80** | 0.75**  | 0.77**             | 0.19*       | -0.22*     | -0.19*              | -0.10             | -0.09  | -0.30**   |
| Family              |                |        | 0.38**  | 0.44**             | 0.20*       | -0.20*     | -0.13               | 0.01              | -0.14  | -0.28**   |
| Friends             |                |        |         | 0.37**             | 0.12        | -0.09      | -0.13               | 0.06              | 0.01   | -0.15     |
| Significant Others  |                |        |         |                    | 0.10        | -0.21*     | -0.17               | -0.07             | -0.09  | -0.25**   |
| Self-Esteem         |                |        |         |                    |             | -0.29**    | -0.24*              | -0.04             | -0.23* | -0.27**   |
| Aggression          |                |        |         |                    |             |            | 0.84**              | 0.60**            | 0.77** | 0.65**    |
| Physical aggression |                |        |         |                    |             |            |                     | 0.33**            | 0.55** | 0.38**    |
| Verbal Aggression   |                |        |         |                    |             |            |                     |                   | 0.39** | 0.31**    |
| Anger               |                |        |         |                    |             |            |                     |                   |        | 0.26**    |
| Hostility           |                |        |         |                    |             |            |                     |                   |        |           |

\*value of correlation sign at 0.05 level

\*\*value of correlation sign at 0.01 level

A high and positive correlation was found between the social support and friends ( $r=0.80$ ), high and positive correlation between social support and friends ( $r=0.75$ ) and social support and significant others ( $r=0.77$ ). The results have shown that there

was a high and positive correlation between aggression and physical aggression ( $r=0.84$ ) and also a positive correlation between aggression and anger ( $r=0.77$ ).

The present study aimed to find out the positive correlation between the social support and self esteem. Social support was found to be significantly and positively correlated to Self Esteem ( $r=0.19$ ). The dimensions of social support was differently and positively related to Self Esteem, i.e. correlation of family and self esteem ( $r=0.20$ ), friends and self esteem ( $r=0.12$ ) and significant others and self esteem ( $r=0.10$ ). The previous research has also proved that a positive relationship does exist between social support and self esteem. The social support as being measured on the different aspects like family, friends and significant others. In the present study the correlation analysis has concluded that the adolescents have rated the family most as their social support. The reason could be that the family is the first and foremost attribute since the day the person is born and that is where the person's self image is created and person feels very much secured being in the family. When there is good interaction and family facilitates each other in every aspect there is always a probability of building up the self esteem.

A research on social support by Gecas (1972) found out that the adolescents were high on self esteem when in a social environment. It is important here to say that if the social support environment is improved it would lead to an increase in the level of self-esteem. According to Nolen et al., (1999) found out through the research that individuals with high self esteem are having probability to have more social support.

A study was done by Hoffman et al. (1988) on social support and self esteem among 76 Israeli. The factors under study included self-esteem, stressful life events and level of support. The study found out that low correlation was found between the paternal support and self-esteem. The study did found out that the friends support was high.

Cakar and Ikiz (2010) did a study to find out the relationship between perceived social support and self esteem among adolescents. The results show that there was a gender based significant difference of peer groups and teacher support levels but no difference was found on the levels of self esteem. The statistically significant and positive relationship was found among perceived social support levels and levels of self esteem among adolescents.

Social support was found to be negatively correlated to aggression ( $r=0.22$ ). The dimensions of social support was differently and negatively related to Aggression, i.e. family and aggression ( $r=0.20$ ), friends and aggression ( $r=0.09$ ) and significant others and aggression ( $r=0.21$ ). The correlation has found a very little difference in relation to the aggression with family and significant others. Through the results it can be seen that the reason of aggression to adolescents can be the family as well as someone who is considered as significant in their life. Apparently, the relationship was high with one dimension of social support both with self esteem and aggression and that dimension is family. So the present study has shown that aggression and self-esteem both have been influenced by the family structure of the adolescents.

The above said results are also supported by a research done by Zerkowitz (1987) to find out the relationship between social support and aggressive behavior among families of children from low income. The relationship was mainly influenced by the cate-

gories of the members of the network that they belonged to and also the type of the support that they were offered by the same network members. The group members who had aggressive tendencies under study were had high probability to put the children under same aggressive tendencies than compared to the children whose members were polite.

## VIII. CONCLUSION

The purpose of the study was to find the impact of social support on self esteem and aggression. Based on the findings, it was seen that the hypotheses were proved. The social support has positive and significant relationship with self esteem. The social support was also found to be significantly and negatively correlated with aggression. The studies in relation to the present study have also shown the significant relationship of social support with self esteem and aggression. The social support does influence the self esteem of the person in every respect in a positive way. The social support can also influence negatively which could lead to aggression. The child learns firstly from home, i.e. the home environment should be calm and parents should not dispute on any issue in front of their child because it could lead to negative impression and slowly the child leads to the same behavior. The friend circle should also be supportive and encourage the love and affection among the peer group.

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# Data Centric Based Routing Protocols for Wireless Sensor Networks: A Survey

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**Abstract-** Sensor networks are quite different from traditional networks in different ways: sensor networks have severe energy concerns, redundant low-rate data, and many-to-one flows. Routing protocols developed for other adhoc networks cannot be applied directly in WSN because of the energy constraint of the sensor nodes. Data-centric technologies are needed to perform in-network aggregation of data to yield energy-efficient dissemination. Sensor networks are used in many applications like environment monitoring, health, industrial control units, military applications and in the various computing environments. Since sensor the entire sensor node are battery powered devices, energy consumption of nodes during transmission or reception of packets affects the life-time of the entire network. In this paper we model data-centric routing and compare its performance with traditional end-to-end routing schemes.

**Index Terms-** Wireless sensor networks, Data-centric routing protocols, Data aggregation, Directed diffusion, One-shot complex queries, Novel adaptive approach, Resource adaptation.

## I. INTRODUCTION

Routing in wireless sensor network (WSN) is divided in four categories:

- Data-centric protocols
- Hierarchical protocols
- Geographical protocols
- Quality of service(QOS) based protocols

In WSN it is not feasible to assign a global identification to a node due to high density and overhead it. The features of these sensor nodes include small size, low cost, low computation power, multifunctional(can perform sensing, data processing, routing etc.), easily communicate within short distances etc. Originally wireless sensor networks were designed for military applications (which include battlefield surveillance, object protection, intelligent guiding, remote sensing etc.) but nowadays it has wide range of civilian applications also in the areas like environment, health, home, space exploration, chemical processing, disaster relief and other commercial areas.

## II. CHALLENGES FOR ROUTING PROTOCOL

Since WSN's have their own challenges utilizing traditional routing protocol is not workable. In following some challenges are discussed:

### A. Energy consumption

The main concern in developing protocols for WSNs is energy consumption. Due to limited energy resource, data shall be delivered in an energy-efficient manner. Thus, conventional routing protocols are not suitable.

### B. Scalability

Scalable routing protocol can expand to support increasing workloads. To provide scalability in WSN, distributed protocols are needed. Due to high density of nodes in WSN, full image of topology cannot be obtained in a node; therefore distributed protocols which rely on a limited knowledge of topology are preferred.

### C. Addressing

Regarding to the high number of sensor nodes in WSN assigning a unique address to each node is not viable. Therefore, address-based routing protocols are not suitable for this type of networks. In addition, in WSN, information from a collection of sensors are preferred over the information from individual sensor nodes. Addressing mechanisms which do not rely on unique ID are used.

### D. Robustness

There is no dedicated router in WSNs; consequently routing protocols operate on sensor nodes. Regarding the high probability of node failure in WSNs, it is intrinsic for routing protocols to provide robustness to node failure.

## III. WIRELESS SENSOR NETWORK DESIGN CHALLENGES

Depending on the application, different architectures and design goals/constraints have been considered for sensor networks. Since the performance of a routing protocol is closely related to the architectural model, so the design of the routing protocols for WSN is challenging. This section attempts to list down the main aspects involved in the design challenges of sensor networks.

### A. Limited Energy Capacity

The big challenge for the network designers in hostile environments is energy. Since sensor nodes have limited energy capacity because they are battery powered. So when the energy of a sensor reaches a certain threshold, they become faulty and are not able to function properly which affects the overall network performance to great extent. Consequently the routing protocols designed for sensors should be as energy efficient as possible to extend their lifetime, and hence prolong the network lifetime.

### B. Sensor Location

Managing the locations of the sensors is another challenge that features the design of the routing protocols. Most of the proposed protocols assume that the sensors either are equipped with GPS receivers or use some localization technique to learn about their locations.

### C. Limited Hardware Resources

Only limited computational functionalities can be performed by sensors due to their limited processing and storage capacities beside limited energy capacity. These hardware constraints present many challenges in software development and network protocol design for sensor networks.

### D. Node Deployment

Topological deployment of the sensors in WSNs is application dependent and finally affects the performance of the routing protocol. The deployment is either deterministic or self-organizing. In deterministic situations, the sensors are manually placed and data is routed through pre-determined paths. However in self-organizing systems, the sensor nodes are scattered randomly creating an infrastructure in an ad hoc manner. In that infrastructure, the position of the sink or the cluster-head is also crucial in terms of energy efficiency and performance.

### E. Data Aggregation

In WSN the redundancy of data generated from sensor nodes is a key concern. Similar packets from multiple nodes can be aggregated to reduce the extra overhead due to number of the transmissions. Many proposed routing protocols are using data aggregation technique to achieve energy efficiency and data transfer optimization.

### F. Diverse sensing application requirements

Sensors networks have a wide range of diverse applications. Each application has its own specifications and constraints different from other application. There is no network protocol which can fully meet the criteria of all applications. Therefore the routing protocols designed should compute an optimal path and guarantee the accurate data delivery to the sink on time.

### G. Network Characteristics and Unreliable Environment

The WSN is consistently prone to frequent topology changes because of extremely vulnerable to node failure, sensors addition, deletion, node damage, link failure, sensor energy exhaustion etc. also susceptible to noise, time consistency and errors due to wireless nature of the network. So the network routing protocol/mechanism be capable of sustain the network topology dynamics, increase network size, energy consumption level, sensor nodes mobility and their related issues like coverage and connectivity to retain specific application requirements.

### H. Scalability

Scalability is very important in WSN as the network size can grow rapidly. So the routing protocols should be designed to work consistently, keeping in consideration that sensors may not necessarily have the same capabilities in terms of energy, processing, sensing, and particularly communication. Furthermore, care should be taken to design routing protocol as there could be

asymmetric communication between sensors instead of symmetric (a pair of sensors may not be able to have communication in both directions).

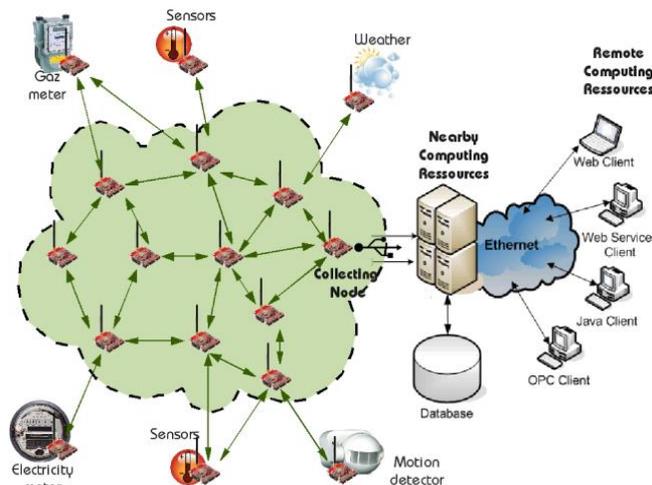


Figure 1: Structural view of wireless sensor networks.

## IV. DATA-CENTRIC ROUTING PROTOCOLS

Data-centric protocols differ from traditional address-centric protocols in the manner that the data is sent from source sensors to the sink. In **address-centric** protocols, each source sensor that has the appropriate data responds by sending its data to the sink independently of all other sensors. However, in **data-centric** protocols, when the source sensors send their data to the sink, intermediate sensors can perform some form of aggregation on the data originating from multiple source sensors and send the aggregated data toward the sink. This process can result in energy savings because of less transmission required to send the data from the sources to the sink. In this section, we review some of the data-centric routing protocols for WSNs.

### 3.1 Sensor Protocols for Information via Negotiation (SPIN):

SPIN protocol was designed to improve classic flooding protocols and overcome the problems they may cause, for example, implosion and overlap. The SPIN protocols are resource aware and resource adaptive. The sensors running the SPIN protocols are able to compute the energy consumption required to compute, send, and receive data over the network. Thus, they can make informed decisions for efficient use of their own resources. The SPIN protocols are based on two key mechanisms namely **negotiation** and **resource adaptation**. SPIN uses **meta-data** as the descriptors of the data that the sensors want to disseminate. The notion of meta-data avoids the occurrence of overlap given sensors can name the interesting portion of the data they want to get. It may be noted here that the size of the meta-data should definitely be less than that of the corresponding sensor data. This allows the sensors to use their energy and bandwidth efficiently.

There are two protocols in the SPIN family: SPIN-1 (or SPIN-PP) and SPIN-2 (or SPIN-EC). While SPIN-1 uses a negotiation mechanism to reduce the consumption of the sensors, SPIN-2 uses a resource-aware mechanism for energy savings. Both protocols allow the sensors to exchange information about

their sensed data, thus helping them to obtain the data they are interested in.

### 3.2 Directed Diffusion (DD):

Direct diffusion is a data centric query based and application-aware protocol where data aggregation is carried out at each node in the network. The nodes will not advertise the sensed data until a request is made by the BS, and all the data generated by sensor node is named by attribute-value pairs. The gradient specifies data rate and the direction in which to send the events. The node which receives the events information from the source attempts to find a matching entry in its interest cache. All sensor nodes in a directed-diffusion-based network are application-aware, which enables diffusion to achieve energy savings by selecting empirically good paths, and by caching and processing data in the network. Caching can increase the efficiency, robustness, and scalability of coordination between sensor nodes, which is the essence of the data diffusion paradigm.

### 3.3 Rumor Routing (RR):

Rumor routing is another variation of Directed Diffusion and is mainly intended for contexts in which geographic routing criteria are not applicable. Generally Directed Diffusion floods the query to the entire network when there is no geographic criterion to diffuse tasks. However, in some cases there is only a little amount of data requested from the nodes and thus the use of flooding is unnecessary. An alternative approach is to flood the events if number of events is small and number of queries is large. Rumor routing is between event flooding and query flooding. The idea is to route the queries to the nodes that have observed a particular event rather than flooding the entire network to retrieve information about the occurring events. In order to flood events through the network, the rumor routing algorithm employs long-lived packets, called agents. When a node detects an event, it adds such event to its local table and generates an agent. Agents travel the network in order to propagate information about local events to distant nodes. When a node generates a query for an event, the nodes that know the route, can respond to the query by referring its event table. Hence, the cost of flooding the whole network is avoided. Rumor routing maintains only one path between source and destination as opposed to Directed Diffusion where data can be sent through multiple paths at low rates.

### 3.4 COUGAR:

A data-centric protocol that views the network as a huge distributed database system. The main idea is to use declarative queries in order to abstract query processing from the network layer functions such as selection of relevant sensors etc. and utilize in-network data aggregation to save energy. The abstraction is supported through a new query layer between the network and application layers. COUGAR proposes architecture for the sensor database system where sensor nodes select a leader node to perform aggregation and transmit the data to the gateway (sink). The gateway is responsible for generating a query plan, which specifies the necessary information about the data flow and in-network computation for the incoming query and send it to the relevant nodes. The query plan also describes how to select a leader for the query. The architecture provides in-network com-

putation ability for all the sensor nodes. Such ability ensures energy efficiency especially when the number of sensors generating and sending data to the leader is huge. Although COUGAR provides a network-layer independent solution for querying the sensors, it has some drawbacks: First of all, introducing additional query layer on each sensor node will bring extra overhead to sensor nodes in terms of energy consumption and storage. Second, in network data computation from several nodes will require synchronization, i.e. a relaying node should wait every packet from each incoming source, before sending the data to the leader node. Third, the leader nodes should be dynamically maintained to prevent them from failure.

### 3.5 Active Query Forwarding in Sensor Networks (ACQUIRE):

ACQUIRE is another data centric querying mechanism used for querying named data. It provides superior query optimization to answer specific types of queries, called **one-shot complex queries for replicated data**. ACQUIRE query (i.e., interest for named data) consists of several sub queries for which several simple responses are provided by several relevant sensors. Each sub-query is answered based on the currently stored data at its relevant sensor. ACQUIRE allows a sensor to inject an active query in a network following either a random or a specified trajectory until the query gets answered by some sensors on the path using a localized update mechanism. Unlike other query techniques, ACQUIRE allows the queries to inject a complex query into the network to be forwarded stepwise through a sequence of sensors.

### 3.6 DRUG:

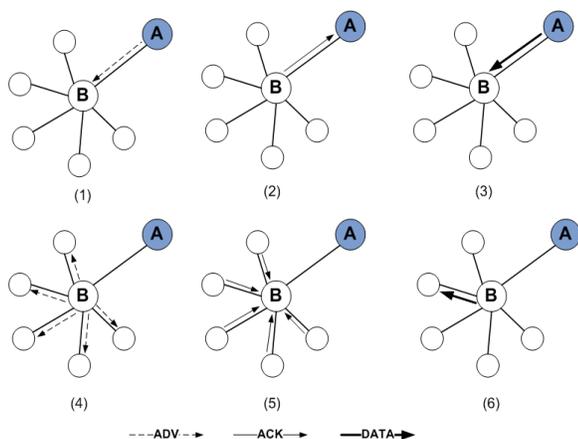
This protocol introduces a novel adaptive approach to find an optimal routing path from source to sink when the sensor nodes are deployed randomly in a restricted service area with single sink. This also aggregates the data in intermediate node to reduce the duplicate data. Data centric protocols more focus on data rather than the address of the destination. Here our approach focuses on both data as well as the destination address. DRUG protocol uses three types of messages to communicate between different nodes as shown in Figure 3, such as:

(i) **ADV**: new data advertisement. When a sensor node has data to share, it can advertise this fact by transmitting an ADV message containing meta-data.

(ii) **ACK**: request for data. A SPIN node sends an ACK message when it wishes to receive data.

(iii) **DATA**: data message. DATA messages contain actual sensor data with a meta-data header. ADV and ACK messages contain only meta-data.

In networks where the cost of sending and receiving a message is largely determined by the messages size, ADV and ACK messages will therefore be cheaper to transmit and receive than their corresponding DATA messages. DRUG protocol is efficient than both spin and flooding. The pictorial representation of the DRUG protocol is as follows



V. COMPARISSION OF ROUTING PROTOCOLS

| ROUTING PRO-<br>TOCOLS | CLASSIFICATION        | MOBILITY          | POWER<br>USAGE | DATA AG-<br>GREGATION | SCALABILITY | MULTI<br>PATH |  |  |
|------------------------|-----------------------|-------------------|----------------|-----------------------|-------------|---------------|--|--|
| SPIN                   | FLAT                  | POSSIBLE          | LIMITED        | YES                   | LIMITED     | YES           |  |  |
| DD                     | FLAT                  | LIMITED           | LIMITED        | YES                   | LIMITED     | YES           |  |  |
| RR                     | FLAT                  | VERY LIM-<br>ITED | N/A            | YES                   | GOOD        | NO            |  |  |
| COUGAR                 | FLAT                  | NO                | LIMITED        | YES                   | LIMITED     | NO            |  |  |
| ACQUIRE                | FLAT                  | LIMITED           | N/A            | YES                   | LIMITED     | NO            |  |  |
| DRUG                   | FLAT/<br>HIERARCHICAL | LIMITED           | LIMITED        | YES                   | GOOD        | NO            |  |  |

VI. CONCLUSION

Routing in sensor networks is a new area of research, with a limited, but rapidly growing set of research results. In this paper, we investigated a comprehensive list of data-centric protocols. There are many issues need to be addressed by researchers e.g.: energy efficiency and life time. Great advantages are achieved because of not using ID instead a general question regarding a special phenomenon to be asked and a response to be gathered. The best algorithm which an implement this idea is ACQUIRE and is strongly recommended to be used in future.

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# Development of Forensic Science and Criminal Prosecution-India.

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**Abstract-** The concept of forensic science is not a new one in India, though its application was not known by our Indian the use of fingerprint which was also known as 'Trija' by the illiterates was induced centuries ago as it was known at that time as well that the same are inimitable. Ancestors in the present scientific form but its detailed reference can be seen from our literature written 2300 years ago like the *Kautilya's Arthashastra*.

This being said this Article talks about not only the development of the Forensic Science in India but also talks in detail about the changes which have been brought about which have been explained with the help of case laws.

The perfect equality of logic and reasoning given in this article will help in giving the impression that everyone with basic knowledge of the statutory interpretation can transverse without any trepidation.

**Index Terms-** Development, Forensic Science, India, Legal Aspect, Prosecution.

## I. INTRODUCTION

**H**istory: The ancient world lacked standardized forensic practices, which aided criminals in escaping punishment. Criminal investigations and trials relied on forced confessions and witness testimony. However ancient sources contain several accounts of techniques that foreshadow the concepts of forensic science that is developed centuries later, such as the "Eureka" legend told of Archimedes (287–212 BC).<sup>1</sup>

In ancient India too, medical opinion was frequently applied to the requirements of the law. By law the minimum age for the marriage of girls was fixed at 12 years; the duration of pregnancy was recognized as being between 9 and 12 lunar months with an average of 10 months and there is evidence that doctors had to opine on such cases.

Sir William Herschel was one of the first to advocate the use of fingerprinting in the identification of criminal suspects. While working for the Indian Civil Service, he began to use thumbprints on documents as a security measure to prevent the then-rampant repudiation of signatures in 1858. In 1877 at Hooghly (near Calcutta) he instituted the use of fingerprints on contracts and deeds and he registered government pensioners' fingerprints to prevent the collection of money by relatives after

a pensioner's death. Herschel also fingerprinted prisoners upon sentencing to prevent various frauds that were attempted in order to avoid serving a prison sentence.<sup>2</sup>

In 1897 a Fingerprint Bureau was established in Calcutta (Kolkata), India, after the Council of the Governor General approved a committee report stating that fingerprints should be used for the classification of criminal records. Working in the Calcutta Anthropometric Bureau, before it became the Fingerprint Bureau, were Azizul Haque and Hem Chandra Bose. Haque and Bose were Indian fingerprint experts who have been credited with the primary development of a fingerprint classification system eventually named after their supervisor, Sir Edward Richard Henry. The Henry Classification System, co-devised by Haque and Bose, was accepted in England and Wales when the first United Kingdom Fingerprint Bureau was founded in Scotland Yard, the Metropolitan Police headquarters, London, in 1901. Sir Edward Richard Henry subsequently achieved improvements in dactyloscopy.<sup>3</sup>

In 1968, the Ministry of Home Affairs, Government of India, set up a Forensic Science Laboratory for Delhi Police and the Central Bureau of Investigation under the administrative control of the Central Bureau of Investigation. This laboratory now provides expert opinion on various aspects of Forensic Science concerning crime investigation. Apart from Delhi Police and the CBI, it also provides assistance to the Central Government Departments, State Forensic Science Laboratories, Defense Forces, Government Undertakings, Universities, and Banks etc. in criminal cases. The laboratory has a search and development set up to tackle special problems. The expertise available at the CFSL is also utilized in teaching and training activities conducted by the CBI, Lok Nayak Jai Prakash Narayan, National Institute of Criminology & Forensic Sciences, Police Training Institutions, Universities and Government Departments conducting Law Enforcement Courses etc.

In the 19th century, it was discovered that almost any contact between a finger and a fixed surface left a latent mark that could be made visible by a variety of procedures (e.g., the use of a fine powder). In 1894 in England the Troup Committee, a group established by the Home Secretary to determine the best means of personal identification, accepted that no two individuals had the same fingerprints—a proposition that has never been seriously refuted. In 1900 another committee recommended the use of fingerprints for criminal identification. Fingerprint evidence was first accepted in an Argentine court in the 1890s and

<sup>1</sup> Schafer, Elizabeth D. (2008). "Ancient science and Forensics". In Ayn Embardson, Allan D. Pass (eds.) *Forensic Science*. Salem Press p.40. ISBN 978-1-58765-423-7  
[http://www.princeton.edu/~achaney/tmve/wiki100k/docs/Forensic\\_science.html](http://www.princeton.edu/~achaney/tmve/wiki100k/docs/Forensic_science.html)

<sup>2</sup> Herschel, William James (November 25, 1880). *Skin Furrows of the hand*. *Nature* 23(578):76

<sup>3</sup> Sodhi J.S.; Kaur, asjeed (2005). "The Forgotten Indian Pioneers Of Fingerprint Science". *Current Science* 88 (1): 185-191.

in an English court in 1902. Many other countries soon adopted systems of fingerprint identification as well.<sup>4</sup>

Forensic Science, an amalgamation of almost all faculties of knowledge is an essential and efficient enabler in the dispensation of justice in criminal, civil, regulatory and social contexts. Historically our forefathers in India have practiced forensic application in variety of forms. Present day Indian forensics, as chronicled, owes its genesis to several British initiated ventures such as Chemical Examiner's Laboratory (Madras, 1849), Anthropometric Bureau (1892), Finger Print Bureau (1897), Inspectorate of Explosives (1898), Office of Government Handwriting Expert (1904), Serology Department (1910), Foot Print Section (1915), Note Forgery Section (1917), Ballistics Laboratory (1930) and Scientific Section (1936). Having subsequently undergone clubbing / regrouping / spreading, as of now, there are 28 State / Union Territory Forensic Science Laboratories (State / UT FSLs) along with their Regional FSLs (32 RFSLs) and Mobile FSLs (144 MFSLs); they are mostly with the respective Home Department either directly or through police establishment<sup>5</sup>

## II. PRESENT DAY

The term crime has been given numerous definition by many prominent jurists like :

Sir William Blackstone defines crime in his 'Commentaries on Law of England' as An act committed in violation of public law forbidding or commanding it. Similarly, Sir James Stephen defines crime as An act forbidding by the law and revolting to the moral sentiments of the society. Whereas, Kenny states that Crime are wrongs whose sanction is punitive and in no way remissible by an private person, but is remissible by the Crown alone, if remissible at all.

Just like for the identification of any sort of organism it is necessary that one looks into its DNA and to identify individuals, forensic scientists scan DNA regions, or loci, that vary from person to person and use the data to create a DNA profile of that individual (sometimes called a DNA fingerprint). There is an extremely small chance that another person has the same DNA profile for a particular set of 13 regions.<sup>6</sup>

Among the many new tools that science has provided for the analysis of forensic evidence is the powerful and controversial analysis of deoxyribonucleic acid, or DNA, the material that makes up the genetic code of most organisms. DNA analysis, also called DNA typing or DNA profiling, examines DNA found in physical evidence such as blood, hair, and semen, and determines whether it can be matched to DNA taken from specific individuals. DNA analysis has become a common form of evidence in criminal trials. It is also used in civil litigation, particu-

<sup>4</sup> <http://www.britannica.com/EBchecked/topic/142953/crime/53437/The-role-of-forensic-science>

<sup>5</sup>Dr. Gopal Ji. Misra & Dr. C. Damodaran, "*Perspective Plan For Indian Forensics*", Final Report presented to the Ministry of Home Affairs Government of India, New Delhi.

<sup>6</sup> Ankur Mishra, *recent trends used in Medical Forensic Science and Indian Law*, <http://www.lawyersclubindia.com/articles/RECENT-TRENDS-USED-IN-MEDICAL-FORENSIC-SCIENCE-INDIAN-LAW-2701.asp#.VGjEA8mUQ05>, visited on 11/11/2014.

larly in cases involving the determination of Paternity of Identity.<sup>7</sup>

Forensic science in today's world is an advanced scientific technique which is used in criminal and civil investigations, it is capable of answering important questions and forms an integrated part of criminal justice system. Both State and Central Government have developed Labs for the same which intern assist courts, police system and private agents and individuals during investigation or cross examination procedure.

During the investigation forensic evidence is collected by the expert at the scene of the crime and each evidence is so collected is so unique in its own way that it becomes necessary to test it and to analyses it separately in order to reach to the conclusion . sometimes, complex cases involve multiple experts specializing in the same field to examine and to give the analysis with respect to the evidence so collected.

Today more than 30 million cases are still pending either the courts in India and agencies like the International Forensic Sciences (IFS) and Central Forensic Science Laboratory (CBI) are used as an alternative solution.

## III. SUB-DIVISIONS

- a) **Forensic accounting** is the study and interpretation of accounting evidence
- b) **-Forensic aerial photography** is the study and interpretation of aerial photographic evidence
- c) **Computational forensics** concerns the development of algorithms and software to assist forensic examination.
- d) **Criminalistics** is the application of various sciences to answer questions relating to examination and comparison of biological evidence, trace evidence, impression evidence (such as fingerprints, footwear impressions, and tire tracks), controlled substances, ballistics, firearm and tool mark examination, and other evidence in criminal investigations. In typical circumstances evidence is processed in a Crime lab.
- e) **Forensic dactyloscopy** is the study of fingerprints.
- f) **Digital forensics** is the application of proven scientific methods and techniques in order to recover data from electronic / digital media. Digital Forensic specialists work in the field as well as in the lab.
- g) **Forensic document examination** or questioned document examination answers questions about a disputed document using a variety of scientific processes and methods. Many examinations involve a comparison of the questioned document, or components of the document, with a set of known standards. The most common type of examination involves handwriting, whereby the examiner tries to address concerns about potential authorship.<sup>8</sup>

<sup>7</sup> Dr. Nirpat Patel The Role in Criminal investigation- Admissibility in Indian Legal System and future perspective, International Journal of Humanities and Social Sciences, [www.ijhssi.org](http://www.ijhssi.org).

<sup>8</sup> Matthewr. Burne Vernalpoole, Massachusetts Aerial Photo Survey of Potential Vernal Pools, 2001  
[www.mass.gov/eea/docs/dfg/nhosp/vernal.../ma-aerial-survey-pvp.pdf](http://www.mass.gov/eea/docs/dfg/nhosp/vernal.../ma-aerial-survey-pvp.pdf)

#### IV. RESEARCH QUESTION

The object of this paper is to understand the origin of Forensic Science and its introduction along with development in India.

This paper will explain how this science has become an integral part of our justice system along with the impact it has created on the perception of experts.

#### V. ANALYSIS

Forensic science is defined as the application of science in answering questions that are of legal interest. More specifically, forensic scientists employ techniques and tools to interpret crime scene evidence, and use that information in investigations. Forensic scientists and technicians come from a variety of academic backgrounds, although most have completed coursework in the life sciences, chemistry and law enforcement.<sup>9</sup>

The creation of National Accreditation Board For Testing and Calibration Laboratories (NABL) has been for the purpose of four objectives which define the purpose and nature of the program.

1. To improve the quality of laboratory services provided to criminal justice system.
2. To develop and maintain criteria which can be used by a laboratory to assess its level of
3. performance and to strengthen its operations.
4. To provide an independent, impartial and objective system by which laboratories can be
5. benefited through a total operational review.
6. To offer to the general public and users of the laboratory services a means of identifying
7. those laboratories which have demonstrated that they meet established standards.<sup>10</sup>

The forensic science laboratories, or the organization, like the International Forensic Sciences (Ifs), Indian Forensic Science Improvement Board and Central Forensic Science Laboratory (CBI) etc. are legally identifiable. The forensic science laboratories are organized and operated in such a way that it meets the accreditation requirements, while performing work in its permanent, temporary or mobile facilities (including field operations and regional laboratories). The laboratory clearly defines and documents the type and extent of the forensic science services it provides. Management ensures that:

- a) The laboratory does not engage in any activities that might diminish trust in its competence, impartiality, judgment or operational integrity, and
- b) The laboratory personnel are free from commercial, financial or any other pressure that might adversely affect the quality of their work.<sup>11</sup>

<sup>9</sup> Sir Krishna, *Forensic Science*, Symbiosis Law School, Pune, India, <http://www.legalservicesindia.com/article/article/forensic-science-601-1.html>, visited on 14/11/2014.

<sup>10</sup> NATIONAL ACCREDITATION BOARD FOR TESTING AND CALIBRATION LABORATORIES, specific guidelines for accreditation of forensic science laboratories and checklist for assessors.

<sup>11</sup> [www.ifs.edu.in/IFS.EDU.BROCHURE.pdf](http://www.ifs.edu.in/IFS.EDU.BROCHURE.pdf)

#### Forensic Science and other Statutes:

In India, law regarding evidence is uniform in both Civil and criminal cases, the degree of proof required may be somewhat different in civil and criminal cases but mode of giving evidence is govern by same legislation. In India, we have adversarial system of justice administration and ordinarily medical evidence is admitted only when the expert gives an oral evidence under oath in the courts of law except under special circumstances like:

1. When evidence has already been admitted in a lower court;
2. Expert opinions expressed in a treatise
3. Evidence given in a previous judicial proceeding;
4. Expert cannot be called as witness;<sup>12</sup>

In, India, Hospital records like admission/discharge register, birth/ death certificates etc., it is a common perception that lot of time and effort is required to record evidence and therefore by enlarge members of the medical profession does not like to involve in medico legal cases. Some of the possible reasons put forward for this perception are:

1. Undue time consumption;
2. Repeated adjournments;

Criminal Procedure Code and Indian Evidence Act 1872 are the parent procedural laws which govern criminal trials in India, while Criminal procedure Code prescribes the procedure from the point of taking cognizance of crime by appropriate judicial Magistrates till the delivery of final order of Conviction or acquittal or any appropriate order looking into the fact of the case. Indian Evidence Act is limited in its scope of leading evidences in civil or criminal cases either by the prosecution or defendant, applicant or respondent. Act also deals with kind of evidences and relevancy of any fact which can be brought as evidence in any case.<sup>13</sup>

Sec. 313 of the Criminal Procedure Code (Cr.P.C.) must also be amended so as to draw adverse inference against the accused if he fails to answer any relevant material against him therefore, making it easy for the law enforcers to use DNA tests against him.<sup>14</sup>

The field reality is that while the same Code of Criminal Procedure, (Indian) Evidence Act and (Indian) Penal Code apply to all the citizens of India, forensic services accorded to the different population segments by the various delivery units of the Union, State and UT welfare governments, however, differ owing to gradients of professional (training) development, procedures & processes, external exposure, equipment etc. resources, enabling logistics and service conditions. The scene also represents inter-regional variations with respect to the population size, and the volume and nature of crimes.

So far as criminal jurisprudence in India is concerned doctrine of onus probandi is in the field and therefore "One shall be presume innocent till his crime is proved" not only proved but proved beyond reasonable doubt, this principle of Onus probendi

<sup>12</sup>Arindam Datta, "*Forensic Evidence: The Legal Scenario*", Dept. of Law, University of Calcutta, <http://www.legalserviceindia.com/article/1153-Forensic-Evidence.html>

<sup>13</sup>Adarsh M. Dhabarde, *Forensic Evidences in Criminal Trial: Need of the Hour*,

<sup>14</sup> SUPRA 8

is recognized under chapter of the Evidence Act which has restricted use of forensic science in criminal trials in India. It is very difficult to say anything beyond reasonable doubt so far as techniques of ascertaining fact with the help of forensic science is concerned. But with the passes of time modern techniques developed in the field of Forensic science are capable of ascertaining facts somewhat beyond reasonable doubt. In this background it is more appropriate to conduct a study in the recent Judgments of Supreme Court of India to see the change in the approach and attitude of Judiciary in appreciating forensic evidences in Criminal cases.

## **Forensic Science and Criminal Prosecution**

### **Scene of Occurrence:**

A scene of occurrence can be defined as the meeting place of the persons involved in the crime. Traces are exchanged by the parties amongst themselves and with the scene, leaving odds and ends and mark of tools, wearing apparels, and means of transport, hands and feet.<sup>15</sup> Thus, the scene of occurrence provides a wealth of information which is useful to:

- Establish corpus delicti
- Provide link between the criminal, the victim and the scene of occurrence; and
- Evaluate the pattern of events.

Except in the cases of forgery is less important due to limited utility, the scene is of great importance in almost all crimes.<sup>16</sup> Planning, care and diligence are required in the examination of the scene. The success or failure of the investigation in many cases depends entirely upon the proper handling of the scene. The scene of occurrence cannot be preserved forever and changes rapidly.<sup>17</sup>

Some of the evidence gets lost soon after the occurrence; the other evidence disappears, gets contaminated or altered with further passage of time.<sup>18</sup> The opportunity to examine the scene is available only once. If the same is not fully exploited the wealth of information is lost forever.

### ***In Marachalil Chandra Tukaram Talekar v. State of Gujarat.*<sup>19</sup>**

*It was argued with great vehemence in the High Court as well as in the court of sessions that there was trial of blood from the front door of the house of the vakil into the corridor rooms marked H and H-1 in the plan and that supported the defense theory that the deceased Kannan received the stab injuries not in or near the house in question but somewhere far away near the railway station. The High Court took the view that if Kannan had received the injuries somewhere outside the house it was impossible for him to have come into the room in view of the doctor's evidence. It was concluded on the material placed on the record*

<sup>15</sup> "Forensic Sciences and Criminology" by Wafi Aziz Safwi. Available at [www.legalservicesindia.com](http://www.legalservicesindia.com) as visited on November 13, 2014.

<sup>16</sup> Forensic Science in Criminal Investigation & Trials, B. R. Sharma, Fourth Edition, Universal Law Publications.

<sup>17</sup> NIJ. Electronic Crime Scene Investigation: A Guide for First Responders (2001)

<sup>18</sup> "History and development of forensic science in India" by RK Tewari, KV Ravikumar Bureau of Police Research & Development, Ministry of Home Affairs Government of India, New Delhi, India.

<sup>19</sup> 1980 Cri. L.J.5 (Guj.)

*that there could be no room for doubt that Kannan received the injuries in the room itself and not outside, and that he was carried out of the room while life was still lingering and therefore, there would be dripping of the blood from the body during the course of transit as the injuries were very serious and vital arteries had been cut.*

### **Fingerprints:**

The identification of criminals through fingerprints was the first important break-through in the scientific investigation of crime. As usual, the judiciary and the public took some time to believe in the utility of fingerprints as a scientific aid.<sup>20</sup> The same is now recognized throughout the world. The importance of fingerprints in criminal investigation is immense, because they are:

#### **Unique**

Ridge pattern of each finger has individuality. The patterns vary not only from one individual to another, but they are different in the same individual on each finger. Duplication of pattern has never been observed. Nor the same is expected.

#### **Permanent**

The fingerprints of an individual do not change throughout his life. In fact, the ridges appear before birth. They start appearing during third or fourth month of pregnancy. They remain even after the death of the individual ever till the epidermal skin is destroyed by fire, putrefaction or is eaten by insects or other creatures.

In a murder case the body of the victim was partially burnt and buried. The same was discovered many days after the murder. The body was completely disfigured and could not be identified. The investigating officer got removed the remaining skin pieces from the tips of the fingers through a doctor. He sent them to fingerprint bureau along with the one authentic print of the deceased available on his will. The bureau confirmed the identity of the deceased. The digital skin pieces were recovered and sent to the finger print bureau. The fingerprints of the deceased tallied with the fingerprints of the convict, available in the records, the permanence of fingerprints permits identification of an individual even after many years, if his finger print record is available. Many criminals have been identified through this medium after years of absconding.

#### **Universal**

All individuals and hence all criminals carry this medium of identification. The finger digits and surface of the hands carry the friction ridges. The fingers have more intricate patterns. They allow easier individualization and classification.

A criminal uses his hands in the commission of crime. He leaves marks at the scene of occurrence or on the objects which come in contact in the commission of crime. There are fair chances of occurrence of finger prints, therefore in all types of crime.

#### **Inimitable**

Successful forgery of fingerprints has not been reported so far. Near perfect forgeries have been attempted. It is possible that the advancement of science may bring the forgery still closer to perfection but complete success in the enterprise is extremely difficult, if not impossible.

<sup>20</sup> "Forensic Science in Criminal Investigation", Dr. Jai Shanker Singh, Unique Law Publications.

For all practical purposes it may be taken that it is not possible to forge a fingerprint. This is important because no person can deny his or her fingerprints. The identification through fingerprints is certain and infallible.

**In Bazari Hajam v. King Emperor**<sup>21</sup>

The question arose whether it will be safe to act on the uncorroborated testimony of the fingerprints and declare the guilt of the accused.

On this point Bucknill, J., observed thus:

*"I think that apart from the fact that I should be rather sorry without any corroborative circumstances to convict a person of a serious crime solely and entirely upon similarity of thumb marks or finger prints, the very fact of the taking of a thumb-impression from an accused person for the purpose of possible manufacture of the evidence by which he could be incriminated is in itself sufficient to warrant one in setting aside the conviction upon the understanding and upon the assumption that such was not really a fair trial."*

The above view was disapproved of by Schwabe, **C.J. in Public Prosecutor v. Kandasami Thevan**<sup>22</sup> although the point did not directly arise in the case as there were thumb-impressions of the accused in evidence other than that taken by the judge in court for comparison with the thumb-impressions in the document alleged to have been forged.

#### **Track Marks:**

The culprit approaches, stays and then leaves the scene of occurrence. He leaves track marks on and around the place in the form of prints and impressions (collectively called "marks") of feet, shoes, tyres, hoofs and the like. The evidence often connects the criminal with the crime conclusively. It should, therefore be properly understood, collected, evaluated and presented in the courts. The track marks establish not only the presence of the culprit at the scene of crime but also give the number of participants. The evidence is helpful in tracking down the criminals to their houses or hide-outs, especially in India where most of the people live in rural areas. The roads in the country side are not metal led. Besides, the criminal, ordinarily, follows untraded routes; fields, garden and stream beds. He leaves track marks on routes used before and after the commission of the crime. The nature of the vehicle used in the commission of crime whether it is a cycle, scooter, car, bus, truck, tractor, rickshaw, bullock cart or a buggy can be ascertained. It is sometimes possible to identify the individual vehicle also. In some cases animals are involved in crimes sometimes.<sup>23</sup> For example, a horse or a camel may be used for transport; a cow, a buffalo or a bullock may be stolen or a dog or a tamed wild best, like a snake or a tiger may be used to destroy or kill a human-being or a domestic animal. The type of the animal or the beast can be found out from the track marks. Foot Wear marks includes the marks of shoes, sandals, chappals, socks and the like. The footwear may be factory- made or hand made.

Rejecting the contention that the study of footprints is not a science in **Din Muhammad v. Emperor**,<sup>24</sup> the court of the Judi-

cial Commissioner at Nagpur (H.J. Stanyon and H.F. Halifax, A.J. Cs ) as far back as in 1914 held:

*"The knowledge of footprints has similarly been systematized and pursued by trackers, mainly uncivilized and ignorant people an all other respects, all over the world. The matter is therefore undoubtedly a science and the opinion of a person especially skilled in it is a relevant fact, under Sec- 45 of the Evidence Act"*.

#### Necessity of application of Forensic Science

In criminal investigation, use of forensic science is the need of the modern times. In India, the investigation of crime and prosecution of persons having committed the crime are not up to the mark. Even in heinous crimes large number of criminals could not be prosecuted and a few percentage of trials end in acquittal as a result of which number of criminals and crimes are increasing day- to- day. These frequent acquittals are mainly due to obsolete techniques of investigation which leave many loopholes. Thus, for effective investigation scientific ways of investigation is not necessary. The "third degree" methods used by the investigating agencies in British period are not accepted by the new generation of Criminal Investigating Agencies, judges and public at large.<sup>25</sup> "Third degree" methods for making confession have not completely vanished but their misuse has increased and to control over this issue, the Human Rights Commissions has been established in India and all over the world. Hence, modern scientific methods for investigation of crimes and connecting the criminals with the overt acts are very much necessary in order to make effective the Criminal Justice System.<sup>26</sup>

#### **Cases Solved using Forensic Science**

##### **Vasu v. Santha 1975 (Kerala)**<sup>27</sup>

In the above cases the court has laid down certain guidelines regarding DNA tests and their admissibility to prove parentage.

- (1) That courts in India cannot order blood test as a matter of course;
- (2) Wherever applications are made for such prayers in order to have roving inquiry, the Forensic evidences in Criminal Trial: Need of the Hour prayer for blood test cannot be entertained
- (3) There must be a strong prima facie case in that the husband must establish non-access in order to dispel the presumption arising under Section 112 of the Evidence Act.
- (4) The court must carefully examine as to what would be the consequence of ordering the blood test; whether it will have the effect of branding a child as a bastard and the mother as an unchaste woman.
- (5) No one can be compelled to give sample of blood for analysis. Further the court said

<sup>21</sup> AIR 1922 Pat.73:23 Cr. L.J 638

<sup>22</sup> AIR 1927 Mad. 696:27 Cr. L. J 1251

<sup>23</sup> Saferstein, R. Forensic Science Handbook, Volumes I, II, III. Englewood Cliffs, N.J.: Prentice-Hall, 1982/1988/1993.

<sup>24</sup> Central Provinces Police Gazette dated 27th May, 1914 pp. 125-130

<sup>25</sup> "Victims and Criminal Justice System in India: Need for a Paradigm Shift in the Justice System" Available at [www.doiserbia.nb.rs](http://www.doiserbia.nb.rs) as visited on November 13, 2014.

<sup>26</sup> Crime Scene and Evidence Collection Handbook. Washington, D.C.: Bureau of Alcohol, Tobacco and Firearms, 1999

<sup>27</sup> AIR [1986] M.P. 57,

Blood-grouping test is a useful test to determine the question of disputed paternity. It can be relied upon by courts as a circumstantial evidence, which ultimately excludes a certain individual as a father of the child. However, it requires to be carefully noted no person can be compelled to give sample of blood for analysis against his/her will and no adverse inference can be drawn against him/her for this refusal.

### Tandoor Murder Case (1995) Delhi<sup>28</sup>

This was the first criminal case in India solved by the help of forensics. In this case Shusil Sharma murdered his wife at home by firing three bullets in to his wife Naina Sahni's body. He killed his wife believing that she had her love affair with her classmate and fellow congress worker Matloob Karim. After murdering his wife Sharma took her body in his car to the Bagiya restaurant, where he and restaurant manager Keshav Kumar attempted to burn her in a *tandoor* there. Police recovered Sharma's revolver and blood-stained clothes and sent them to Lodhi Road forensic laboratory. They also took blood sample of Sahni's parents, Harbhajan Singh and Jaswant Kaur and sent them to Hyderabad for a DNA test. According to the lab report, "Blood sample preserved by the doctor while conducting the post mortem and the blood stains on two leads recovered from the skull and the neck of the body of deceased Naina are of 'B' blood group." Confirming that the body was that of Sahni, the DNA report said, "The tests prove beyond any reasonable doubt that the charred body is that of Naina Sahni who is the biological offspring of Mr. Harbhajan Singh and Jaswant Kaur." And finally Mr. Shusil Sharma was found guilty with the help of forensic evidences.

## VI. CHANGES REQUIRED

Lack of work culture in the courts Hardly, any scientific data is available to support or refute this perception in relation to medical evidence. Therefore, it was planned to undertake a pilot study to analyze the quantum of time and effort put in by medical experts to get the evidence recorded in criminal courts and other issues related to it.

The influence of forensic science in India has been to such an extent that the Malimath Committee in its report asked a few section of the Criminal Procedure Code to be amended in order to accommodate the principles of Forensic Science like:

A specific law should be enacted giving guidelines to the police setting uniform standards for obtaining genetic information and creating adequate safeguards to prevent misuse of the same.

A national DNA database should be created which will be immensely helpful in the fight against terrorism. More well-equipped laboratories should be established to handle DNA samples and evidence. Efforts should be taken to create more awareness among general public, Prosecutors, judges and police machinery.

The work in Forensic Science Laboratories being interdisciplinary in nature, there is a need to develop and supplement the

"General Criteria for Laboratory Accreditation" for the purpose of accrediting Forensic Science Laboratories. The document "Specific Criteria for Accreditation of Forensic Science Laboratories" has been evolved by a Technical Committee specifically constituted for the purpose. It supplements the document "General Requirements for the Competence of Testing and Calibration Laboratories" and provides specific guidance on the accreditation of Forensic Science Laboratories for assessors as well as the laboratories who are preparing for accreditation.

### Suggestions by Malimath Committee:

1. More well-equipped laboratories should be established to handle DNA samples and evidence.
2. A specific law should be enacted giving guidelines to the police setting uniform standards for obtaining genetic information and creating adequate safeguards to prevent misuse of the same.
3. A national DNA database should be created which will be immensely helpful in the fight against terrorism.
4. Sec. 313 of the CR.P.C must also be amended so as to draw adverse inference against the accused if he fails to answer any relevant material against him therefore, making it easy for the law enforcers to use DNA tests against him.

## VII. CONCLUSION

There is a unanimity that medical and forensic evidence plays a crucial role in helping the courts of law to arrive at logical conclusions. Therefore, the expert medical professionals should be encouraged to undertake medico legal work and simultaneously the atmosphere in courts should be congenial to the medical witness. This attains utmost importance looking at the outcome of the case, since if good experts avoid court attendance, less objective professional will fill the gap, ultimately affecting the justice. The need to involve more and more professionals in expert testimony has been felt by different organizations. Though many plans have been brought before the ministry of Home Affairs which includes formation of Forensic Council where not only the Evidence Act but the Information Technology Act and The Code of Criminal Procedure will become complementary to the Science.

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# Grading of severity of ocular trauma by various ocular trauma scores and its effect on prognosis

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**Abstract-** OBJECTIVE: Study of Various ocular trauma scores and its effect on prognosis using a prospective study.

**MATERIAL AND METHODS:** Studied 30 eyes in 30 patients with open globe injury underwent full history taking and ophthalmic examination at the time of presentation in our institute. patients were graded by using Ocular Trauma Score (OTS), Ocular Trauma Severity Score (OTSS) and ISOT Score. Outcome measure was final visual acuity (six month after the primary surgical procedure). The significance of various scoring scales in relation to final visual acuity was assessed.

**RESULT:** Out of 30 patients mean age was 25.13 years, with majority between 5 to 10 years of age and 76.7% were males. The common source of injury was metallic object in 33.3%, wood and bamboo stick and thorn in 30%. At presentation as per OTS, ocular injury in 16 out of 30 patients were in category 1 and 2, 100% had final visual acuity < 6/18. Out of 11 patients in category 3, 72.7% had final visual acuity < 6/18. All 3 patients in category 4-5 had final visual acuity > 6/18. Hence, OTS proved as a good pre-operative predictor of visual prognosis. (P = 0.001). According to OTSS at presentation 9 patients were graded as mild, 13 as moderate and 8 as severe. Final visual acuity in 55% patients of mild group was > 6/18, in moderate group 100% cases had final visual acuity > 6/18, 87.5% patients of severe group had final visual acuity of < 6/18. The OTSS underestimated the severe injuries in our case series but found to be significant statistically (P = 0.023).

As per ISOT, 4 patients were in grade 0, 13 patients were in grade 1-2 and 13 were in grade 3-4. 75% patients of grade 0 had final visual acuity > 6/18, 76.9% patients of grade 1-2 had final visual acuity < 6/18. 100% patients of grade 3-4 had final visual acuity < 6/18. It was found to be statistically significant for assessing final visual outcome (P = 0.002).

**CONCLUSION:** The Ocular Trauma Score is considered to be a valuable tool in establishing the severity of an open globe injury. In our study another pre-operative scoring system which ISOT was found to be very sensitive and on putting the data in this score could accurately predict the outcome.

**Index Terms-** Endophthalmitis, ISOT score, Ocular Trauma Score, Ocular Trauma Severity Score, Retinal Detachment.

## I. INTRODUCTION

Ocular trauma has now gained attention as a major cause of visual morbidity.<sup>1</sup> The terminology and classification of ocular trauma adopted by the International Society of Ocular Trauma in 1997 has provided a clear definition and standardization of ocular trauma terminology.<sup>2</sup> Assessment of severity of ocular injury at presentation using a standardized scoring system is helpful for unambiguous interpretation and reporting of research results to allow for internationally valid comparisons.<sup>3</sup> Our aim in this study was to identify the factors that significantly predicted visual outcome after open globe injuries and reliability of various ocular trauma indices in predicting severity of trauma.

## II. METHOD OF STUDY

This is a prospective study, conducted in Department of Ophthalmology at MGM Medical College and M.Y. Hospital, Indore from Dec 2010 to May 2012 including all patients who meet the inclusion and exclusion criteria of this study.

All patients with open globe injury were included.

Patients with previous ocular surgery, previous ocular trauma, major eye disease, new injury during follow up were excluded.

At presentation, all patients underwent a detailed history and ophthalmic evaluation and were graded as per following scoring systems

a) Ocular Trauma Score (OTS) – Kuhn et al<sup>4</sup>

b) Ocular Trauma Severity Score (OTSS) – Vasu et al<sup>5</sup>

c) ISOT Score<sup>6</sup>

Outcome measure was final visual acuity (six month after the primary surgical procedure). The significance of various scoring scales in relation to final visual acuity was assessed.

## III. OBSERVATION AND RESULTS

A total of 30 patients of open globe injuries were included in the study with mean age 25.13 years, with majority between 5 to 10 years of age. 76.7% were males. Most of injuries (93.3%) were unintentional, while only 6.7% injuries were the result of assault. The source of injury was metallic object in 10 cases (33.3%),

consisting of iron rod and nail. Second most common source of injury was wood and bamboo stick and thorn in 9 cases (30%) . Stones and gravel in 7 (23.3%) cases. The other source of injury were due to pen tip in 2 cases (6.7%) , glass was the source of injury in 2 cases (6.7%).

At presentation as per OTS , ocular injury in 16 out of 30 patients were in category 1 and 2 , 100% had final visual acuity < 6/18 . Out of 11 patients in category 3, 72.7% had final visual acuity <6/18. All 3 patients in category 4-5 had final visual acuity >6/18. Hence, OTS proved as a good pre operative predictor of visual prognosis. (Extended Mantel-Haenszel test for trend: chi-sq. = 11.844) ( P = 0.001)

Accoding to OTSS at presentation 9 patients were graded as mild , 13 as moderate and 8 as severe. Final visual acuity in 55% patients of mild group was >6/18, in moderate group 100% cases had final visual acuity >6/18, 87.5% patients of severe group had final visual acuity of <6/18. The OTSS underestimated the severe injuries in our case series but found to be significant statistically.(Extended Mantel-Haenszel test for trend:chi-sq. = 5.142) ( P = 0.023)

As per ISOT , 4 patients lied in grade 0, 13 patients were in grade 1-2 and 13 were in grade 3-4.

75% patients of grade 0 had final visual acuity >6/18 , 76.9%patients of grade 1-2 had final visual acuity<6/18. 100% patients of grade 3-4 had final visual acuity of<6/18.It was found to be statistically significant for assessing final visual outcome. (Extended Mantel-Haenszel test for trend: chi-sq. = 9.797) [DF = 1] (P = 0.002)

#### IV. CONCLUSION

The Ocular Trauma Score is considered to be a valuable tool in establishing the severity of an open globe injury. However, as the presence of Endophthalmitis and Retinal detachment are delayed complications of trauma, the value of the score in predicting pre-operative evaluation of open globe injury is uncertain, but in our case series it was found to be statically significant. In our study another pre-operative scoring system which was based on internationally accepted factors to classify an open globe injury named ISOT was found to be very sensitive and on putting the data in this score could accurately predict the outcome. The OTSS underestimated the severe injuries in our case series but found to be significant statistically.

This completes the entire process required for widespread of research work on open front. Generally all International Journals

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# Effect of NPK on Physico- Chemical Parameters of Gladiolus (*Gladiolus hybridus* Hort.) cv. White Prosperity

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**Abstract-** It can be concluded from the investigation that the application of N, P, K and their interaction significantly improves the physiological as well as bio-chemical parameters in gladiolus. The application of  $N_2P_2K_2$  (4.5:2.7:2.25 g/plant) was observed to be the best in respect of vase life of spike, earliest first flower bud appearance, number of florets per spike and longest vase life of spike and highest nitrogen content in leaves. The application of  $N_2P_2K_1$  (4.5:2.7:1.8 g/plant) was found to be the best in respect of longest duration of flowering, the maximum number of spikes per plant, maximum length of spike, maximum diameter of florets, maximum length of florets, the maximum chlorophyll content in leaves, anthocyanin content in petals and potassium content in leaves and  $N_2P_1K_1$  (4.5:1.8:1.8 g/plant) was found to be the best in respect of high phosphorus content in leaves.

## I. INTRODUCTION

Gladiolus botanically known as *Gladiolus hybridus* Hort. belongs to family Iridiaceae. The herbaceous plant sprouts from axillary buds of an underground structure, the corm, a condensed vertical root stock covered with dried leaf bases. The inflorescence spike bears up to 25 florets arranged alternately on the axis. Gladiolus is commonly known as 'sword lily' because it has sword-shaped foliage. Gladiolus is one of the four famous cut flowers in the world (Bai *et al.*, 2009). Its magnificent inflorescence with a variety of colours has made it attractive for use in herbaceous borders, beddings, pots and for cut flowers. It has a great economic value and wide market in the country. In India, It is next to rose in Indian flower trade. Gladiolus responds well to balanced nutrition for better growth and maximum flower production. Inadequate plant nutrition causes serious disorders and may eventually lead to decline of plant vigour and yield.

Nitrogen is the one of the most important nutrients producing growth and yield responses in gladiolus. Leaf analysis indicates that the leaves should contain on a dry weight basis 2.5 - 3.0% nitrogen or more for optimum yield. The quantity of phosphorus required by gladiolus is about one-tenth of the nitrogen expressed in terms of foliar analysis. Gladiolus requires about 3-4% potassium in the leaves on a dry weight basis for the best yield and quality of flowers. Foliar nutrition with NPK in addition to soil application significantly affects vegetative growth and floral characters (Roy *et al.*, 1995). Nutrition plays an important role in the overall growth performance of the gladiolus crop. Plant analysis has been found to be a useful diagnostic tool to work out the amount of fertilizers to be applied.

## II. MATERIALS AND METHODS

The experiment was laid out at the K.N.K. College of Horticulture, Mandsaur (M.P.) during Kharif & Rabi seasons of 2012-2013 on the Gladiolus flower cv. White Prosperity. The experiment was laid out in factorial completely randomized design with three replications. Two levels each of nitrogen (3.6 and 4.5 g N/pot) phosphorus (1.8 and 2.7 g P/Pot) and potassium (1.8 and 2.25 g K/Pot) were applied. The observations on different physiological parameters and bio-chemical parameters were recorded. The pots were filled by the medium (soil: sand: FYM – 1:1:1) @ 5 kg/ pot. One healthy corm was planted in one pot. Nutrients were applied as full dose of P, K and half dose N at planting time and two split doses of N at 30 and 60 days after planting. For the vase life, cut flowers were kept in flask containing distilled water and the numbers of days up to wilting was counted. Length of spike was calculated by measuring the length from the base of spike to the last of the florets. Diameter and length of floret was measured by electronic digital caliper in cm, horizontal at full bloom stage. Chlorophyll content in leaves was measured by spad meter instrument. For the anthocyanin contents in the petals the alcohol extract of the sample is treated with HCl in aqueous methanol followed by anthocyanin reagent. The colour intensity is measured colorimetrically at 525nm. In order to work out the percentage of N, P and K in gladiolus plant, the samples were analyzed for their NPK content. Nitrogen was estimated by Kjeldal method; P in wet digested samples by ammonium molybdate method (Chapman and Pratt, 1961) and K by flame photometer (Holiday and Preedy, 1953).

## III. RESULTS AND DISCUSSION

### Effect of N, P, K and their interaction on physiological parameters:

In the study different physiological parameters were significantly influenced by the different treatments levels of N, P and K application as compared to control. The longest vase life of spike, earliest first flower bud appearance, longest duration of flowering, the maximum number of spikes per plant, maximum length of spike, maximum number of florets per spike, maximum diameter of florets and maximum length of florets were recorded by  $N_2$ (4.5 g/plant) application. These results are in congruence with Mishra (2004), Kumar and Misra (2003) in gladiolus and Kumar *et al.* (2009) in tuberose. The longest vase life of spike, earliest first flower bud appearance, longest duration of flowering, the maximum number of spikes per plant, maximum length of spike, maximum number of florets per spike, maximum diameter of florets and maximum length of florets were recorded by

P<sub>2</sub>, (2.7 g/plant) application. These findings of the study are in close agreement with the findings of Hossian *et al.* (2011) in gladiolus. Amin *et al.* (2012) and Patel *et al.* (2006) in tuberose. The longest duration of flowering, the maximum number of spikes per plant, maximum length of spike, maximum diameter of florets and maximum length of florets were recorded by K<sub>1</sub>, (1.8 g/plant), while the earliest first flower bud appearance, maximum number of florets per spike and longest vase life of spike were recorded by K<sub>2</sub>, (2.25 g/plant). These results were in agreement with Barman *et al.* (2005) in gladiolus.

In the investigation the longest vase life of spike, earliest first flower bud appearance and maximum number of florets per spike were recorded by N<sub>2</sub>P<sub>2</sub>K<sub>2</sub>, ( 4.5:2.7:2.25 g/plant), longest duration of flowering, the maximum number of spikes per plant, maximum length of spike, maximum diameter of florets, maximum length of florets were recorded by N<sub>2</sub>P<sub>2</sub>K<sub>1</sub>, (4.5:2.7:1.8 g/plant). These findings are in close conformity with the findings of Deo-Shankar and Dubey (2005), Sharma and Singh (2007) and Rajhansa *et al.* (2010) in gladiolus.

#### Effect of N, P, K and their interaction on biochemical parameters:

In the study different bio-chemicals parameters were significantly influenced by the different treatments levels of N, P and K application as compared to control. The maximum chlorophyll content in leaves, anthocyanin content in petals, nitrogen content in leaves, phosphorus content in leaves and potassium content in leaves were recorded with the application of N<sub>2</sub> (4.5 g/plant). These findings are in close conformity with the findings of Singh *et al.* (2010), Sewedan *et al.* (2012) in gladiolus and Chavan *et al.* (2010) in china aster. The maximum chlorophyll content in leaves, anthocyanin content in petals, nitrogen content in leaves, phosphorus content in leaves and potassium content in leaves were recorded with the application of P<sub>2</sub>, (2.7 g/plant). The maximum chlorophyll content in leaves, phosphorus content in leaves and potassium content in leaves were recorded by K<sub>1</sub>, (1.8 g/plant), while anthocyanin content in petals, nitrogen content in leaves, were recorded by K<sub>2</sub>, (2.25 g/plant). These result also supported with Pal and Ghose, (2010) in Marigold.

In the investigation the maximum chlorophyll content in leaves, anthocyanin content in petals and potassium content in leaves were recorded by N<sub>2</sub>P<sub>2</sub>K<sub>1</sub> (4.5:2.7:1.8 g/plant), the maximum nitrogen content in leaves were recorded by N<sub>2</sub>P<sub>2</sub>K<sub>2</sub> (4.5:2.7:2.25 g/plant) and the maximum phosphorus content in leaves were recorded by N<sub>2</sub>P<sub>1</sub>K<sub>1</sub> (4.5:1.8:1.8 g/plant). These findings are in close conformity with the findings of El-Naggar (2009) in carnation, Naik and Barman (2006) in orchid.

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**Table- 1: Effect of N, P, K levels and their interaction on vase life of spike (Days), number of days for first flower bud appearance, duration of flowering (days) and number of spikes per plant**

| Treatment Control/Rest                       | Vase life of spike (Days) | Number of days for first flower bud appearance | Duration of flowering (days) | Number of spikes per plant |
|--|---------------------------|--|------------------------------|----------------------------|
| Control                                      | 6.50                      | 78.33  | 8.00                         | 1.01                       |
| Rest treatments                              | 7.93                      | 78.81  | 9.88                         | 1.23                       |
| F test                                       | <b>SIG</b>                | <b>SIG</b>                                     | <b>SIG</b>                   | <b>SIG</b>                 |
| N <sub>1</sub>                               | 7.54                      | 78.08  | 9.47                         | 1.18                       |
| N <sub>2</sub>                               | 8.33                      | 75.54  | 10.29                        | 1.28                       |
| S.Em.±                                       | <b>0.087</b>              | <b>0.121</b>                                   | <b>0.064</b>                 | <b>0.007</b>               |
| C.D. at 5%                                   | <b>0.260</b>              | <b>0.359</b>                                   | <b>0.200</b>                 | <b>0.022</b>               |
| P <sub>1</sub>                               | 7.66                      | 77.58  | 9.50                         | 1.18                       |
| P <sub>2</sub>                               | 8.20                      | 76.04  | 10.26                        | 1.27                       |
| S.Em.±                                       | <b>0.087</b>              | <b>0.121</b>                                   | <b>0.064</b>                 | <b>0.007</b>               |
| C.D. at 5%                                   | <b>0.260</b>              | <b>0.359</b>                                   | <b>0.200</b>                 | <b>0.022</b>               |
| K <sub>1</sub>                               | 7.70                      | 77.16  | 10.00                        | 1.24                       |
| K <sub>2</sub>                               | 8.16                      | 76.45  | 9.76                         | 1.22                       |
| S.Em.±                                       | <b>0.087</b>              | <b>0.121</b>                                   | <b>0.064</b>                 | <b>0.007</b>               |
| C.D. at 5%                                   | <b>0.260</b>              | <b>0.359</b>                                   | <b>0.200</b>                 | <b>0.022</b>               |
| N <sub>1</sub> P <sub>1</sub> K <sub>1</sub> | 7.16                      | 78.00  | 9.06                         | 1.14                       |
| N <sub>1</sub> P <sub>1</sub> K <sub>2</sub> | 7.66                      | 78.00  | 8.82                         | 1.10                       |
| N <sub>1</sub> P <sub>2</sub> K <sub>1</sub> | 8.16                      | 77.83  | 9.62                         | 1.20                       |
| N <sub>1</sub> P <sub>2</sub> K <sub>2</sub> | 7.16                      | 78.50  | 10.37                        | 1.29                       |
| N <sub>2</sub> P <sub>1</sub> K <sub>1</sub> | 7.33                      | 77.50  | 10.45                        | 1.30                       |
| N <sub>2</sub> P <sub>1</sub> K <sub>2</sub> | 8.50                      | 76.83  | 9.65                         | 1.20                       |
| N <sub>2</sub> P <sub>2</sub> K <sub>1</sub> | 8.16                      | 75.33  | 10.88                        | 1.34                       |
| N <sub>2</sub> P <sub>2</sub> K <sub>2</sub> | 9.33                      | 72.50  | 10.18                        | 1.27                       |
| S.Em.±                                       | <b>0.175</b>              | <b>0.242</b>                                   | <b>0.134</b>                 | <b>0.015</b>               |
| C.D. at 5%                                   | <b>0.521</b>              | <b>0.719</b>                                   | <b>0.400</b>                 | <b>0.045</b>               |

**Table- 2: Effect of N, P, K levels and their interaction on length of spike (cm), number of florets per spike, diameter of florets (cm) and length of florets (cm)**

| Treatment Control/Rest                       | Length of spike (cm) | Number of florets per spike | Diameter of florets (cm) | Length of florets (cm) |
|--|----------------------|-----------------------------|--------------------------|------------------------|
| Control                                      | 60.80                | 7.16                        | 7.09                     | 7.59                   |
| Rest treatments                              | 74.02                | 9.29                        | 8.63                     | 9.13                   |
| F test                                       | <b>SIG</b>           | <b>SIG</b>                  | <b>SIG</b>               | <b>SIG</b>             |
| N <sub>1</sub>                               | 71.10                | 8.70                        | 8.29                     | 8.79                   |
| N <sub>2</sub>                               | 76.95                | 9.87                        | 8.97                     | 9.47                   |
| S.Em.±                                       | <b>0.459</b>         | <b>0.100</b>                | <b>0.055</b>             | <b>0.053</b>           |
| C.D. at 5%                                   | <b>1.365</b>         | <b>0.297</b>                | <b>0.159</b>             | <b>0.159</b>           |
| P <sub>1</sub>                               | 71.30                | 8.62                        | 8.31                     | 8.81                   |
| P <sub>2</sub>                               | 76.75                | 9.95                        | 8.95                     | 9.45                   |
| S.Em.±                                       | <b>0.459</b>         | <b>0.100</b>                | <b>0.055</b>             | <b>0.053</b>           |
| C.D. at 5%                                   | <b>1.365</b>         | <b>0.297</b>                | <b>0.159</b>             | <b>0.159</b>           |
| K <sub>1</sub>                               | 74.85                | 9.12                        | 8.73                     | 9.23                   |
| K <sub>2</sub>                               | 73.20                | 9.45                        | 8.54                     | 9.04                   |
| S.Em.±                                       | <b>0.459</b>         | <b>0.100</b>                | <b>0.055</b>             | <b>0.053</b>           |
| C.D. at 5%                                   | <b>1.365</b>         | <b>0.297</b>                | <b>0.159</b>             | <b>0.159</b>           |
| N <sub>1</sub> P <sub>1</sub> K <sub>1</sub> | 68.40                | 8.50                        | 7.98                     | 8.48                   |
| N <sub>1</sub> P <sub>1</sub> K <sub>2</sub> | 66.20                | 8.66                        | 7.72                     | 8.22                   |
| N <sub>1</sub> P <sub>2</sub> K <sub>1</sub> | 72.00                | 9.00                        | 8.40                     | 8.90                   |
| N <sub>1</sub> P <sub>2</sub> K <sub>2</sub> | 77.80                | 8.66                        | 9.07                     | 9.57                   |
| N <sub>2</sub> P <sub>1</sub> K <sub>1</sub> | 78.40                | 9.16                        | 9.14                     | 9.64                   |
| N <sub>2</sub> P <sub>1</sub> K <sub>2</sub> | 72.20                | 8.16                        | 8.42                     | 8.92                   |
| N <sub>2</sub> P <sub>2</sub> K <sub>1</sub> | 80.60                | 9.83                        | 9.40                     | 9.90                   |
| N <sub>2</sub> P <sub>2</sub> K <sub>2</sub> | 76.60                | 12.33                       | 8.93                     | 9.43                   |
| S.Em.±                                       | <b>0.918</b>         | <b>0.200</b>                | <b>0.107</b>             | <b>0.107</b>           |
| C.D. at 5%                                   | <b>2.730</b>         | <b>0.595</b>                | <b>0.319</b>             | <b>0.319</b>           |

leaves (%) and anthocyanin pigment content in petals  
(mg/100g)

**Table- 3: Effect of N, P, K levels and their interaction on ni-trogen,phosphorus, potassium and chlorophyll content in**

| Treatment Control/Rest                         | Nitrogen content in leaves (%) | Phosphorus content in leaves (%) | Potassium content in leaves (%) | Chlorophyll content in leaves (spad value) | Anthocyanin pigment content in petals (mg/100g) |
|--|--------------------------------|----------------------------------|---------------------------------|--|---|
| <b>Control</b>                                 | 0.93                           | 0.13                             | 2.33                            | 64.51                                      | 0.33  |
| <b>Rest treatments</b>                         | 1.33                           | 0.15                             | 2.83                            | 77.72                                      | 0.44  |
| <b>F test</b>                                  | <b>SIG</b>                     | <b>SIG</b>                       | <b>SIG</b>                      | <b>SIG</b>                                 | <b>SIG</b>                                      |
| <b>N<sub>1</sub></b>                           | 1.21                           | 0.14                             | 2.72                            | 74.65                                      | 0.40  |
| <b>N<sub>2</sub></b>                           | 1.44                           | 0.16                             | 2.94                            | 80.79                                      | 0.47  |
| <b>S.Em.±</b>                                  | <b>0.024</b>                   | <b>0.001</b>                     | <b>0.017</b>                    | <b>0.475</b>                               | <b>0.009</b>                                    |
| <b>C.D. at 5%</b>                              | <b>0.073</b>                   | <b>0.004</b>                     | <b>0.052</b>                    | <b>1.412</b>                               | <b>0.027</b>                                    |
| <b>P<sub>1</sub></b>                           | 1.18                           | 0.15                             | 2.73                            | 74.86                                      | 0.39  |
| <b>P<sub>2</sub></b>                           | 1.47                           | 0.16                             | 2.94                            | 80.58                                      | 0.48  |
| <b>S.Em.±</b>                                  | <b>0.024</b>                   | <b>0.001</b>                     | <b>0.017</b>                    | <b>0.475</b>                               | <b>0.009</b>                                    |
| <b>C.D. at 5%</b>                              | <b>0.073</b>                   | <b>0.004</b>                     | <b>0.052</b>                    | <b>1.412</b>                               | <b>0.027</b>                                    |
| <b>K<sub>1</sub></b>                           | 1.27                           | 0.16                             | 2.86                            | 78.59                                      | 0.43  |
| <b>K<sub>2</sub></b>                           | 1.38                           | 0.15                             | 2.80                            | 76.86                                      | 0.44  |
| <b>S.Em.±</b>                                  | <b>0.024</b>                   | <b>0.001</b>                     | <b>0.017</b>                    | <b>0.475</b>                               | <b>0.009</b>                                    |
| <b>C.D. at 5%</b>                              | <b>0.073</b>                   | <b>0.004</b>                     | <b>0.052</b>                    | <b>1.412</b>                               | <b>NS</b>                                       |
| <b>N<sub>1</sub>P<sub>1</sub>K<sub>1</sub></b> | 1.14                           | 0.14                             | 2.62                            | 71.82                                      | 0.37  |
| <b>N<sub>1</sub>P<sub>1</sub>K<sub>2</sub></b> | 1.10                           | 0.12                             | 2.53                            | 69.51                                      | 0.35  |
| <b>N<sub>1</sub>P<sub>2</sub>K<sub>1</sub></b> | 1.32                           | 0.16                             | 2.76                            | 75.60                                      | 0.38  |
| <b>N<sub>1</sub>P<sub>2</sub>K<sub>2</sub></b> | 1.29                           | 0.14                             | 2.98                            | 81.69                                      | 0.51  |
| <b>N<sub>2</sub>P<sub>1</sub>K<sub>1</sub></b> | 1.30                           | 0.17                             | 3.00                            | 82.32                                      | 0.45  |
| <b>N<sub>2</sub>P<sub>1</sub>K<sub>2</sub></b> | 1.20                           | 0.16                             | 2.76                            | 75.81                                      | 0.40  |
| <b>N<sub>2</sub>P<sub>2</sub>K<sub>1</sub></b> | 1.34                           | 0.15                             | 3.08                            | 84.63                                      | 0.52  |
| <b>N<sub>2</sub>P<sub>2</sub>K<sub>2</sub></b> | 1.94                           | 0.16                             | 2.93                            | 80.43                                      | 0.50  |
| <b>S.Em.±</b>                                  | <b>0.049</b>                   | <b>0.003</b>                     | <b>0.035</b>                    | <b>0.951</b>                               | <b>0.018</b>                                    |
| <b>C.D. at 5%</b>                              | <b>0.147</b>                   | <b>0.009</b>                     | <b>0.104</b>                    | <b>2.825</b>                               | <b>0.055</b>                                    |

# A Recyclable Polymer Supported Copper Catalyst for Aza-Michael Reaction with Aromatic Amines and Using Water as a Green Solvent

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**Abstract-** A simple and green protocol is developed for Aza Michael reaction of aromatic amine with activated olefins in water as a green solvent by using recyclable polymer supported copper acetate as a catalyst.

**Index Terms-** Aza Michael addition, Water as a Green solvent, Aromatic Amines, Polymer supported Cu(II)

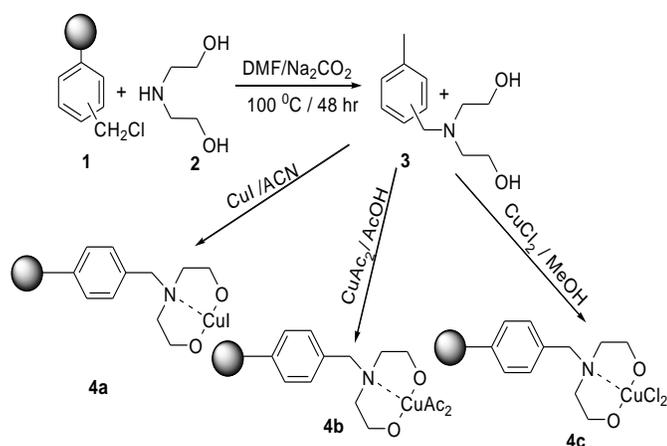
The catalytic addition of an N-H bond across a multiple bond (hydroamination), to give valuable nitrogen-containing molecules is of great interest to both academic and industrial researchers<sup>1</sup>. The hydroamination reaction proceeds with 100% atom economy which makes it one of the most desirable processes applicable in the area of natural products, pharmaceuticals, dyes, fine chemicals, polymers and surfactants<sup>2</sup>. There are several reports on hydroamination of un-activated alkenes especially catalyzed by transition metal complexes in homogeneous and heterogeneous conditions<sup>3-6</sup>. On the other hand, hydroamination of activated olefins (acrylate derivatives) is a Michael type addition reaction, which is a simplistic approach to synthesize amino acid derivatives. These amino acid derivatives have a wide variety of applications in the synthesis of peptide analogues, precursor for amino alcohols, optically active amino acids, lactams and diamines<sup>7-8</sup>. In earlier studies, Bronsted and Lewis acids such as H<sub>2</sub>SO<sub>4</sub>, HBF<sub>4</sub> and FeCl<sub>3</sub> have been used for this reaction<sup>9-10</sup>. Recently hydroamination of acrylates with amines has been reported with copper and bismuth salts<sup>11-12</sup>, and complexes of Ni (II) and Pd (II)<sup>13-14</sup>. Due to the economic attractiveness of copper<sup>15</sup> and by using some special ligands such as N, N- and N, O-bidentate compounds, many Cu-catalyzed C-N<sup>16-17</sup>, C-O<sup>18-19</sup>, C-S<sup>20-21</sup> and C-C<sup>22-23</sup> bond formation reactions have led to a resurgence of interest in carbon-heteroatom coupling reactions, and their applications seem to be of more and more importance<sup>24-25</sup>.

However homogeneous catalysts have some disadvantages such as they may easily be destroyed during the course of the reaction, contamination in the final products, separation from reaction mass and they cannot be easily recovered after the reaction for reuse. These disadvantages can be overcome by anchoring metal on suitable supports which will allow easy separation and recyclability of the catalyst with minimal amount of product contamination with metal. These studies confirm that the anchoring of metal on solid support not only exhibits improved catalyst activity, stability and selectivity of the product but also

enables easy recovery and reuse of the catalyst. Often heterogeneous organic transformations grow due to their well-documented advantages over homogeneous catalytic systems. But surprisingly there are very few reports available on the use of heterogeneous catalysts for hydroamination of activated olefins. Zeolite beta and clays have been reported so far for this reaction<sup>26-29</sup>. Zeolites cannot be used for larger substrates because of their smaller pore sizes, whereas clays have low thermal stability which affects the catalyst regeneration. Palladium complexes immobilized on silica and alumina surfaces have been reported for hydroamination of O-activated alkenes<sup>30</sup>.

On the basis of report on hydroamination of acrylates with amines by using homogeneous "Copper and bismuth salts"<sup>31-32</sup>, and Michael addition of aniline is easily proceed in specific polar protic solvents (water as solvent) and fluorinated solvent as reaction promoter. We tried to avoid fluorinated promoter and use recyclable polymer supported copper catalyst<sup>33-34</sup>.

Herein we report the synthesis of novel polymer supported copper catalyst and its application for Aza-Michael reaction in water as a green solvent so that process became a total green process. Our strategy was to modify Merrifield resin (1) with Diethanol amine (2)<sup>35</sup> and then allows it to bind copper through ligand exchanged. (Scheme 1)<sup>36</sup> The resulting binding interaction also needs to be strong enough to prevent the copper from dissociating from the polymer support under the reaction conditions. Hence, using Cu(OAc)<sub>2</sub> as the source of copper, displacement of acetate would provide a copper-bound polymer-supported catalyst. Here we use copper acetate, copper Iodide, copper Chloride as a source of copper.



**Scheme 1.** Synthesis of polymer supported Copper catalyst

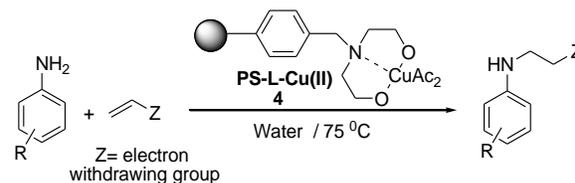
Due to insolubilities of the polymer supported copper catalyst in all common organic solvents, its structural investigation was limited to its physicochemical properties, chemical analysis, SEM, TGA and IR. Table 1 provides the data for elemental analysis of polymer supported ligand and the polymer supported copper catalysts. Copper content in the catalysts determined by EDAX suggests 3.76 wt % Cu in the catalyst. The band at 676  $\text{cm}^{-1}$  for C-Cl stretching had disappeared in the polymer anchored ligand. A few new bands appeared, e.g. those at 3311  $\text{cm}^{-1}$  (broad) along with bands at 1641  $\text{cm}^{-1}$  showed the presence of free -OH groups in the ligand. On complexation with copper, the frequency of free -OH groups are reduced in intensity. In FT-IR spectra of PS-L-CuCl<sub>2</sub> and PS-L-CuI complexes, all bands were almost same as PS-L-Cu(OAc)<sub>2</sub> complex. FT-IR spectra of the polymer supported ligand and copper catalysts are given in Fig. 1. FTIR spectra of Merrifield resin and modified Merrifield resin shows no peak at 865  $\text{cm}^{-1}$  peak (CH<sub>2</sub>-Cl), indicating replacement of CH<sub>2</sub>Cl group by CH<sub>2</sub>-N group. The scanning electron micrographs (Fig. 2) of the polymer supported ligand and supported copper catalysts clearly show the morphological change which occurred on the surface of polystyrene after loading of metal on it. Energy dispersive spectroscopy analysis of X-rays (EDAX) data for the polymer anchored ligand and copper catalysts are given in Fig. 3. The EDX data also inform that the attachment of copper metal on the surface of the polymer matrix. Thermal stability of the complexes was investigated using DSC at a heating rate of 10 deg C/min in the air over a temperature range of 30-300 C. DSC curves of the polymer supported ligand and supported copper catalysts are shown in Fig. 5. The ligand and copper complexes were stable up to 200-250 °C and above this temperature they decomposed. Differential scanning Chromatography study suggests that the polymer supported copper complexes degrade at considerably higher temperature.

**Table 1.** Chemical composition of polymer anchored ligand and polymer supported Cu (II) catalyst

| Compound              | Color        | C%    | H%   | Cl%  | N%     | Cu%             |
|-----------------------|--------------|-------|------|------|--------|-----------------|
| PS-L                  | White        | 73.16 | 6.42 | 3.11 | (5.54) | -               |
| LCu(OAc) <sub>2</sub> | Green        | 63.09 | 5.88 | 3.17 | 4.81   | 5.17,4.73,4.71* |
| L-CuI                 | Bluish Green | 65.68 | 5.62 | 3.20 | 4.97   | 4.53            |

| L-CuCl <sub>2</sub> | Light Green | 67.73 | 5.75 | 8.01 | 5.01 | 4.64 |
|---------------------|-------------|-------|------|------|------|------|
|---------------------|-------------|-------|------|------|------|------|

\*used catalyst



**Scheme 2.** Aza Michael addition using polystyrene supported Cu(OAc)<sub>2</sub> as a catalyst and water as solvent

**Table 2.** Effect of catalysts on the Aza Michael addition reaction

| Entry | Catalyst               | Yield <sup>b</sup> (%) |
|-------|------------------------|------------------------|
| 1     | PS-L-CuI               | 82                     |
| 2     | PS-L-CuAc <sub>2</sub> | 89                     |
| 3     | PS-L-CuCl <sub>2</sub> | 79                     |

<sup>a</sup>Reaction Conditions: Aniline (1.5 mmol), Ethyl Acrylate (4.5 mmol), Water (3 mL), catalyst (25 mol %) at 75°C temperature for 16h.

<sup>b</sup>Isolated yield.

The reaction of aniline with Ethyl acrylate was chosen as a model reaction. Initially in an effort to develop an efficient catalyst various copper based catalysts were scanned for Aza Michael addition reaction, where polymer supported Cu(OAc)<sub>2</sub> gave the maximum yield of 89% (Table 2, entry 2).

The reaction was optimized for various reaction parameters such as temperature, solvent and catalyst loading. The Amine remains unconsumed when the reaction was done at room temperature (Table 3, entry 7). The effect of temperature on the yield of product was monitored from 50°C to 90°C (Table 3, entry 5, 8, 9). However, no further increase in the yield was obtained by increasing temperature from 75°C to 90°C. Hence 75°C was chosen as optimum reaction temperature.

Among the solvent system studied, water ethanol mixture was found to be the best solvent (Table 4, entry 4) giving a maximum yield of the desired product. However water alone also giving good result (Table 4, entry 3).

**Table 3.** Effect of Time and Temperature on Aza-Michael reaction

| Entry | Temp( °C) | Time hrs | Yield <sup>b</sup> (%) |
|-------|-----------|----------|------------------------|
| 1     | 75        | 05       | 66                     |
| 2     | 75        | 08       | 78                     |
| 3     | 75        | 11       | 85                     |
| 4     | 75        | 14       | 94                     |
| 5     | 75        | 16       | 95                     |
| 6     | 75        | 18       | 95                     |
| 7     | R.T.      | 16       | Nil                    |
| 8     | 50        | 16       | 56                     |
| 9     | 90        | 16       | 93                     |

<sup>a</sup>Reaction Conditions: Aniline (1.5 mmol), Ethyl Acrylate (4.5 mmol), Water (3 mL), catalyst (25 mol %).

<sup>b</sup>Isolated yield.

**Table 4.** Effect of solvent<sup>a</sup> on Aza Michael Reaction

| Entry | Solvent                    | Temp( °C) | Yield <sup>b</sup> (%) |
|-------|----------------------------|-----------|------------------------|
| 1     | Water                      | 75        | 44                     |
| 2     | Water + Ethanol            | 75        | 65                     |
| 3     | Water + catalyst           | 75        | 89                     |
| 4     | Water + Ethanol + catalyst | 75        | 98                     |
| 5     | Ethanol                    | 75        | -                      |

<sup>a</sup>Reaction Conditions: Aniline (1.5 mmol), Ethyl Acrylate (4.5 mmol), catalyst (25 mol %) at 75°C temperature for 16h.

<sup>b</sup>Isolated yield.

Catalyst concentration was optimized by varying its concentration from 0.05 gm to 0.3 gm (Table 5, entry 1-6). An increase in the product yield was observed in 0.05 to 0.02 gm of catalyst amount. Hence 0.2 gm was considered as an optimum catalyst concentration. (Table 5, entry 4)

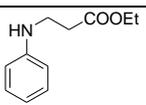
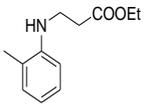
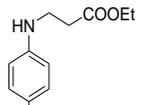
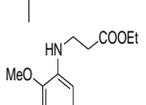
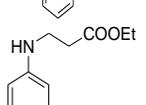
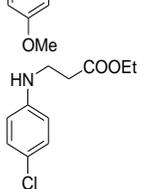
**Table 5.** Effect of catalyst for Aza Michael Reaction<sup>a</sup>

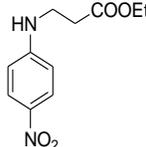
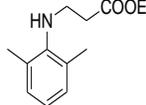
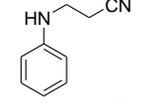
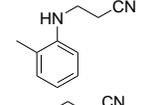
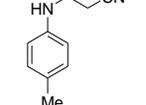
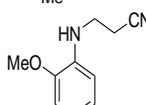
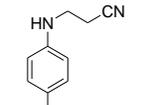
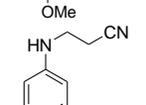
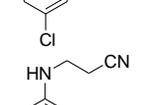
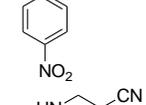
| Entry | Catalyst in gm | Yield <sup>b</sup> (%) |
|-------|----------------|------------------------|
| 1     | 0.05           | 66                     |
| 2     | 0.1            | 78                     |
| 3     | 0.15           | 85                     |
| 4     | 0.2            | 95                     |
| 5     | 0.25           | 94                     |
| 6     | 0.30           | 96                     |

<sup>a</sup>Reaction Conditions: Aniline (1.5 mmol), Ethyl Acrylate (4.5 mmol), Water (3 mL), at 75°C temperature for 16h.

<sup>b</sup>Isolated yield.

**Table 6.** Aza-Michael Reaction of Aromatic amine with Activated olefins in presence of PS-L-CuAc<sub>2</sub>.

| Entry | R =   | R <sub>1</sub> = | Time(h) | Product   | Yield <sup>b</sup> (%) |
|-------|-------|------------------|---------|---|------------------------|
| 1     | H     | COOEt            | 16      |  | 84                     |
| 2     | 2-Me  | COOEt            | 20      |  | 64                     |
| 3     | 4-Me  | COOEt            | 16      |  | 85                     |
| 4     | 2-MeO | COOEt            | 16      |  | 81                     |
| 5     | 4-MeO | COOEt            | 12      |  | 99                     |
| 6     | 4-Cl  | COOEt            | 24      |  | 25                     |

|    |                   |       |    |   |    |
|----|-------------------|-------|----|---|----|
| 7  | 4-NO <sub>2</sub> | COOEt | 24 |    | 15 |
| 8  | 2,6-di-Me         | COOEt | 24 |    | 10 |
| 9  | H                 | -CN   | 16 |    | 89 |
| 10 | 2-Me              | -CN   | 24 |    | 70 |
| 11 | 4-Me              | -CN   | 16 |    | 84 |
| 12 | 2-MeO             | -CN   | 16 |    | 85 |
| 13 | 4-MeO             | -CN   | 12 |   | 99 |
| 14 | 4-Cl              | -CN   | 24 |  | 32 |
| 15 | 4-NO <sub>2</sub> | -CN   | 24 |  | 15 |
| 16 | 2,6-di-Me         | -CN   | 24 |  | 10 |

<sup>a</sup>Reaction Conditions: Aniline (1.5 mmol), Ethyl Acrylate (4.5 mmol), Water (3 mL), catalyst (25 mol %) at 75°C temperature..

<sup>b</sup>Isolated yield.

To explore the general applicability of the catalyst, hydroamination's of EA with different amines were carried out and the mono-addition product yield after 16 h of reaction was compared (Table 6). The nature of substituent's on the aromatic ring of aniline derivatives has considerable effect over the reactivity. The electron-donating groups at the -Para positions gave higher yields of mono-addition while -Ortho position substituted because of steric factors gave lower conversion, anti-Markovnikov products. The aromatic amines with electron withdrawing substituent such as 4-Chloro-aniline (25%) were less reactive, P-nitroaniline showed traces of reactivity with EA. These results

indicate that the amine reactivity depends on their basicity. It is well known that aromatic amines with electron donating substituent are more basic than amines with electron withdrawing substituent. As the basicity of amines increased their reactivity also increased in hydroamination of activated olefins and vice versa.

In conclusion, we have reported the novel catalyst and simple method for preparation of chloro-methylated polystyrene supported copper (II) complex and its successful application for the Aza Michael addition reaction of various aromatic amines with activated olefins. The present system is moisture stable and the catalyst can be synthesized readily from inexpensive and commercially available starting materials. Moreover the catalyst was reused for several consecutive cycles with consistent catalytic activity. Further work is in progress to broaden the scope of this catalytic system for other organic transformation.

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- [34] Kavita De, J. Legros, B. Crousse, J. Org. Chem. 2009, 74, pp. 6260-6265
- [35] **Synthesis of modified Merrifield Resin with Diethanol Amine (3):** The preparation procedure followed to obtain the catalyst is given in Scheme 1. The catalyst was readily prepared in two steps. Firstly, the 2 g of 2% Di-vinyl benzene cross linked Merrifield resin (1) treated with 0.979 g of Diethanol amine (2) to produce a corresponding polymer anchored ligand (3) in the presence of sodium carbonate base (0.759 g) using N,N-dimethylformamide as solvent (DMF) at 100 deg. C for 48 h to obtain a light brown polymer (L). The polymer was washed thoroughly with DMF to remove excess Diethanol amine and then with 1 M HCl to remove the excess base. Finally, it was washed with double distilled water, dried and stored at room temperature for further use.

### [36] Synthesis of the metal complexes (4)

This Polymer anchored Diethanol amine ligand 3 (1 g) in acetic acid (20 mL) was treated with 5 mL 1% (w/v) acetic acid solution of copper acetate over a period of nearly 30 min under constant stirring. Then the reaction mixture was refluxed for 24 h. The greenish yellow copper complex (CuL(Ac)<sub>2</sub>) 4b thus formed was filtered and washed thoroughly with ethanol and dried in room temperature under vacuum.

The Polymer anchored Diethanol amine ligand 3 (1 g) in acetonitrile (20 mL) was treated with 5 mL 1% (w/v) acetonitrile solution of copper iodide over a period of nearly 30 min under constant stirring. Then the reaction mixture was refluxed for 24 h. The green color copper complex (CuLI) 4a thus formed was filtered and washed thoroughly with ethanol and dried at room temperature under vacuum.

The Polymer anchored Diethanol amine ligand 3 (1 g) in methanol (20 mL) was treated with 5 mL 1% (w/v) methanolic solution of copper chloride over a period of nearly 30 min under constant stirring. Then the reaction mixture was refluxed for 24 h. The light green color copper complex (CuLCl<sub>2</sub>) 4c thus formed was filtered and washed thoroughly with ethanol and dried at room temperature under vacuum

- [37] **General procedure for addition of aromatic amine to activated olefins:** In an oven dried 100 mL RB flask, polymer supported Cu(II) catalyst (200 mg, 0.0329 mmol), activated olefin (3 mmol), aromatic amines (1 mmol), and 6 ml solvent were stirred, at 75°C. The reaction mixtures were collected at different time intervals and after extraction with MDC identified by GCMS and quantified by GC. After the completion of the reaction, the catalyst was filtered off and washed with water followed by ethanol and dried in oven. The filtrate was extracted with Methyl Dichloride (3\*20 mL) and the combined organic layers were dried with anhydrous Na<sub>2</sub>SO<sub>4</sub> by vacuum. The filtrate was concentrated by vacuum and the resulting residue was purified by column chromatography on silica gel to provide the desired product.

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# Solving Quintics and Septics by Radicals

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**Abstract-** Formulas are given for solving by radicals every solvable quintic or septic. The formula for the quintics are much shorter than the preceding ones, while the formula for the septics seems the first published one. Instead of using resolvent as the preceding papers on this subject, this paper uses the factorization of the polynomials whose roots are the sum of two different roots of the input (for the quintics) or the sum of three different roots of the input (for the septics).

## I. INTRODUCTION

Solving equations by radical is a long standing open problem. The problem was almost closed by Abel who proved that, *in general*, the solutions of the equations of degree five or higher may not be expressed in term of radicals. However Abel did left open two sub problems.

The first one is, given an equation, to test if it is solvable by radicals. This problem has, theoretically, been solved by Galois who introduced Galois theory for this purpose. However, for a given equation, the computation which is needed is not practicable without a computer. Even with a computer, the computation needs very efficient algorithms, and it is rather recent that one is able to compute the Galois group and thus to test solvability of equations of degrees up to 15 (Geissler and

The second problem is, when one has a solvable equation, to effectively compute the solutions in term of radicals. All the papers that we know on this subject concern the quintic equations (Paxton Young, 1888; Dummit, 1991; Lazard, 2004; Lavalée et al., 2005) or sextic equations (Hagedorn, 2000). One of the reasons for this is the size of the formulas. The formula for the quintic given in Lazard (2004) is three pages length. Using the same method to solve a septic equation would need to consider a resolvent equation of degree 120 instead of degree 6 for solving quintics. Such a computation is thus unrealistic.

In this paper we present some progress on this second problem. Firstly we describe a new formula for solving quintics which is much shorter than the preceding ones. Secondly, we present a complete formula for solving solvable septics. In the worst case the roots extractions which are needed for getting the first root are one seventh root, the root of a cyclic cubic (which involves a cubic root and  $\sqrt{-3}$ ) and the square root of the product of the discriminant by  $-7$ . For the other roots, one has to add a seventh root of unit, which involves  $\sqrt{-7}$ ,  $\sqrt{-3}$  and a cubic root. As far as we know this is the first complete formula for solving solvable septics.

The key idea which allows these progresses is the following. In the preceding formulas for quintics, the roots are expressed in term of a single invariant, which is a root of a polynomial of degree six, the quintic being solvable if and only if this polynomial

has a rational root. Instead we use the characterization given by Bruen et al. (1986) of the solvable polynomials of prime degree in the following way.

Let  $f$  be a quintic whose discriminant is a square, and  $f_{10}$  be the polynomial of degree 10 whose roots are the sums of two different roots of  $f$ . The quintic  $f$  is solvable if and only if  $f_{10}$  factors into two quintics. Thus the for every solvable quintic, the polynomial  $f_{10}$  factors in two quintics over the field extension by the square root of the discriminant. The coefficient of these quintics is not only invariants of the group of order 10, but they generate the algebra of the invariants of this group. It follows that the roots of the input quintic may be expressed in term of these invariants. This is detailed in Section 4.

Similarly, for a septic, let  $f_{35}$  be the polynomial of degree 35 whose roots are the sums of three different roots of the septic. The septic is solvable if and only if  $f_{35}$  factors either in more than two factors or in a factor of degree 21 and a factor of degree 14. Factorizing further on the extension by the square root of the discriminant, we get, in any case, two polynomials of degree 7 which are invariant by the group of order 21. These two factors do not provide directly enough invariants to express the solutions. We have thus to deduce from them other septics which are invariant by the same group of order 21 for expressing the roots of the input septic.

The details are given in Section 5.

## II. GENERALITIES AND NOTATION

In this section, we describe the generalities which may applied to any solvable equation of prime degree, even the trivial cases 2 and 3.

We consider a univariate irreducible polynomial  $f = x^n + a_1x^{n-1} + \dots + a_n$  of prime degree  $n$ , with coefficients in a field whose characteristic does not divide  $n(n-1)$ .

To simplify the formulas, we usually suppose that  $f$  is in *depressed* form, that is that  $a_1 = 0$ . This does not restricts the generality, as the depressed form may be obtained by the Tschirnhaus transformation  $x \rightarrow x - a_1/n$  and the roots of the initial polynomial may be obtained by subtracting  $a_1/n$  from the roots of the depressed form.

We choose once for all an arbitrary root  $x_0$  off, a cycle  $\sigma$  of order  $n$  in the Galois group of  $f$  and a primitive  $n$ th root of unit  $\omega$ .

These choices allow to number the other roots of  $f$  by  $x_i = \sigma^i(x_0)$ . The index  $i$  of  $x_i$  is supposed to belong to the finite field  $F_n$ , i.e.  $x_{i+n} = x_i$ .

As usual when solving by radical in prime degree  $n$  the roots are computed from their Fourier transform  $u_j = \sum_{i=0}^{n-1} \omega^{ij} x_i$ . In

particular  $u_0 = x_0 + \dots + x_{n-1}$  is the sum of the roots and, if the polynomial is in depressed form, we have  $u_0 = 0$ .

We have  $\sigma(u_j) = \omega^{-j}u_j$ . It follows that any monomial in the  $u_i$  whose the sum of the indexes are a multiple of  $n$  is invariant by  $\sigma$ .

As  $n$  is supposed to be prime, the polynomial  $f$  is solvable if and only if its Galois group is contained in the affine group of  $F_n$ , of order  $n(n-1)$ . Each element of this groups of order  $n(n-1)$  is defined by a pair  $(a, b)$  of elements of  $F_n$ , with  $b \neq 0$ , and acts on  $x_i$  by  $x_i \rightarrow x_{a+bi}$ . If  $g$  is a generator of the multiplicative group  $F_n^*$ , this group is thus generated by  $\sigma$ , which corresponds to  $(a, b) = (1, 1)$  and the automorphism  $\gamma$ , which corresponds to  $(a, b) = (0, g)$ . Thus  $\gamma(x_i) = x_{gi}$  and  $\gamma(u_i) = u_{ig^{-1}}$ . In this paper, we choose  $g = 3$ ,  $g^{-1} = 2$  when  $n = 5$  and  $g = 5$ ,  $g^{-1} = 3$  when  $n = 7$ .

These notations allow to be more accurate than in the introduction for describing our method. The factorization of the minimal polynomial of the sum of two or three roots over the field extension by the square root of the discriminant provides

<sup>1</sup> This is true even in degree 2 and 3, even if it is not explicit on classical formulas.

a number of invariants of the group of order  $n(n-1)/2$  generated by  $\sigma$  and  $\gamma^2$ . The game consists in defining some polynomials in the  $u_i$  which are invariant by this group, in expressing them in term of these known invariants, which gives some equations in the  $u_i$ . One of these equations is a polynomial of degree  $(n-1)/2$  in  $u_i^n$  which allows to compute  $u_1$ . The other equations depend only on  $u_1$  and some  $u_i$  and are linear in  $u_i$  and thus allows to express  $u_i$  in term of  $u_1$ .

A key ingredient for this is an algorithm for expressing some invariant in term of a given set of invariants, which will be described in next section.

### 2.1 Reducing invariants

The invariants, we are considering here are homogeneous polynomials in the indeterminates  $x_0, \dots, x_{n-1}$ , which are invariant under the action of a subgroup of the symmetric group of all permutations of the  $x_i$ .<sup>2</sup> In practice we will consider only invariants for the group of order  $n(n-1)/2$ .

The problem that we consider is to express an invariant (which is useful for solving) in term of a given set of invariants (which are easy to compute). The method that we use is essentially described in Lazard (2004). It is based on the following classical result.

**Proposition 1.** *The algebra of the invariants of a subgroup  $G$  of the group of permutations of  $n$  elements is a free module of finite type over the ring of the polynomials in the elementary symmetric functions.*

To describe how this result may be used, we need some notation.

We denote by  $E_d$  the elementary symmetric function of degree  $d$  of the  $x_i$ , and we associate to it a new indeterminate  $e_d$  and the polynomial  $E_d - e_d$  (depending on the variables  $x_0, \dots, x_{n-1}$  and  $e_d$ ). Let  $G$  be the Grobner basis of the ideal  $\langle E_1 - e_1, \dots, E_n - e_n \rangle$ , for a monomial ordering which eliminates the  $x_i$  (i.e. for comparing two monomials, one uses the powers of the  $e_d$  only

when the powers of the  $x_i$  are the same). The following result is proved in Lazard (2004).

**Lemma 2.** *An invariant belongs to a basis of the free module of Proposition 1 if and only if the leading monomial of its normal form by  $G$  is independent of the  $e_d$ .*

<sup>2</sup> We use the same notations for the roots of a specific polynomial  $f$  and for the roots of the generic polynomial  $\prod_{i=0}^{n-1} (x-x_i)$ . The choice between the two meanings of  $x_i$  will be clear from the context. This ambiguity is useful as it allows, even in the case of a specific polynomial, to consider an invariant either as an element of the field of the coefficients or as a polynomial function of the roots.

This allows the following procedure to compute invariants.

For the first invariant  $F_1$ , we compute its normal  $NF(F_1)$  form by  $G$ . If it belongs to a basis of the free module of invariants (i.e. its leading term depends only on the  $x_i$ ), we introduce a new indeterminate  $f_1$  and the polynomial  $P_1 := NF(F_1) - f_1$ .

From now on, the normal form procedure is modified and consists in reducing first by  $G$ , then by  $P_1, \dots$ , a polynomial being reducible by some  $P_i$  only if its leading term is the product of the leading term of  $P_i$  by a monomial which is independent of the  $x_i$ .

With this special normal form procedure, if the normal form of an invariant has leading term which depends only on the  $x_i$ , it is linearly independent of the invariant corresponding to the preceding  $P_i$ , and one may add a new indeterminate  $f_i$  and a new polynomial  $P_i$ . On the other hand, if the normal form depends only on the  $e_i$  and the  $f_i$  then this gives the expression of the new invariant in term of the preceding ones.

This procedure allows to output easily the formulas presented in the next sections.

## III. MINIMAL POLYNOMIAL OF SUMS OF ROOTS

As the solutions are expressed by factorizing the minimal polynomial of the sum of two or three roots of the input polynomial, we need to compute this minimal polynomial. This may be done at run time by a sub procedure of the solving procedure, but it is better to compute it, once for all, as a polynomial whose coefficients are polynomials in the coefficients of a generic polynomial. This has the advantage to avoid to take care of the nature of the coefficients when writing the solving procedure, and also to be closer to what is usually called a formula.

We know of several ways to do this computation. We present the two which are the most convenient for solving in degree 5 and 7.

### 3.1 Sum of two roots by resultant

Let  $f(x)$  be a polynomial. If  $s$  is the sum of two roots of  $f$ , then there is  $\alpha$  such  $\alpha$  and  $s - \alpha$  are roots of  $f$ . Thus  $s$  is a root of the polynomial  $R$  defined in MAPLE syntax by `resultant(f, subs(x=s-x,f),x)`. Unfortunately,  $R$  is not the minimal polynomial of  $s$ . It the product of the square of the desired polynomial and the polynomial whose roots are the double of a root of  $f$ .

One may get the desired polynomial by factoring  $R$ , but it is much more convenient to get it directly without factoring. For this purpose, we consider the two polynomials  $f_+ = f(x)+f(y)$  and  $f_- = (f(x) - f(y))/(x - y)$ . Both are symmetric in  $x$  and  $y$ . Thus, if we substitute  $x$  by  $(s+d)/2$  and  $y$  by  $(s-d)/2$ , we get two polynomials in  $s$  and  $d^2$ , and we get the desired polynomial by the resultant eliminating  $d^2$ . This resultant is the minimal polynomial of  $s$ . In fact the desired minimal polynomial has degree  $n(n-1)/2$ . The degrees in  $d^2$  of  $f_+$  and  $f_-$  are respectively  $\lfloor n/2 \rfloor$  and  $\lfloor (n-1)/2 \rfloor$ . The degrees in  $s$  of the coefficient of  $d^{2i}$  in  $f_+$  and  $f_-$  are respectively at most  $n-2i$  and  $n-2i-1$ . It follows that the resultant has degree in  $s$  at most  $n(n-1)/2$  which is the degree of the desired minimal polynomial.

This computation is easily and efficiently implemented in MAPLE by the following instructions.  
`fx :=f; fy :=subs (x = y, f);  
 fp :=subs (t =sqrt (t), primpart (subs (x = (s + t)/2, y = (s - t)/2, fx +fy)));  
 fm:=subs (t =sqrt (t),  
 primpart (normal (subs (x = (s + t)/2, y = (s - t)/2, (fx -fy)/(x - y)))));  
 collect (primpart (resultant (fp, fm, t)), s);`

### 3.2 Sum of three roots by Newton's identities

For getting the minimal polynomial of the sum of three roots, the preceding method based on a resultant computation may not be used because there are several variables to eliminate. Grobner bases may be used, but induce problems of efficiency when the coefficients of the input polynomial are algebraic numbers or are generic (independent variables). This case of generic coefficients is especially important because it provides a formula which may be used directly, whichever is the nature of the coefficients.

To get this minimal polynomial, we use Newton inequality in the following way.

We start from the polynomial  $f = x^n + a_1 x^{n-1} + \dots + a_{n-1} x + a_n$ . There are  $N = n(n-1)(n-2)/6$  sums of three different roots. Thus we are looking for a polynomial of degree  $N$ . We compute first the sums  $S_i$  of the  $i$ th powers of the roots for  $i = 1, \dots, N$  by the Newton inequalities:

$$\begin{aligned} -S_1 &= a_1 \\ -S_i &= a_1 S_{i-1} + a_2 S_{i-2} + \dots + a_{i-1} S_1 + i a_i \quad \text{for } i \leq n \\ -S_i &= a_1 S_{i-1} + a_2 S_{i-2} + \dots + a_{n-1} S_{i-n+1} + a_n S_{i-n} \quad \text{for } i > n \end{aligned}$$

Then we compute, for  $i + j \leq N$  the sums  $S_2(i, j)$  of the products  $x^i y^j$  where  $x$  and  $y$  are two different roots of  $f$ . We have

$$\begin{aligned} S_{i,j} &= S_i S_j - S_{i+j} \quad \text{if } i > j \\ S_{i,i} &= (S_i^2 - S_{2i})/2. \end{aligned}$$

From this we deduce the sums  $S_3(i, j, k)$  of the products  $x^i y^j z^k$  of three powers of roots:

$$\begin{aligned} S_{i,j,k} &= S_i S_j S_k - S_{i+j,k} - S_{i+k,j} & \text{if } i > j > k \\ S_{i,i,k} &= S_k S_{i,i} - S_{i+k,i} & \text{if } i > k \\ S_{i,k,k} &= S_i S_{k,k} - S_{i+k,k} & \text{if } i > k \\ S_{i,i,i} &= (S_i S_{i,i} - S_{2i,i})/3. \end{aligned}$$

These sums are useful to compute the sums of Newton of the roots of the desired polynomial of degree  $N$ . In fact these sums of Newton are the sums of the  $(x+y+z)^m$  where  $x, y, z$  runs over all triplets of roots of  $f$ . When expanding these sums of products, the  $S_i, S_{i,j}, S_{i,j,k}$  appear with multinomial coefficients. However it should be remarked that a term  $x^i y^j$  appears in the expansion of  $n-2$  terms  $(x+y+z)^m$  and  $x^i$  in the expansion of  $(n-1)(n-2)/2$  terms.

Thus we have

$$\begin{aligned} S(m) &= \sum (x+y+z)^m = \frac{(n-1)(n-2)}{2} S_m \\ &+ (n-2) \sum_{i \geq j, i+j=m} \binom{m}{i} S_{i,j} + \sum_{i \geq j \geq k, i+j+k=m} \binom{m}{i, j, k} S_{i,j,k} \end{aligned}$$

Finally the coefficients of the desired polynomial are obtained by using the Newton identities again:

$$A_0 = 1; \quad -k A_k = \sum_{i=1}^k S(i) A_{k-i} \quad \text{for } k = 1 \dots n(n-1)(n-2)/6$$

Although rather involved this procedure is quite efficient: Applied to the generic depressed polynomial of degree 7, all the  $A_i$  have together 2, 635 terms which are computed in around two seconds on a laptop.

## IV. QUINTICS

### 4.1 Generic quintic

Let  $F = x^5 + A_1 x^4 + A_2 x^3 + A_3 x^2 + A_4 x + A_5 = \prod_{i=0}^4 (x - x_i)$  be a generic quintics, where the roots  $x_i$  are indeterminates. The action on the sums of two roots of the circular permutation  $\sigma$  defined in Section 2 has two orbits, containing respectively  $x_0 + x_1$  and  $x_0 + x_2$ . These orbits are invariant under the action of  $\gamma^2$  and exchanged by  $\gamma$ . It follows that the polynomials  $F_1 = \prod_{i=0}^4 s - (x_i + x_{i+1})$  and  $F_2 = \prod_{i=0}^4 s - (x_i + x_{i+2})$  (recall that the indexes are defined modulo 5) are invariant by the group of order 10 generated by  $\sigma$  and  $\gamma^2$ .

Let us denote respectively by  $B_i$  and  $C_i$  the coefficients of  $s^{5-i}$  in  $F_1$  and  $F_2$ . Let also  $D_i = B_i - C_i$ . All these polynomials in the  $x_i$  are thus invariant for the group of order 10.

The procedure described in Section 2.1 allows to prove easily the following.

**Proposition 3.** We have  $B_1 = C_1 = 2A_1, B_2 + C_2 = 3A_2 + 2A_1^2, B_3 + C_3 = A_3 + 3A_1 A_2$ .

There is a base of the free module of the invariants of the group of 10 elements containing  $1, D_2, D_3, D_4, D_5, D_2^2, D_2 D_3, D_2^3, D_3^2, D_2 D_5, D_2^4, D_2 D_3 D_5$ .

There is another base containing the same invariants, with  $D_2^2$  and  $D_2 D_3$  replaced by  $B_4 + C_4$  and  $B_5 + C_5$ .

Let us recall that the Molien series of a group is the formal series whose coefficient of degree  $i$  is the dimension of the vector space of the invariants of degree  $i$ .

$i$ . The Molien series of the symmetric group of order  $n$  is the series expansion of  $1/\prod_{i=1}^n (1 - t^i)$ . Proposition 1 implies that the Molien series of a group of permutations is the expansion of  $M/\prod_{i=1}^n (1 - t^i)$  where  $M$  is a polynomial whose coefficient of degree  $i$  is the number of invariants of degree  $i$  in the bases defined in Proposition 1. There are standard procedures to compute the Molien series. One is implemented in software MAGMA, which gives that for the group of order 10 the polynomial  $M$  is  $t^{10} + t^8 + t^7 + 2t^6 + 2t^5 + 2t^4 + t^3 + t^2 + 1$ . Similarly, the polynomial  $M$  for the maximal solvable group of order 20 is  $t^8 + t^7 + t^6 + t^5 + t^4 + 1$ . It follows.

**Proposition 4.** *Each set of invariants described in Proposition 3 is a basis over the ring of elementary symmetric functions of the module of the invariants of the group of 10 elements.*

*A basis of the invariants of the maximal solvable group of degree 5 and order 20 is  $(1, D_2^2, D_2 D_3, D_3^2, D_2 D_5, D_2^4)$ .*

#### 4.2 Solving quintics

When the generic polynomial  $F$  of the preceding section is specialized to a polynomial  $f = a_0 x^5 + a_1 x^4 + a_2 x^3 + a_3 x^2 + a_4 x + a_5$ , all the invariants specialize as well. In this section, we denote by  $K$  the field of the coefficients of  $f$ . If  $f$  is irreducible over  $K$  and solvable, its Galois group may be of order 20. Let us consider the extension  $K(\sqrt{D})$  of  $K$  generated by the square root of the discriminant  $D$  of  $f$ . Over this field the Galois group is either the cyclic group of order 5 or the group of order 10. It follows that the specializations  $f_1$  and  $f_2$  of  $F_1$  and  $F_2$  have their coefficients in this field and are irreducible on it (the Galois group is transitive on their roots). Moreover, if the discriminant of  $f$  is not a square, its Galois group is transitive on the sums of two roots and  $f_1$  and  $f_2$  are conjugate, i.e. they are exchanged by changing the sign of the square root of the discriminant. Thus we have the following

**Proposition 5.** *Over  $K(\sqrt{D})$ , the minimal polynomial  $f_{10}$  of the sum of two roots of  $f$  factors exactly in two factors of degree 5.*

*Moreover if the discriminant of  $f$  is not a square (i.e.  $K(\sqrt{D}) \neq K$ ), then  $f_1$  and  $f_2$  are conjugate. It follows that, in any case, the coefficients of  $f_1 + f_2$  and  $(f_1 - f_2)\sqrt{D}$  belong to  $K$ .*

To simplify the formulas, from now on we suppose, w.l.o.g., that  $f$  is in depressed form, that is  $a_1 = 0$ .

Supposing, w.l.o.g., that  $f_1$  and  $f_2$  are monic, let us denote by  $e_i$  and  $d_i$  the coefficients of degree  $5 - i$  of  $f_1 + f_2$  and  $(f_1 - f_2)\sqrt{D}$  respectively. Proposition 4 shows that any invariant of the group of order 10 may be expressed polynomially in term of the  $a_i$ ,  $d_i$  and  $e_i$ , and we have described a procedure to compute such an expression.

The following polynomials in the  $u_i$  (Fourier transform of the roots) are such invariants. We give them with their expression in term of the coefficients of  $f_1$  and  $f_2$  computed by above procedure.

$$u_1 u_4 = -\frac{1}{2} d_2 - \frac{5}{2} a_2 \tag{1}$$

$$u_1^5 + u_4^5 = \frac{125}{2} d_5 + 125 e_5 - \frac{25}{4} d_3 a_2 - \frac{75}{4} d_2 a_3 - \frac{125}{2} a_2 a_3 - \frac{375}{2} a_5 \tag{2}$$

$$u_1^2 u_2 + u_1^3 u_3 = -\frac{5}{2} d_3 - \frac{25}{2} a_3 \tag{3}$$

$$u_1^3 u_2 + u_4^3 u_3 = \frac{25}{2} d_4 + \frac{15}{2} e_4 - \frac{15}{2} d_2 a_2 - 40 a_4 - \frac{5}{2} a_2^2 \tag{4}$$

Equations 1 and 2 show that  $u_1^5$  and  $u_2^5$  are the roots of a quadratic equation with may be solved to get  $u_1^5$ . Extracting a fifth root gives  $u_1$ . If it is not null, the value of  $u_1 u_4$  gives  $u_4$  rationally in term of  $u_1$ . Then  $u_2$  and  $u_3$  are deduced by solving the linear system given by Equations 3 and 4. Finally the roots are deduced by inverse Fourier transform. This procedure is made explicit below.

However some care is needed if the quadratic equation for  $u_1^5$  has a null root or a double root.

If the two roots of this quadratic equation are null, one may exchange  $f_1$  and  $f_2$ , which amounts to change the sign of all  $d_i$  in the above relations. If the new quadratic equation would have also two null roots, then all the  $u_i$  would be null and the five roots of  $f$  would be equal, which is impossible as  $f$  is irreducible.

If one root of the quadratic equation is null then one chooses  $u_4 = 0$  and  $u_1$  is the fifth root of the right hand side of Equation 2.

The determinant of the linear system in  $u_2$  and  $u_3$  is  $u_1^5 - u_4^5$ . We show now that it may be null only if  $u_1 = u_4 = 0$ . In fact, if  $u_1^5 = u_4^5 \neq 0$ , we have  $u_4 = \omega^i u_1$  for some  $i$ , where  $\omega$  is the primitive root of unit which has been chosen. Thus, if we denote by  $h_1$  and  $h_3$  the right hand sides of Equations 1 and 3 respectively, we have  $u_1^2 = h_1/\omega^i$  and  $u_2 \omega^2 + u_3 = h_3$ . As  $u_2 u_3 = d_2/2 - 5 a_5$  (conjugate equation of Equation 1), we see that all the  $u_i$  and thus all the roots belong to an extension of  $K$  of degree prime to 5, which implies that  $f$  is not irreducible. Thus we have proved that the following MAPLE procedure computes the roots of  $f$ . However, for better readability we write separately the polynomial of degree 10 which is factored during the procedure. For the same reason, the usual mathematical notation for product and root extractions has been preferred to the alphanumeric notation which is usual in programming languages.

$$f_{10} = s^{10} + 3 a_2 s^8 + a_3 s^7 + (-3 a_4 + 3 a_2^2) s^6 + (2 a_2 a_3 - 11 a_5) s^5 + (-2 a_4 a_2 + a_2^3 - a_3^2) s^4 + (-4 a_4 a_3 + a_2^2 a_3 - 4 a_5 a_2) s^3 + (7 a_5 a_3 + a_4 a_2^2 - 4 a_4^2 - a_2 a_3^2) s^2 + (4 a_4 a_5 - a_2^2 a_5 - a_3^3) s - a_5^2 + a_2 a_3 a_5 - a_4 a_3^2 \tag{5}$$

With this definition, the MAPLE procedure is:

```

quintic := proc (pol);
x := op (indets (pol));
t := coeff(pol, x, 4)/coeff(pol, x, 5)/5;
f := primpart (subs (x=x-t,pol));
D := discrim (f, x);
for i from 2 to 5 do ai := coeff(f, x, 5 - i) od;
f10 := factor ( < Equation 5 > , D1/2);
if not type (f10, ' * ') then RETURN ("the quintic is not solvable") fi;
(f1, f2) := op (f10);
e4 := coeff(f1 + f2, s, 1); e5 := coeff(f1 + f2, s, 0);
d2 := √5 · coeff(f1 - f2, s, 3); d3 := √5 · coeff(f1 - f2, s, 2);
d4 := √5 · coeff(f1 - f2, s, 1); d5 := √5 · coeff(f1 - f2, s, 0);
if d2/2 - 5 a2/2 = 0
and 125 d5/2 + 125 e5 - 25 d3 a2/4 - 75 d2 a3/4 - 125 a2 a3/2 - 375 a5/2 = 0
then d2 := -d2; d3 := -d3; d4 := -d4; d5 := -d5; fi;
h1 := -d2/2 - 5 a2; h3 := -5 d3/2 - 25 a3/2;
h2 := 125 d5/2 + 125 e5 - 25 d3 a2/4 - 75 d2 a3/4 - 125 a2 a3/2 - 375 a5/2;
h4 := 25 d4/2 + 15 e4/2 - 15 d2 a2/2 - 40 a4 - 5 a22/2;
if h1 = 0 then u1 := h21/5; u4 := 0; d := h2
else d := √(h22 - 4 h15); u1 := ((-h2 + d)/2)1/5; u4 := h1/u1; fi;
ω := (√(-2 √5 - 10 + √5 - 1))/4;
u2 := (h4 u12 - h3 u43)/d; u3 := (h3 u13 - h4 u42)/d;
result :=
-t + (u1 + u2 + u3 + u4)/5,
-t + (ω u1 + ω2 u2 + ω3 u3 + ω4 u4)/5, -t + (ω2 u1 + ω4 u2 + ω u3 + ω3 u4)/5,
-t + (ω3 u1 + ω u2 + ω4 u3 + ω2 u4)/5, -t + (ω4 u1 + ω3 u2 + ω2 u3 + ω u4)/5
end;
    
```

**Remark 6.** The length of this complete program has to be compared with the three pages length formula of Lazard (2004). On the other hand, more square roots appear apparently in our new formula than in the one of Lazard (2004). In fact  $\sqrt{D}$  and  $\sqrt{5}$  appear both in factor of the  $d_i$ . Thus if they are replaced by  $\sqrt{5D}$ , the final expression of the roots contains exactly the same square roots as in Lazard (2004).

V. SEPTICS

For solving septics, we consider the minimal polynomial of the sums of three different roots, which is of degree 35. It is shown in Bruen et al. (1986) (Theorem II.3.2) that the factorization of this polynomial allows to determine the Galois group.

**Proposition 7.** *The minimal polynomial of the sum of three roots is irreducible if the Galois group is either the alternate or the symmetric group. It has two irreducible factors of degrees 7 and 28 in the case of the non solvable group of order 168, two irreducible factors of degrees 14 and 21 in the case of the solvable group of order 42, three irreducible factors, one of degrees 21 and two of degree 7 in case of the solvable group of order 21, four irreducible factors, one of degree 14 and three of degree 7 in case of the dihedral group of order 14 and five irreducible factors of degree 7 in the case of the cyclic group of order seven.*

To explain how this result may be used in solving, we have to look inside its proof, which will be done in next subsection.

5.1 Generic septic

Let  $x_0, \dots, x_6$  be the seven roots of a generic septic.

The circular permutation  $\sigma$  defined in Section 2 acts on the sum of three roots. There are five orbits under this action, generated respectively by  $x_0+x_1+x_3, x_0+x_2+x_3, x_0+x_1+x_6, x_0+x_2+x_5$  and  $x_0+x_3+x_4$ . Let us denote  $\mathcal{O}_1, \dots, \mathcal{O}_5$  these orbits, numbered in that order. The permutation  $\sigma : x_i \rightarrow x_{5i}$  exchanges  $\mathcal{O}_1$  and  $\mathcal{O}_2$  and permutes circularly the three other orbits. As each solvable group is generated by  $\sigma$  and a power of  $\sigma$ , the part of Proposition 7 devoted to solvable groups deduce easily.

Let  $F_i = \prod_{x+y+z} c_i(s - (x+y+z))$ , for  $i = 1, 2$ . As  $\mathcal{O}_1$  and  $\mathcal{O}_2$  are fixed by  $\gamma^2$ , the coefficients of the powers of  $s$  in  $F_1$  and  $F_2$  are invariants of the solvable group of order 21. Like for quintic, we want to use these invariants to express the solution. Unfortunately we do not have yet enough invariants, and we have to introduce other septics which are invariant for the same group.

The first such septic is the polynomial  $F_3$  whose roots are the elements of the orbit of  $x_1+x_2+x_4 - (x_3+x_5+x_6)$  (difference of an element of  $\mathcal{O}_1$  and an element of  $\mathcal{O}_2$  which have no root in common). This polynomial do not give sufficiently many new invariants. In fact, it will be useful only in some special cases.

Recall that we denote by  $u_0, \dots, u_6$  the Fourier transform of the  $x_i$  and that the image of  $u_i$  by  $\sigma$  is  $u_i/\omega^i$ . With our choice of  $\gamma$ , we have  $\gamma(u_i) = u_{3i}$  and  $\gamma^2(u_i) = u_{2i}$  (indexes defined modulo 7). It follows easily that  $\gamma^2(\sigma(u_i)) = \sigma^4(\gamma^2(u_i))$  which means that the orbit of  $u_1+u_2+u_4$  (resp.  $u_3+u_5+u_6$ ) is left invariant by the action of  $\gamma^2$ . Thus the septics  $G_1$  and  $G_2$  which have these orbits as roots are invariant by the group of order 21.

At this point the solving strategy becomes clear:

Firstly, given a solvable septic  $f$  defined on a field  $K$ , compute the septics  $f_1, f_2, f_3, g_1$  and  $g_2$  which are the specialization of  $F_1, F_2, F_3, G_1$  and  $G_2$ . As these septics are not invariant under

the maximal solvable group, these computations will be done over  $K(\sqrt{D})$  the extension of the field of the coefficients of  $f$  by the square root of the discriminant  $D$  of  $f$ . On this field, the Galois group of  $f$  is included in the group of 21 elements and the coefficients of  $f_1, f_2, f_3$  are thus rational. As the definition of  $g_1$  and  $g_2$  involve the seventh roots of unit,  $g_1$  and  $g_2$  are rational on  $K(\sqrt{D}, \omega)$ . In fact we will see that the coefficients of  $f_1 + f_2, (f_1 + f_2)\sqrt{D}, f_3\sqrt{D}$  belong to  $K$  while those of  $g_1$  and  $g_2$  belong to  $K(\sqrt{-7D})$ .

Secondly, design some polynomials in the  $u_i$  which are invariants under the action of this group, express them as functions of the coefficients of  $f_1, \dots$  and use these expressions to compute the  $u_i$ .

5.2 Computing invariant septics  $f_1$  and  $f_2$

From now on, we consider a solvable septic  $f$  whose coefficients belong to a field  $K$  of characteristic different from 2, 3, 7. W.l.o.g. we suppose that that it is in depressed form, that is its coefficient of degree 6 is null. This implies that  $u_0 = 0$ .

To compute  $f_1$  and  $f_2$ , we use Proposition 7. Thus we factorize the minimal polynomial of the sum of three roots, whose computation has been described in Section 3.2.

If the Galois group has the order 21, there are two factors of degree 7 which are  $f_1$  and  $f_2$ . It does not matter which is named  $f_1$ , because they are exchanged if we replace  $\sigma$  by  $\sigma^{-1}$  when numbering the roots.

If the polynomial of degree 35 has a factor of degree 14 (group of order 14 or 42), we factorize it over the field  $K(\sqrt{D})$  where  $D$  is the discriminant of  $f$ . This gives two factors of degree 7 which are  $f_1$  and  $f_2$ .

It remains the case of the cyclic group where there are 5 factors of degree 7. One has to decide which are the specialization of  $f_1$  and  $f_2$ . For this we use the following property of above defined orbits  $\mathcal{O}_i$ .

**Lemma 8.** *Given any element  $s$  of  $\mathcal{O}_1$  or  $\mathcal{O}_2$ , there exists in each other orbit exactly one element which has not root in common with  $s$ .*

*Given an element  $s$  of  $\mathcal{O}_3, \mathcal{O}_4$  or  $\mathcal{O}_5$  and another orbit  $\mathcal{O}_j$ , there exist an element  $t \in \mathcal{O}_j$  with no root in common with  $s$  if and only if  $j = 1$  or  $2$ . In this case there is exactly one such element.*

*Proof.* By cases enumeration.

**Proposition 9.** *Let  $f$  an irreducible septic in depressed form, and  $h_1$  and  $h_2$  be two different factors of degree 7 of the minimal polynomial of degree 35 of the sum of three roots of  $f$ . Then a root  $s_1$  of  $h_1$  and a root  $s_2$  of  $h_2$  have a root of  $f$  as common summand if and only if  $f(-s_1 - s_2) \neq 0$ .*

*If the system  $h_1(s_1) = h_2(s_2) = f(-s_1 - s_2) = 0$  has a solution, then it has exactly 7 solutions*

*Proof.* If  $s_1$  and  $s_2$  have no root of  $f$  as a common summand, then  $s_1$  and  $s_2$  involve 6 different roots of  $f$ . As the sum of the seven roots of  $f$  is null, we have thus  $f(-s_1 - s_2) = 0$ .

If  $(s_1, s_2)$  is solution of  $h_1(s_1) = h_2(s_2) = f(-s_1 - s_2) = 0$ , we obtain immediately six other solutions by permuting circularly the roots of  $f$ . If  $-s_1 - s_2$  is a root  $x$  of  $f$ , this defines a linear relation  $c_0x_0 + \dots + c_6x_6 = 0$  between the roots of  $f$ , with non negative integer coefficients. As the Galois group of  $f$  contains a circular permutation of the roots, the roots of  $f$  are in the kernel of the circulant matrix defined by the vector  $(c_0, \dots, c_6)$ . As the eigenvalues of this matrix are  $c_0 + \omega^i c_1 + \dots + \omega^{6i} c_6$  for  $i = 0, \dots, 6$

(where  $\omega$  is a primitive seventh root of unit) the determinant of this matrix is null if and only if either  $c_0 + \dots + c_6 = 0$  (eigenvalue for  $i = 0$ ) or if all the  $c_i$  are equal (unique equation satisfied by a primitive root of unit). As the  $c_i$  are non negative, the first case is excluded, all the  $c_i$  are equal to 1 and  $s_1$  and  $s_2$  have no root of  $f$  as a common summand.

**Corollary 10.** *Let  $f$  be a septic in depressed form whose Galois group is cyclic, and let  $h_i, i = 1, \dots, 5$  be the factors of degree 7 of the minimal polynomial  $f_{35}$  of the sum of three roots. Let  $R(t)$  be the resultant with respect to  $s$  of  $f(-s - t)$  and  $h_i(s)$ .*

- *If the remainder of the Euclidean division of  $R(t)$  by  $h_i(t)$  is null for  $i = 2, 3, 4$  then the roots of  $h_1$  belong to one of the orbits  $\mathcal{O}_1$  or  $\mathcal{O}_2$*

- *If the remainder of the division of  $R(t)$  by  $h_i(t)$  is null for exactly two  $i$  in  $\{2, 3, 4\}$  then the roots of the two corresponding  $h_i$  belong to the orbits  $\mathcal{O}_1$  and  $\mathcal{O}_2$ .*

- *If the remainder of the division of  $R(t)$  by  $h_i(t)$  is null for exactly one  $i$  in  $\{2, 3, 4\}$  then the roots of  $h_5$  and of this  $h_i$  belong to the orbits  $\mathcal{O}_1$  and  $\mathcal{O}_2$ .*

*Proof.* This follows immediately from the preceding results, because the remainder is null if and only the system  $f(-s - t) = h_i(s) = h_i(t) = 0$  has a solution (and thus seven).

Except in the first case, this corollary allows to choose the factors of  $f_{35}$  corresponding to  $\mathcal{O}_1$  and  $\mathcal{O}_2$ . In the first case, the lacking orbit may be found by applying the corollary to  $h_2$  instead of  $h_1$

### 5.3 Other invariant septics

Having the invariants polynomials  $f_1$  and  $f_2$  whose roots are the orbits of  $x_0+x_1+x_3$  and  $x_0+x_2+x_3$ , we may deduce several other septics which are also invariants by the group of 21 elements.

The first one is  $f_3$  whose set of roots is the orbit of  $x_1+x_2+x_5 - (x_3+x_5+x_6)$ . A root of  $f_3$  is the difference of a root of  $f_1$  (orbit  $\mathcal{O}_1$ ) and a root of  $f_2$  (orbit  $\mathcal{O}_2$ ), with no common summand. It follows from Proposition 9 that, if  $t$  is such a root of  $f_3$ , then there exists  $s_1$  and  $s_2$  such  $f_1(s_1) = f_2(s_2) = f(-s_1-s_2) = t-s_1+s_2 = 0$ . Moreover  $s_1$  and  $s_2$  are unique if  $t$  is given and every  $t$  which belongs to a solution of this system is a root of  $f_3$ .

This shows that  $f_3$  may be obtained by eliminating  $s_1$  and  $s_2$ . There are several ways to do this elimination, the simplest one being the following.

**Proposition 11.** *The polynomial  $f_3$  is the GCD of  $R_1$  and  $R_2$ , where  $R_1$  (resp.  $R_2$ ) is the resultant of  $f(x)$  and  $f_1((t-x)/2)$  (resp.  $f_2((-t-x)/2)$ ) with respect to  $x$ .*

*Proof.* It follows from Proposition 9 that  $t$  is a root of this GCD if and only if there is a root  $x$  of  $f$ , a root  $s_1$  of  $f_1$  and a root  $s_2$  of  $f_2$  such that  $s_1 = (t-x)/2$  and  $s_2 = (-t-x)/2$ , that is  $s_1 + s_2 = -x$  and  $s_1 - s_2 = t$ .

**Remark 12.** The computation implied by Proposition 11 may be viewed as an algorithm. It may also be viewed as a formula, because a resultant or a GCD of fixed degree (here 7) are both polynomial in term of the coefficients of their arguments (for GCD, this follows from the subresultant theory).

To compute the invariant septics  $g_2$  and  $g_3$  which have, as roots, the orbits under the cyclic group of  $u_1 + u_2 + u_4$  and  $u_3 + u_5 + u_6$  respectively, we need a lemma.

**Lemma 13.** *If  $u_0, \dots, u_6$  is the Fourier transform of the roots  $x_0, \dots, x_6$  of an irreducible septic  $f$ , then there is a square*

*root of  $-7$  such that  $u_1 + u_2 + u_4 - (u_3 + u_5 + u_6) = (x_1 + x_2 + x_4 - (x_3 + x_5 + x_6))\sqrt{-7}$ .*

*Proof.* Expand and simplify the definition of the  $u_i$ .

This lemma is used in the following way. Let  $t_1, t_2, s_1, s_2$  be the images under the action of  $\sigma^j$ , for some  $i$ , of, respectively,  $u_1 + u_2 + u_4, u_3 + u_5 + u_6, x_1 + x_2 + x_4$  and  $x_3 + x_5 + x_6$ . By Lemma 13, there is a root  $x$  of  $f$  such the following relations are satisfied:  $s_1 + s_2 + x = 0, t_1 + t_2 = 7x, t_1 - t_2 = (s_1 - s_2)\sqrt{-7}, f(x) = 0, f_1(s_1) = 0$  and  $f_2(s_2) = 0$ . Using the three linear equations to eliminate, say,  $s_1, s_2$  and  $x$ , we get three equations of degree 7 in  $t_1$  and  $t_2$ . Thus like for computing  $f_3$ , we get the minimal polynomials of  $g_1$  and  $g_2$  as a GCD of resultants, Proposition 9 implying that this GCD is exactly of degree 7.

However, this way of computing  $g_1$  and  $g_2$  is not efficient. In fact it implies generally to compute in  $K(\sqrt{D}, \sqrt{-7})$ , which is an extension of degree 4. We present a way for doing this elimination, which takes advantage of the symmetry of the problem to work on the smaller extension  $K(\sqrt{-7D})$ .

The basic remark is that, if the discriminant  $D$  is not a square, then  $f_1$  and  $f_2$  are conjugate, i.e. they are exchanged if one change the sign of  $\sqrt{D}$ . It follows that, if  $f_1$  and  $f_2$  are monic (which is obtained by dividing them by their leading coefficient), then  $f_+(s_1, s_2) = f_1(s_1) + f_2(s_2)$  and  $f_-(s_1, s_2) = (f_1(s_1) - f_2(s_2))\sqrt{D}$  are bivariate polynomials whose part depending on  $\sqrt{D}$  is anti-symmetric in  $s_1$  and  $s_2$ , i.e. is a multiple of  $s_1 - s_2$ , while the part independent of  $\sqrt{D}$  is symmetric.

This suggest to use  $f_+$  and  $f_-$  for the elimination, that is, to compute  $g_1$  (resp.  $g_2$ ) as the GCD of the resultants with respect to  $t_2$  (resp.  $t_1$ ) of  $f(t_1 + t_2/7)$  and  $f_{\pm}(-\frac{t_1+t_2}{14} + \frac{t_1-t_2}{2\sqrt{-7}}, -\frac{t_1+t_2}{14} - \frac{t_1-t_2}{2\sqrt{-7}})$ , where  $f_{\pm}$  is  $f_+$  for the first resultant and  $f_-$  for the second.

With this way to proceed the elimination, the polynomials involved in the resultant computation have their coefficients in the extension of the base field by  $\sqrt{-7D}$ . It is useful to remark that this may also be obtained by replacing  $\sqrt{-D}$  by  $\sqrt{-7}$  in the definition of  $f_-$ . This has the advantage to have smaller coefficients if  $D$  is large.

It should be noted that the computation of  $g_1$  and  $g_2$  is a critical step in the computation of the roots: On typical examples, one needs around 30 seconds to compute the roots with an elimination starting from  $f_1$  and  $f_2$ , while only 3 seconds are needed with the elimination starting from  $f_+$  and  $f_-$ .

### 5.4 Computing $u_1, u_2, u_4$

Let  $g_1 = t^7 + b_3 t^4 + b_4 t^3 + b_5 t^2 + b_6 t + b_7$  be the polynomial computed in the preceding section, which has, as roots,  $u_1+u_2+u_4$  and its images under the action of the powers of  $\sigma$ . The fact that the coefficients of degree 5 and 6 are null is a consequence of the nullity of the sum of the roots of  $f$ . This may be proved by computing  $g_1$  in the case of the generic polynomial  $\prod_{i=0}^6 (x - x_i)$ .

The  $b_i$  are invariants of the group of 21 elements. It appears that every invariant of this group, which is constructed from  $u_1, u_2, u_4$ , may be expressed in term of the  $b_i$ .<sup>3</sup> In fact, the method of Section 2.1 shows<sup>3</sup> This has not been proved, but it is true for

all invariants we have constructed from

$$\begin{aligned} u_1 u_2 u_4 &= -b_3/14 \\ u_1 u_2^3 + u_2 u_4^3 + u_4 u_1^3 &= -b_4/7 \\ u_1^3 u_2^2 + u_2^3 u_4^2 + u_4^3 u_1^2 &= -b_5/14 \\ u_1^5 u_2 + u_2^5 u_4 + u_4^5 u_1 &= -b_6/7 - b_3^2/196 \\ u_1^7 + u_2^7 + u_4^7 &= -b_7 - b_3 b_4/14 \end{aligned}$$

This system of equation allows to compute  $u_1, u_2$  and  $u_4$ . Before proceeding further, let us first remark that  $u_1, u_2$  and  $u_4$  may be arbitrarily permuted circularly: this amounts to use  $\sigma^2$  instead of  $\sigma$  to label the roots. Similarly,  $u_1, u_2, u_4$  and  $u_3, u_5, u_6$  may be exchanged. This is equivalent to exchange  $f_1$  and  $f_2$  and thus also  $g_1$  and  $g_2$ . This amounts to replace  $\sigma$  by  $\sigma^3$  to label the roots.

This system of equations allows to compute  $u_1$  and to express rationally  $u_2$  and  $u_4$  in term of  $u_1$ . However several cases have to be considered.

If  $b_3 = 0$ , one of  $u_1, u_2, u_4$  is null. As we have choice for labeling the  $u_i$ , we chose  $u_4 = 0$ , and Equations 7, 8, 9 become  $u_1 u_2^3 = -b_4/7, u_1^3 u_2^2 = -b_5/14, u_1^5 u_2 = -b_6/7$ . Thus either  $b_4 = b_5 = b_6 = 0$ , another  $u_i$  is null and the last one is given by Equation 10 or none of  $b_4, b_5, b_6$  is null and  $u_1$  and  $u_2$  are not null and may be computed from Equation 7, 8 only.

Thus the different cases are the following ones.

- $b_3 = b_4 = b_7 = 0$ . This implies  $b_5 = b_6 = 0$  and  $u_1 = u_2 = u_4 = 0$ . This does not allow to express  $u_3, u_5, u_6$  in term of  $u_1$ . Thus, in this case we exchange  $f_1$  and  $f_2$  and also  $g_1$  and  $g_2$ . After this exchange we are no more in this case: if we were, all the  $u_i$  and thus all the roots of the septic would be equal to 0.

- $b_3 = b_4 = 0, b_7 \neq 0$ . We choose  $u_2 = u_4 = 0$  and Equation 10 gives  $u_1 = -\sqrt[7]{b_7}$ .

- $b_3 = 0, b_4 \neq 0$ . We choose  $u_4 = 0$ . Thus  $u_1$  and  $u_2$  are not null. It is easy to deduce from Equations 7, 8 and 9 that  $u_1 = \sqrt[7]{\frac{-b_5 b_6}{14 b_4}}$  and  $u_2 = \frac{2 u_1^2 b_4}{b_5} \cdot 4$

- $b_3 \neq 0$ . This general case needs more attention than the preceding ones and will be detailed in the next paragraphs.

The elementary symmetric functions in  $u_1^7, u_2^7$  and  $u_4^7$  are invariant under the action of the group of order 21, and are function of the  $b_i$ . The sum and the product have already be computed as Equations 10 and 6. The last elementary symmetric function  $u_1^7 u_2^7 + u_2^7 u_4^7 + u_4^7 u_1^7$  may be computed by the method of Section 2.1. This allows to express  $u_1$  as the seventh root of a root of a cubic polynomial, but does not allows to express rationally  $u_2$  and  $u_4$  in term of  $u_1$ . Therefore we use another method to solve Equations 6 to 10.

As we have supposed  $u_3 \neq 0$ , Equation 6 may be solved in  $u_4$  and its solution may

$u_1, u_2, u_4$

<sup>4</sup> There several possible formulas. These seem among the simplest ones.

be substituted in Equations 7 to 10 to get four polynomial equations in  $u_1, u_2$  and the  $b_i$ .

The Grobner basis of this system, for the total degree ordering, may be computed in MAPLE with the option `method=fgb` in about 15 second and contains 474 polynomials, too much for our purpose. However, if we add the equation  $t b_3 - 1 = 0$  to confirm that  $b_3 \neq 0$ , then the Grobner basis eliminating  $t$  is computed in 1.5 seconds and contains 154 polynomials which are independent of  $t$ . Starting from it, a Grobner basis for an ordering eliminating  $u_2$  (in MAPLE, `lexdeg([u_2], [u_1, b_7, b_6, b_5, b_4, b_3])`, `method=fgb`) gives three relations between the  $b_i$ , a polynomial of degree 3 in  $u_1^7$  with coefficients depending on the  $b_i$  and many polynomials which are linear in  $u_2$ . Among them the fifteenth has the lower degree in  $u_1$  and has the shape  $Au_2 + Bu_1^2$  where  $A$  and  $B$  are linear polynomials in  $u_1^7$  with coefficients depending on the  $b_i$ .

These polynomials may be simplified by replacing them by their normal form by the Grobner basis of the relations between the  $b_i$  for the lexicographical ordering such  $b_7 > b_6 > b_5 > b_4 > b_3$ . The resulting relations are

$$u_1 = \sqrt[7]{u_1} \tag{11}$$

$$0 = U_1^3 + (b_7 + \frac{b_3 b_4}{14})U_1^2 + (-\frac{b_5^2 b_4}{14^2 7} - \frac{b_4^2 b_3^2}{14^2 49} + \frac{b_6 b_5 b_3}{14^2 7} - \frac{b_5 b_3^2}{14^4})U_1 + (\frac{b_3}{14})^7 \tag{12}$$

$$u_2 = -2u_1^2 \frac{14^3 (7 b_6 b_5 + 2 b_4^2 b_3 - \frac{1}{2} b_5 b_3^2) U_1 + A}{14^3 (b_5 b_4 b_3 - 28 b_6^2 - \frac{1}{14} b_4^3 - 4 b_4^3) U_1 + B} \tag{13}$$

$$u_4 = \frac{-b_3}{14 u_1 u_2} \tag{14}$$

where

$$\begin{aligned} A &= 28 b_5 b_4 b_3^3 - 28 b_4^3 b_3^2 + 98 b_5^2 b_3 + b_6^3 + 196 b_6 b_5 b_4 b_3 - 196 b_5^2 b_4^2 + 7 b_6 b_4^4 \\ B &= b_4 b_3^5 + 28 b_6 b_4 b_3^3 - 28 b_5 b_4^2 b_3^2 + 14 b_5^2 b_3^3 \end{aligned}$$

Thus  $u_1$  is the seventh root of a root of a cubic equation and  $u_2$  and  $u_4$  are expressed rationally in term of  $u_1$  and the same root of this cubic equation. However, to avoid division by 0 we have to define  $U_1$  as a root of the quotient of the right hand side of Equation 12 by its GCD with the denominator in Equation 13. This avoids a division by zero because we will shows that Equation 12 never has multiple roots.

**Proposition 14.** *The discriminant of Equation 12 is the square of*

$$\frac{b_5^2 b_4^2 b_3}{7^3 14^2} - \frac{b_5^3 b_3^2}{14^5} - \frac{b_6 b_5 b_3^2 b_4}{7^4 14} + \frac{b_3^7}{14^7} - \frac{b_4^4 b_5}{7^4 14} - \frac{b_6 b_5^2}{14^3 7} - \frac{b_3^3 b_4^3}{14^2 7^4} + \frac{3 b_5 b_4 b_4^3}{14^5 7} - \frac{b_6 b_5^3}{14^4 7^2} + \frac{b_6 b_4^3 b_3}{7^4 14} \tag{15}$$

and is not null unless if  $b_3 = b_4 = 0$ .

It follows that, unless if  $b_3 = b_4 = 0$ , either Equation 12 has three distinct roots in  $K(\sqrt{-7D})$  or its right hand side is irreducible with cyclic Galois group.

*Proof.* The discriminant of Equation 12 is the square of  $(u_1^7 - u_2^7)(u_2^7 - u_4^7)(u_4^7 - u_1^7)$ . To express this in term of the  $b_i$ , we proceed as follows. First compute the Grobner basis  $G_1$  of Equations 6 to 10 for an elimination ordering eliminating the  $u_i$  (1/3 second in MAPLE for the ordering `lexdeg([u_1, u_2, u_4], [b_3, b_4,`

$b_5, b_6, b_7]$ , method =  $fgb$ ) and the Grobner basis  $G_2$  of the elements of  $G_1$  which depend only on  $b_3, b_4, b_5, b_6, b_7$ , for the lexicographical ordering such that  $b_7 > b_6 > b_5 > b_4 > b_3$ . Then Polynomial 15 is obtained by taking the normal form by  $G_2$  of the normal form by  $G_1$  of  $(u_1^7 - u_2^7)(u_2^7 - u_4^7)(u_4^7 - u_1^7)$ .

Thus the discriminant of Equation 12 is a square in  $K(\sqrt{-7D})$ . This implies that, if it is irreducible, then its Galois group is cyclic. If the right hand side is factorized in a linear (in  $U_1$ ) polynomial and a quadratic one, the quadratic one is not irreducible, because its discriminant is a square. In fact, the discriminant of a product is the product of the discriminants of the factors times the square of their resultants.

Thus it remains to prove that the discriminant is not null. Suppose that it is null. Then two roots are be equal, say  $u_1^7 = u_2^7$ , as permuting the indexes of the roots  $x_i$  permutes also the  $u_i$ . This double root is not null, as we have supposed that at most one of the  $u_i$  is null. If  $\omega$  is a primitive root of unit, we have thus  $u_2 = \omega^i u_1$  for some  $i$ . Substituting this in Equation 6, solving it in  $u_4$  and substituting the values of  $u_2$  and  $u_4$  in Equations 7 and 8 gives two equations of degree 9 in  $u_1$  whose difference has degree 6. Thus  $u_1$ , and thus also  $u_2$  and  $u_4$  are in an extension  $L$  of degree at most 6 of  $K(\sqrt{-7D})$ .

We will prove in next section that either  $u_3, u_5, u_6$  may be rationally expressed in term of  $u_1$  or Equation 12 has a triple root. In the latter case we will prove that  $u_3, u_5$  and  $u_6$  belong to an extension of degree at most 6 of  $L$ . Thus, in both cases, all the  $u_i$  belong to an extension of  $K$  of degree prime to 7. The same is thus true for  $x_0$  which is the quotient by 7 of the sum of the  $u_i$ , which proves that the input polynomial is not irreducible.

**Corollary 15.** *The root  $U_1$  of Equation 12 belongs either to  $K(\sqrt{-7D})$  or to an extension by a cubic root of  $K(\sqrt{-3}, \sqrt{-7D})$ .*

*Proof.* The square root which appears in Cardano's formula for the roots of a cubic equation is the square root of the product of the discriminant, a square and  $-3$ .

### 5.5 Final computation of the roots

As the roots will be obtained by reverse Fourier transform of the  $u_i$ , for computing them we need to express  $u_3, u_5, u_6$  rationally in term of  $u_1, u_2, u_4$  and the invariants which have been already computed. For this purpose, we consider four invariants of the group of order 21, which may be expressed in term of the coefficients of  $f, f_1, f_2, f_3, g_1, g_2$ , using the method of Section 2.1.

Among these polynomials,  $f$  has its coefficients in  $K$ ,  $g_1$  and  $g_2$  have their coefficients in  $K(\sqrt{-7D})$ , but the other ones have coefficients in  $K(\sqrt{D})$ . Thus we will consider  $f^+ = f_1 + f_2$ , which has its coefficients in  $K$  and  $f^- = (f_1 - f_2)\sqrt{-7}$  which is the product by  $\sqrt{-7D}$  of a septic with coefficients in  $K$ . We will denote by  $a_i$  (resp.  $b_i, c_i, d_i^+, d_i^-$ ) the coefficient of degree  $7-i$  of  $f$  (resp.  $g_1, g_2, f^+, f^-$ ).

The roots of the septic  $f_3$  are the elements of the orbit under the cyclic group of  $x_1 + x_2 + x_4 - x_3 - x_5 - x_6$ . Thus it changes of sign when one changes in it the signs both the variable and  $\sqrt{D}$ . Thus its coefficients of even degree are the product of an element of  $K$  by  $\sqrt{D}$ . We need only the product by  $\sqrt{-7}$  of its coefficient of degree 2 which is thus in  $K(\sqrt{-7D})$  and will be denoted by  $e_5$ . With these notations we get the following relations which are linear in  $u_3, u_5, u_6$ .

$$u_1 u_6 + u_2 u_5 + u_4 u_3 = -7a_2 \tag{16}$$

$$u_4^2 u_6 + u_1^2 u_5 + u_2^2 u_3 = -\frac{1}{14} b_3 + \frac{21}{4} d_3^+ - \frac{7}{4} d_3^- - 14a_3 \tag{17}$$

$$u_4 u_2^2 u_6 + u_1 u_4^2 u_5 + u_2 u_1^2 u_3 = \frac{1}{21} c_4 - \frac{1}{42} b_4 + \frac{49}{12} d_4^+ + \frac{49}{12} d_4^- - \frac{98}{3} a_4 \tag{18}$$

$$u_1^4 u_3 + u_2^4 u_6 + u_4^4 u_5 = 7e_5 - \frac{1}{7} c_5 - \frac{3}{14} b_5 - \frac{343}{4} d_5^+ - \frac{343}{4} d_5^- + b_3 a_2 - 343 a_5 \tag{19}$$

Thus, if the determinant of the coefficients of  $u_3, u_5, u_6$  in three of these equations is not null, then by solving this linear system, one gets a rational expression of  $u_3, u_5, u_6$  in term of  $u_1, u_2, u_4$ .

These four determinants are invariant under the action of the group of order 21. Thus, using the method of the proof of Proposition 14, we may express them in term of the  $b_i$ :

$$\det(16, 17, 18) = -\frac{1}{7} b_6 - \frac{1}{49} b_5^2$$

$$\det(16, 17, 19) = -b_7 - \frac{4}{49} b_3 b_4$$

$$\det(16, 18, 19) = -\frac{1}{49} b_4^2 - \frac{3}{196} b_3 b_5$$

$$\det(17, 18, 19) = -\frac{1}{2744} b_3^3 + \frac{1}{98} b_4 b_5 - \frac{1}{49} b_3 b_5$$

It follows that if  $b_3 = b_6 = 0$  one gets  $u_3, u_5, u_6$  by solving Equations 16, 17, 19. If  $b_3 = 0, b_6 \neq 0$ , the first three equations give the result. If  $b_3 \neq 0$ , we will show that the determinant of either Equations 16, 17, 18 or Equations 16, 18, 19 is not null.

**Lemma 16.** *If  $b_3 \neq 0$  and the determinants  $\det(16, 17, 18)$  and  $\det(16, 18, 19)$  are both null, then  $u_1^7 = u_2^7 = u_4^7$*

*Proof.* Let us consider the Grobner basis of the relations between the  $b_i$ , named  $G_2$  in the proof of Proposition 14. The hypotheses is that we have three more relations  $7 b_6 + b_3^2 = 0, 4 b_4^2 + 3 b_3 b_5 = 0$  and  $b_3 v - 1 = 0$ , the latter, which introduces a new variable, implying that  $b_3 \neq 0$ . Adding to  $G_2$  the left hand sides of these relation, let  $G_3$  be the Grobner basis the lexicographical ordering  $v > b_7 > b_6 > b_5 > b_4 > b_3$ . The first element of  $G_3$  is the square of  $112 b_4^3 + 27 b_3^4$ . Let  $G_4$  be the Grobner basis for the same ordering of the ideal which is obtained by adding this polynomial to  $G_3$ . This Grobner basis consists in 8 binomials.

Now, let us consider Equation 12, which has  $u_1^7, u_2^7$  and  $u_4^7$  as roots. It has the shape  $U_1^3 + AU_1^2 + BU_1 + C$  where  $A, B, C$  are polynomials in the  $b_i$ . Its three roots are equal if and only if  $3B - A^2$  and  $27C - A^3$  are both null. As the normal forms by  $G_4$  of these two polynomials is null the lemma is proved.

We are now ready to finish the proof of Proposition 14.

**Proposition 17.** *If the discriminant of Equation 12 is null and  $b_3 \neq 0$ , then the input septic is reducible.*

*Proof.* We have already proved that  $u_1, u_2, u_4$  belong to an extension of  $K$  of degree prime to 6. If Equation 12 has a double root and a simple one, we have just shown that  $u_3, u_5, u_6$  may be expressed rationally in term of  $u_1, u_2, u_4$ , and belong to the same

field. As  $x_0$  is the quotient by 7 of the sum of all  $u_i$  it belongs also to this field and the input septic is not irreducible

If Equation 12 has a triple root, we need further work.

If  $u_1^7 = u_2^7 = u_4^7 \neq 0$ , there are seventh roots of unit  $\omega_1$  and  $\omega_4$  such that  $x_2 = \omega_2 u_1$  and  $x_3 = \omega_4 u_1$ . Thus Equation 16 becomes  $u_6 + \omega_2 u_5 + \omega_4 u_3 = h_1$  for some  $h_1$  belonging to the field containing  $u_1, u_2$  and  $u_4$ . Similarly, the analogous of Equations 17 and 18 where  $u_1, u_2, u_4$  and  $u_6, u_5, u_3$  are exchanged, become  $u_3^2 + \omega_2 u_6^2 + \omega_4 u_5^2 = h_2$  and  $u_3 u_5^2 + \omega_4 u_6 u_5^2 + \omega_2 u_6 u_3^2 = h_3$ . Thus we have three equations in  $u_3, u_5, u_6$  of degrees 1, 2, 3. B'ezout theorem asserts that, if the number of solutions in an algebraically closed extension is finite, then it is at most 6, and the solutions belong to an extension of the field containing  $h_1, h_2, h_3, \omega_2$  and  $\omega_4$  which of degree at most 6. Thus it remains to prove that the number of solutions is finite to get that all the  $u_i$ , and thus  $x_0$  belong to an extension of  $K$  of degree prime to 7, that is that  $f$  is not irreducible.

To prove that the number of solutions is finite, one may use the linear equation to eliminate  $u_6$  and obtain two equations in  $u_3, u_5, \omega_2, \omega_4, h_1, h_2, h_3$ . Considering  $\omega_2, \omega_4, h_1, h_2, h_3$  as indeterminates, their resultant with respect to  $u_5$  is easy to compute. It is a polynomial of degree 6 in  $u_3$  whose leading coefficient is a polynomial in  $\omega_2$  and  $\omega_4$ , which do not vanishes if  $\omega_2$  and  $\omega_4$  are substituted by seventh roots of unit. This may be proved by computing a Grobner basis, reduced to 1, of the ideal generated by this leading coefficient,  $\omega_2^7 - 1$  and  $\omega_4^7 - 1$ . This may also be proved by obtaining 1 as the GCD of  $\omega_4^7 - 1$  and the resultant with respect to  $\omega_2$  of  $\omega_2^7 - 1$  and this leading coefficient.

We have now finished to describe how to compute the  $u_i$  in term of radical. The roots may be deduced by computing the inverse Fourier transform and, if the term of degree 6 of the input septic was not null, adding the mean value of the roots, i.e.  $-a_1/7 a_0$  where  $a_1$  and  $a_0$  are the coefficients of degree 6 and 7 of this input septic.

**Remark 18.** To solve the linear system in the  $u_3, u_5, u_6$  the best way seems to use Cramer's rules, because we have a simple form of the determinant which is independent from the  $u_i$ .

**Remark 19.** The invariant septic  $f_3$  is only used in Equation 19. Thus it is not needed except if  $b_3 = b_4 = 0$  or  $b_3^2 + 7 b_6 = 0$ . It is thus better to compute it at the end and only if needed.

### 5.6 Conclusion

In summary we have proved the following.

**Theorem 20.** A root of a solvable irreducible septic of discriminant  $D$  defined on a field  $K$  of characteristic different from 2, 3, 7, may be computed as an element of either an extension of  $K(\sqrt{-7D})$  by a seventh root or as an element an extension by a seventh root of an extension of  $K(\sqrt{-3}, \sqrt{-7D})$  by a cubic root. The other roots belong to the extension of the preceding by a primitive seventh of unit, which belongs to an extension of  $K(\sqrt{-3}, \sqrt{-7})$  by a cubic root.

This theorem is fully constructive, as we have described how to effectively compute the root. This procedure has been implemented and tested on various examples for all the cases which are considered in the algorithm. The typical time of computation is about three seconds.

The correctness of the output has been verified by substituting the roots in the input polynomial and either evaluating numerically the result to zero (floating point with a precision of 30

decimal digits) or simplifying it to 0 with MAPLE's instruction evala(convert(expression, RootOf)).

For saving space, we do not give explicitly the algorithm, but as its description is split on various sections, we summarize it as follows.

*Starting from an irreducible septic,  
Apply the Tschirnaus transformation  $x \rightarrow x - T$  to get a depressed septic.  
Compute the polynomial of degree 35 of the sums of three roots (Section 3.2).  
Factorize it to test solvability and compute septics  $f_1$  and  $f_2$  (Section 5.2).  
Compute the invariant septics  $g_1$  and  $g_2$  (Section 5.3).  
If  $g_1 = t^7$  then exchange  $f_1, g_1$  with  $f_2, g_2$ .  
 $b_i := \text{coeff}(g_1, t, 7 - i)$  for  $i = 3, \dots, 7$ .  
If  $b_3 = b_4 = 0$  then  
 $u_1 := -\sqrt[7]{b_7}, u_2 := 0, u_4 = 0$ .  
Compute the polynomial  $f_3$  (Section 5.3)  
Compute  $u_3, u_5, u_6$  by Cramer's rules from Equations 16, 17, 19,  
If  $b_3 = 0, b_4 \neq 0$  then  
 $u_1 := \sqrt[7]{\frac{7b_6 b_7}{14b_4}}, u_2 := \frac{2u_1^2 b_4}{b_6}, u_4 := 0$   
Compute  $u_3, u_5, u_6$  by Cramer's rules from Equations 16, 17, 18,  
If  $b_3 \neq 0$  then  
Use Equations 11 to 14 to define  $u_1, u_2, u_4$ , choosing the root  
in Equation 12 in order to avoid division by zero in Equation 13  
If  $7b_6 + 49b_3^2 \neq 0$   
then compute  $u_3, u_5, u_6$  by Cramer's rules from Equations 16, 17, 18,  
else  
Compute the polynomial  $f_3$  (Section 5.3)  
Compute  $u_3, u_5, u_6$  by Cramer's rules from Equations 16, 18, 19.  
 $\omega :=$  the expression by radicals of a primitive 7th root of unit.*

The roots are

$$\begin{aligned} & -T + \frac{u_1 + u_2 + u_3 + u_4 + u_5 + u_6}{7}, \\ & -T + \frac{\omega u_1 + \omega^2 u_2 + \omega^3 u_3 + \omega^4 u_4 + \omega^5 u_5 + \omega^6 u_6}{7}, \quad -T + \frac{\omega^2 u_1 + \omega^4 u_2 + \omega^6 u_3 + \omega u_4 + \omega^3 u_5 + \omega^5 u_6}{7}, \\ & -T + \frac{\omega^3 u_1 + \omega^6 u_2 + \omega^2 u_3 + \omega^5 u_4 + \omega u_5 + \omega^4 u_6}{7}, \quad -T + \frac{\omega^4 u_1 + \omega u_2 + \omega^5 u_3 + \omega^2 u_4 + \omega^6 u_5 + \omega^3 u_6}{7}, \\ & -T + \frac{\omega^5 u_1 + \omega^3 u_2 + \omega u_3 + \omega^6 u_4 + \omega^4 u_5 + \omega^2 u_6}{7}, \quad -T + \frac{\omega^6 u_1 + \omega^5 u_2 + \omega^4 u_3 + \omega^3 u_4 + \omega^2 u_5 + \omega u_6}{7}. \end{aligned}$$

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# Constraints to Rural Women's Participation in International Fund for Agricultural Development (IFAD)/Community Based Agricultural and Rural Development Programme (CBARDP) in Kebbi State, Nigeria

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**Abstract-** This study examined rural women's constraints to participation in IFAD/CBARDP on poverty reduction in Kebbi State Nigeria. Multi-stage random sampling technique was used to select a total of one hundred and (120) beneficiaries (Rural Women). Interview schedule was the main tool used for data collection while descriptive statistics (frequency distribution and percentages) were used to analyse the data. The result showed that the mean age of the respondents was 40 years, 69% were married, the average household size of the beneficiaries was 10 persons, 95% of the beneficiaries did not have formal education, 62% of the beneficiaries were into trading as their major occupation, the average farm size of those involved in farming as their occupation was 0.225 hectares and the average amount of years spent in the programme was 5 years. While 28% of the beneficiaries had no problem during participation, inadequate cash was the major constraint of 14% of those beneficiaries that had problem during the programme. It could be concluded that majority of the respondents have not encountered any constraint in the course of their participation in the programme. For those respondents that reported inadequate cash to be their constraint, provision of adequate cash with proper monitoring mechanism should be put in place for effective participation of rural women in the programme.

**Index Terms-** Constraints, Rural, Women, Participation, Kebbi State

## I. INTRODUCTION

The International Fund for Agricultural Development (IFAD) is a specialized agency of the United Nations, dedicated to eradicating poverty and hunger in developing countries. It works in remote rural areas of the world to help countries achieve the Millennium Development Goals. Through low-interest loans and grants, IFAD develops and finances projects that enable rural poor people to overcome poverty themselves (IFAD, 2006).

IFAD tackles poverty not just as a lender, but as an advocate for the small farmers, herders, fisher folk, landless workers, artisans and indigenous peoples who live in rural areas and represent 75 per cent of the world's 1.2 billion extremely poor people (IFAD, 2004). IFAD works with governments, donors, non-governmental organizations, local communities and many other partners to fight the underlying causes of rural poverty. It acts as a catalyst, bringing together partners, resources, knowledge and

policies that create the conditions in which rural poor people can increase agricultural productivity, as well as seek out other options for earning income (Aliyu, 2003). IFAD-supported rural development programmes and projects, increase rural poor people's access to financial services, markets, technology, land and other natural resources (IFAD, 2007).

IFAD is dedicated to eradicating rural poverty in developing countries. Seventy-five per cent of the world's poorest people - 1.05 billion women, children and men - live in rural areas and depend on agriculture and related activities for their livelihoods. Working with rural poor people, governments, donors, non-governmental organizations and many other partners, IFAD focuses on country-specific solutions, which can involve increasing rural poor peoples' access to financial services, markets, technology, land and other natural resources (IFAD, 2003).

International Fund for Agricultural Development (IFAD) is an international development partner that has been intervening in the economies of countries like Nigeria to help them achieve the desired objectives. In Nigeria IFAD has been giving support to agricultural sector to help reduce the level of poverty among women (Aliyu, 2003). It is against this background that this paper intends to assess the constraints of rural women participation in IFAD/CBARDP intervention programme with a particular reference to selected rural communities in Kebbi State Nigeria.

## II. METHODOLOGY

### The Study Area

Kebbi State was carved out of old Sokoto State in 1991; it consists of 21 Local Government Areas and four Emirate councils. It is located within latitude 10° 05' to 13° 27' North and Longitude 3° 35' to 6° 03' East. It is located in the North Western Nigeria; Kebbi State occupies a total land area of 36,800 square kilometres. It shares boundaries with Sokoto State on the North-Eastern axis, Zamfara State on the Eastern part, Niger State on the Southern part and Republic of Niger on the Western part (nigeria.galleria.com, 2004). According to NPC (2006) Kebbi State has an estimated population of 3,662,103 people. The state has four major tribes, which include: Hausa, Fulani, Dakarkari and Gungawa, Others minor tribes include Zabarmawa, Dandawa, Kambari, Yorubas and Ibos. Islam is the dominant religion of the people.

Rainfall begins in April and ends in October with highest rain in July and August. The annual rainfall ranges from 400-

800mm (KSG, 2008). Generally, the state is characterized by high temperatures especially in the month of March, April, and May. The annual temperature varies from 21<sup>o</sup>C to 38<sup>o</sup>C (KAR-DA, 1992). Kebbi State has an agriculturally viable environment since it is endowed with high soil fertility, vast farm land and economically viable rivers such as river Niger and it is also sheltered by fine tropical climate. Owing to these factors, Agriculture has remained the major source of revenue and indeed the backbone of the economy of the state. Major food crops produced in the area are millet, guinea corn, maize, cassava, potatoes, rice, beans, onions and vegetables. While Cash crops include wheat, soybeans, ginger, groundnuts and tobacco (nigeriagalleria.com, 2004).

**Sampling Procedure and Sample Size**

Multi-stage random sampling technique was used for the study. The first stage was the random selection of four Local Government Areas from the nine Local Government Areas that are participating in the programme. The second stage involved the random selection of two villages from each of the Local Government areas selected and finally, beneficiaries were drawn from each of the villages using proportionate random sampling. Thus, a total of one hundred and twenty (120) beneficiaries constitute the sample size for the study.

**Data Collection**

Primary and secondary data were used for this study. The primary data were generated through interview schedule, while secondary data were obtained from relevant literature such as text books, Journals, internet, and official documents from IFAD-CBARDP offices in the affected Local Government Areas. Data analyses were carried out using descriptive statistics (means, frequency distribution and percentages).

**III. RESULTS AND DISCUSSION**

**Socio-economic Characteristics of Beneficiaries**

Socio-economic characteristics of the house hold members are known to affect the welfare or living standard of the household as well as its poverty status (Ngaski *et al.*, 2010). In this regard, the socio-economic characteristics that were investigated include age, marital status, and occupation, household size and level of education. From Table 1, 28% were within the age range of 32-41years. With a mean age of 40.38 years, this is an indication that most of the beneficiaries were in their prime age, in which they possess the energy to carry out income generating activities. This agrees with David *et al.*, (2009) who stated that, 15-64 years is a period that is economically productive in a population. Furthermore, the size of the mean age according to Modupe (2008) shows that most of the women were still in their active economic years which precluded the possibility of maximizing the economic opportunities provided by the programme. Based on their marital status, majority (69%) of the beneficiaries were married this indicated that the single, married, divorced, and widows benefited from the programme. This result is in conformity with the work of Nwachukwu and Ezeh (2007) who carried out a similar research and reported that majority of the beneficiaries were married. Result further revealed that 47% of beneficiaries are having household size of between 2 – 8 members

and the average household size was 10 people per house. This large household size is a common characteristic of rural households especially in Northern Nigeria where polygamy is mostly practiced. This result is in conformity with the findings of sherma *et al.* (2003) that carried out a research among farm families and reported that an average family size of over six members per household. According to Nwachukwu and Ezeh (2007), household size has some implication on the amount of labour available for economic activities.

It could be observed from the result that majority (95%) of the beneficiaries acquired only Quranic education. Thus, most of beneficiaries had no formal education. This result agrees with that of Aqeela, *et al.* (2005) that two third of the one billion of illiterate persons in the world are women and girls, and it disproved the findings of Islam (1997) who stated that primary and secondary education enhances understanding of a programme and productivity. It could be observed from the result is that majority (61.7%) of the beneficiaries were petty traders and 0.8% of them were civil servants. The result implies that very few of them were civil servants. This result is not in conformity with the findings of Ephraim *et al.* (2008) who have shown that crop production is by far the most important single source of income providing well above 46% of total income for people in Niger, Kebbi and Kaduna States. As majority of the beneficiaries in the study area were found to engage in petty trading.

Result also revealed that 22% were into farming, 17% cultivated less than 1 ha of land. This finding implies that the study area is not dominated by women farmers and that the few women farmers found in the area were small scale farmers. This agrees with the findings of Adeola *et al.* (2008) that most of the rural women farmers are small scale farmers. The distribution of the beneficiaries according to the years spent during participation is also presented in Table 1. This indicated that 49%, of the beneficiaries had between 7-9 years of experience. It also indicates that most of them had about 5 years’ experience. The implication is that most of the women beneficiaries were familiar with the different activities provided by the programme.

**Table 1: Personal Characteristics of Beneficiaries**

| <b>Variables</b>          | <b>Frequency</b> | <b>Percentage</b> |
|---------------------------|------------------|-------------------|
| <b>Age(years)</b>         |                  |                   |
| 12 -21                    | 8                | 6.7               |
| 22 – 31                   | 26               | 21.7              |
| 32 – 41                   | 34               | 28.3              |
| 42 – 51                   | 33               | 27.5              |
| 52 – 61                   | 14               | 11.5              |
| 62 and above              | 5                | 4.2               |
| <b>Marital – Status</b>   |                  |                   |
| Single                    | 1                | 0.8               |
| Married                   | 82               | 68.8              |
| Divorced                  | 3                | 2.5               |
| Widowed                   | 34               | 28.3              |
| <b>Household size</b>     |                  |                   |
| 2 – 8                     | 56               | 46.7              |
| 9 – 15                    | 54               | 45.0              |
| 16 – 22                   | 8                | 6.7               |
| 23 and above              | 2                | 1.7               |
| <b>Level of education</b> |                  |                   |

|                                |     |      |
|--------------------------------|-----|------|
| Quranic education              | 114 | 95.0 |
| Primary education              | 3   | 2.5  |
| Secondary education            | 3   | 2.5  |
| Tertiary education             | 0   | 0    |
| <b>Occupation</b>              |     |      |
| Farming                        | 26  | 21.7 |
| Trading                        | 74  | 61.7 |
| Civil servant                  | 1   | 0.8  |
| Artisanship                    | 17  | 14.2 |
| Others                         | 2   | 0.16 |
| <b>Farm size (ha)</b>          |     |      |
| 0.25 – 1                       | 20  | 16.7 |
| 1.25 – 2                       | 6   | 5    |
| <b>Period of participation</b> |     |      |
| Years                          |     |      |
| 1 – 3                          | 49  | 40.8 |
| 4 – 6                          | 12  | 10.0 |
| 7 and above                    | 59  | 49.2 |

Mean 5 years  
Source: Field survey Data and Computation by the Researchers, 2014.

### Constraints to Rural Women's Participation in the Programme

In spite of the enormous contribution of the programme to the well-being of its beneficiaries, the beneficiaries were not devoid of problems. This study therefore identified several problems encountered by the beneficiaries during participation in the study area. Though the beneficiaries were faced with multiplicity of problems, these problems were grouped and analysed in Table 2. Result revealed that 28.3% of the beneficiaries had no problems at all, 14.2% indicated that the cash given to them was not enough, groundnut oil extraction machine provided in their area was not enough was a major problem for only 0.8% of the beneficiaries.

**Table 2: Identified Constraints Faced by the Beneficiaries during Participation**

| Constraints   | Frequency  | Percentage |
|---|------------|------------|
| No constraint                                       | 34         | 28.3       |
| We were not given cash                              | 5          | 4.2        |
| We were not given fertilizer                        | 1          | 0.8        |
| Family problem                                      | 2          | 1.7        |
| Long process involved in account opening            | 15         | 12.5       |
| Machines were not provided after training           | 11         | 9.2        |
| Scarcity of water for fish and vegetable production | 12         | 10.0       |
| Bad roads   | 10         | 8.3        |
| Oil extraction machines were not enough             | 1          | 0.8        |
| A lot of women were not included in the programme   | 4          | 3.3        |
| The cash given was not enough                       | 17         | 14.2       |
| Inadequate teaching materials                       | 8          | 6.7        |
| <b>Total</b>  | <b>120</b> | <b>100</b> |

Source: Field survey Data and Computation by the Researchers, 2014.

### IV. CONCLUSIONS

It could be concluded that majority of the beneficiaries have not encountered any constraint in the course of their participation in the programme. For those beneficiaries that reported inadequate cash to be their constraint, provision of adequate cash with proper monitoring mechanism should be put in place for effective participation of rural women in the programme.

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# An Overview and Classification of E-Readiness Assessment Models

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**Abstract-** E-readiness of governments has become a vital policy tool for all countries since it enhances the trust of the citizens through applying the principles of good governance. Recently, e-readiness is becoming more accepted at the level of governments, organizations and citizens especially in the growing global open market. However, e-readiness has turned into a core feature of the international socio-economic development due to its ability to transform the society including the movement from traditional relations to more modern ways of thinking or dealing with health, education and production. This paper presents the different international organizations that have developed a variety of e-readiness models to participate in the global digital economy at the level of e-commerce, e-government and general ICT diffusion. Moreover, the paper provides classifications of the assessment models of e-readiness as e-economy and e-society assessment tools, the methods of quantitative and qualitative pictures and finally the area of focus whether it is macro or micro. In line with this, governments should prepare inventive and realistic e-government projects as providing online services. Thus, such assessment tools are fundamental to achieve substantial progress at the level of e-government, e-commerce, e-education, e-health and e-science that constitute the information society.

**Index Terms-** E-readiness, ICT, E-society, E-economy, Lebanon

## I. INTRODUCTION

As the economic structure of developing countries has been mainly dependent on the technology progress, governments tend to continuously find innovative ways to alter and keep swiftness with such growing technology (Damaskopoulos & Evgeniou, 2003). Accordingly, the electronic readiness or e-readiness of governments has become an important policy tool for any country since it opens the way in front of the citizens to interact with the government and enhances their trust which in turn advances the economic efficiency and business (Holden & Millett 2005). Thus, e-readiness is becoming more accepted at the level of governments, organizations and citizens especially in the growing global open market (Lou, 2010; Das et al., 2009).

## II. LITERATURE REVIEW

The Economist Intelligence Unit (EIU, 2006) stated that different corporate and international organizations have developed a

variety of e-readiness models to participate in the global digital economy at the level of e-commerce, e-government and general ICT diffusion. Different indices have been developed for the assessment of e-readiness and consequently to measure its component indicators. These indices include "the International Telecommunication Union Digital Access Index, World Economic Forum Networked Readiness Index, United Nations Conference on Trade and Development ICT Development Index, the Economist Intelligence Unit e-Readiness Index, Mosaic Group Index, Conference Board of Canada Connectedness Index and ORBICOM Infostate Index".

Thus, the variety of indices makes it difficult to find a specified definition to be used in the term of e-readiness due to the multiplicity of its applications. Musa (2010) claimed that there has been more than one effort to define what is meant by e-readiness. The United Nations University stated that "e-readiness measures how well a society is positioned to utilize the opportunities provided by ICT, where ICT infrastructure, human capital, regulations, policies and internet penetration are all crucial components of e-readiness" (Ojo et al., 2007). According to the readiness guide for developing countries, Harvard University defined e-readiness as the "degree to which a community is prepared to participate in the Networked World. It is gauged by assessing a community's relative advancement in the areas that are most critical for ICT adoption and the most important applications of ICTs".

From other perspective, EIU (2006) characterized e-readiness as the "state of play of a country's ICT infrastructure and the ability of its consumer, businesses and governments to use ICT to their benefit". Consequently, an inclusive definition can be figured out from the above definitions of e-readiness as the capacity of the community to use ICT as infrastructure to transfer the traditional economy into a digital economy. It fosters competitive and global market through creating a society with abilities to participate in the new economy and respectively, to develop the human capabilities and economic performance.

From these definitions, there are many reasons which stand behind adopting the ICT and motivating the countries as well as the governments to be engaged in the process of e-readiness and respectively, in the new economy. These reasons include benefiting from the ICT to overcome problems and keeping up with the global economy in a digital way. In addition, Potnis and Pardo (2011) claimed that the quality of life for nations is tested through the process of e-readiness, thus it is essential to adopt

ICT to prevent being in the lag within other nations and economies.

It was noted by Dada (2006) that most of literature which is related to e-readiness is to some extent new, and it is progressively more approved that the quick rate of information delivered through e-readiness has become a core feature of the international socio-economic development and the dramatic advance in the use of ICT in business and industry (Saesor & Liangrokpart, 2012; Zarimpas, 2009). In the past years, the role of electronic networks has grown exponentially in developed and developing societies, where a series of e-readiness assessment and measurement models have been developed since 1998 (Eweni, 2012; Economist, 2006; Vosloo & Belle, 2005).

The earliest definitions of e-readiness were established in 1998 by the Computer Systems Policy Project (CSPP) through the development of first e-readiness assessment tool "Readiness Guide for Living in the Networked World" (Mutulaa & Brakel, 2006). In this meaning, the concept of e-readiness has been found during the latest 1990s in order to cover the framework of the infrastructure of ICT. This concept took in crystallization to include indices and indicators for evaluating e-readiness to compare the e-readiness of different countries (Lanvin & Qiang, 2004). As the e-readiness grows globally, most countries in the developing world are still trying to implement applicable infrastructures to achieve levels of e-readiness that are sufficient enough to contribute in the emerging global information economy (Lou, 2010).

### III. IMPORTANCE OF E-READINESS

As e-readiness is considered one the main faces of development for any country, it represents the transformation of society including the movement from traditional relations and methods to more modern ways of thinking or dealing with health, education and production. The key drivers of such transformation depend on scientific ways of thinking that enable decision makers from recognizing what they know and what do not, thus allowing them to identify the crucial variables that influence the outcomes while trying to make implications based on accessible data (Babcock, 2005).

In parallel to the emergence of ICT, new economies are more concerned on having a sustained non-inflationary growth with a high level of employment to advance the economic growth and productivity. Therefore, it appears that e-readiness is much concerned with the improvement of national economy, human capital and governance performances in developing countries. This leads to ask if there exist a causal relationship between both phenomena of ICT advancements and new economy (Grigorovici, 2004).

Alemayehu (2008) argued that arriving to a successful business and economy, e-readiness can be a source of competitive advantage in the networked economy. EIU (2006) claimed that when governments encourage the use of digital technologies and provide its services online or wirelessly, its citizens' ability to

utilise technology skilfully increases and the economy, business and legal systems becomes more transparent and efficient.

According to the investments, e-readiness assessment models provide information for decision makers in both private and public sectors regarding the proper levels of investments and the suitable policy formulations required for e-government projects (Potnis & Pardo 2011). Davidrajuh and Tvedteras (2006) argued that investor must have good knowledge about the market he is going to invest in. Thus, e-readiness gives the impression about the country and its indices reflect if it is healthy and attractive environment for external investors. Furthermore, it enables the analysts to be engaged in quite customized inquiries, in which customization can be achieved at the economic, industrial, and organizational levels. As well as it provides policy makers with comprehensive scorecard of their economy's competitiveness related to the international counterparts in the digital era across the globe. This is important because investing in countries with higher scores in this area may lead to more secured returns (Ifinedo, 2005; Choucri, et al., 2003).

Moreover it is noted by Lanvin and Qiang (2004) that e-readiness can contribute significantly to the economic growth by increasing its productivity from different perspectives that result from reorganization across the entire economy such as the high growth of total factor productivity (TFP) in ICT producing industries and the real ICT capital stock per worker.

Hence, e-readiness is realised when governments use ICT to boost economic and social development (EIU, 2006). This realization is noted based on the study made by Lanvin and Qiang (2004) and Dada (2006) about the effects of ICT on the national economy through increasing the competitiveness, creating the value of new products and improving the employment and empowerment as well.

Overall, e-readiness is considered important since it creates new business opportunities and competitiveness (Janom & Zakaria 2008). The micro level of benefits of the e-readiness is highlighted from Mutulaa and Brakel (2006) as it is expected to transact business, enhance their operations and management, save time, improve quality and faster delivery of services. In addition, it tends to reduce manpower requirements, increase cost effectiveness, provide better presentations and enhance product selection. These in turn reduce procurements costs, and allow the share of information and communication to improve the general skills of employees and facilitate their access to trade information.

Globally, e-readiness can facilitate the sources of competitive advantage and opportunities for economic and social development (EIU, 2003). Also, ICT constitute the way businesses now interact with key stakeholders such as suppliers, customers, employees and investors. Moreover, the importance of ICTs for economic development in the networked world lay largely in their potential to facilitate the identification, acquisition, organization, dissemination and application of information (Mutulaa & Brakel, 2006).

Finally and from the social and political perspectives, e-readiness also allows people to share their experience with the world as well as can empower individuals to participate in the political institutions and policymaking of their community, giving voice to those who have traditionally been excluded (Lanvin & Qiang, 2004). In addition, it empowers people in developing countries to overcome development obstacles and interconnectivity across nations to overcome the limitations of physical location (Janom & Zakaria 2008).

#### IV. CLASSIFICATION OF THE E-READINESS ASSESSMENTS TOOLS

The e-readiness assessments are very diverse in their goals, strategies and results (Mutula, 2010). E-readiness assessments are designed to evaluate organizational capabilities, access and opportunities offered through e-government initiatives. They have emerged as opportunities to collect, organize, share and manage ICTs related data (Potnis & Pardo, 2011). According to Musa (2010), e-readiness has this diversity in order to offer different uses in different manners.

Many researchers have classified e-readiness according to its economic or social perspectives (Azab, et al., 2009; Janom & Zakaria, 2008; Luyt, 2006; Lanvin & Qiang, 2004). From the perspective of e-society, the society benefits from using the ICT when it is related to social objectives like social inclusion, individual property rights and population density. On the other hand, e-readiness will be under the perspective of e-economy since its role related to the economy and in specific business potential to benefit from integrating ICT in its environment. For

instance, some of the economic aspects include taxes and tariffs, quantity of exports, and IT spending by industry. However,

these two categories which are described as e-economy assessment tools and e-society assessment tools are not mutually exclusive. Nonetheless, e-society tools incorporate business growth and consider it necessary for society's e-readiness. While e-economy tools contain some factors of interest to the larger society, such as privacy and universal access (Vaezi & Bimar, 2009).

It is noticed recently that the international concern has been developed of what is known as e-readiness assessment tools, where a number of organizations began to develop survey frameworks as shown in table 1, in order to provide quantitative and qualitative pictures of how thoroughly a particular community, region, or country could take advantage of information technology for its development activities (Luyt, 2006).

As claimed by Hourali et al (2008), these categories of models also have different assessment methodologies such as questionnaires, statistical methods, best practices and historical analyses. In this context, there are several studies that have been conducted about e-readiness assessment tools, measurements, aspects, indicators and methods (Mutula, 2010; Vaezi & Bimar, 2009; Zaied et al., 2007; Luyt, 2006; Mutula & Brakel, 2006; Rizk, 2004; Bui, 2003). They were developed by different organizations to measure the e-readiness of the countries and its economies in the recent two decades. Zhai (2011) argued that based on these theories and models, the influencing factors can be classified into innovation characteristics, organization characteristics and environment characteristics.

**Table 2: Assessment models of E-readiness.**

| Organization Name                                       | Content tool                            | Year        | Aspects   | Area            | Methodology  |
|---|---|-------------|-----------|-----------------|--------------|
| Economist Intelligence Unit                             | E-Business Readiness Ranking            | (2003)      | E-economy | Macro           | Quantitative |
| Center for International Development Harvard University | Networked Readiness Index               | (2002-2003) | E-society | Macro           | Quantitative |
| IDC   | Information Society Index               | (2000-2002) | E-society | Macro           | Quantitative |
| UNDP  | Technology Achievement Index            | (2001)      | E-society | Macro           | Quantitative |
| UNCTAD  | ICT Development Indices                 | 2001)       | E-society | Macro           | Quantitative |
| McConnell   | McConnell International Risk Business   | (2000-2002) | E-economy | Macro           | Qualitative  |
| Computer Systems Policy Projects CSPP                   | Readiness Guide                         | (2001)      | E-society | Macro and Micro | Qualitative  |
| Mosaic Group  | A framework for Assessing the Diffusion | (2001)      | E-economy | Macro           | Qualitative  |

|            | of the Internet                          |        |           |       |              |
|------------|--|--------|-----------|-------|--------------|
| World Bank | Knowledge assessment methodology         | (1998) | E-economy | Macro | Qualitative  |
| Orbicom    | Monitoring the digital divide and beyond | (2002) | E-society | Macro | Qualitative  |
| IUT        | Digital Access Index                     | (1998) | E-society | Macro | Quantitative |
| WITSA      | International survey of e-commerce       | (2000) | E-economy | Macro | Qualitative  |
| APEC       | APEC readiness initiative                | (1999) | E-economy | Macro | Quantitative |
| USAID      | ICT assessments                          | (1999) | E-society | Macro | Qualitative  |
| ASEAN      | E-Readiness Assessment                   | 2001   | E-society | Macro | Qualitative  |

The analysis of the literature proves that most of the researches study the indicators of e-readiness related to infrastructure and technology, people and human skills and accessibility and connectivity (Zaied et al., 2007). Whereas, Rao (2003) considered the 8Cs: connectivity, content, community, commerce, capacity, culture, corporation and capital as the checklist to measure the ability of any country to be involved in e-readiness in order to make their businesses more efficient or develop new export sectors.

Moreover, Ojo et al (2007) organized the indices of e-readiness into two categories. Indices that are related to particular themes such as e-commerce and e-government, while other category includes general indices which measure the capacity of ICT, internet diffusion and other access-related issues without any particular focus on specific aspects of information society.

For example, the Economist Intelligence Unit Index of e-readiness measures the degree to which a society is ready for e-commerce and e-business opportunities. While the UN-DESA e-readiness model, is more involved with e-government readiness.

In the same context, Ojo et al (2007) goes farther than in showing the significance of the e-readiness assessments as it is not only useful in implementing e-government in the right way, but also keeping it on way and pushing it further on in which an effective e-government readiness assessment framework is a necessary condition for advancing e-government.

## V. CONCLUSION

Accordingly, governments should prepare innovative and practical e-government projects in line with the private sector, which has to be encouraged in adapting e-commerce as to provide online services. Therefore, such initiatives and general assessment tools are fundamental to achieve substantial progress and they are needed to identify the basic concerns for social actions towards the information society that is based on e-government, e-commerce, e-education, e-health and e-science etc.

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# Oil Palm Fronds Juice: A Potential Feedstock for Bioethanol Production

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**Abstract-** The rise in global oil demand along with current environmental crisis; global warming and climate mitigation has been a serious issue. Thus, the need for an alternative fuel from renewable resources that promotes sustainability is vital to replace our dependence on fossil fuel. High sugar content in Oil Palm Frond Juice (OPFJ) indicates its potential as a feedstock in ethanol fermentation. Two strains of *Saccharomyces cerevisiae*; SA79 and HC10 are screened for high fermentation efficiency. Percentage yield bioethanol revealed that *S. cerevisiae* HC10 (55.72%) was proven a better strain than *S. cerevisiae* SA79 (43.19%). A growth profile of *S. cerevisiae* HC10 was performed in 60 h time period with 6 h interval sampling time. Specific growth rate ( $\mu$ ) and doubling time ( $t_d$ ) of 0.037h<sup>-1</sup> and 18.7h, respectively shows that *S. cerevisiae* HC10 fermentation of OPFJ is industrially applicable. In OPFJ fermentation, *S. cerevisiae* HC10 shows a much better yield (79.77 %) and thus an optimization using Response Surface Methodology was done. The optimized fermentation parameters were; OPFJ (40%), inoculum size (20%), pH (4.5), and fermentation time (24 h) with ethanol of 6.81 g/L. The batch fermentation was up-scaled to 1.5L working volume in a bioreactor to study relationships between agitation speed (rpm) and initial oxygen concentration (%). The highest ethanol (6.00 g/L) was obtained when the fermentation process was performed at 100 rpm and 30% initial oxygen concentration. In conclusion, OPFJ is a good fermentation feedstock for bioethanol fermentation because it has very high (647.8g/L) sugars content and high yield of ethanol production.

**Index Terms-** Oil Palm Frond Juice, *Saccharomyces cerevisiae*, bioethanol, Response Surface Methodology

## I. INTRODUCTION

Nowadays, energy demand for industrial, commercial and residential purposes, electricity generation and transportation is primarily supplied by fossil fuels. Burning of fossil fuel is known to be one of the main reasons for adverse climate change experienced throughout the centuries. The undesirable phenomenon is strongly linked to the accumulation of greenhouse gases in the atmosphere, and that the human activity especially through the combustion of fossil fuels is the major contributing factor [1].

Furthermore, strong dependence for fossil fuel raise the thought that what will happen when the sources runs out? Thus, the solution is to find the best alternatives before the problem

occurs. Brazil has been the leading country in producing renewable fuel using sugarcane as the source [2].

In addition, as reported by Ariffin [Fazilah](#) [3], Oil Palm Fronds (OPF) fiber was used as raw material for bioethanol production, whereby the cellulose and hemicellulose component are converted into simple fermentable sugars *via* hydrothermal treatment and enzymatic hydrolysis. However, the pre-treatment process is time consuming and requires high expenses. This obstacle gives rise to the need for finding an alternative approach to obtain renewable sugars from palm oil waste.

Oil palm sap (obtained by pressing OPF or oil palm trunk) is known to be one of the best sources for producing bioethanol [4]. The main reason is that oil palm frond is considered as waste material in many countries in the world. Using the juice obtained from oil palm frond as sources for fermentation is highly beneficial due to its renewability, low cost, and it is highly available in Malaysia. The juice is believed to contain various simple sugars including monosaccharide such as glucose and fructose as well as disaccharide such as sucrose [5]. Thus, the sugary property of oil palm fronds juice may give us an idea of turning this wasted juice as the alternative feedstock for bioethanol fermentation.

During ethanol fermentation process, enzymes from microorganisms will convert carbon sources, usually sugars, into ethanol anaerobically [6]. Yeasts are among the most frequently used microorganism in ethanol fermentation. *Saccharomyces cerevisiae* are normally chosen for ethanol fermentation due to its safety and high efficiency in fermenting sugars to ethanol [7]. Various parameters should also be taken into account during fermentation. Those parameters include the nutrient supply, oxygen supply, pH of the fermentation environment, fermentation temperature, and also the time for fermentation process.

Thus, the aims of this study was to produce ethanol through fermentation process using OPF juice as substrate. Parameters which affect the ethanol fermentation processes were examined and optimized. With this, it is possible to reduce the overall cost for bioethanol production since the feedstock (OPF juice) used was obtained from agricultural residual (OPF) and is free.

## II. MATERIALS AND METHODS

### 2.1 Raw Material and sample preparation

The OPF was harvested from a local oil palm plantation located at Bukit Minyak, Penang, Malaysia. The leaves of the fronds were cut off and discarded and the OPF was cut into 3 to 4 shorter pieces for easy transport. Hard outer skin layer of OPF

were peeled off to avoid mechanical failure in the next step. The peeled OPF were pressed using a sugarcane pressing machine [5] within 24 hours after they were harvested from the tree [8]. OPF juice produced was collected and was centrifuged at 10 000 rpm for 15 minutes (U-1900, Hitachi). A clear yellowish-coloured supernatant obtained was stored at -20°C [5] for further use.

### 2.2 Determination Sugars Composition in OPF Juice

Three types of fermentable sugars which are present in OPFJ such as glucose, fructose and sucrose were determined by High Performance Liquid Chromatography (HPLC) (Shimadzu LC, Japan) equipped with Refractive Index (RI) detector using APS-Hypersil column (diameter of 250mm × 46mm). The mobile phase used was 70% Acetonitrile and 30% of de-ionized water. Oven temperature was set at 40°C whereas pump flow rate was set at 0.6 mL/min.

### 2.3 Pure Yeast Culture Establishment

Two strains of yeast, *S. cerevisiae* SA79 and *S. cerevisiae* HC10 which were previously determined as potential ethanol producer were used in this study. The strains were subculture in 100 mL nutrient broth supplemented with g/L; Yeast Extract, 5; Peptone, 10 and 15% of glucose solution, 50 [8]. Glucose solution was prepared and autoclave separately from the nutrient broth. The strains were cultured in a 250 mL conical flask and were incubated at 30°C using incubator shaker for 24 hours and agitated at 150 rpm. Agar slant were prepared using universal bottles and the medium composition used was as described above but with addition of agar powder (20g/L) [8]. After incubation, the culture was streaked onto agar slant and incubated for 2-3 days at 30°C. The grown colonies in the agar slant were sealed carefully using parafilm and were stored in refrigerator at 4°C prior to use.

### 2.4 Yeast Screening

Inoculums for both strains were prepared in 100 mL medium broth using 250 mL conical flask incubated at 30°C for 24 hours and agitated at 150 rpm [8]. Optical Density (OD) for each inoculums were measured using spectrophotometer (U-1900, Hitachi, Japan) and were standardized to an approximate value of OD 0.8. Nutrient broth (98 mL) was prepared for both strains. The pH of the medium was adjusted to 4.5 [9] prior to autoclave at 121°C for 15 minutes. Standardized inoculums (2 mL) was then transferred into the sterilized medium and the flasks were incubated at 30°C [10] for 24 hours [9] at 150 rpm [10]. After fermentation, yeast biomass, glucose consumption and ethanol production were analyzed in order to determine the best yeast strain.

#### 2.4.1 Growth Profile of Yeast

The inoculums of the selected strain was prepared according to the method described above. The inoculums (2% v/v) was then transferred into 200 mL sterilized nutrient broth containing 30 mL OPFJ as the carbon source. The flasks were incubated at 30°C for 60 hours and shake at 150 rpm. Sample (10mL) was taken every 6 hours interval for 60 hours. Analysis of yeast biomass, sugar utilization and ethanol production were performed. Samples were stored at -20°C if no analysis was

carried out immediately. Kinetic parameters were determined to gain deeper understanding about the strain.

### 2.5 Bioethanol Production Process

The OPFJ was thaw to ambient temperature and autoclave at 121°C with a retention time of 15 minutes. Nutrient broth medium without glucose solution was prepared with an initial pH adjusted to pH 4.5 prior to autoclave at 121°C for 15 minutes.

#### 2.5.1 Shake Flask System and Optimization

Optimization of fermentation process for ethanol production was performed using Central Composite Design from Design-Expert® version 7 program. The conditions for 30 combinations of experimental run with 4 parameters such as amount of OPFJ (% v/v), size of inoculums (% v/v), initial pH and incubation time are shown in Table I. Total working volume for each flask was kept constant at 100 mL for every run. Each run were done in duplicates. After fermentation, 15 mL of sample were taken to analyze for biomass, sugar utilization and ethanol production. The best combination condition suggested by the design program was validated by performing fermentation according to the suggested parameters.

**Table I: Thirty Combinations of Experimental Runs using Response Surface Method; Central Composite Design**

| Std | Run | Block   | OPFJ (%) | Inoculum (mL) | Initial pH | Incubation Time (h) |
|-----|-----|---------|----------|---------------|------------|---------------------|
| 18  | 1   | Block 1 | 60       | 15            | 6.0        | 72                  |
| 7   | 2   | Block 1 | 40       | 20            | 7.0        | 48                  |
| 1   | 3   | Block 1 | 40       | 10            | 5.0        | 48                  |
| 16  | 4   | Block 1 | 80       | 20            | 7.0        | 96                  |
| 3   | 5   | Block 1 | 40       | 20            | 5.0        | 48                  |
| 4   | 6   | Block 1 | 80       | 20            | 5.0        | 48                  |
| 19  | 7   | Block 1 | 60       | 15            | 6.0        | 72                  |
| 10  | 8   | Block 1 | 80       | 10            | 5.0        | 96                  |
| 14  | 9   | Block 1 | 80       | 10            | 7.0        | 96                  |
| 13  | 10  | Block 1 | 40       | 10            | 7.0        | 96                  |
| 17  | 11  | Block 1 | 60       | 15            | 6.0        | 72                  |
| 6   | 12  | Block 1 | 80       | 10            | 7.0        | 48                  |
| 15  | 13  | Block 1 | 40       | 20            | 7.0        | 96                  |
| 8   | 14  | Block 1 | 80       | 20            | 7.0        | 48                  |
| 5   | 15  | Block 1 | 40       | 10            | 7.0        | 48                  |
| 2   | 16  | Block 1 | 80       | 10            | 5.0        | 48                  |
| 12  | 17  | Block 1 | 80       | 20            | 5.0        | 96                  |
| 20  | 18  | Block 1 | 60       | 15            | 6.0        | 72                  |
| 11  | 19  | Block 1 | 40       | 20            | 5.0        | 96                  |
| 9   | 20  | Block 1 | 40       | 10            | 5.0        | 96                  |
| 26  | 21  | Block 1 | 60       | 15            | 8.0        | 72                  |
| 23  | 22  | Block 1 | 60       | 5.0           | 6.0        | 72                  |
| 25  | 23  | Block 1 | 60       | 15            | 4.0        | 72                  |
| 27  | 24  | Block 1 | 60       | 15            | 6.0        | 24                  |
| 28  | 25  | Block 1 | 60       | 15            | 6.0        | 120                 |
| 24  | 26  | Block 1 | 60       | 25            | 6.0        | 72                  |
| 22  | 27  | Block 1 | 100      | 15            | 6.0        | 72                  |
| 30  | 28  | Block 1 | 60       | 15            | 6.0        | 72                  |
| 21  | 29  | Block 1 | 20       | 15            | 6.0        | 72                  |

### 2.5.2 Bioethanol Production Using Bioreactor System

Bioethanol production process was further performed using 2.5 L bench-top Minifors Bioreactor. Factors which affect the ethanol fermentation process such as Agitation (rpm) speed and initial oxygen concentration (%) were investigated. The optimized conditions [such as amount of OPFJ (%), size of inoculums (%), initial pH and incubation time] obtained from shake flask system were used as initial conditions in the bioreactor system. Total working volume of the fermentation process were kept constant at 1.5L and the process was carried out at 30°C with an air flow rate of 1vvm [11]. Each run were performed in duplicates according to the conditions shown in Table II. After fermentation, 15 mL of sample were taken for analysis of biomass, sugar utilization and ethanol production.

**Table II: Agitation and Initial Oxygen Concentration used in Bioreactor System for Bioethanol Production**

| Batch           | Sample name | Agitation (rpm) | Initial O <sub>2</sub> concentration (%) |
|-----------------|-------------|-----------------|--|
| 1 <sup>st</sup> | 1           | 200             | 10                                       |
|                 | 2           | 200             | 20                                       |
|                 | 3           | 200             | 30                                       |
| 2 <sup>nd</sup> | 4           | 100             | 30                                       |
|                 | 5           | 200             | 30                                       |
|                 | 6           | 300             | 30                                       |

## 2.6 Analysis

### 2.6.1 Determination of Yeast Biomass

The yeast biomass was determined by measuring the dry cell weight. Cells suspensions were vacuum-filtered through 0.45µm filter paper and were rinsed 2 times using distilled water. The filtered papers were dried in an oven at 70°C for more than 24 hours until constant weight was obtained. The dried filter papers were weighed on an analytical balance to obtained the dry cell weight.

### 2.6.2 Determination of Sugars Residual

The remaining sugars in OPFJ after fermentation was determined according to the method described in Section 2.2.

### 2.6.3 Determination of Ethanol using GC System

Ethanol produced were analyzed using Gas Chromatography (GC) (Shimadzu, Japan) equipped with Flame Ionization Detector. Helium (He) was used as carrier gas and RT-Q-BOND column (inner diameter of 0.32 mm) was used and the oven temperature was set at 200°C. The flow rate used was 21.9 mL/min and the operating pressure was 71.1 kPa. Five min holding time was used for each sample.

## III. RESULTS AND DISCUSSIONS

### 3.1 Sugar Composition of OPF Juice

Table III showed the major types of sugars (Glucose, sucrose and fructose) founded in OPFJ with their respective

concentration (g/L). Glucose shows the highest percentage (77.96%) followed by sucrose (16.22%) and fructose (5.82%). These sugars are among some of the common sugars favorable for yeast consumption.

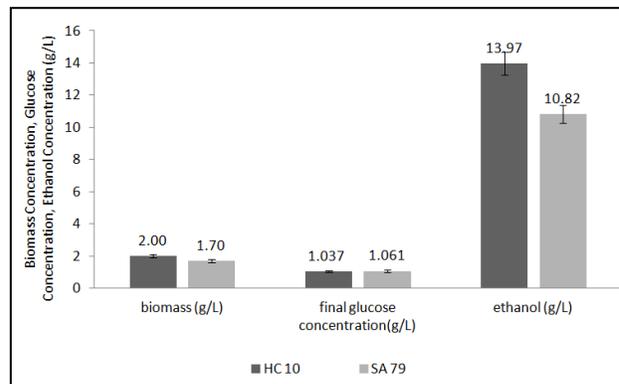
Previous study shows the same pattern whereby glucose is the dominant sugar followed by sucrose and fructose [5]. However, the percentages of individual sugars composition obtained by the study were different from this study. This may due to several factors such as the way of handling the juice during and after pressing and the difference in individual oil palm tree itself. In this study, 16.22% of sucrose was recorded, which shows 10.67% less than sucrose recorded by Zahari et al. [5]. However, glucose and fructose obtained from this study were 7.06% and 3.61% higher than the one recorded by Zahari et al., [5], respectively. This result was an indication of the breakdown of sucrose into its monomer; glucose and fructose. Furthermore, the difference in the age of oil palm tree that was harvested also gives different amount of sugar whereby older tree contains lesser sugar [12].

**Table III: Sugar Composition in Oil Palm Fronds Juice (OPFJ)**

| Sugar        | Amount of sugar (g/L) | Percentage (%) |
|--------------|-----------------------|----------------|
| Fructose     | 37.72                 | 5.82           |
| Glucose      | 504.99                | 77.96          |
| Sucrose      | 105.04                | 16.22          |
| <b>Total</b> | <b>647.76</b>         | <b>100</b>     |

### 3.2 Selection of Potential Yeast for Ethanol Production

As shown in the Figure 1, *S. cerevisiae* HC10 was found to be well grown throughout the fermentation when compared to *S. cerevisiae* SA97 indicated by the biomass yield of 0.04g cell/g glucose and 0.03g cell/g glucose, respectively. This shows that *S. cerevisiae* HC10 is more suitable to be used in present study. Previous study stated that apart from glucose, other component in fermentation medium can affect the effectiveness of fermentation since yeasts has a complex nutritional requirements to achieve optimum fermentation and the requirements would vary from one strain to another [9].

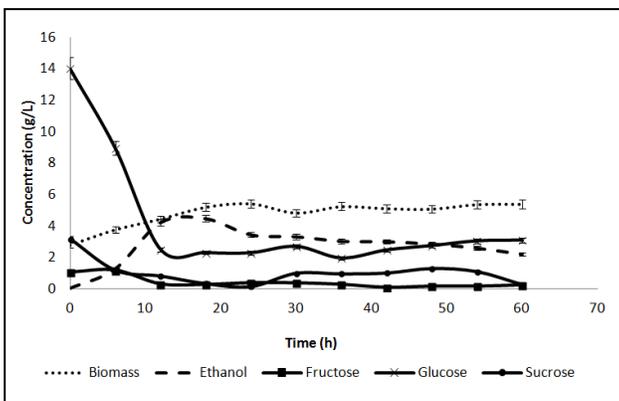


**Figure 1: Biomass, glucose residual and ethanol obtained from *S. cerevisiae* HC 10 and *S. cerevisiae* SA 79.**

On the other hand, only small differences (0.0237 g/L) in glucose residual were detected after the fermentation process. However, the ethanol yield was significant different in *S. cerevisiae* HC10 (0.29g ethanol/g glucose) and *S. cerevisiae* SA79 (0.22g ethanol/g glucose). On top of that, ethanol yield indicated that *S. cerevisiae* HC10 (55.72%) was more efficient than *S. cerevisiae* SA79 (43.19%). The ethanol yield obtained from this study was higher than the ethanol yield (6.5 g/L) recorded by [Maurice \(2011\)](#). Higher ethanol production suggested that *S. cerevisiae* SA79 and *S. cerevisiae* HC10 are able to produce more ethanol than the conventional Baker's Yeast. *S. cerevisiae* HC10 was chosen as the best yeast to be used further for the experiment due to its ability to grow well in the fermentation media and to produce higher yield of ethanol.

### 3.3 Growth Profile of *S. cerevisiae* HC10

*S. cerevisiae* HC10 enter exponential phase from 0 h to 18 h, indicated by a sharp increased in biomass (Figure 2). Lag phase was not shown in the growth curve since the yeast culture has already been acclimatized during inoculums preparation. During the exponential phase, the yeast rapidly consumes the most preferable carbon source which is commonly identified as glucose [13].



**Figure 2: Concentration of biomass, ethanol and sugars residual during the fermentation process.**

From 24 h to 30 h, the growth declined but starting to rise up again after 36 h. This phenomenon suggested that the culture is undergone diauxic growth. It is a process whereby a shift of metabolism happens from fermentation to respiration when glucose becomes limiting [13]. Ethanol and other product such as acetate that are produced during fermentation will be consumed as the replacement for the previously consumed carbon sources [13]. The yeast strain enters the stationary phase starting from 36 h to 60 h and no net increased in cell population are shown in the Figure.

On the other hand, during 0 h to 18, all the sugars concentration shows decreased in pattern with marginally decreased in glucose concentration. The result suggests that all of the sugar were intensively consumed during exponential phase for growth. During 0 h to 6 h of fermentation, sucrose concentration decreased while fructose concentration shows a small increased. This phenomenon was due to the breakdown of sucrose into fructose and glucose [14]. However, reduction in glucose concentration was rapidly due its consumption twice as

fast as fructose when both of the sugar are present in a fermentation medium [15]. All sugars were not fully utilized at the end of the fermentation, suggesting a longer fermentation period should be performed.

Also shown in the Figure, ethanol production was the highest during the exponential phase. However, 18 h onwards ethanol production was reduced due to microbial stress factor such as high ethanol concentration in the fermentation environment that starts to take place [16]. In addition, decreased in ethanol concentration until end of the fermentation may due to ethanol being used up as an alternative carbon source as well as ethanol evaporation due to the continuous agitation action during the fermentation.

Kinetic values of the fermentation process are determined and shown in Table IV. Specific growth rate ( $\mu$ ) in the range of  $0.03 \text{ h}^{-1}$  and  $0.40 \text{ h}^{-1}$  is considered to be relevant to many industrial application [17]. A study by [Estela-Escalante \[18\]](#) shows that apple juice fermentation by *S. cerevisiae* has a  $\mu$  value of  $0.13 \text{ h}^{-1}$  which is slightly higher than  $\mu$  obtained in this study. In natural environments, a low  $\mu$  indicates that the cell growth was constrained by limited amount of growth-limiting nutrients [19].

**Table IV: Kinetic values obtained from fermentation of OPFJ by *S.cerevisiae* HC10**

| Kinetic Parameter                       | Value                                    |
|---|--|
| Specific growth rate ( $\mu$ )          | $0.037 \text{ h}^{-1}$                   |
| Doubling Time (td)                      | 18.73 h                                  |
| Glucose consumption                     | 10.9232 g/L                              |
| Biomass yield coefficient ( $Y_{x/s}$ ) | 0.2066 g cell/g glucose                  |
| Ethanol yield coefficient ( $Y_{p/s}$ ) | 0.4005 g ethanol/g glucose               |
| Maximum productivity of biomass         | $0.0895 \text{ g L}^{-1} \text{ h}^{-1}$ |
| Final productivity of biomass           | $0.0895 \text{ g L}^{-1} \text{ h}^{-1}$ |
| Maximum productivity of ethanol         | $0.1514 \text{ g L}^{-1} \text{ h}^{-1}$ |
| Final productivity of ethanol           | $0.0363 \text{ g L}^{-1} \text{ h}^{-1}$ |
| Percent yield of ethanol                | 79.77 %                                  |

Although the doubling time obtained from this present study was 18.73 h but it still represent a fast growth in the natural environment [19]. At near 0 growth rate, the cells are likely to have longer life span due to increasing level of stress response [20]. In this study, glucose was identified as the primary substrate and thus was referred for further kinetics parameter calculation. An amount of 0.2g of cell was produced for every grams of glucose consumed shows 0.1g higher than the studied reported by [Estela-Escalante \(2012\)](#). Meanwhile, 0.4g of ethanol was produced by consumption of 1 grams of glucose.

There is a difference of  $0.1 \text{ g L}^{-1} \text{ h}^{-1}$  between maximum and final ethanol productivity, indicated that ethanol production reaches its maximum value within the course of 60 h fermentation, which can also be seen in Figure 2. This is a usual pattern found in batch mode fermentation whereby substrates are a limiting factor. The percentage yield of ethanol obtained was around 80% which is considerably high with reference to a study on *S. cerevisiae* ethanol fermentation of tropical maize syrup that has ethanol yield of around 90% [14]. One of the reason behind high percentage yield gained from [Chen et al. \[14\]](#) was due to the used of concentrated tropical maize syrup.

3.4 Optimization of Bioethanol Production Process Using Shake Flask System

Optimization using CCD design revealed that the result obtained was suitable for quadratic model. But there is a considerable probability of having a significant lack of fit. Based on Model Summary Statistic (Table Va), the standard deviation (1.03) was low enough and acceptable. R-squared (0.71) shows

that the model is having a considerable regression but acceptable and PRESS value (86.48) was low (Table Vb). ANOVA report for Response Surface Quadratic Model implies that the model was significant (F value: 2.69) (Table VI). In addition, only pH and time factors bring significant effect (P<0.05) in ethanol production. The normal plot of residuals shows approximately linear thus no transformation correction is needed.

Table Va: Fit Summary Analysis (Sequential Model Sum of Squares [Type I])

| Source           | Sum of Square | df       | Mean Square | F value     | p-value       | prob>F           |
|------------------|---------------|----------|-------------|-------------|---------------|------------------|
| Mean             | 511.51        | 1        | 511.51      |             |               | <u>Suggested</u> |
| Linear           | 13.52         | 4        | 3.38        | 1.99        | 0.1265        |                  |
| 2FI              | 11.45         | 6        | 1.91        | 1.17        | 0.3616        |                  |
| <u>Quadratic</u> | <u>15.00</u>  | <u>4</u> | <u>3.75</u> | <u>3.53</u> | <u>0.0321</u> | <u>Suggested</u> |
| Cubic            | 12.04         | 8        | 1.51        | 2.70        | 0.1040        | Aliased          |
| Residual         | 3.90          | 7        | 0.56        |             |               |                  |
| Total            | 567.42        | 30       | 18.91       |             |               |                  |

Table Vb: Fit Summary Analysis (Model Summary Statistics)

| Source           | Std. Dev.   | R-squared     | Adjusted R-squared | Predicted R-squared | PRESS        |                  |
|------------------|-------------|---------------|--------------------|---------------------|--------------|------------------|
| Linear           | 1.30        | 0.2418        | 0.1204             | -0.1629             | 65.02        |                  |
| 2FI              | 1.28        | 0.4467        | 0.1554             | -0.4484             | 80.98        |                  |
| <u>Quadratic</u> | <u>1.03</u> | <u>0.7149</u> | <u>0.4487</u>      | <u>-0.5469</u>      | <u>86.48</u> | <u>Suggested</u> |
| Cubic            | 0.75        | 0.9302        | 0.7110             | -5.8940             | 385.43       | Aliased          |

Table VI: Analysis of Variance

| Source         | Sum of Squares | df | Mean Square | F Value | p-value | Prob > F    |
|----------------|----------------|----|-------------|---------|---------|-------------|
| Model          | 39.97          | 14 | 2.85        | 2.69    | 0.0337  | significant |
| A-vol OPFJ     | 1.12           | 1  | 1.12        | 1.05    | 0.3219  |             |
| B-vol inoculum | 0.21           | 1  | 0.21        | 0.2     | 0.6646  |             |
| C-pH           | 5.42           | 1  | 5.42        | 5.1     | 0.0393  |             |
| D-time         | 6.77           | 1  | 6.77        | 6.37    | 0.0233  |             |
| AB             | 0.54           | 1  | 0.54        | 0.51    | 0.4872  |             |
| AC             | 3.96           | 1  | 3.96        | 3.73    | 0.0727  |             |
| AD             | 0.66           | 1  | 0.66        | 0.62    | 0.4429  |             |
| BC             | 2.56           | 1  | 2.56        | 2.41    | 0.1416  |             |
| BD             | 3.26           | 1  | 3.26        | 3.07    | 0.1003  |             |
| CD             | 0.48           | 1  | 0.48        | 0.45    | 0.5131  |             |
| A <sup>2</sup> | 1.03           | 1  | 1.03        | 0.97    | 0.3394  |             |
| B <sup>2</sup> | 3.41           | 1  | 3.41        | 3.21    | 0.0933  |             |
| C <sup>2</sup> | 4.4            | 1  | 4.4         | 4.14    | 0.06    |             |
| D <sup>2</sup> | 4.89           | 1  | 4.89        | 4.6     | 0.0487  |             |
| Residual       | 15.94          | 15 | 1.06        |         |         |             |
| Lack of Fit    | 14.71          | 10 | 1.47        | 5.95    | 0.0313  | significant |
| Pure Error     | 1.24           | 5  | 0.25        |         |         |             |
| Cor Total      | 55.91          | 29 |             |         |         |             |

**Table VII: Criteria used in numerical optimization**

| Name            | Goal            | Lower Limit | Upper Limit | Lower Weight | Upper Weight | Importance |
|-----------------|-----------------|-------------|-------------|--------------|--------------|------------|
| OPFJ Volume     | in range        | 40          | 80          | 1            | 1            | 3          |
| Inoculum Volume | maximize        | 10          | 20          | 1            | 1            | 3          |
| pH              | targeted = 4.50 | 4           | 8           | 1            | 1            | 3          |
| Time            | in range        | 24          | 96          | 1            | 1            | 3          |
| Ethanol         | maximize        | 0.3629      | 7.5973      | 1            | 1            | 3          |

**Table VIII: Suggested experimental conditions (solution) based on the preset criteria**

| Volume OPFJ (%) | Volume Inoculum (ml) | pH  | Time (h) | Ethanol (g/L) | Desirability |          |
|-----------------|----------------------|-----|----------|---------------|--------------|----------|
| 40.96           | 20                   | 4.5 | 24.06    | 7.61          | 1            | Selected |
| 40.74           | 20                   | 4.5 | 24.07    | 7.62          | 0.99         |          |
| 40.00           | 20                   | 4.5 | 24.00    | 7.66          | 0.99         |          |
| 42.02           | 20                   | 4.5 | 24.00    | 7.58          | 0.99         |          |
| 42.81           | 20                   | 4.5 | 24.07    | 7.54          | 0.99         |          |

Numerical optimization was carried out in order to determine the conditions which gave the highest ethanol production. The criteria for each factor used in optimization are shown in Table VII and the suggested experimental conditions based on the preset criteria are shown in Table VIII. An experiment was conducted to validate the suggested combination and the ethanol obtained (6.81g/L) was closer to the suggested value (7.61g/L).

### 3.5 Ethanol Production Using Bioreactor System

*S. cerevisiae* is facultative anaerobes and required oxygen for growing but ethanol fermentation is an anaerobic process. Thus, initial oxygen concentration should be high enough to enable biomass growth but not too high until disable the fermentation process because in oxygen rich environment, respiration will occur instead of fermentation. The results obtained demonstrated that during 24 hour of fermentation, the yeast has experiences a longer respiration time (Table IX). Increased in biomass produced from 10% to 30% initial oxygen concentration was the factor that causes the ethanol production to increase. A decrease in ethanol for sample number 2 was due to evaporation of alcohol as a result of contamination.

Due to a positive outcome from initial oxygen concentration of 30%, this value was used in second phase of the experiment whereby agitation factor was further investigated. Results obtained revealed that increasing agitation rate give a higher biomass concentration but a much lower ethanol concentration. Agitation plays an important role in homogenising the fermentation medium as well as aiding in oxygen transfer rate in system. Increase in agitation speed results in a better dissolve oxygen concentration in the fermentation medium, thus yeast are

supplied with an adequate amount of oxygen, making them to favour respiration than fermentation.

**Table IX: Effect of agitation (rpm) and initial oxygen concentration (%) on biomass and ethanol production**

| Sample Name | Agitation | Initial O <sub>2</sub> Concentration (%) | Biomass (g/L) | Ethanol (g/L) |
|-------------|-----------|--|---------------|---------------|
| 1           | 200       | 10                                       | 6.9150 ± 0.97 | 3.6250 ± 0.81 |
| 2           | 200       | 20                                       | 6.8550 ± 1.09 | 2.5314 ± 1.12 |
| 3           | 200       | 30                                       | 7.7300 ± 0.33 | 4.7580 ± 0.54 |
| 4           | 100       | 30                                       | 6.9450 ± 0.53 | 6.0010 ± 0.44 |
| 5           | 200       | 30                                       | 7.3230 ± 0.25 | 4.8085 ± 0.29 |
| 6           | 300       | 30                                       | 8.8000 ± 0.48 | 1.5147 ± 0.16 |

## IV. CONCLUSION

OPFJ was proven to contain a high amount (647.76 g/L) of fermentable sugar; glucose, fructose, and sucrose. Conversion of fermentable sugar by *S. cerevisiae* HC10 from OPFJ to bioethanol was high (79.77%) thus proving that OPFJ was a good fermentation feedstock. Optimized fermentation conditions for bioethanol production were OPFJ (40%), inoculums size (20%), pH (4.5), and fermentation time (24h). Ethanol production using bioreactor system indicated that initial

concentration of oxygen is important for biomass growth but must be controlled to prevent prolong of respiration time. Higher agitation results in better oxygen transfer rate but needed to be regulated to ensure a high production of ethanol.

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# Dr. Oz's Anxiety Scale as an Indicator of Test/Examination Anxiety among Male/Female College Students

Dr. Naveed Shibli, Inas Hasan, Ayesha Shakeel, Sundas Shakeel, Siara Yousaf, Mehmood Iqbal

**Abstract-** How a test measuring anxiety could be used to study examination anxiety was the focus of present study? Dr. OZ's Anxiety Scale Test was used to assess examination/test anxiety among 60 college students including 30 male and 30 female subjects. The results revealed that Dr. OZ's Anxiety Scale Test successfully depicts examination/test anxiety among subjects, moreover, the test also reflected gender based examination/test anxiety among subjects.

**Index Terms-** Dr. OZ's Anxiety Scale Test, Examination/Test anxiety, Gender

## I. INTRODUCTION

Academic achievement tests are a common feature of school and college studies and have become gradually an important area of concern for experts because such play an important role in the educational growth of students. One thoroughly examined area like others in that context is test related anxiety. Experts studied various aspects in that context like, physiological over-arousal, other somatic symptoms as well as psychological symptoms like worry, dread, fear of failure.(Zeidne1998). The academic performance is the major concern of students in all kinds of academic tests and during the study of test anxiety researchers found that emotional distress reduces academic performance and is a contributing factor in students drop out rates (Andrews & Wilding 2004). The studies by (Pritchard & Wilson 2003) and (Vaez & Laflamme,2008) also support the negative impact of distress on performance during academic tests. Interestingly test anxiety is neither emic contributor nor an etic imposed concept rather it was found that such exists among the students around the globe (Lowe & Ang 2012) another study also found that such test related anxiety phenomenon is there among the students in the entire world. (Dalkiran et al 2014) and 25 to 40% students experience test anxiety ( J.C. 2010) that include, worry and dread, physiological over arousal, poor concentration, going blank, or freezing, confusion or poor organization, low self – esteem, depression, anger and feelings of hopelessness (Cherry, Kendra 2012) However, (Parviz and Minoo 2010) viewed test anxiety differently and named it as 'anticipatory anxiety, situational anxiety or evaluation anxiety' that to them helps and add to mental and physical alertness. Some studies regarding the impact of gender in case of test anxiety have also been reported, (Yasmin Ni , Rabia and Charles 2012) found the relationship of gender in case of academic performance of medical students in academic tests whereas, (Brenda 2012) found, "gender differences in SAT-V, SAT-M, and overall SAT scores" however to Yarden ( 2014) the use of 'comprehensive research checks' is

more helpful in academic success, whereas to Areille, (2013) listening music is the best remedy to counter studies related stress that could be a source of examination anxiety.

## II. METHOD AND PROCEDURE

The present study was designed to check the relationship of anxiety with examination on the bases of gender. An identical sample of 60 college students on age/grade and top positions in the class for their academic performance selected as sample for the study.. These college students belonged to the same chain of colleges. The sample of 60 students include equal number of boys (30) and girls (30).

All the subjects were administered Dr. OZ's Anxiety Scale Test developed by Marla W. Deibler. This test measures, worry, distress and panic and reveals these states in four levels of anxiety, scores 0-4 reflect minimal non significant anxiety, scores 5 to 9 represent mild anxiety, scores 10-14 indicate moderate anxiety and scores 15 or above are for severe anxiety. The test was administered to the both groups of subjects exactly two months before the final term examination and again the same was administered to the same subjects two days before the start of final term examination. The difference of subject scores on both occasions compared to find the difference.

## III. RESULTS

It was found that majority of the students scored more on the test in their second performance close to the examination as compared with their previous scores on the test two months before the examination and the difference of the scores of the subjects on both occasions was statistically significant reflecting thereby the increase of anxiety close to the examinations among the subjects moreover the proportion of the increase of test scores reflecting the amount of anxiety close to the examination during second performance was more among female participants as compared with the male subjects reflecting the role of gender in case of test anxiety among the selected subjects.

## IV. CONCLUSIONS

Students experience more test anxiety close to the examinations as compared with the routine studies and the girls are more prone to test anxiety as compared with the boys.

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# Glycosylated Hemoglobin (HbA1c) is a reliable Predictor of left ventricular hypertrophy (LVH) and left ventricular diastolic dysfunction (LVDD) in newly diagnosed type 2 diabetic patients of western Uttar Pradesh

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**Abstract-** Cardiovascular diseases like congestive heart failure, coronary artery disease, myocardial infarction account for highest mortality in diabetic patient. Left ventricular hypertrophy which is an ominous prognostic sign and independent risk factor for cardiac events is often present along with left ventricular diastolic dysfunction (LVDD) in type 2 diabetes mellitus patients. the aim of the present study is to verify whether HbA1c detect pre-clinical diastolic dysfunction in type-2 diabetic patients. Total 100 patients of newly diagnosed type 2 diabetes mellitus were selected for this cross sectional study. Patients of age between 30 to 60 yrs were selected for the study. HbA1C was estimated by Boronate affinity chromatography. Left ventricular hypertrophy was detected by measuring left ventricular mass index (LVMI) using Transthoracic Echocardiography, according to recommendation of American Society of Echocardiography (ASE). HbA1c is seems to be reliable predictor of LVDD. Our Study demonstrated a very significant positive correlation between level of glycosylated hemoglobin(HbA1C) and frequency of LVH and LVDD in the newly diagnosed cases of type 2 diabetes mellitus. Similar correlation was also observed with FPG.

**Index Terms-** Glycosylated Hemoglobin Left ventricular dysfunction

## I. INTRODUCTION

Diabetes mellitus is a worldwide health problem, afflicting millions in both developed and developing countries<sup>1</sup>. Moreover, there is emerging evidence that a diabetes-related syndrome called Syndrome-X (characterized by truncal obesity, insulin resistance, diabetes, high blood pressure and premature coronary artery disease)<sup>2</sup> is the most important cause for the rapidly increasing urban menace of coronary artery disease afflicting urban middle and upper classes. Cardiovascular diseases like congestive heart failure, coronary artery disease, myocardial infarction account for highest mortality in diabetic patient<sup>3, 4</sup>. Left

ventricular hypertrophy which is an ominous prognostic sign and independent risk factor for cardiac events is often present along with left ventricular diastolic dysfunction (LVDD) in type 2 diabetes mellitus patients<sup>5</sup>. The possible contribution of hyperinsulinemia and hyperglycemia to left ventricular mass have been suggested in normotensive diabetic patient<sup>6</sup>. Echocardiography provides a reliable non invasive tool for detection of LVDD and left ventricular mass and has been proven more sensitive method for detection of left ventricular hypertrophy<sup>7</sup> than other techniques. Left ventricular mass in diabetic patients may also increases with the HbA1C level<sup>8, 9</sup>. So a poor glycemic control is also associated with more chances of having left ventricular hypertrophy<sup>10</sup>. Hence, the aim of the present study is to verify whether HbA1c detect pre-clinical diastolic dysfunction in type-2 diabetic patients.

## II. METHODS

### Study population

This was a cross sectional study conducted at the L.L.R.M. Medical College, Meerut during 2012–2013 .All patients with type 2 diabetes mellitus who are attending Medicine OPD, Endocrinology OPD, were included in the study who fulfilled the following inclusion criteria.( Age > 30 years & < 60 years , Patient who gave written informed consent, Mentally and physically fit up to a minimum level required to participate in study and patients with newly diagnosed type 2 diabetes mellitus (with in 1 month) according to WHO criteria and ADA recommendations for diabetes mellitus<sup>11</sup>)

The Exclusion criteria were: those who were unable to provide informed consent, any substance abuse, mental illness or medical condition that in opinion of investigator would make it difficult to participate in intervention and Patient of known hypertension with or without treatment, ischemic heart disease, cardiomyopathy, valvular heart disease, heart failure, chronic pulmonary illness, severe anaemia, hemoglobinopathies.

**Investigations:**

Fasting and Post prandial Plasma glucose (FPG and PPPG) – HbA1C  
Electrocardiography (ECG)  
Plane Chest X-ray

2D Echocardiography: M-mode and pulsed Doppler Transthoracic Echocardiography according to recommendation of American Society of Echocardiography<sup>12</sup>

Venous blood was collected after 8 hours of fasting, into two test tubes; with P vial for plasma glucose and with Ethylene Diamine Tetra Acetic Acid (EDTA) for HbA1c.

**HbA1C** was estimated by Boronate affinity chromatography (HPLC) which separates total glycosylated haemoglobin by binding to solid-phase dihydroxyborate using Nycocard immunoassay kit (USA).

**Table showing diagnostic criteria for IFG, IGT & diabetes mellitus**

|          | FBS (mg/dl)  | 2 hr Glucose (mg/dl) | HbA1C (%) |
|----------|--------------|----------------------|-----------|
| Normal   | < 100        | < 140                | < 6       |
| IFG      | ≥100 & < 126 | < 140                | 6 – 6.4   |
| IGT      | < 126        | ≥ 140                | 6- 6.4    |
| DIABETES | ≥ 126        | ≥ 200                | ≥ 6.5     |

**LEFT VENTRICULAR HYPERTROPHY-**

Left ventricular hypertrophy was detected by measuring left ventricular mass index (LVMI) using Transthoracic Echocardiography, according to recommendation of American Society of Echocardiography (ASE).

The following M Mode parameters were measured -

- Left ventricular end diastolic diameter (LVIDed)
- Left ventricular end systolic diameter (LVIDes)
- Ventricular septum thickness (IVSTed)
- Posterior wall thickness in diastole (PWTed)

**Left ventricular mass (LVM):** calculated by ASE formula i.e.  $LVM = 0.8[1.04\{(LVIDed+PWTed+IVSTed)^3-(LVIDed)^3\}]+0.6$  gm

Left ventricular mass index (LVMI)- LVM / BSA

LVH is considered if LVMI >45 g/m<sup>2.7</sup> in female and >49 g/m<sup>2.7</sup> in male.

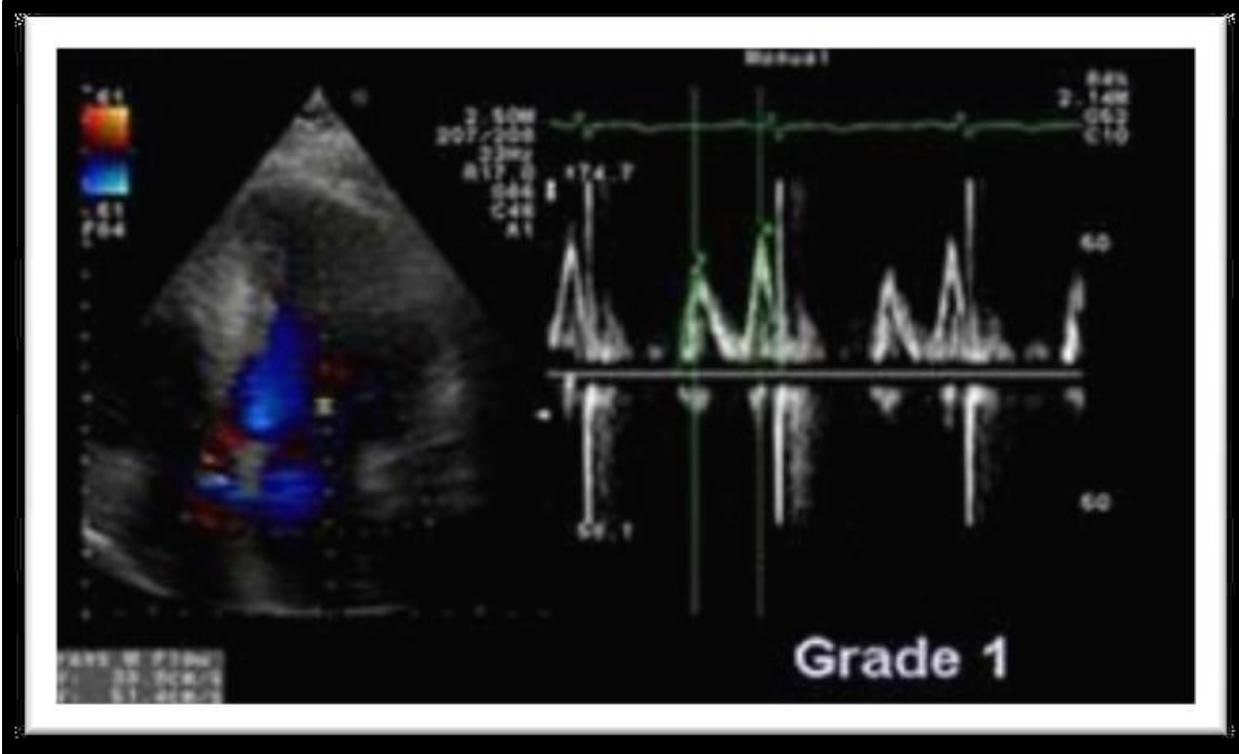
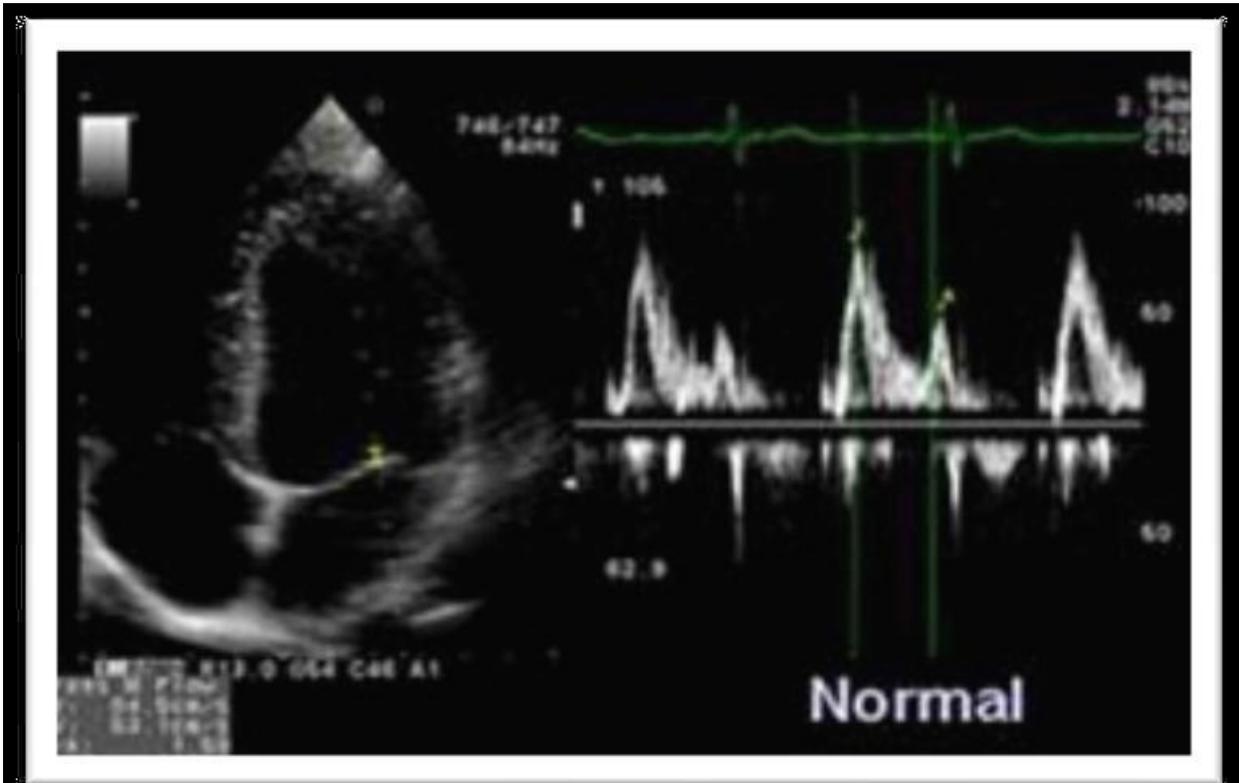
**LEFT VENTRICULAR DIASTOLIC DYSFUNCTION:**

This was evaluated by **Pulsed Doppler echocardiography**. Pulsed-wave Doppler (PWD)-derived transmitral inflow velocities were obtained in the apical 4-chamber view, with the sample volume placed at the mitral valve leaflet tips. Measurements included the transmitral early diastolic rapid filling (**E-wave**) and atrial contraction late filling (**A-wave**) velocities to calculate E/A ratio, isovolumetric relaxation time (IVRT) and deceleration time (DT). For tissue Doppler imaging (**TDI**), the mitral annulus velocity was obtained with a 2 mm sample volume lateral side and septal side of the mitral annulus. Diastolic dysfunction was labeled according to the standard guidelines. Left ventricular overall ejection fraction (systolic function) was calculated by modified Simpson’s method; and, LVEF ≥ 50% was considered as normal. All echocardiographic measurements were averaged over three consecutive cardiac cycles, measured by a single investigator blinded to all other variables. LV diastolic dysfunction was considered to be present if any of the following findings were seen, as previously described:

- E/A ratio < 1 or > 2
- DT < 150 or > 220 ms,
- IVRT < 60 or > 100 ms, or
- E/e’ratio > 15

Evaluation of different degrees of diastolic dysfunction using data obtained from the transmitral flow pattern (top) and analysis of tissue Doppler at the mitral annulus level (bottom). Legend: DD-diastolic dysfunction; DDT-diastolic deceleration time; E-transmitral flow velocity during early ventricular filling; A-transmitral flow velocity during atrial contraction; e'-Tissue Doppler velocity at the mitral annulus level during early ventricular filling.

**2D-ECHO PHOTOGRAPHS SHOWING LVDD**





**Statistical analysis:** Data were analysed for mean, percentage, standard deviation, Student's t test, Fisher's exact test, by using SPSS-16 (Statistical Package for the Social Sciences) for Windows (SPSS, Chicago, IL). The t-test and Fisher's exact

tests were applied to study quantitative and qualitative data, respectively with P-value < 0.05 was considered statistically significant.

### III. OBSERVATIONS AND RESULTS

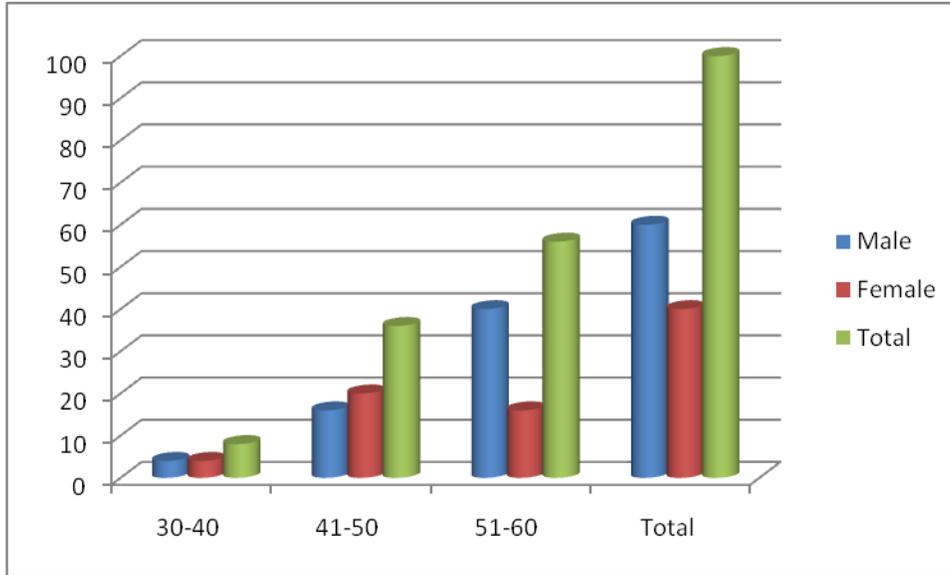
*Table 2: Age and Sex wise distribution of cases*

| Age (yrs)    | Male |    | Female |    | Total |     |
|--------------|------|----|--------|----|-------|-----|
|              | No.  | %  | No.    | %  | No.   | %   |
| 30-40        | 04   | 04 | 04     | 04 | 08    | 08  |
| 41-50        | 16   | 16 | 20     | 20 | 36    | 36  |
| 51-60        | 40   | 40 | 16     | 16 | 56    | 56  |
| <b>Total</b> | 60   | 60 | 40     | 40 | 100   | 100 |

Total 100 patients of newly diagnosed type 2 diabetes mellitus were selected for this cross sectional study. Out of which 60 (60%) were males and 40 (40%) females. Patients of age be-

tween 30 to 60 yrs were selected for the study. Maximum patient belongs to age group 50-60 yrs (56 patients) and minimum in age group 30-40 yrs (08 patients).

**Figure 1: Bar diagram showing age and sex wise distribution of cases**



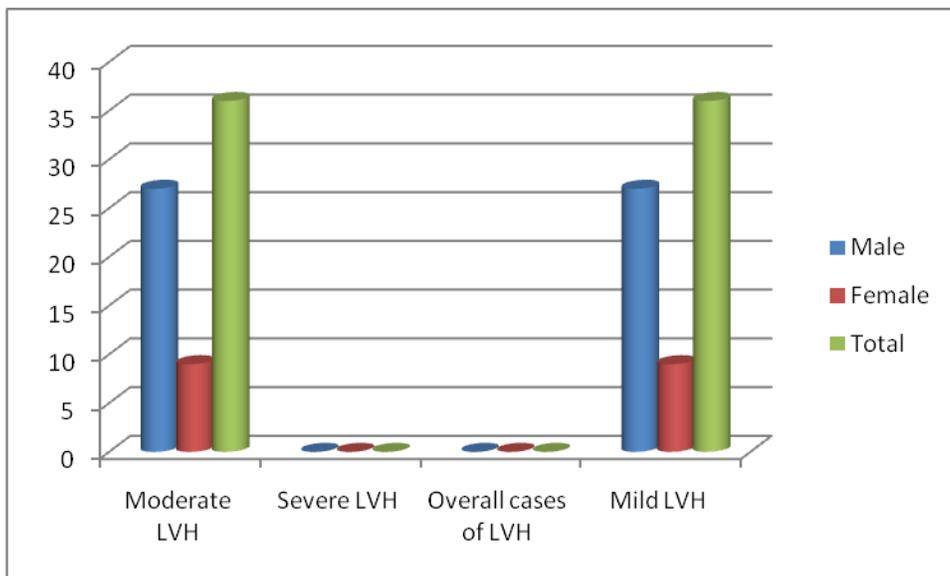
**Table 3: Frequency of Left Ventricular hypertrophy in Subjects and gender wise distribution of cases**

| Mild LVH     | Moderate LVH | Severe LVH | Overall cases of LVH | Mild LVH  |
|--------------|--------------|------------|----------------------|-----------|
| Male         | 27           | 0          | 0                    | 27        |
| Female       | 09           | 0          | 0                    | 09        |
| <b>Total</b> | <b>36</b>    | <b>0</b>   | <b>0</b>             | <b>36</b> |

Table 3 shows that, out of 100 patients of newly diagnosed normotensive type 2 DM ; 36 % patients were found to have left ventricular hypertrophy. Only mild left ventricular hypertrophy

was present in all cases as detected by 2D echocardiography by measuring left ventricular mass index Out of 36 cases 27 were male and 09 were females.

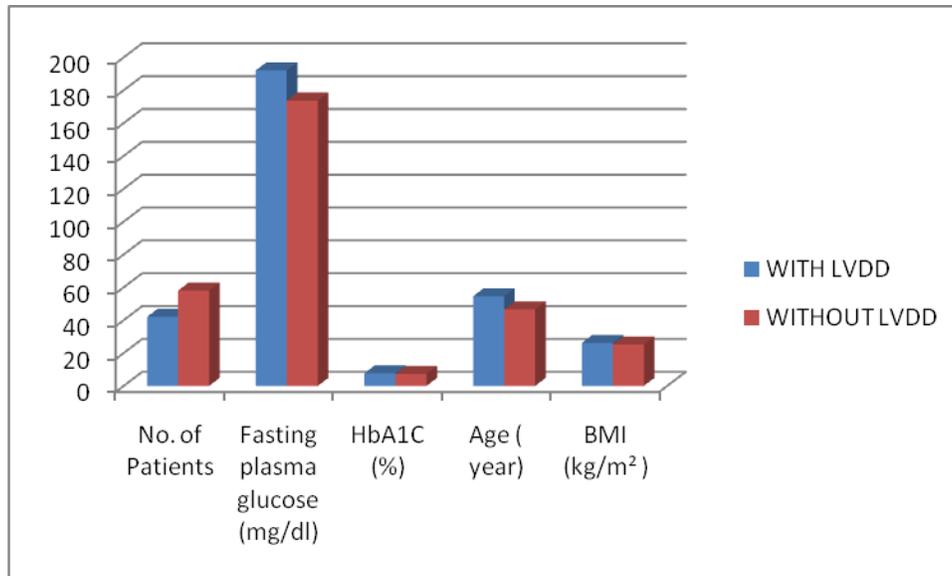
**Figure 2: Frequency of Left Ventricular hypertrophy in subjects and gender wise distribution of cases**



**Table-4: Comparative Parameters of the Patients with LV Diastolic dysfunction**

| PARAMETERS                     | WITH LVDD     | WITHOUT LVDD   | P VALUE ('t' test) |
|--------------------------------|---------------|----------------|--------------------|
| No. of Patients                | 42            | 58             | n/a                |
| Fasting plasma glucose (mg/dl) | 192.05 ±29.82 | 173.67 ± 27.71 | 0.0020             |
| HbA1C (%)                      | 7.69 ±1.01    | 7.26 ± 0.74    | 0.0157             |
| Age ( year)                    | 54.56 ± 6.49  | 46.48 ±7.15    | 0.0012             |
| BMI (kg/m <sup>2</sup> )       | 26.09±2.84    | 25.15±2.36     | 0.0743             |

**Figure-3: Comparative Parameters of the Patients with LV Diastolic dysfunction**



Mean FPG of subjects with LVDD was 192.05 ±29.82/dl and that of population without LVDD was 173.67 ± 27.71mg/dl .This shows that FPG is positively associated with the incidence of LVDD in population as mean of FPG of population with LVDD was higher as compare to population without LVDD and correlation was found very significant (p=0.0020) .

The mean HbA1C of subjects with LVDD was 7.69 ± 1.01as compare to subjects without LVDD 7.26 ± 0.74 the Correlation was found significant using unpaired t test (p value 0.0157).This signifies that higher the value of HbA1C at the time of diagnosis , higher will be the incidence of LVDD .Mean age of subjects with LVDD was 54.56 ± 6.49yrs and that of population without LVDD was 46.48 ± 7.15yrs. Age is positively associated with the incidence of diabetic LVDD in population as mean of age of population with LVDD was higher as compare to population without LVDD and correlation was found very significant (p=0.0012) mean body mass index of subjects with LVDD was 26.09±2.84 kg/m<sup>2</sup> and that of population without LVDD was 25.15±2.36kg/m<sup>2</sup> .BMI is not positively associated with the incidence of diabetic LVDD in population as mean of BMI of population and correlation was not significant (p=0.0743) .

#### IV. DISCUSSION

Diabetes Mellitus is a metabolic disease, associated with a number of complications including nephropathy, neuropathy,

ischemic heart disease, cerebrovascular disease and peripheral vascular diseases. Type 2 DM is likely to remain undiagnosed for years. The gap between the onset of the disease and clinical diagnosis of diabetes leads to the development of these chronic complications, which are the leading causes of premature mortality among diabetic patients. In this study, which is one of the first studies in this regards in western U.P., we assessed the correlation of left ventricular diastolic dysfunction (LVDD) with various parameters like glycosylated haemoglobin (HbA1C), plasma Glucose, Age and body mass index (BMI). In our study, incidence of left ventricular hypertrophy in Type 2 diabetics without known hypertension, cardiac, cerebrovascular or peripheral vascular disease, has demonstrated that LVH (defined according to the ASE guidelines ) was common, occurring among 36 % of the patients<sup>13</sup>, which is similar to study done by Somratne et al<sup>14</sup>. suggesting that type 2 diabetes per se is associated with LVH. Left ventricular hypertrophy which is an ominous prognostic sign and independent risk factor for cardiac events is often present in type 2 diabetes mellitus patients .The possible contribution of hyperinsulinemia and hyperglycemia to left ventricular mass have been suggested in normotensive diabetic patient but. Dawson et al <sup>15</sup>:in UK found a very high prevalence of 74 % which may be because he included already diagnosed cases of type 2 DM<sup>16</sup>. In this study a positive correlation was found between prevalence of LVH and level of HbA1C and Age but association with BMI was not significant. Incidence of LVH was found higher in males as compare to females. Study demonstrates high

incidence of diastolic dysfunction in normotensive and asymptomatic type 2 diabetics even at the time of diagnosis and this finding has a positive correlation with HbA1C and age at the time of diagnosis of diabetes. No significant HbA1C and age at the time of diagnosis of diabetes.

## V. CONCLUSION

HbA1c is seems to be reliable predictor of LVDD. Our Study demonstrated a very significant positive correlation between level of glycosylated hemoglobin(HbA1C) and frequency of LVH and LVDD in the newly diagnosed cases of type 2 diabetes mellitus. Similar correlation was also observed with FPG.

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# Extended EAACK- An Secure Intrusion Detection System with Detection and Localization of Multiple Spoofing Attackers in MANET

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**Abstract-** Invention of wireless network has brought up drastic change in networking. Mobile Ad hoc NETWORK (MANET) has been evolved as one of the promising technology based on implementation of wireless network. Providing mobility, flexible infrastructure, fast and low cost deployment are the key features of MANET. MANET is being most widely used wireless technology has limited security against network attacks. Dynamic configurability adds flexibility to MANET but it makes it vulnerable to attacks like DoS, Wormhole, Man-In-Middle Attack, IP Spoofing Attacks. In this paper, we propose an intrusion detection system Extended Enhanced Adaptive Acknowledgement (E-EAACK) which will detect the intrusion and localize the attacker. This system includes security components of prevention, detection and reaction. Specially designed for MANET, E-EAACK serves in detection of malicious behaviour without much affecting Network Performance. In addition it will detect and localize multiple IP Spoofing Attacks. We propose, the use of digital signature for authentication of nodes and S-ACK scheme for detecting anomalous behaviour in network. The implementation of GADE model for detection of attacks and IDOL framework for localization of the intruder makes E-EAACK a more effective security solution for MANET.

**Index Terms-** MANET,EAACK, Digital Signature, GADE, IDOL.

## I. INTRODUCTION

With constantly changing technology, people prefer to have information on their fingertips anywhere - anytime

Thus increasing in the use of wireless networks. MANET one of the promising technology in wireless networking has features like dynamic configurability, low cost of deployment. MANET does not need a fixed infrastructure[2]. MANET is dynamically configurable network in which nodes set up paths among themselves to transmit packets[1]. Without getting help of fixed infrastructure MANET forms self-configuring network by collection of mobile nodes. Transmitter and receivers both are equipped in a MANET node, so node can act as a Router and a Host at the same time.

There are two scenarios concerning topology in MANET. First, single-hop network where nodes within the radio communication range can directly communicate with each other; Second, Multi-hop network where nodes outside each the range

must depend on some other nodes to relay messages. Thus acting like a Router to relay messages to other nodes outside each others range have to rely on some other nodes to relay messages.

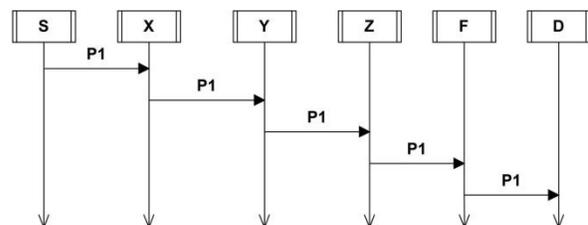


Figure 1: Relay of Messages in MANET

The Mobile Ad hoc Wireless Network is more vulnerable to be attacked than wired network. These vulnerabilities exist due to the structure of MANET and are difficult to remove. Attacks with malicious intent are made to exploit these loop-holes and to deteriorate the MANET operation. Attack prevention measures, such as authentication and encryption, can be used as the primary defence mechanism for reducing the possibilities of attacks. However, these techniques have some or the other limitations that are designed for a set of some known attacks. They are inefficient to prevent newer attacks that are designed for bypassing the existing security methods.

Due to the transparency of wireless networks, they are especially vulnerable to spoofing attacks where an attacker falsifies its identity to masquerade as another device, or even creates multiple illegal identities. Spoofing attacks are a serious threat as they represent a form of identity compromise and can facilitate a variety of traffic injection attacks, such as DoS attacks. It is thus desirable to detect the presence of spoofing and remove them from the network [6] [7].

## II. RELATED WORK

Due to the limitations of most of MANET routing rules, nodes MANET are reluctant on other nodes cooperation to relay data. This dependency facilitates an attacker opportunity to have its impact on network by compromising one or more nodes. To tackle this problem, it arises the need of enhancing the security level of MANETs.

4.2 Watchdog:

Watchdog was designed to improve the throughput of network with the existence of malicious node. It works for detecting malicious node by constantly listening to its next hop transmission.

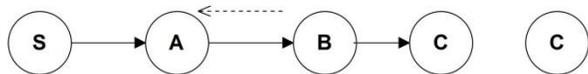


Figure 2: Operation in Watchdog

If the next hop fails to relay the packet ahead within certain period of time, it results in increment of failure counter. Furthermore, if failure counter exceeds a specific threshold value, it reports network as misbehaving. Watchdog scheme fails in the following:

- a. ambiguous collisions
- b. receivers collisions
- c. limited transmission power
- d. false misbehaviour report
- e. partial dropping[3]

2.2 TWOACK:

TWOACK [4] is neither an enhancement nor a Watch-dog based scheme. Aiming to resolve the receiver collision and limited transmission power problems of Watch-dog, TWOACK detects misbehaving links by acknowledging every data packets transmitted over each three consecutive nodes along the path from the source to the destination. Upon retrieval of a packet, each node along the route is required to send back an acknowledgement packet to the node that is two hops away from it down the route. TWOACK is required to work on routing protocols such as Dynamic Source Routing (DSR). The working process

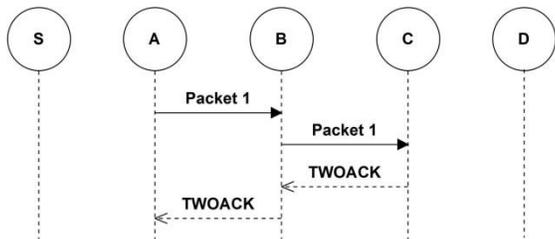


Figure 3: TWOACK scheme

of TWOACK is demonstrated figure, node a first forwards packet 1 to node B, and then node B forwards Packet 1 to node C. When node C receives Packet 1, as it is two hops away from node A, node C is obliged to generate a TWOACK packet, which contains reverse route from node A to node C, and sends it back to node A. The retrieval of this TWOACK packet at node A indicates the transmission of Packet 1 from node A to node C is successful. Other-wise, if this TWOACK packet is not received in a prede-fined time period, both nodes B and C are reported malicious. TWOACK scheme successfully solves the receiver collision and limited transmission power problems posed by Watchdog. However, the acknowledgement process required in every

packet transmission process added a significant amount of unwanted network overhead. Due to the limited battery power nature of MANETs, such redundant transmission process can easily degrade the life span of the entire network.

2.3 AACK :

It is a hybrid scheme which uses TWOACK for acknowledgement. AACK is acknowledgement based network layer scheme which consists a combination of schemes called TACK (similar to TWOAACK) and end-to-end acknowledgement scheme called ACKnowledgement . Compared to TWOACK, AACK significantly reduces network overhead, while still able to maintain or even out- shine the same network throughput[5]. In AACK, first

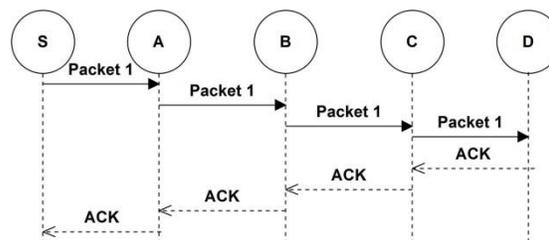


Figure 4: ACK scheme

the data transmit from source to destination. When the destination receives a packet it is required to send back an acknowledgement packet to source in the reverse route of the data packet. Within the specified time period if the source receives the acknowledgement packet, then the packet transmission is successfully. Otherwise, the source will switch to TACK scheme by sending a TACK packet. This hybrid scheme greatly reduces network traffic but is still unable to cope up with false misbehaviour report and forged acknowledgement.

2.4 Detecting spoofing attacks in mobile wireless environment:

Wireless network enables an attacker to masquerade as one of the device existing in network easily. This system proposes a method for detecting spoofing attack in mobile wireless environment. system develop the DEMOTE system which use of Received Signal Strength(RSS) traces collected over time without the knowledge of spatial constraint of the wireless node, utilizes temporal constraint to predict the best RSS. This approach does not require any changes or cooperation from wireless device other than packet transmission. By experiment from an office building environment system show that DEMOTE achieves accurate attack detection in both signal space as well as physical space using localization [9] [10] [11].

2.5 Detecting and Localization wireless spoofing attacks :

The system proposes both detection spoofing attacks as well as locating positions of attackers. System firstly works as a detector for wireless spoofing by using cluster analysis. Secondly, the system integrates the attack detector with real-time internal localization system which is also able to localize the positions of the attackers using point based algorithms. The system has evaluated our method through investigation using both Wi-Fi network as well as

ZigBee network. Their result shows that it is possible to detect wireless spoofing with both high detection rate and low false positive rate[8].

### III. SYSTEM DESCRIPTION

The EEAACK system will consist of following techniques, model or mechanisms for intrusion detection and localization.

#### 3.1 ACK

ACK is nothing but an end to end acknowledgment scheme. It acts as a crossbreed scheme in EEAACK. When there are no misbehaving nodes the transmission from source to destination is successful. Then destination sends an acknowledgement packet to source within predefined time constraint, otherwise source will switch to S-ACK mode[12].

#### 3.2 S-ACK

Source sends S-ACK packet in the intention of detecting misbehaving nodes in the route. S-ACK sends acknowledgment back to source after the packet reaches consecutive three nodes ahead the route. The third node required to send a S-ACK acknowledgement to first node. S-ACK mode facilitates easy detection of misbehaving nodes in the presence of receiver collision and limited power for transmission[12].

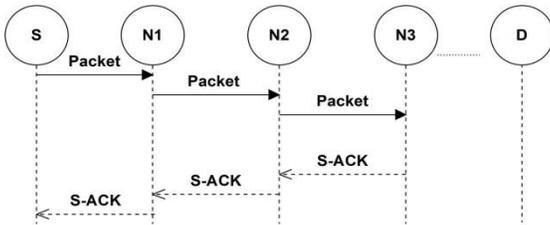


Figure 5: S-ACK scheme

N1, N2, N3 are three consecutive nodes. N1 sends S-ACK data packet to N2 which is next in the route and N2 relays it to N3. When N3 receives the S-ACK data packet it acknowledges N2 with S-ACK acknowledgement packet and N2 acknowledges back to N1. If N1 doesn't receive the acknowledgement within a particular time it will report N2, N3 as malicious nodes by generating a misbehaviour report. This misbehaviour report is sent back to the Source. To validate this report the source switches itself to MRA mode.

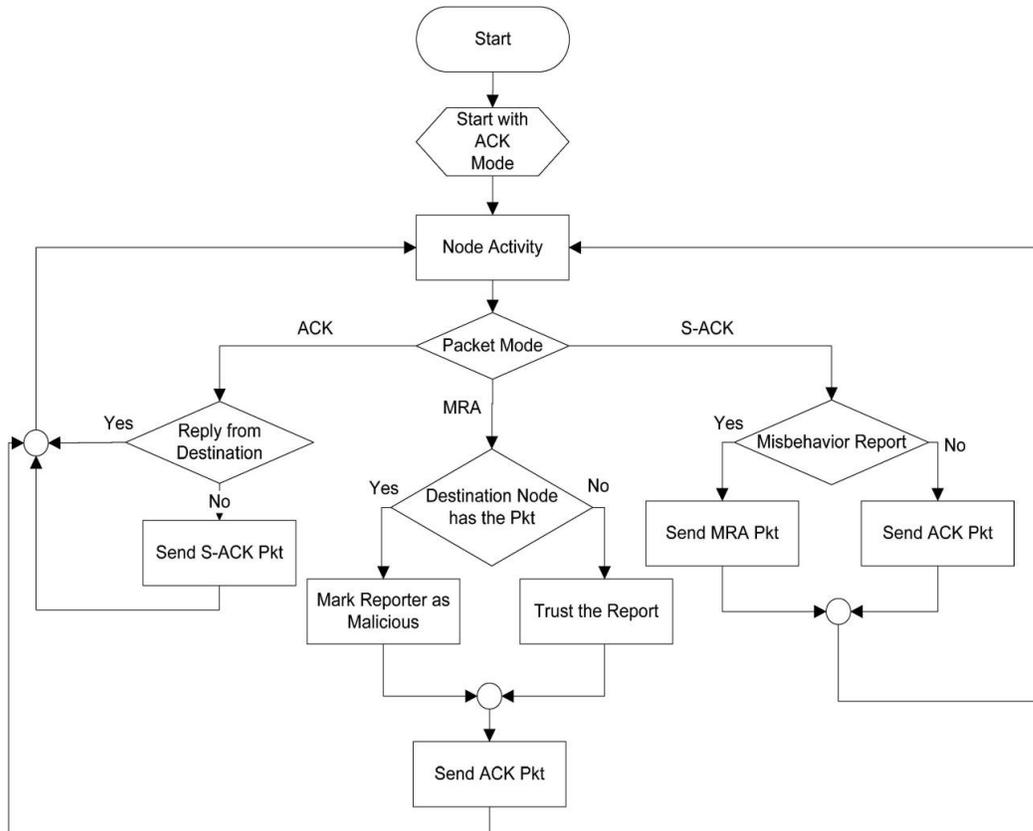
#### 3.3 MRA

Misbehaviour Report Analysis (MRA)[12] is a scheme to confirm misbehaviour report generated in S-ACK mode. This report may be a false one as attacker may interfere in S-ACK scheme generating a false misbehaviour report. As a result, this may cause destruction of network by compromising guiltless nodes.

In MRA the source will check with the destination whether the destination node have received the missing packet through a different route. MRA mode is initiated by checking local knowledge base of sender for getting alternative route to destination; otherwise source uses Dynamic Source Routing method for alternative route. Once the destination gets the MRA packet, it compares the MRA packet with the local knowledge base to verify if the re-reported packet was received by it. If received, then it informs the source that the misbehaviour report is false else it is considered as a legitimate report.

#### 3.4 Digital Signature

All the above schemes are based on acknowledgement. These acknowledgements could be doubtful and must be checked for their rightfulness. We use digital signature in order to maintain integrity of the system. If we don't use digital signature the above discussed 3 schemes will be defenceless. We can use DSA or RSA algorithms to implement digital signature schemes.



**Figure 6: Detection**

### 3.5 GADE

GADE stands for Generalize Attack Detection Model. It is attack detection method used in our system. There are two stages: First, attack detection; second, determine number of attackers. Attackers use transmission power of 10db to send packets, whereas original node uses 15db transmission power level observed according to the attributes in Received Signal Strength. RSS is a property correlated with location in physical space. The spoofing at-tacker used transmission power of 10 dB to send packets, whereas the original node used 15 dB transmission power levels. System observed that the curve of  $D_m$  under the different transmission power level shifts to the right indicating larger  $D_m$  values. System observes this difference between power levels and detects attack effectively in GADE model[13].

GADE uses cluster analysis for attack detection. RSS readings from wireless nodes may fluctuate and they should be clustered together. The cluster analysis for attack detection, System presents the Receiver Operating Characteristic curves of using  $D_m$  as a test statistic to perform attack detection for both the 802.11 and the 802.15.4 networks. The detection rate and false positive rate for both networks under different threshold settings. The results are encouraging, showing that for false positive rates less than 10 percent, the detection rate are above 98 per cent when the threshold is around 8 db. Even when the false positive rate goes to zero, the detection rate is still more than 95 per cent for both networks.

The estimation of the number of attackers will cause failure in localizing the multiple adversaries. As we do not know how many adversaries will use the same node identity to launch attacks, determining the number of attackers becomes a multiclass detection problem and is similar to determining how many clusters exist in the RSS readings. The System Evolution is a new method to analyse cluster structures and estimate the number of clusters. The System Evolution method uses the twin-cluster model, which are the two closest clusters among  $K$  potential clusters of a data set. The twin-cluster model is used for energy calculation.

The advantage of Silhouette Plot is that it is suitable for estimating the best partition. Whereas the System Evolution method performs well under difficult cases such as when there exists slightly overlapping between clusters and there are smaller clusters near larger clusters.

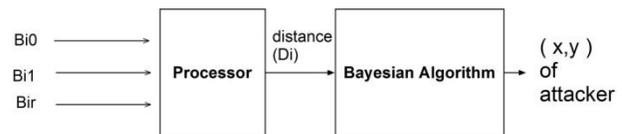
The training data collected during the offline training phase, we can further improve the performance of determining the number of spoofing attackers. In addition, given several statistic methods available to detect the number of attackers, such as System Evolution and SILENCE, system can combine the characteristics of these methods to achieve a higher detection rate. This mechanism explores Support Vector Machines to classify the number of the spoofing at-tackers.

#### iii. IDOL:

Integrated detection and Localization Framework[13] IDOL framework used to localize multiple attackers. IDOL efficiently detects attackers using different transmission power mechanism. The mainstream method of averaging RSS readings cannot differentiate RSS readings from different location and thus is not viable for localizing the attackers. This framework uses RSS

medoids returned from SILENCE as input to localization algorithms to estimate the positions of intruders. In order to efficiently implement IDOL we use following algorithms:

- a. RADAR-gridded: For localizing adversaries this algorithm uses RSS readings and nearest neighbour matching technique in single space, to localize the attacker.
- b. Area-Based Probability: ABP incorporates signal map. Experimental area is split into regular grid to equal size according to RSS reading observed for that particular grid.
- c. Bayesian Networks: BN uses signal to distance propagation model (multilateration) to localize the attacker.



**Figure 7: Working of BN**

## IV. CONCLUSION

Packet Dropping and Identity based attacks have always been main threats to MANET. In this paper, we proposed a fully equipped system named E-EAACK primarily intended for MANET and made it efficient in comparison to other popular mechanisms. It also overcomes the issues in MANET such as limited transmission power, receivers collision and false misbehaviour report.

We also propose the use of RSS based spatial correlation associated with each node that is hard to falsify for detecting identity based attacks. Our system can do both, detect the attack and decide the number of invaders and exclude them.

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# CT Evaluation and Study: Anthropometric Measurement of Knee Joint in Asian Population

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**Abstract-** Published studies have shown variation in sizes and angles of various anthropometric measurement namely tibial torsion, proximal femur geometry, distal femur and proximal tibia dimensions etc. This is an anthropometric study of proximal tibia and distal femur to identify variations in the subset of Indian population undergoing total knee replacement.

**Femur:-**

1. Mean AP length 69.92 (SD 4.7).
2. Mean ML width 70.46 (SD 5.8).
3. Mean aspect ratio (ML / AP) was 0.97 (SD 0.18).

**Similarly, Tibia:-**

1. Mean AP length 43.16 (SD 3.7).
2. Mean ML width 66.92 (SD 5.33).

**Material and methods:** We studied the morphology of 28 knee joints by c.t. scan in the Department of Orthopaedics, Joint Replacement Unit, Apollo hospitals, Chennai between October 2011 to December 2012.

**Results :** Measurements of tibial sections in both AP(43.16) and ML(66.92) dimensions, seem to be lower when compared to average measurements of other studies. There was no significant difference in aspect ratio seen in genders. Femoral sizes were ML (70.46) and AP(69.62) divided into subgroup in 5mm increments (Table VIII), the aspect ratio seen to be closer to the overall cohort with no significant variation.

**Discussion :** The ML width of femur was found to be 70.46 (SD 5.8). It was significantly greater than (P < 0.01) in female than in male. The tibial medial lateral diameter was 66.92 (SD 5.33) and anterior posterior diameter was 43.16 (SD 3.71)

**Conclusion :** The measured dimensions were smaller as compared to Caucasian population

**Index Terms-** anthropometry ,knee,c.t.scan ,India,Caucasian

## I. INTRODUCTION

Anthropometry (Greek word anthropos "man" and metron "measure") refers to the measurement of the human individual. It has been used for identification, for the purposes of understanding human physical variations, in palaeoanthropology and in various attempts to correlate physical with racial and psychological traits.

Today, anthropometry plays an important role in industrial design, clothing design, ergonomics and architecture. Statistical data about the distribution of body dimensions in the population are used to optimize size and shape of the various products manufactured in bulk for the population at large.

Additionally changes in life-styles, nutrition and ethnic composition of populations lead to changes in the distribution of body dimensions (e.g. the obesity epidemic the current concern of an obesity epidemic in developed world), these justifies periodic updating of anthropometric data collections and understand the variations seen in size, shape, features etc., an important consideration especially for products that are designed for global consumption. There is increasing evidence to suggest, today, that the premise "one size fits all" is untrue and it is essential to factor the morphologic variations in tailoring products across races and ethnic communities, and require regular updating of anthropometric data collections.

Caucasian population has been known to have higher morphometric values <sup>(1,2,3,4,5,6,7,8,9)</sup>.

**Following Table -1. Shows the variations reported between Caucasian population and Asian population and Indian population.**

| PARAMETERS | INDIAN POPULATION (mm) | ASIAN POPULATION (mm) | CAUCASIAN POPULATION (mm) |
|------------|------------------------|-----------------------|---------------------------|
|            |                        |                       |                           |

|   |                                       |   |                                       |
|---|---------------------------------------|---|---------------------------------------|
| <b>Femoral ML canal width, 20mm above the lesser trochanter</b> | 36.78<br>Rawal et al <sup>(10)</sup>  | -   | 51.5<br>Noble et al <sup>(11)</sup>   |
| <b>ML canal width at the isthmus as 12mm</b>                    | 9.02<br>Rawal et al <sup>(10)</sup>   | 10.5<br>Mahaisavariya et al <sup>(12)</sup> | 12<br>Noble et al <sup>(11)</sup>     |
| <b>Distal Femoral (MLwidth)</b>                                 | -                                     | 65.0<br>Ewe et al <sup>(13)</sup>           | 88.6<br>Terzidis et al <sup>(9)</sup> |
| <b>Distal Femoral AP Diameter</b>                               | 61<br>Vaidya et al <sup>(14)</sup>    | 59.9<br>Ewe et al <sup>(13)</sup>           | 58.7<br>Terzidis et al <sup>(9)</sup> |
| <b>Tibial Torsion (Degree)</b>                                  | 21.6<br>Mullaji et al <sup>(15)</sup> | -   | 38.9<br>Hovinga et al <sup>(7)</sup>  |
| <b>Coronal bowing of femur (Degree)</b>                         | 8.15<br>Rawal et al <sup>(10)</sup>   | 5.75<br>Mahaisavariya et al <sup>(12)</sup> | 9<br>Noble et al <sup>(11)</sup>      |

A difference of 16.8% was found in the femoral head offset between Indian and Swiss populations<sup>(10)</sup>.

Only few publications have focused at anthropometric measurements in Indian population ( Vaidya et al<sup>(14)</sup>, Rawal et al<sup>(10)</sup>, Siwach et al<sup>(16)</sup>, Mullaji et al<sup>(15)</sup>, Mullaji et al<sup>(37)</sup> ). In rest of the Asian subcontinent and Middle-East again, some authors have reported differences ( Cheng et al<sup>(1)</sup>, Chaichankul et al<sup>(2)</sup>, Ewe et al<sup>(13)</sup>, Mahaisavariya et al<sup>(12)</sup> ). The region of interest revisiting the subject has been given to the increasing number of Total Knee Replacements being performed today. The currently available implants have been designed on data obtained from Caucasian studies and some issues with regard to size and design have been reported by the surgeons in the Asian belt.

Published studies have used different measurement like Vernier calipers<sup>(14,16)</sup>, Ultrasonography<sup>(8,18)</sup>, CT scan<sup>(14,10,19,20)</sup>, MRI<sup>(2,21)</sup>. This study was based on measurements obtained from CT scan being performed for patients awaiting total knee replacement surgery. In addition, the source of these dimensional measurements have ranged from X-ray, CT scan, MRI to cadaveric bones, intraoperative. Each of these techniques may have a potential fallacy. CT scan on the other hand, is non-invasive method and enables much more precise measurements with digital scale. Also it is a reproducible technique.

Most dimensional measurements of knee joints had been done with respect to cadaveric and intra operative measurements. CT scan measurements are bone-specific and gives accurate values of required dimensions so that it can provide a reliable, reproducible database for further studies, sizing and manufacture of implants.

## II. AIMS AND OBJECTIVES

**Aims:** 1. To Study anthropometrically knee joint

2. Compare differences in measurements in males and female.

**OBJECTIVES :** 1.To study the anthropometric data of a population group from within the region (India) and to compare it with the published reports of the other regional ethnic groups namely Chinese, Japanese and the Caucasians.

## III. MATERIAL AND METHODS

We studied the morphology of knee joints in the Department of Orthopaedics, Joint Replacement Unit, Apollo hospitals, Chennai between October 2011 to December 2012.

### Inclusion criteria:

- 1 All patients undergoing Total Knee Arthroplasty.
- 2 Age more than 40 years.

### Exclusion criteria:

1. Previous fracture or bony surgery to knee, arthroscopy excluded
2. Any epiphysio-metaphyseal disease
3. Any bone tumor near knee joint
4. Any congenital abnormality affecting knee joint

### Subjects and Method:

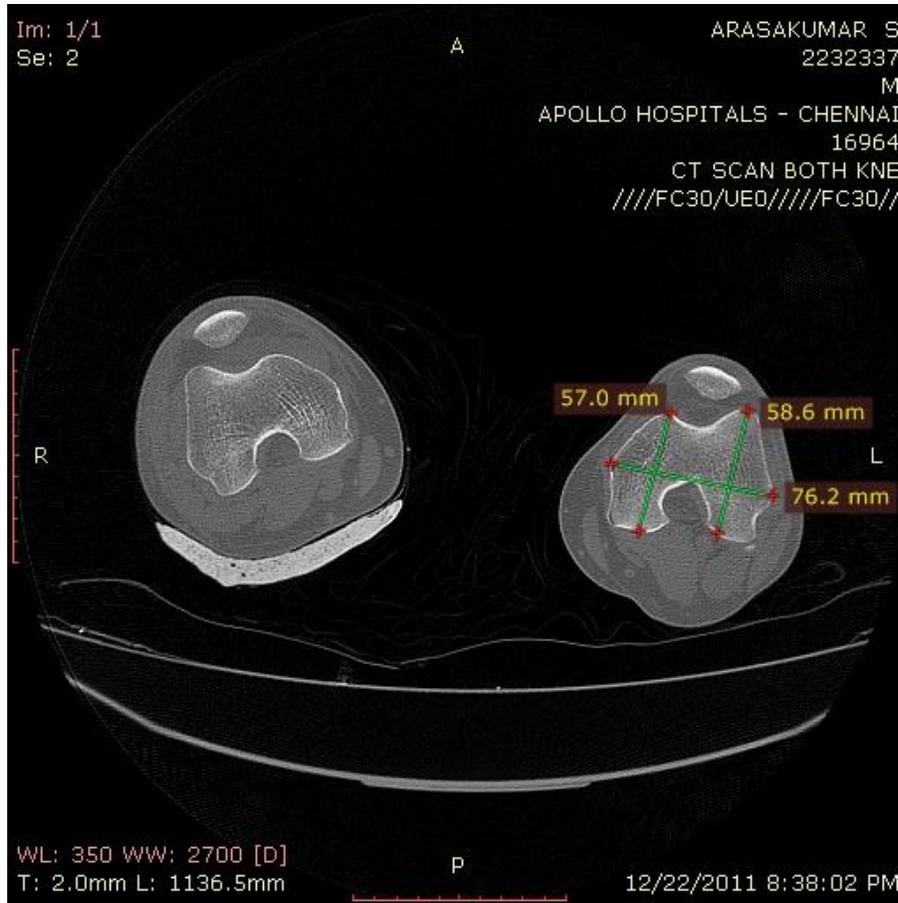
A total of 28 patients with osteoarthritis awaiting T.K.R (Total Knee Replacement) surgery having age > 40years underwent CT scan. All CT scan were performed by making patient supine in an extended position with their patella facing towards the ceiling so that similar images can be collected. CT scan machines used were 64-MDCT AQUILLION and 320-MDCT AQUILLION (MD-MultiDetector) giving 0.5mm thickness slices.

All patients were demonstrated and instructed to keep their lower limbs in extended and neutral position through out the CT scan duration.

After making the position, name, age, sex, were entered in each CT scan.

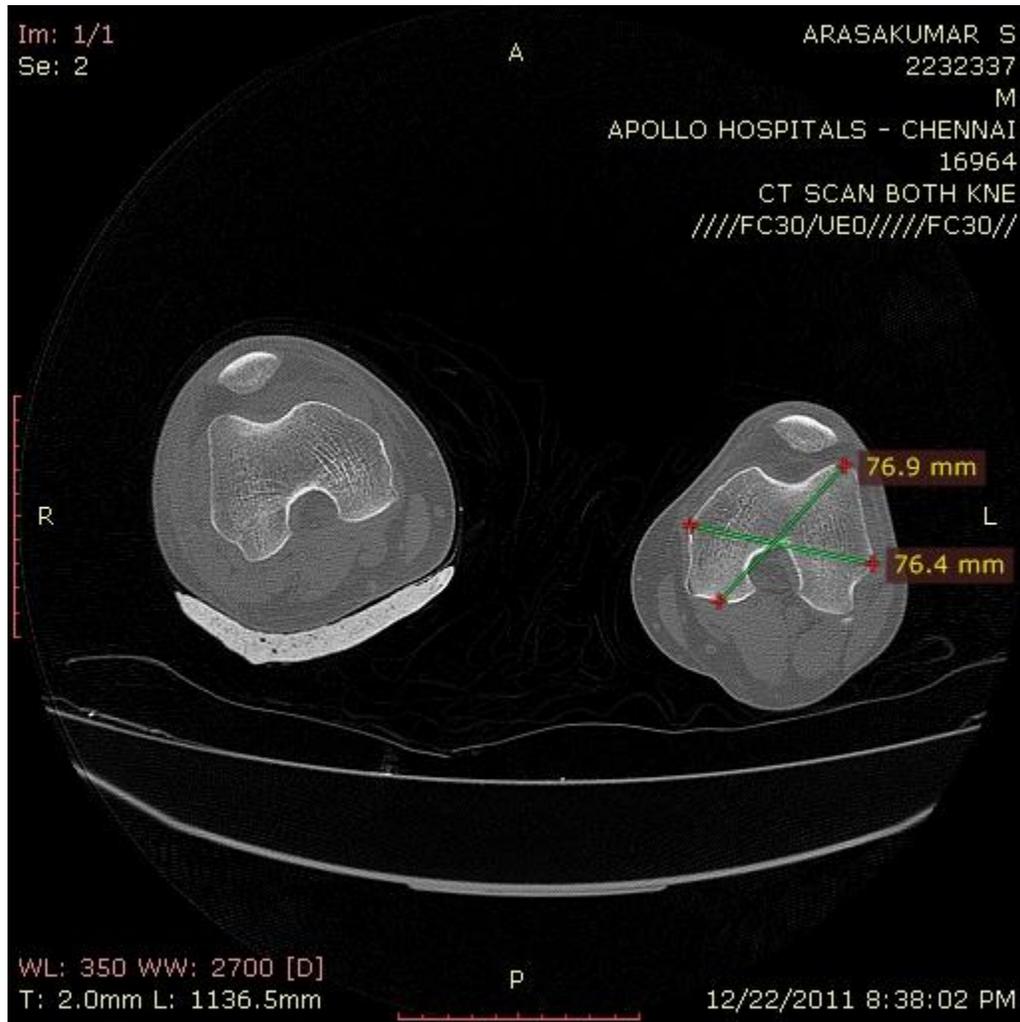
The image selected for distal femur is one at transepicondylar level showing most prominent epicondyles<sup>(13)</sup>.

Following image shows the measurements of femoral medial lateral (fML), femoral medial condyle anterior-posterior (fMAP), femoral lateral condyle anterior-posterior diameter (fLAP).



**Figure - 7:** Showing measurement at transepicondylar level. The horizontal line is the distance between most prominent points over epicondyles and called as fML (medial-lateral) diameter. Another vertical line starting from most anterior point on medial condyle to most posterior point in medial condyle is called as fMAP (medial condyle anterior-posterior) diameter. The vertical line starting from most anterior point on lateral condyle to most posterior point in lateral condyle is called as fLAP (lateral condyle anterior-posterior) diameter.

Following image shows measurement of overall anterior-posterior (fAP) diameter of femur.



**Figure-8:** The oblique line starting from most prominent point in between both condyles and the lower most in between both condyles crossing obliquely on fML diameter is fAP(Anterior-posterior).

The basis for choosing tibia measurement was referred to the transepicondylar<sup>(2)</sup> axis of the distal femur. Following image shows measurement of tibial medial- lateral dimension (tML).



**Figure-9: The horizontal line is the distance between most prominent points referring to the transepicondylar axis of femur called as tML (medial-lateral) diameter.**

Following image shows measurement of tibia anterior-posterior diameter (tAP).



**Figure-10: The vertical line bisecting tML diameter is called as tAP (Anterior-posterior).**

Following image shows measurement of tibial medial condyle antero-posterior (tMAP), tibial lateral condyle anterior-posterior (tLAP).



**Figure-11:** The vertical line starting from most anterior point on medial condyle to most posterior point in medial condyle is called as tMAP (medial condyle anterior-posterior) diameter. The vertical line starting from most anterior point on lateral condyle to most posterior point in lateral condyle is called as tLAP (lateral condyle anterior-posterior) diameter.

All measurements were recorded in millimeters using the DICOM (Digital Imaging and Communication in Medicine) imaging software manually with the help of radiology technicians and implant engineers.

#### IV. STATISTICAL DATA ANALYSIS

We used standard SPSS-14.0 version (Statistical Product and Service Solutions) software and t-test, ANOVA to analyse our data. Following tables shows the analysed parameters.

**Table – I. Average values of the tibia morphology measurement (mm).**

| Parameters | Male         | Female       | Combined     |
|------------|--------------|--------------|--------------|
| tML        | 72.18 ± 4.35 | 64.43 ± 3.7  | 66.92 ± 5.33 |
| tAP        | 46.60 ± 2.35 | 41.53 ± 3.07 | 43.16 ± 3.71 |
| tML /tAP   | 1.56 ± 0.12  | 1.57 ± 0.11  | 1.57 ± 0.11  |

± - Stands for Standard Deviation.

**Table – II. Average values of the tibia morphology measurement (mm).**

|      | N  | MIN | MAX   | MEAN  | S.D  |
|------|----|-----|-------|-------|------|
| tMAP | 28 | 34  | 50.80 | 43.58 | 3.33 |

|              |    |       |       |       |      |
|--------------|----|-------|-------|-------|------|
| <b>t LAP</b> | 28 | 35.10 | 51.30 | 42.41 | 4.18 |
|--------------|----|-------|-------|-------|------|

**Table –III. Average values of the femur morphology measurement (mm).**

| Parameters      | Male         | Female       | Combined    |
|-----------------|--------------|--------------|-------------|
| <b>fML</b>      | 76.86 ± 4.84 | 67.42 ± 3.09 | 70.46 ± 5.8 |
| <b>fAP</b>      | 73.55 ± 3.42 | 67.75 ± 4.18 | 69.62 ± 4.7 |
| <b>fML /fAP</b> | 1.04 ± 0.07  | 0.94 ± 0.21  | 0.97 ± 0.18 |

± - Stands for Standard Deviation.

**Table – IV. Average values of the femur morphology measurement (mm).**

|              | N  | MIN   | MAX   | MEAN  | S.D  |
|--------------|----|-------|-------|-------|------|
| <b>fMAP</b>  | 28 | 47.60 | 60.80 | 52.97 | 3.4  |
| <b>f LAP</b> | 28 | 50.80 | 62.20 | 55.10 | 3.57 |

**Table – V. Aspect ratio comparison of femur of current available implants.**

| Company Name        | Scorpio      | Genesis II  | Nex gen     | PFC         |
|---------------------|--------------|-------------|-------------|-------------|
| <b>Aspect ratio</b> | 1.11         | 1.17        | 1.23        | 1.07        |
|                     | 1.11         | 1.14        | 1.21        | 1.07        |
|                     | 1.10         | 1.13        | 1.17        | 1.06        |
|                     | 1.12         | 1.12        | 1.18        | 1.08        |
|                     | 1.09         | 1.12        | 1.17        | 1.09        |
|                     | 1.11         | 1.11        | 1.17        | 1.05        |
|                     | 1.10         | 1.10        | 1.14        | 1.05        |
|                     | 1.1          | 1.06        | 1.11        | -           |
|                     | <b>Range</b> | 1.09 - 1.12 | 1.06 - 1.17 | 1.11 - 1.23 |

**Table –VI. Aspect ratio comparison of tibia of current available implants.**

| Company name        | Scorpio     | Genesis II  | Nex gen     | PFC         |
|---------------------|-------------|-------------|-------------|-------------|
| <b>Aspect ratio</b> | 1.5         | 1.42        | 1.45        | 1.48        |
|                     | 1.5         | 1.42        | 1.51        | 1.48        |
|                     | 1.5         | 1.41        | 1.43        | 1.48        |
|                     | 1.51        | 1.42        | 1.60        | 1.51        |
|                     | 1.51        | 1.42        | 1.48        | 1.49        |
|                     | 1.50        | 1.42        | 1.60        | 1.50        |
|                     | 1.51        | 1.44        | 1.51        | 1.50        |
|                     | -           | 1.44        | 1.67        | -           |
|                     | -           | -           | 1.56        | -           |
| <b>Range</b>        | 1.50 – 1.51 | 1.41 – 1.44 | 1.43 – 1.67 | 1.48 – 1.51 |

**Table –VII. Aspect ratio comparison in males and females.**

| Range         | Femur       | Tibia       |
|---------------|-------------|-------------|
| <b>Female</b> | 0.85 – 1.1  | 1.33 – 1.80 |
| <b>Male</b>   | 0.91 – 1.12 | 1.35 – 1.78 |

There is no statistical significant difference between aspect ratio in females and males. (using t-tests)

**Table –VIII. Medial – Lateral Variations.**  
We divided our femoral data on the basis of anterior-posterior diameter (AP) into three groups .

|                     | Group I<br>(AP 61-65) |               | Group II<br>(AP 65.1-70) |              | Group III<br>(AP >70) |               |
|---------------------|-----------------------|---------------|--------------------------|--------------|-----------------------|---------------|
|                     | Males                 | Females       | Males                    | Females      | Males                 | Females       |
| <b>Mean ML</b>      |                       | 66.39         |                          | 67.19        | 77.09                 | 69.98         |
| <b>SD</b>           |                       | 3.02          |                          | 2.28         | 5.13                  | 5.41          |
| <b>n</b>            |                       | 5             | 1                        | 11           | 8                     | 3             |
| <b>95% of CI</b>    |                       | 66.62 – 70.15 |                          | 65.66 -68.72 | 72.79 – 81.38         | 56.53 – 83.43 |
| <b>Aspect Ratio</b> |                       | 1.04 ± 0.04   |                          | 0.89 ± 0.28  | 1.03 ± 0.07           | 0.93 ± 0.06   |

± - Stands for Standard Deviation.

Base of AP = mean of FAPL (left side) and FAPR (right side).

CI-Confidential Intervals.

### V. OBSERVATIONS AND RESULTS

The study involved a total of 28 adult patients (19 females and 9 males) who were subjected to CT scan preoperatively. The CT scan measurements were taken from 64 MDCT AQUILLION and 320 MDCT AQUILLION machines.

Measurements of tibial sections in both AP and ML dimensions seem to be lower when compared to average measurements of other studies. There was no significant difference in aspect ratio seen in genders.

Ethnic femoral sizes were divided into subgroup in 5mm increments (Table VIII), the aspect ratio seen to be closer to the overall cohort with no significant variation.

### VI. DISCUSSION

This is the study done to measure AP (Anterior Posterior) and ML (Medial Lateral) dimensions of distal femur and proximal tibia in knee joint.

Various studies in Caucasian and Asian population suggested the anthropometric variations. The measurements of our study were more representative of the distal femur, as it took into consideration the distance between the most anterior and the most posterior points, in addition to the length of the lateral condyle.

Following table shows measurements on distal femur in various studies

| Study                            | fML         | fAP         | AR          | fMAP        | fLAP        |
|----------------------------------|-------------|-------------|-------------|-------------|-------------|
| Mensch et al <sup>(29)</sup>     | 76.8 ± 7.2  |             |             |             |             |
| Berger et al <sup>(5)</sup>      | 80.2 ± 4.1  | 64.1        | 1.24        | 64.1 ± 3.0  | 63.0        |
| Trezidis et al <sup>(9)</sup>    | 88.6 ± 4.2  | 58.7        | 1.50        | 58.7 ± 4.1  | 58.5 ± 4.0  |
| Ewe et al <sup>(13)</sup>        | 65.0 ± 5.0  | 59.9 ± 4.8  | 1.09 ± 0.07 | -           | -           |
| Chaichankul et al <sup>(2)</sup> | 64.06 ± 6.3 | 45.43 ± 4.5 | 1.41 ± 0.12 | -           | -           |
| Cheng et al <sup>(1)</sup>       | 71.0 ± 3.0  | 64.1 ± 2.7  | 1.11 ± 0.02 | 51.1 ± 3.3  | 50.7 ± 4.0  |
| <b>Our study</b>                 | 70.46 ± 5.8 | 69.62 ± 4.7 | 0.97 ± 0.18 | 52.97 ± 3.4 | 55.10 ± 3.5 |

± - Stands for Standard Deviation.

The ML width of femur was found to be 70.46 (SD 5.8). It was significantly greater than ( $P < 0.01$ ) in female than in male. It is the most frequently measured anatomic parameter of the distal femur. However, there is great variability between studies regarding the definition of measuring points as well as the measurement techniques and the type of sample. As a result, any comparison would provide unreliable conclusions. We measured the bicondylar width of the femur according to the definition of Farrally and Moore which is the maximum distance across the condyles in the transverse plane<sup>(17)</sup>. They reported an average of

83.1mm in Caucasian femur which is similar to another Caucasian study<sup>(9)</sup> 83.9mm (SD 0.63) our value seems to be similar to other Asian studies.

The mean medial condyle diameter of femur was 52.97 mm (SD 3.4) and mean lateral condyle diameter was 55.10 (SD 3.5) which were lower than Caucasian studies namely **Berger et al**<sup>(5)</sup>, **Terzidis et al**<sup>(9)</sup>, but seems close to Chinese study **Cheng et al**<sup>(1)</sup>. The aspect ratio of our study was 0.97 (0.18) which seems to be much less than Caucasian<sup>(29,5,9)</sup> and other Asian studies<sup>(13,1,2)</sup>.

Following table shows measurements on proximal tibia in various studies

| Study                        | tML         | tAP         | AR          | tMAP         | tLAP        |
|------------------------------|-------------|-------------|-------------|--------------|-------------|
| Mensch et al <sup>(29)</sup> | 74.9 ± 6.1  | 48.9        | 1.53        | 48.9 ± 4.3   | 45.3 ± 3.7  |
| Uehera et al <sup>(25)</sup> | 74.3 ± 6.6  | 48.3 ± 5.4  | 1.53        | -            | -           |
| Kwak et al <sup>(3)</sup>    | 71.9 ± 5.6  | 45.7 ± 3.8  | 1.57        | -            | -           |
| Cheng et al <sup>(1)</sup>   | 73.0 ± 4.6  | 48.8 ± 3.4  | 1.49        | -            | -           |
| <b>Our study</b>             | 66.92 ± 5.3 | 43.16 ± 3.7 | 1.57 ± 0.11 | 43.58 ± 3.33 | 42.41 ± 4.1 |

± - Stands for Standard Deviation.

The tibial medial lateral diameter was 66.92 (SD 5.33) and anterior posterior diameter was 43.16 (SD 3.71) which seems to be smaller than Caucasian study **Mensch et al**<sup>(29)</sup> and other Asian studies<sup>(1,3,25)</sup>. The aspect ratio was 1.57 (0.11) which seems to be similar to the other studies.

In Caucasian and diverse ethnic Asian population groups, various studies<sup>(1,2,3,4,5,6,7,8,9)</sup> addresses the anthropometric measurement. This study is focused on measurements of distal femur and proximal tibia. Different methods have been employed<sup>(14,10,2,19,20,18,21)</sup> to measure actual sizes. They range from plain X-rays, cadaveric measurements to CT scan and MRI measurements.

**Seedhom et al**<sup>(34)</sup> in their study concluded that the measurements were more precise at the level of epicondyles. Identification of exact epicondylar points with the help of CT scans is precise. Hence, we performed our measurements on CT section availability of CT slices (0.5mm thickness from 64 MDCT and 320 MDCT AQUILLION) enable identification of widest points which use feel minimal inherent error possible in plain X-ray and clinical measurements.

The measurements were derived from CT scans done as part of evaluation of patients undergoing Total Knee Replacement Surgery. Method of measurement necessitate identification of most anterior and most posterior points and similarly most medial and most lateral points, which is more precise on well-performed CT scan, the reason being that it is possible to approximate the measurement upto two decimal with the help of digital scale. This enables a more accurate measurement with minimal error.

The values in the finding of this study is of importance clinically in surgical treatment of arthritic knee of prosthetic joints. Surgeons in this part of the world have time and again mentioned and pointed out to the difficulties in obtaining proper sized implant. Most of the currently available designs have been manufactured in accordance to the sizes with respect to Caucasian database. This accounts for difficulties faced by the surgeons in this continent. The findings of this study closely confess to finding reported in studies by other authors<sup>(1,2,13)</sup>. Aspect ratio seems definitely smaller especially in females when compared to Caucasians. The clinical implication of the same is overhang of prosthesis at time of surgery and its implications. Availability of more intermediate size is one solution offered today's its stands to reason. This enables a more precise execution of the surgical procedure with respect to component sizing thereby avoiding implant overhang beyond bone margins and better restoration of flexion and extension gaps.

Recent studies have shown that gender differences of distal femur morphometry depend on other morphometric measurements of femur, such as the femur length and width<sup>(35)</sup>. In the study by **Dargel et al**<sup>(36)</sup> 2011, when gender differences were corrected for differences in femur length, medial-lateral dimensions of knees were still significantly larger in men than in women; however matched paired analysis did not prove those differences to be consistent.

There are instances of extreme outlines with significant morphologic variation seen in some patients. Hence probably the use of these values in various ethnic subgroups during manufac-

ture of implants would be a solution to the concern of performing surgenes.

## VII. CONCLUSION

Variations exist in anthropometric measurements of distal femur and proximal tibia when compared with Caucasian database. It was also observed in this study, our size resemble close to that have been reported by **Cheng et al**<sup>(1)</sup>, **Chaichankul et al**<sup>(2)</sup>, **Ewe et al**<sup>(13)</sup>.

Females have smaller aspect ratio and dimension as compared to males of similar age. One advantage of this study has been the precise measurement of broadest dimension based on CT scan. It is fair to assume that these measurements are close to the true values. A further study with a larger cohort of cases with same methodology could be helpful in establishing a regional anthropometric database for ethnic Indians.

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# Efficient Synthesis of 1, 5- Benzothiazepine Derivatives Using Benzyl Tri Ethyl Ammonium Chloride in Ethanol

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**Abstract-** New Heterocyclic systems namely derivatives (**a-d**) have been synthesized via reaction of 3-((E)-3-morpholino or piperidin-1-yl or 4-phenylpiperazin-1-yl or 4-(4-methoxyphenyl)piperazin-1-yl)acryloylquinolin-2(1H)-one (**3a-d**) derivatives and 2-amino thiophenol by using benzyl tri ethyl ammonium chloride in good yields. Some of the compounds have shown good anti-inflammatory activity.

**Index Terms-** Heterocycles, 1,5- benzothiazepine, 2-amino thiophenol, benzyl tri ethyl ammonium chloride

## I. INTRODUCTION

Oxygen, nitrogen, sulphur containing heterocycles has been under investigation for a long time because of their important medicinal properties. Among these type of molecules, 1,5- benzothiazepines have been shown to have various important biological activities such as coronary vasodilatory<sup>1</sup>, tranquiliser<sup>2,3</sup>, anti depressant<sup>4</sup>, anti spasmodic<sup>5</sup>, neuroleptic<sup>6</sup>, CNS<sup>7</sup> and anti HIV<sup>8</sup> activity. Synthesis of this group of benzothiazepines have been intensely studied and numerous procedures are described in the literature<sup>9-12</sup> and 2H-(1)-quinolin-2-one are also endowed with activity<sup>13</sup>, modification of these reaction conditions or the development of new procedures are important to get newer insight into the formation of these 1,5-benzothiazepines. In continuation of ongoing and previous investigation<sup>14-17</sup>. The present aim of this study was, therefore to introduce simple and convenient procedures for the synthesis of 3-((E)-2,3-dihydro-2-(morpholino or piperidin-1-yl or 4-phenylpiperazin-1-yl or 4-(4-methoxyphenyl)piperazin-1-yl)benzo[b][1,4]thiazepin-4-yl)-4-hydroxy-1-methylquinolin-2(1H)-one (**3a-d**) in very good yield by the reaction of 2-aminothiophenol with 4-hydroxy-1-methyl-3-((E)-3-morpholino or piperidin-1-yl or 4-phenylpiperazin-1-yl or 4-(4-methoxyphenyl)piperazin-1-yl)acryloylquinolin-2(1H)-one (**2a-d**), in the presence of benzyl triethyl ammonium chloride in ethanol guided mainly by the observation that many times the combination of two or more heterocyclic nuclei in singular molecular framework enhances the biological profile many a fold

## II. MATERIALS AND METHOD

The requisite starting material 3-((E)-3-(dimethylamino)acryloyl)-4-hydroxy-1-methylquinolin-2(1H)-one (**1**) and 4-hydroxy-1-methyl-3-((E)-3-morpholino or piperidin-1-yl or 4-phenylpiperazin-1-yl or 4-(4-methoxyphenyl)piperazin-1-yl)acryloylquinolin-2(1H)-one (**2a-**

**d**), have been prepared by the known literature method.<sup>18</sup> Condensation of (**1**) with variety of alicyclic 2° amines in reflux condition resulted in 4-hydroxy-1-methyl-3-((E)-3-morpholino or piperidin-1-yl or 4-phenylpiperazin-1-yl or 4-(4-methoxyphenyl)piperazin-1-yl)acryloylquinolin-2(1H)-one (**2a-d**), these compounds (**2a-d**) are treated with 2-amino thiophenol using catalytic amount of benzyl triethyl ammonium chloride in ethanol afforded 3-((E)-2,3-dihydro-2-(morpholino or piperidin-1-yl or 4-phenylpiperazin-1-yl or 4-(4-methoxyphenyl)piperazin-1-yl)benzo[b][1,4]thiazepin-4-yl)-4-hydroxy-1-methylquinolin-2(1H)-one (**3a-d**) on very good yields. The compounds have been characterized by spectral means such as IR, NMR and mass. In IR spectra characteristic bond at 1600.81 cm<sup>-1</sup> is attributed to (C=N) bond for the structure (**3a**) was unequivocally proved by the NMR spectra of the protons attached to the carbons C-2 and C-3 which appeared as a typical ABX pattern (**3a**):  $\delta$ 3.32(1H, dd,  $J_{AB}=12.5\text{Hz}; J_{AX}=15.0\text{Hz}; H_A$ ),  $\delta$ 4.85(1H, dd,  $J_{BA}=12.5\text{Hz}; J_{BX}=15.0\text{Hz}; H_B$ ),  $\delta$ 5.52(1H, dd,  $J_{XA}=15.0\text{Hz}; J_{XB}=7.5\text{Hz}; H_X$ ). All physical data of compounds were recorded.

## III. RESULTS AND DISCUSSION

Among the synthesized compounds, four compounds of 1,5-benzothiazepines derivatives were screened for anti-inflammatory activity by the Carrageenan induced paw edema assay in rats at a Dose of 100 mg/kg Body weight, orally. The data is presented in **Table-1**

In an attempt to carry out structural modifications of the parent molecule and for the optimization of the biological activity, the substituted 1,5-benzothiazepines were substituted with morpholine, piperidine, phenyl piperazine, (4-methoxyphenyl) piperazine groups and this 1,5-benzothiazepines derivatives were subjected to an anti-inflammatory activity.

In the substituted 1,5-benzothiazepines were substituted by phenyl piperazine and piperidine groups (**sample 3, 2, Table 1**) at position and they showed less activity than the standard drug. Among these two compounds piperazine derivative have shown greater activity than piperidine derivative

In the phenyl piperazine derivative (**sample 3, Table-1**) showed 10.87% inhibition of Rat paw edema indicating mild activity of the pharmacophoric group. Substitution with, (4-methoxyphenyl) piperazine groups (**sample 4, Table 1**) causes reduction in the activity and moderate activity when compared with phenyl piperazine substituted derivative. Substitution by morpholine derivative (**sample 1, Table 1**) showed less activity. Substitution by piperidine derivative (**sample 2, Table 1**) showed negligible activity.

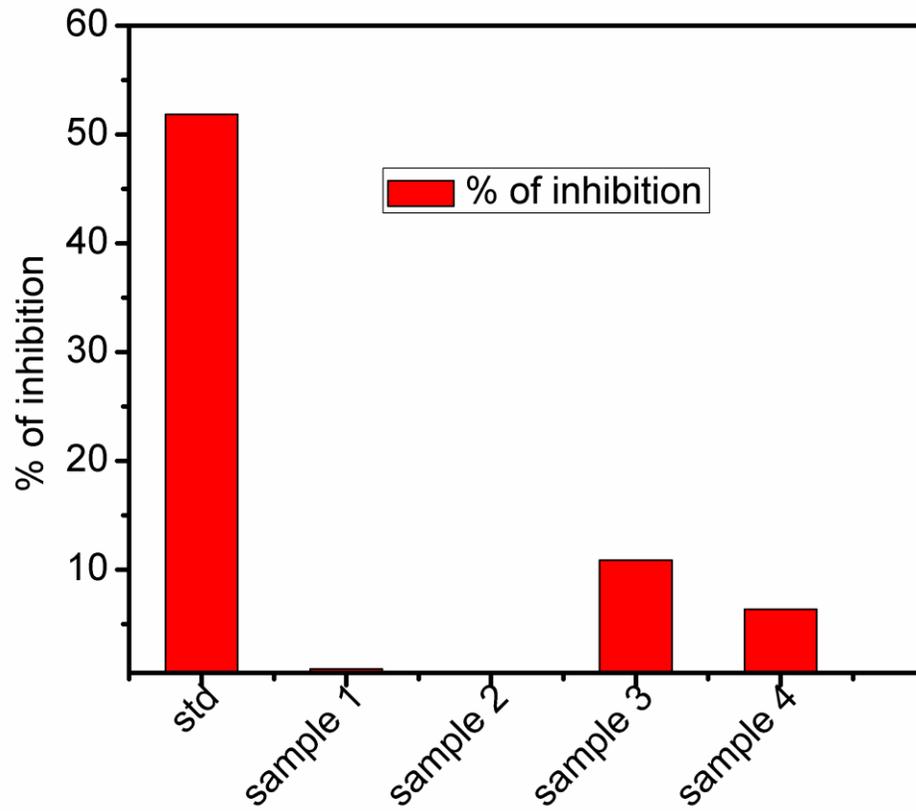
**Table 1: Anti-Inflammatory Activity In Carrageenan Induced Rat Paw Edema Model**

**Compound Dose** : 100 mg / Kg  
**Standard [Indomethacin]** : 10 mg / Kg

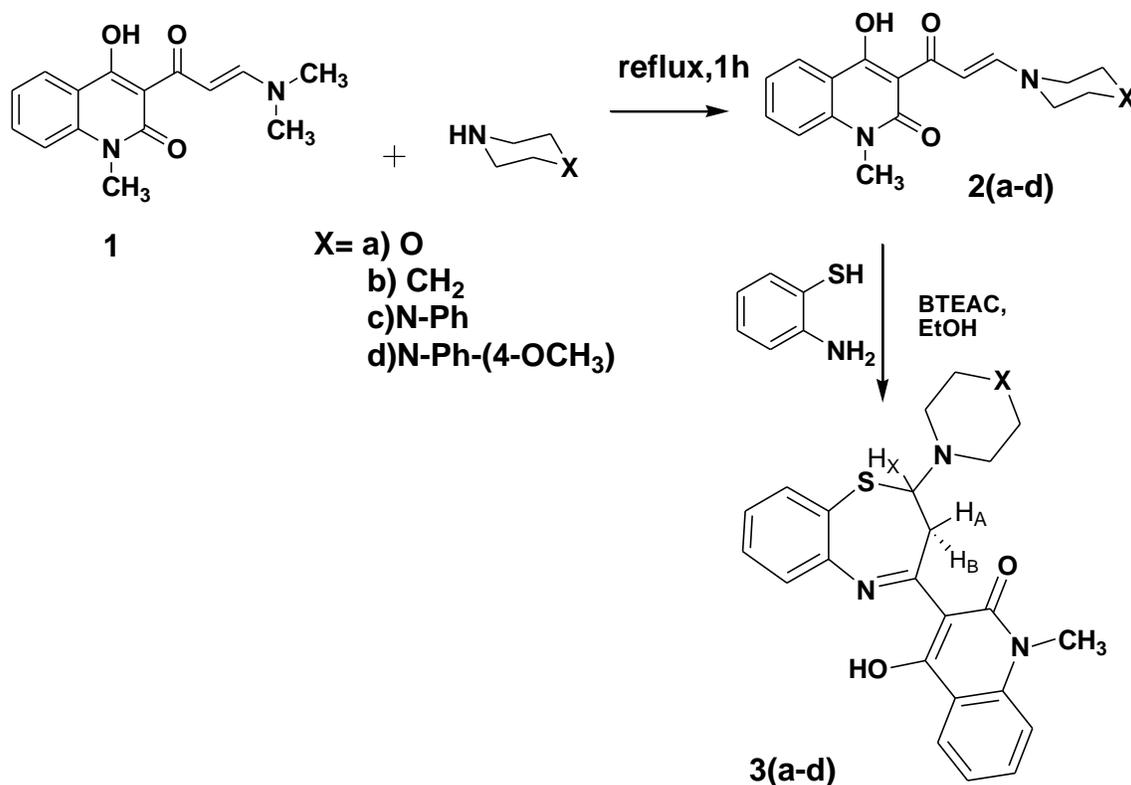
| Rat No.          | Group          | Initial Paw Volume(mL) | Final paw Volume(mL) | Difference in Paw Volume(mL) | % of inhibition   |
|------------------|----------------|------------------------|----------------------|------------------------------|-------------------|
| 1                | <b>CONTROL</b> | 1.12                   | 2.26                 | 1.14                         |                   |
| 2                |                | 1.20                   | 2.39                 | 1.19                         |                   |
| 3                |                | 1.33                   | 2.44                 | 1.11                         |                   |
| 4                |                | 1.44                   | 2.56                 | 1.12                         |                   |
| <b>Mean ± SE</b> |                |                        |                      | <b>1.14±0.03</b>             |                   |
| 5                | <b>STD</b>     | 1.29                   | 1.77                 | 0.48                         | 57.80             |
| 6                |                | 1.32                   | 1.87                 | 0.55                         | 51.40             |
| 7                |                | 1.39                   | 2.00                 | 0.61                         | 46.40             |
| <b>Mean ± SE</b> |                |                        |                      |                              | <b>51.87±3.30</b> |
| 8                | <b>1</b>       | 1.35                   | 2.46                 | 1.11                         | 2.60              |
| 9                |                | 1.25                   | 2.47                 | 1.22                         | 0.00              |
| 10               |                | 1.36                   | 2.55                 | 1.19                         | 0.00              |
| <b>Mean ± SE</b> |                |                        |                      |                              | <b>0.87±0.87</b>  |
| 11               | <b>2</b>       | 1.22                   | 2.55                 | 1.33                         | 0.00              |
| 12               |                | 1.21                   | 2.41                 | 1.20                         | 0.00              |
| 13               |                | 1.23                   | 2.68                 | 1.45                         | 0.00              |
| <b>Mean ± SE</b> |                |                        |                      |                              | <b>0.00±0.00</b>  |
| 14               | <b>3</b>       | 1.23                   | 2.27                 | 1.04                         | 10.30             |
| 15               |                | 1.28                   | 2.27                 | 0.99                         | 14.60             |
| 16               |                | 1.19                   | 2.26                 | 1.07                         | 7.70              |
| <b>Mean ± SE</b> |                |                        |                      |                              | <b>10.87±2.01</b> |
|                  | <b>4</b>       | 1.35                   | 2.42                 | 1.07                         | 6.07              |
|                  |                | 1.24                   | 2.23                 | 0.99                         | 13.00             |
|                  |                | 1.27                   | 2.56                 | 1.19                         | 0.00              |
| <b>Mean ± SE</b> |                |                        |                      |                              | <b>6.36±3.76</b>  |

**ANTI-INFLAMMATORY ACTIVITY IN CARRAGEENAN INDUCED RAT PAW EDEMA MODEL**  
**Compound Dose** : 100 mg / Kg

**Standard [Indomethacin]** : 10 mg / Kg



**EXPERIMENTAL DATA**



All the reaction mixtures were stirred magnetically and were monitored by TLC using 0.25mm. which were visualized with UV light. Melting points were recorded on a Buchie R-535 apparatus. IR spectra were recorded on a perkin-Elmer FT-IR 240-c spectrophotometer. Mass spectro were on a finnigan MAT 1020

mass spectrometer. Proton NMR were recorded on 200 MHz spectrometer in CDCl<sub>3</sub>. and the chemical shift values were reported in  $\delta$  (ppm) and J values are expressed in hertz.

**3-((E)-3-(dimethylamino)acryloyl)-4-hydroxy-1-methylquinolin-2(1H)-one : (1)**

Synthesized according to the reported procedure<sup>18</sup>.

**4-hydroxy-1-methyl-3-((E)-3-morpholino or piperidin-1-yl or 4-phenylpiperazin-1-yl or 4-(4-methoxyphenyl)piperazin-1-yl)acryloylquinolin-2(1H)-one : 2(a-d)**

Synthesized according to the reported procedure<sup>18</sup>.

**3-((E)-2,3-dihydro-2-(morpholino or piperidin-1-yl or 4-phenylpiperazin-1-yl or 4-(4-methoxyphenyl)piperazin-1-yl)benzo[b][1,4]thiazepin-4-yl)-4-hydroxy-1-methylquinolin-2(1H)-one: 3(a-d)<sup>19</sup>**

4-hydroxy-1-methyl-3-((E)-3-morpholino or piperidin-1-yl or 4-phenylpiperazin-1-yl or 4-(4-methoxyphenyl)piperazin-1-yl)acryloylquinolin-2(1H)-one **2(a-d)** (0.01mmole) was dissolved in ethanol (20ml), to this 2-amino thiophenol (0.01mmole) and catalytic amount of BTEAC(0.06mmole) was added and the reaction mixture was refluxed on water bath. after 1hr a yellow fluffy solid starts separating out. the reaction mixture was further refluxed for one more hour, cooled and the separated solid was filtered and washed several times with hot ethanol. The compound was dried and recrystallised using acetone to get pure 1,5-benzothiazepines. all other derivatives were prepared accordingly. The results are shown below.

**3-((E)-2,3-dihydro-2-morpholinobenzo[b][1,4]thiazepin-4-yl)-4-hydroxy-1-methylquinolin-2(1H)-one: 3a**

MP: 251 °C, Yield : 79%, IR(KBr,  $\nu_{\text{max}}$  cm<sup>-1</sup>) : 1601.83 (C=N), <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>)

:  $\delta$  2.21-2.40 (m, 4H, N(CH<sub>2</sub>)<sub>2</sub>),  $\delta$  2.72-2.79 (m, 4H),  $\delta$  3.32 (1H, dd,  $J_{AB}$ =12.5 Hz;  $J_{AX}$ =15.0 Hz;  $H_A$

$\delta$  3.82 (s, 3H, N-CH<sub>3</sub>),  $\delta$  4.38 (dd,  $J_1$ =12.5 Hz,  $J_2$ =7 Hz, 1H),  $\delta$  4.85 (1H, dd,  $J_{BA}$ =12.5 Hz;  $J_{BX}$ =15.0 Hz;  $H_B$ ),  $\delta$  5.52 (1H, dd,  $J_{XA}$ =15.0 Hz;  $J_{XB}$ =7.5 Hz;  $H_X$ )  $\delta$  7.02-7.15 (m, 4H)  $\delta$  7.22-7.34 (m, 3H)  $\delta$

7.49-7.55 (m, 2H)  $\delta$  7.59-7.62 (m, 1H),  $\delta$  7.70-7.79 (m, 1H),  $\delta$  8.30 (d,  $J$ =6.6, 1H) ESI-MS (m/z) : 421[M+1]<sup>+</sup> Anal Calcd for C<sub>23</sub>H<sub>23</sub>N<sub>3</sub>O<sub>3</sub>S : C 65.54; H, 5.50; N, 9.97; O 11.39; S, 7.61 Found; C 65.44; H, 5.45; N, 9.90; O 11.31; S, 7.59.

**3-((E)-2,3-dihydro-2-(piperidin-1-yl)benzo[b][1,4]thiazepin-4-yl)-4-hydroxy-1-methylquinolin-2(1H)-one:3b**

MP:237°C, Yield:71%, IR(KBr,  $\nu_{\max}$ cm<sup>-1</sup>): 1601.53 (C=N), <sup>1</sup>H NMR (200 MHz, CDCl<sub>3</sub>) : $\delta$ 1.52-1.65(m,6H,(CH<sub>2</sub>)<sub>3</sub>), $\delta$ 2.42-2.50(m,4H,N(CH<sub>2</sub>)<sub>2</sub>), $\delta$ 2.72- 2.82(1H,dd, $J_{AB}$ =12.5Hz; $J_{AX}$ =15.0Hz;H<sub>A</sub>), $\delta$ 3.45(S,3H,N-CH<sub>3</sub>) $\delta$  4.16(1H, dd  $J_{BA}$ =15 Hz; $J_{BX}$ =7.0 Hz ;H<sub>B</sub>)  $\delta$  5.41(1H, dd,  $J_{XA}$ =15.0Hz ;  $J_{XB}$ =7.0Hz;H<sub>X</sub>),  $\delta$  7.08- 7.16(m,4H)  $\delta$  7.13-7.31(m,3H), 7.35-7.46(m,2H)  $\delta$  7.50-7.70(m,2H),  $\delta$  8.29(d, $J$ =6.8 Hz,1H) ESI-MS (m/z) : 422[M+1]<sup>+</sup>  
Anal Calcd for C<sub>24</sub>H<sub>25</sub>N<sub>3</sub>O<sub>2</sub>S : C 68.71; H, 6.01; N, 10.02; O, 7.63; S, 7.64; Found; C 68.69; H, 5.97; N, 9.53; O 7.60 ; S, 7.63

**3-((E)-2,3-dihydro-2-(4-phenylpiperazin-1-yl)benzo[b][1,4]thiazepin-4-yl)-4-hydroxy-1-methylquinolin-2(1H)-one:3c**

MP 232°C Yield:73%, IR(KBr,  $\nu_{\max}$ cm<sup>-1</sup>): 1644.7(C=N), <sup>1</sup>H NMR (400 MHz, CDCl<sub>3</sub>) : $\delta$ 1.8-1.92(m,4H),  $\delta$  2.2- 2.36(m,4H)  $\delta$  2.96(1H,dd, $J_{AB}$ =12.5Hz; $J_{AX}$ =13.0Hz;H<sub>A</sub>) $\delta$ 3.63(S,3H,N-CH<sub>3</sub>)  $\delta$ 4.47(1H, dd,  $J_{BA}$ =12.5 Hz; $J_{BX}$ =7.0 Hz ;H<sub>B</sub>)  $\delta$  5.80(1H, dd,  $J_{XA}$ =15.0Hz ; $J_{XB}$ =7.5Hz;H<sub>X</sub>)  $\delta$  7.25-7.34(m,5H), $\delta$ 7.41-7.50(m,4H)  $\delta$  7.53-7.61(m,3H),  $\delta$  7.63-7.78(m,2H),  $\delta$  7.81-7.89(m,1H),  $\delta$  7.92-7.99(m,1H),  $\delta$  8.29(d, $J$ =6.6 Hz,1H), ESI-MS (m/z) : 497[M+1]<sup>+</sup>  
Anal Calcd for C<sub>29</sub>H<sub>28</sub>N<sub>4</sub>O<sub>2</sub>S : C 70.14; H, 5.68; N, 11.28; O 6.44; S, 6.46  
Found C 70.12; H, 5.60; N, 11.24; O 6.41; S, 6.43.

**3-((E)-2,3-dihydro-2-(4-(4-methoxyphenyl)piperazin-1-yl)benzo[b][1,4]thiazepin-4-yl)-4-hydroxy-1-methylquinolin-2(1H)-one: 3d**

MP :267°C, Yield :76%, IR(KBr) : 1644.7(C=N) HNMR(400MHz,CDCl<sub>3</sub>) :  $\delta$  1.81-1.91(m,4H)  $\delta$  2.21-2.38(m,4H), 2.96(1H,dd, $J_{AB}$ =12.5Hz; $J_{AX}$ =13.0Hz;H<sub>A</sub>),  $\delta$  3.65( S,3H,N-CH<sub>3</sub>), $\delta$  3.90(S,3H,O-CH<sub>3</sub>) ,  $\delta$  4.80(1H, dd,  $J_{BA}$ =12.5 Hz; $J_{BX}$ =7.0 Hz ;H<sub>B</sub>)  $\delta$  5.52(1H, dd,  $J_{XA}$ =15.0Hz ; $J_{XB}$ =7.5Hz;H<sub>X</sub>)  $\delta$  7.1-7.3( m,4H),  $\delta$  7.3-7.41(m,3H),  $\delta$  7.44-7.52(m,2H)  $\delta$  7.58-7.65(m,1H),  $\delta$  7.71-7.82(m,1H)  $\delta$  8.21(d, $J$ =6.8,1H), ESI-MS (m/z) : 497 [M+1]<sup>+</sup> Anal Calcd for C<sub>29</sub>H<sub>28</sub>N<sub>4</sub>O<sub>2</sub>S : C 70.14; H, 5.68; N, 11.28; O 6.44; S, 6.46 Found C 70.12; H, 5.60; N, 11.24; O 6.41; S, 6.4

IV. CONCLUSION

- The proposed compounds were synthesized successfully and characterized.
- They were evaluated for Anti-inflammatory activity by Carrageenan induced Rat Paw Edema model. All the compounds screened were found to be less active than standard in case of Anti-inflammatory activity .
- Hence, it is concluded that there is ample scope for further developing this field.

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# Positive Impact of Smartphone Application: Whatsapp & Facebook for Online Business

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**Abstract-** Science and technologies contribute to the development and improvement of various activities globally. One of those activities is a day to day business such as household selling; home based, kitchen needs and utilities, wedding door gifts and souvenirs, flower arrangements/bouquets, artworks, cloth, scarf and varieties of other products. In this paper we aim to explore the positive impact of the smartphone application for online business. The usage of smartphone applications such as WhatsApp and Facebook has contributed enormously to especially online business. Research has been conducted using informal interview, questionnaire, and online survey based on question develop by researcher. The respondents consist of 100 targeted participants which involves university students, housewives, and random public at various places. The outcome indicates that the smartphone application has given the positive impact to the online business which can help to develop business success.

**Index Terms-** Smartphone, application, online business, Impact.

## I. INTRODUCTION

In today's energetic worldwide business, the ability to be responsive and alert to technological changes is more significant than ever before. Information and the interactions around it has turn out to be the key asset of most businesses. New technology may present negative or positive for many businesses. As nowadays selling activities become much easier and simpler ever than traditional time by using the online system. The aims of people who tend to participate or involve in online business entrepreneur is to gain profit. Nonetheless they must ensure that their product is well known and recognize by the public. The online business was introduces by the internet as an innovative means of doing business in addition to making a profit. Competence entrepreneurs persist to discover ways to make use of the internet for their business purposes. Dissemination information of the product and goods is significantly required to help the business to promote or update their product. Looking into the new technology especially hand phone is no longer just a device to make call and sending message. It has been upgraded to become smarter and sophisticated with multi-function and application and the name also has changed to become 'smartphone.' Based on Jyoti, Sutee and Efraxia (2014), "*A Smartphone is defined as a mobile device that allows users to make telephone calls, sends and receives emails, downloads files, provides an internet connection and uses applications*". Smartphone application offers lots of benefits to online business nowadays. Notwithstanding, the uni-

versality of smartphone application has becoming as business and consumers' preferences as a way of interactive communication. Thus the objective of this paper is to focus on the good or positive impact from the use of smartphone application: WhatsApp and Facebook on the online business and to identify how it can assist in the online business to be developed successfully.

## II. RESEARCH QUESTION

1. Is there any good or positive impact of the smartphone application such as WhatsApp and Facebook on the online business?
2. Is the smartphone application such as WhatsApp and Facebook can help the online business to develop successful?

## III. STATEMENT OF THE PROBLEM

The rapid growth of new technologies globally, has led to studies and research to find possible approach in its application. One of the pivotal roles played in modern technology is the invention of smart phones. The smart phones are used as a means of communication since the social media plays a big role in socialization, especially through WhatsApp and Facebook; there is a need to extend that social aspect into inclusive situation of business opportunity. The indulgment of online business has been introduced in various ways. These ways have not been appropriate due to some factors affecting the online businesses in one way or the other. Therefore, there is a need of introducing solid solution in smart phones application such as WhatsApp and Facebook to enhance online business opportunity.

## IV. LITERATURE REVIEW

Smartphones Applications in daily business in this day and age are mostly vital, to the point of dissimilar categories of business enable an assortment of requirements in the way of applications such as Google apps on android are above of the rivalry when it comes to smart phone applications. This is for the reason that the android operating system is an open source which has a variety of programs that any businessman can use to expand their business. Many more free applications can be downloaded for the purpose of doing businesses. Smartphones such as an iPhone or a Blackberry are necessary as they can assist business to run well and more competent.

Nowadays, smartphone apps are important in providing information to other people especially consumer where it can be considered as consumer information systems (CIS). According to Chun, Chung, and Shin (2013), "smartphone applications are developed by individuals, businesses, government agencies, the military, educational institutions, and any other organizations that want to use the technology to entertain, solve a problem, and fulfill a need". There are several types of communication apps in smartphones which are message and e-mail clients, a platform for clients to do networking which function as a medium to communicate with their consumers.

Smartphone application is gaining popularity to surf for info among the people and it is no longer focusing on large national companies but local businesses, organizations and non-profits are finding successful ways to provide information or engage in sales and marketing activities using mobile content. Although the business can seen on the desktop website, but it is more effective when the businesses engage with the viewer on the mobile website. For online business nowadays, any marketing advertising for the product can directly be promoted to all customers since they use their smartphones all the time. Customers can view their online shopping products online and purchase them from their smartphone applications. Hwang (2012), mentioned that, people used to download application on their smartphones, and it shows how people are depending on these gadgets. Hwang mentioned that, the innovative technology via smartphones application may help the business to expand their product all over the world. Social networking is made easy at just one's fingertips to promote while taking and receiving order from customers around the world.

It is a fact that smartphones may overtake desktop computers for personal use because of the expansion of the application which is growing rapidly among the smartphone users. With the sophisticated features on smartphones, they attract entrepreneurs particularly those who have the interest in the online business. The features and the functions of the smart phone itself help to represent the new frontier via the Internet and World Wide Web to advertise their product. Therefore, mobile app enables an online business to plan and focus on their sales growth. Karrigan (2011) has claimed that "Nearly 50 percent of Techno Metrica survey respondents believe they have been able to spend more time on growing business revenues due to their use of mobile apps. Fifty one percent of these small businesses say their firms are more competitive". (p.3). Therefore, online business also can be categorized as small business, owners mostly have crucial of time in expanding their business, therefore by using smartphone applications, they can increasing their sales and revenue and at the same time they also can use it on the administrative functions.

Furthermore, online businessmen also see the smartphone as an opportunity for their business use. They are currently using the internet as their most valuable tool through creative innovation of advertisement on the product and the emergence of the 4G network will speed up adoption because of newer devices, faster speed, enhanced and more effective mobile apps that allow businesses to communicate with the public.

Advertisers believe that people are more likely to click on an advertisement that targets to their specific interests. Business-

es owners are encouraged to produce alternate versions that provide beneficial functions in order to gain profit. As claimed by Kirk (2011) "the app is basically given away or offered at a very low price and users of the app are exposed to advertising messages". The interactive advertising on mobile is expected to grow due to no charges being imposed on them whenever they try to promote their selling items. If the users of the app are in the right demographic profile or represent a good match between a producer's product or service and their target market, this path can lead to higher profitability as well as the funding necessary to maintain and expand the business.

The advancement of the smartphone apps definitely provides entrepreneurial opportunities. These opportunities however, like most other entrepreneurial opportunities require a sound business plan and which can be considered as part of business career. Far more than a little programming goes into making an app successful, a careful planning must be undertaken to identify opportunities and develop products that offer competitive advantages.

## V. RESEARCH METHODOLOGY

Experimental research method and Pearson correlation coefficient statistical measurements have been used to study how business work with new technology in today's world. Questionnaire, verbal interview and online survey had been distributed specifically to smart phone user as the specify group. The online survey and questionnaire was sent via email to two types of company which are private sector as well as government sector to study their behavior in using smartphone to do online shopping, and for verbal interview it is conducted in the open environment by the researcher.

The questionnaire and survey consisted combination of 10 questions with mix open ended, close ended and likert scale question and grouped into three respective parts which are demographic section of participants which includes basic information regarding respondents such as the gender of the participants, age and status. The second part focused on the experience of online shopping using smartphone and the last part is participant's satisfaction which has been rated by the respondent based on likert scale question.

We used two different approaches which are verbal interview based on the questionnaire and online survey. For verbal interview we asked participants based on the questions stated in the questionnaire which consisted of 10 questions including open ended, close ended and likert scale type, then we interpreted, rated, classified and grouped the different responses different results. For online survey, respondents received email and they needed to answer the same questions in the questionnaire and replied back to the researcher. At the beginning of the research all participants had given consent and all agreed without any forced to participate in this research.

## VI. FINDINGS ANALYSIS AND LIMITATION

By using SPSS (Statistical Package for Social Science) we evaluated result using Pearson product-moment correlation coefficient which was computed to assess the relationship between

the frequent used of smartphone by people and the accessible and effectiveness of a business promoted through smartphone application. There was a positive correlation between the two variables,  $r = 0.98$ ,  $n = 125$ ,  $p = 0.002$ . Overall, there was a strong, positive correlation between smartphone user and the effectiveness of a business through the new technology which is the smartphone.

Out of 100 targeted participants, about 65 participants got actively involved in this study by answering the questions and survey as well as responding to the question asked by the researcher. This group consisted of both gender male and female from different age groups between 20 to 50+ and covered different types of status such as housewives, university students, college student and public picked randomly at different places and time. The participants were also included locals and internationals. About 45% of the participant's responded to the online survey and another 55% responded through informal interviews conducted by the researcher.

From an overall view of the collected response, almost 88% agreed that they have knowledge on certain products via online browsing. Just look around us, people are addicted to smartphone up to the point that they don't put much attention to their surroundings. For example, everywhere we go we can see how people are so attached to their phones. Most of them are smartphone users who actively use smartphone to browse website, social networking, and get information about product through Facebook, WhatsApp group and so on. Advertising business product by using new technology gives easy access especially which using smartphone as it is effective and applicable in today's world. Through this finding we also found that the result supported our purpose of the study which is to see how people can benefit from the usage of smart phone and their positive reactions towards this new technology especially in social application to businesses. Limitation of this research might include the region covered which the research was only held in a city and not include other parts of state as well as rural areas.

## VII. CONCLUSION

In summary, through this paper we have examined how new technology can be a medium for successful business practice especially online business. Overall, the findings showed that new technology such as smartphone can help to develop business success and benefit the people. From the result which fully supports the objective of study it is shown that people are attached to smartphone so it is an advantage for business people to promote their product through this new technology to be more efficient and gain more profit for the business. Moreover, each smartphone is able to access to all applications provided where this allows business people to create their own application program to be used by consumer through which android operating system is an open source and has a variety of programs as anyone can develop for this device. This means that there are many more free applications as well as many standard ones for sale via the internet. Another benefit is that it can automatically sync with desktop computer which this is important to people who do business as they do not have to transfer data from smart phone to desktop in order to access as well as to record it.

In addition, to increase brand awareness, building relationships and grow business by using smartphone as a new technology is an advanced way in how business capitalize on the strategic profit gain. Growing popularity of this new technology can help in product promotion through text message advertising, create a smartphone application, and develop business website.

This application is compatible and accessible from smartphone and also by using social network to engage with mobile customer. The advantages for customer who do online shopping through their smart phone is they have plenty time to browse through and make comparison between products without any effort to bring computer or laptop and they just can browse through their smartphone. They even have wider selection and can get better price as well as can also view other customer feedbacks on the same product and obviously it is time saving for those who always claim that they been busy the whole day. This can be the advanced step for business people to promote their product creatively using this medium and it is also important on how they convince the customer to buy their product by using this new technology of smartphone. In order for business people to survive in this rapidly advance new technological world which uses mobile online revolution, businesses need to be innovative by bringing up their popular digital channels in store to help enhancing their customer experience and also creating a dynamic, exciting and vibrant environment that will keep customer returning through their "door".

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# The management in emergency of a septic complication from tonsillar abscess: cervico mediastinal gangrene - a case report

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**Abstract-** This report is the result of a teamwork of the Unità Operativa di Medicina Iperbarica (Op. Unit of Hyp. Med.) and of the Unità Operativa di Anestesia e Rianimazione (Intensive Care Unit) of the S. Paolo Hospital (Bari, Italy).

Purpose of this work is to make a close examination of the literature about cervico-mediastinal gangrene and to illustrate the management in emergency of a septic complication from a tonsillar abscess: the cervico mediastinal gangrene also called descending necrotizing mediastinitis (D.N.M.) (case report).

Epidemiology: the cervico-mediastinal gangrene is a severe infectious that begins from the cervical district. It is rarely observed in clinical practice, it is fast-spreading and with a multi regional involvement and can affect any age of life.

Etiopathogenesis: the odontogenic origin of the infection is the most frequent, but the gangrene can also arise as a complication of inflammation of the oropharynx and any other infectious disease in the neck if neglected. The beta-hemolytic Streptococcus seems to be the most frequently involved germ, at least in the early stages of infection. Then, when inflammation develops and spreads, this germ can be associated with both aerobes and anaerobes (the latter directly responsible for the production of gas and gangrenous necrosis). The loose connective tissue of the cervical fasciae is the first to be affected, muscular and aponeurotic structures are subsequently involved and then, for contiguity and as a result of the inspiratory acts, inflammation proceeds rapidly along the pretracheal and retrotracheal region up to the mediastinum where it causes cell necrosis, pleural and pericardial effusion, inflammatory spread to the lung parenchyma. In a second step the neurovascular structures may also be affected (phenomena of thrombosis or vascular rupture).

Signs and symptoms: the first clinical signs and symptoms are attributable to the organ that is initially affected by the infection. The progression to cervico-mediastinal gangrene leads to the following signs and symptoms: painful cervical swelling, chest pain, crepitus on palpation, skin color change to dark blue (due to the progressive thrombosis of the tributary cutaneous vessels, fever, tachycardia and tachypnea, sepsis).

Diagnosis: the diagnosis is based on clinical data and must make use of TC scan, the only exams able to document the disease status and the progression of the infection.

Therapy: the cervicotomy is the treatment to be carried out as early as possible when the presence of purulent collections has been documented and may be limited to a single district if gangrene is caught at an early stage, but it must involve all levels of the neck, and even beyond, when the inflammation is wide, or is spreading to the neck or pectoral region. The tracheotomy must accompany the cervicotomy when there is a condition of shortness of breath or when the disease state suggests that an appropriate ventilatory assistance will be necessary in a short time. The antibiotic therapy must be practiced, most of the times, in an empirical way as the germs responsible for the infection are rarely identified and as the initial etiological factor often remains the only cause of the gangrene. It is important to point out the possibility of fungal associated infections: a treatment in this sense must always be considered in advance. The hyperbaric treatment must be considered a weapon of considerable help available in cases of necrotizing fasciitis / gangrene but it cannot be considered "life-saving", nor it is capable of replacing the aforementioned treatments.

As regards the patient of the case report, we followed the guidelines of the literature both for diagnosis and for therapy with the conclusion that, the multidisciplinary approach is the best to perform.

**Index Terms-** Cervical abscess, cervico-mediastinal gangrene, descending mediastinitis, peritonsillar abscess, progressive necrotizing infections.

## I. INTRODUCTION

### Etiopathogenesis of the Cervical Abscess

The cervical abscesses (both peritonsillar and parapharyngeal) arise, in general, by the passage of bacteria (present at the level of the oral mucosa and of the upper respiratory tract) within the surrounding sterile sites and are frequently polymicrobial infections.

This step can occur by direct extension of a primary mucosal infections (eg. pharyngo-tonsillitis, rhinosinusitis, otitis media, especially if relapsing) or can be due to traumatic or iatrogenic lacerations or perforations. It develops between the tonsillar capsule on one side and the muscle floor and the pharyngo-basilar fasciae on the other side [1].

The peritonsillar abscess (P.T.A.) is the most common cause of suppuration of the peripharyngeal spaces, both in adults and children. The information is confirmed by U.S. studies that have shown an incidence of approximately 30 cases per 100,000 inhabitants per year, with no significant differences in gender and race [2].

The predisposing conditions are deep tonsillar crypts, supra-tonsillar recess with retention of septic material, and / or seat of an isolated lymphoreticular cluster (Tourtoral sinus).

The evolution of peritonsillar abscess [3] is currently considered the end point of a continuum which in turn contemplates:

- 1) in the first phase, an acute tonsillitis (in which the inflammatory process is localized in the tonsillar or pharyngo-tonsillar tissue with presence or absence of exudate visible on the surface);
- 2) in the second phase, a peritonsillar cellulitis (characterized by inflammation and edema of the peritonsillar soft tissues, in the absence of suppurative phenomena);
- 3) in the third phase, cellular colliquation phenomena (due to the release of leukocyte enzymes resulting in the formation of a phlegmon or of a peritonsillar abscess).

A review of the literature [4,5] indicates an important role, in the peritonsillar abscess formation, of the Weber's glands. During a oropharyngeal inflammation or obstruction of the duct by debris of food, these glands can be involved, resulting in cellulitis and the following peritonsillar abscess. This hypothesis is supported by the rare cases of recurrence of P.T.A. in patients already undergoing tonsillectomy [4,5,6]. Commensal microbiota and many different bacteria are present at the level of the oral mucosa and of the upper respiratory tract; they are responsible for mucosal infections of the cervical district which can develop into abscessual complications; these abscesses justify the diversity of bacteria that may be involved in the pathogenesis of cervical abscess.

Studies by Repanos and Brook [7,8] point out that in adults a mixed bacterial flora occurred more frequently; it is represented by anaerobic bacteria (*Fusobacterium* spp, *Bacteroides* spp, *Peptostreptococcus* spp, *micrococcus* spp.) and aerobic bacteria (streptococci, staphylococci and *Haemophilus* I.) in 76% of cases, while only anaerobes are found in 18% of cases and aerobes in 6% of cases. Other bacteria, isolated from peritonsillar and parapharyngeal abscesses, include streptococci of *Streptococcus milleri* group (*S. anginosus*, *S. intermedius* and *S. constellatus*), viridans streptococci, *H. influenzae* and anaerobic bacteria typical of the oral microbiota such as *Bacteroides* spp., *Fusobacterium necrophorum* and *nucleatum*, *Prevotella melaninogenica* and *Porphyromonas* spp. While infection by beta-hemolytic streptococci can be mono-microbial, those that involve anaerobes and other streptococci are generally polymicrobial (average number of 5 isolated species) [9,10].

In addition, beta-hemolytic streptococci, *S. pyogenes*, in particular, are a common cause, especially in the forms that occur as a complication of streptococcal pharyngitis [1].

### **Clinic of the Peritonsillar Abscess**

The clinical features are characterized by:

- fever;
- odynophagia and otalgia;
- trismus (in the anterior abscess due to the medial pterygoid muscle contracture);
- open rhinolalia (due to analgesic hypomotility of the soft palate);
- drooling;
- displacement of the tonsils (forward in the posterior abscesses, on the back in the front abscesses);
- ipsilateral lateral-cervical lymphadenopathy.

The mono-laterality of signs and symptoms is pathognomonic [3]. They arise more or less rapidly and sometimes (11-56% of cases) as an exacerbation of bilateral and widespread symptoms of an acute exudative pharyngitis [2,11]. Objectively there are edema and swelling of the soft palate, uvula, front/rear palatine pillar, dislocation and medialization of the tonsil (sometimes covered with purulent exudate) and painful lateral cervical adenopathy (level II and III), all signs and symptoms useful to distinguish a P.T.A. from a simple peritonsillar cellulitis [12,6].

### **Diagnosis of the Peritonsillar Abscess**

#### **Laboratory Tests**

As regards the laboratory tests [3], investigations show a classical neutrophilic leukocytosis, which confirms the bacterial nature of the inflammation.

The bacterial culture does not seem to be useful as a routine, given the frequent finding of a mixed bacterial flora. From 1995 to 2005 Repanos has conducted and described hospital-based studies on 119 patients from whom purulent peritonsillar material was taken; afterwards a broad-spectrum antibiotic therapy was set with an emblematic success in 99% of cases [7]. Furthermore, as previously seen [1], it is difficult to interpret the result is complicated because there are many bacterial species and they are part of the commensal microbiota of the oral cavity and upper respiratory tract, and because of the ease with which contamination can occur at the time of collection of the sample.

The tonsillar swab or the purulent material, eventually taken by needle aspiration from the abscess, may be useful only in selected cases (for example in immunosuppressed patients, patients resistant to current antibiotic therapies, etc.).

### **Diagnostic Imaging**

The diagnostic imaging allows a better definition of the P.T.A. enabling to distinguish a peritonsillar cellulitis from an abscess. The Diagnostic Imaging in the inflammatory disease of the neck and in its complications has three main objectives:

- identification of the disease (clinically suspected);
- typing the disease as inflammatory one and determining its causes;
- determination of the loco-regional space involvement (very important for surgical therapy).

The CT scan with contrast is considered the gold standard in diagnostic imaging in the majority of cervical disease (inflammatory disease and its complications) [13].

### **Therapy of the Peritonsillar Abscess**

A timely medical treatment represented by broad-spectrum antibiotics ("protected" penicillin or cephalosporins, possibly associated, in the case of persistence of symptoms within 24 hours, to metronidazole given the frequent polymicrobial nature of the abscess) [7,14,15] is necessary in each assessed abscess [3].

A surgical therapy must be associated to the medical one.

### **Complications of the Peritonsillar Abscess: cervico-mediastinal gangrene**

[16].  
The complications of P.T.A. (progressive necrotizing infections) depend on various factors such as the delay in diagnosis and the presence of impairment factors in the patient (diabetes, immunosuppression or immunodepression, poor hygiene and social conditions, smoking, etc.) that lead to more severe clinical conditions. The incidence is low nowadays, about 0,4 per 100,000 people [17] with relatively greater frequency in immunocompromised patients; in fact, several authors report isolated cases [18,19] and the authors who report a more numerous casuistry however, merely describe ten cases [20,21].

No age group is spared while preferring adulthood (30-50 years) [22,23,24,25,26,27] and male sex [28].

Some authors report that mediastinitis in antibiotic era [1], occur in 4-5% of the infections of the spaces of the neck [29,30].

The incidence of morbidity and mortality of head and neck abscesses's complications has lowered in recent decades, thanks to the advent of antibiotic therapy and the increasingly early diagnosis (permitted by the above mentioned diagnostic imaging techniques).

The cervico-mediastinal gangrene is often secondary to odontogenic infections (42% of cases) [23,31,32,20,33,25,34,35] and oropharyngeal infections (18% of cases) [36,37] or cervico-facial trauma (8% of cases) [31], and major surgery of the head and neck (1% of cases) [18,32,21,26,38,39].

Sometimes the origin is unknown [25] (variable from 20 to 80% of cases) [26,40,41,42,43,44,27,34,35,45,38,39,46] other times it is the site of previous application of radiation therapy (3% of cases).

The progressive necrotizing infections (P.N.I.) are divided into necrotizing fasciitis, progressive bacterial gangrene and myonecrosis.

The necrotizing fasciitis [47] (a term introduced by Wilson in 1952) of the neck is an inflammatory process of the soft tissues that, resulting in a fascial necrosis, allows easy and wide spread of infection along the laterocervical fasciae to the mediastinum through what may be considered "routes of least resistance". It is a rare but serious complication of P.T.A.. It is characterized by the extension of the inflammatory process to the fascial structures of the neck followed by a gangrene that spreads to the muscle-aponeurotic structures of the neck (myonecrosis), with the possibility of evolution, if not properly diagnosed and treated, in a septic state and the general spread of the necrotic inflammatory process in the mediastinum with pleuro-pericardial and pulmonary involvement (cervico-mediastinal gangrene) with exitus of the patient estimated at around 40% of cases [48,31].

The mediastinum often proves to be the seat of inflammatory processes (the so-called mediastinitis), as extremely rich in fat, which has the following characteristics:

1. it is poorly vascularized;
2. the immunocompetent cells are poorly represented [49].

The growing problem of antibiotic resistance and the increase in cases of immunosuppression have profoundly altered the clinical course of P.N.I..

Surely the prognosis of P.N.I. of the neck, as uniformly considered in the literature, depends not only from complications due to the tissue necrosis of the structures directly involved (both cutaneous and vascular ones), but also from the spread of the septic process in the mediastinum and the thoracic organs (the pleura, pericardium and lungs), which significantly increases mortality (44% vs. 7%) [31,25,21,41,50,51,37,52,53,54]. Other factors which influence the prognosis are: the delayed diagnosis [17,31,19,36,51], the patient's general condition and the existence of dis-metabolic conditions and first of all, diabetes mellitus [31,55,56], hypertension, vascular disease and the existence of the combination of underlying diseases such as kidney failure, liver disease and cardiovascular disorders [25]. Even conditions of immunosuppression, spontaneous [57] or pharmacologically induced [58], as well as smoking and alcohol abuse, or the existence of precarious social conditions and, consequently hygienic ones, may have an important role not only in determining but also in the evolution of the disease [57].

There are several controversies in the literature about the death rate, which varies from 8% to 74% [59] with a higher prevalence of values that are around 30-40% [18,23,31,36,20,25,21,41,27,54,48,60], but the cause of death is directly proportional to the state of infection and severity of any unfavorable prognostic factors.

P.N.I. of the neck and mediastinum presents itself initially as a cellulitis with edema that, in just a few hours, can reach massive proportions.

Signs and symptoms are characterized by:

- painful cervical swelling;
- chest pain;
- crepitus on palpation for subcutaneous emphysema;
- erythema of the overlying skin;
- paresthesia, ulceration (for progressive involvement of the sensitive nervous terminations);
- skin color change to dark blue (for the progressive thrombosis of the tributary cutaneous vessels);
- fever;
- tachycardia and tachypnea;
- sepsis.

The mediastinitis [61] represent a group of acute and chronic diseases, which cause a serious infection of the connective tissue that surrounds the space between the two pleura and the organs in this space. A sneaky and lethal form of mediastinitis is represented by the so-called "descending necrotizing mediastinitis" (D.N.M.) that occurs as a complication of infections arising from odontogenic abscesses or from the cervico-fascial space. As previously described, once spread at the level of cervical fascial planes, through deep contiguous spaces of the neck, the infection drops in the mediastinum, in the pleural spaces, in the pericardium and in the abdomen, causing necrosis, abscess formation and sepsis (P.N.I. of the mediastinum).

The spread of the infection occurs in the cranio-caudal direction for various reasons, including the force of gravity, the acts of breathing and the resulting changes in pressure inside the chest cavity [49,62]. In the literature it is reported that in more than 70% of cases of D.N.M. the spread of sepsis occurs through the retrovisceral space (danger space), in 8% infection originates in the neck and spreads in the mediastinum through the pretracheal space, while in the remaining cases, it spreads through the perivascular space, where the presence of arterial and venous vessels can favour the appearance of serious clinical aspects, determined by thrombosis of the jugular vein or by the erosion of the carotid artery [63]. The criteria needed to define the D.N.M. have been shown to Estrera et al. [64] and are represented by:

- 1) clinical manifestations of severe oropharyngeal infection;
- 2) characteristic radiological signs of mediastinitis;
- 3) documentation of necrotizing mediastinal infection at operation (or at postmortem);
- 4) relationship between oropharyngeal or cervical infection and development of the mediastinal necrotizing process.

### Diagnosis

Whatever the starting point and initial symptoms of the disease, the swelling of the district [24,20,65,57,66,37,52] and the presence of air bubbles, detected by clinical examination by palpation of the fascial structures of the neck [20,65,66] are pathognomonic of the necrotizing evolution of the infection and its spread to fascial structures. This clinical finding, together with the CT confirmation of gas evolution, represents an irrefutable fact of the disease.

In the case of clostridial infection, a time interval (ranging from one to six hours after the traumatic lesion tissue or surgical treatment) can occur. The patient may suffer from sudden and intense pain of the infected area before the onset of clinical signs. This apparent discrepancy between sharp pain in a still clinically normal tissue and the absence of hyperpyrexia requires extreme caution by the medician for the possible development to gangrene. The clostridial infection can rapidly spread with a speed of 15 cm per hour.

The CT scan with contrast of the chest and neck remains the best diagnostic method for patients with suspected mediastinitis, providing information on the extent of necrotizing infectious and the type of surgical approach. It is also necessary for the post-operative monitoring and to highlight any relapses requiring reoperation [63,67,26,39,55,68,52]. The CT scan initially shows an increase in the density of the mediastinal adipose tissue, and subsequently, with the evolution of the infection, the organization of numerous liquid collections, often associated with gas bubbles [69].

The "routine" diagnosis contemplates imaging and blood tests and can be considered essential in monitoring the disease even if sometimes it can not be considered definitive. In fact, the disease is often evolutionary and new purulent collections, as well as new processes of gangrene, may develop in the hours or days immediately following surgery.

The validity of microbacteriological exam of the exudate (performed on abscess or on necrotized tissues) is uncertain.

Most of the authors, while performing such investigations, don't consider them essential since, as noted earlier, often the result is negative [21,41,50,70], sometimes provides questionable results or multiple etiologies [31,36,19,33,21,35,71,72,51,55], sometimes it still allows the recognition of germs considered saprophytes or symbionts and therefore of no use in the indication of the therapeutic program to be undertaken.

It is likely that the polymicrobial participation of gram-positive bacteria (Streptococcus, Staphylococcus, Micrococcus), gram negative (Bacteroides, Neisseria, Proteus, Pseudomonas) and anaerobics (Enterobacter, Propionibacter, Peptostreptococcus) described in the literature [31,19,33,21,35,50,51,55,65] results in a mutual protection of the exogenous agents towards the phagocytic process, the intracellular "killing" and antibiotics, promoting the necrotizing evolution of the disease and thus making impossible the subsequent isolation and identification of the bacterial species involved.

### Therapy

It is widely recognized [23,31,24,36,19,33,21,35,45,39,46,51,55,57,37,52,53,56,73,74,54,75] that the surgical treatment of P.N.I. should be performed as quickly as possible (within the first 12-24 hours in accordance with the extension of the infection). On the

basis of the CT images cervicotomy may be limited to a certain district (at least in the very early forms) or extended as much as possible to other sites; most of the time a wide cervicotomy is necessary, including in some cases other districts (pectoral, neck and mediastinal-chest districts). There is broad agreement in the literature that surgical drainage of the neck and mediastinum should be considered the standard treatment for these patients [63]. In fact, the cervical drainage alone is insufficient in 80% of cases [76,62] and in a meta-analysis of Corsten et al. [77] the comparison between cervicotomy alone and cervicotomy with thoracotomy shows a mortality respectively of 47% (in the first case) versus 19% in cases with double-surgical approach [49]. In the mediastinal diffusion a thoracotomy is necessary accompanied by a pleuroscopy and by the positioning of suction drains at this level.

Patients undergoing this type of combined treatment require a contextual tracheotomy that is useful, in addition to the immediate ventilatory assistance, also for the hospitalization in intensive care. Some authors [33,53,54,78] believe that such action is necessary to ensure a patent airway and ventilatory assistance and, at the same time, to promote drainage of the peritracheal abscess, other authors [46,37,52,73] consider the tracheotomy a way of spread of the inflammatory process to the thoracic structures.

With regard to antibiotic therapy, in the absence of a bacterial culture and according to the above, the empirical treatment is recommended (combining an antibiotic active against gram positive bacteria and a specific one against gram negative and reserving the antifungal therapy to cases with proven fungal presence) [18,20,40,41,39,50,68,79,80,81,82,83].

The association of hyperbaric oxygen therapy (H.B.O.T.) is controversial. Brummelkamp et al. in 1961 were the first to hypothesize the use of H.B.O.T. in the treatment of gangrene [84,85], but until today, there are no double-blind studies on the effectiveness of H.B.O.T. in soft tissue infections. However, there are many experiments that provide useful data, even if these experiments include non-uniform clinical and anatomo-pathological conditions. In addition, there is no agreement on the program to be adopted and no clinical study regarding the protocol to be used in the hyperbaric treatment. The duration of the treatment may vary from five days (in exclusively anti-infectives treatments) to two or three weeks (for treatments that tend to provide benefits even in wound healing); the number of sessions varies from 5 to 10 in acute conditions but the number may increase in intensive therapeutic treatments such as in the case of necrotizing fasciitis / gangrene. H.B.O.T. is usually administered with a FiO<sub>2</sub> of 100%, 2 or 3 ATA for an average duration ranging from 60 to 90 minutes per session [86].

There is not even agreement on the ideal sequence of the different therapies: H.B.O.T. can be provided before, during or after surgical treatment (however, the general recommendation is that it should be started as early as possible).

Since the late 80's, with the appearance of Evidence Based Medicine (E.B.M.), a medical and technological review has been addressed in this regard.

The Study Group for the Hyperbaric Therapy of the Italian National Health Council has decided to extend the treatment with H.B.O.T. to progressive necrotizing infections, divided into progressive bacterial gangrene, necrotizing fasciitis and myonecrosis. As previously reported, in such conditions (typically polymicrobial ones), the skin, subcutaneous tissues, bands and muscles are involved in inflammation and necrosis; vessels thrombosis also is realized due to the action of bacterial toxins capable of activating enzymes such as lipase and hyaluronidase. The European Committee for Hyperbaric Medicine (ECHM), in the 7th Conference held in Lille in 2004, directed the use of H.B.O.T. in infections of soft tissues like the medical and surgical treatment [87]. Hyperbaric Oxygen Therapy is strongly recommended (recommendation based only on clinical evidence) in the treatment of anaerobic or mixed bacterial necrotizing soft tissue infections (myonecrosis, necrotizing fasciitis, etc...). H.B.O.T. should be integrated in a treatment protocol comprising adequate surgical and antibiotic therapy (Type 1 recommendation, level C). The sequential order for H.B.O.T., antibiotics and surgery is a function of the condition of the patient, the surgical possibilities and hyperbaric oxygen availability (Type 1 recommendation, level C). [88,87].

The mechanism of action of H.B.O.T. in acute infectious processes is expressed through better tissue oxygenation resulting in the stimulation of white blood cells (in their phagocytic function) and edema reduction. Furthermore, the increased levels of PO<sub>2</sub> in tissues prevent or reverse the tendency of leukocytes to adhere to vascular endothelium, thus reducing endothelial damage [89]. Once blocked the infection, H.B.O.T. enhances the formation of collagen [90] and stimulates angiogenesis, facilitating the healing of tissue lesions [91,92]. H.B.O.T. has therefore three modes of action: the "hemorheological one", that restores normal negative charges present on the red blood cells that are neutralized in the acidosis created by anaerobic metabolism of bacteria; the "barometric one", governed by the law of Boyle and Mariotte, according to which, at constant temperature, the pressure of a gas is inversely proportional to its volume, whereby in the treatment of gas gangrene H.B.O.T. reduces the volumes of gas with consequent improvement of ischemic tissue; the "bacteriostatic and bactericidal ones" [93,94], the first one against aerobic bacteria lacking the superoxide dismutase enzyme (S.O.D.) necessary to protect from the action of peroxides on lipids of their membranes, the second one against anaerobic germs that can survive in hypoxic environments where there is a depression of phagocytic functions.

The first experimental studies in the treatment of infections caused by Clostridium conducted by Brummelkamp, [84] Holland [95] and Demello [96] have shown that the best therapeutic results derive from contemporary surgical and medical treatments, associated with H.B.O.T. which has the task of stopping the production of alpha-toxin and the growth of the Clostridium in the infected but still vital tissues. To completely stop the production of alpha-toxin is required a PpO<sub>2</sub> of 600 mmHg while to kill the bacteria a PpO<sub>2</sub> superior to 1520 mmHg. [96,97]. Demello [96] and afterwards Him [98] obtained the best survival rates in experiments on animal models (that included the inoculation of anaerobic bacteria) in the integrated treatment of H.B.O.T., surgical drainage and antibiotic therapy. From their studies it appears that, for the survival, repeated surgical treatments of drainage and debridement of infected tissue are essential but an improvement in terms of survival and rapidity of healing is achieved only with the targeted antibiotic therapy in association with H.B.O.T. (Table 1)

Table. 1: Comparative study about survival with different types of treatment (experimental study in dogs), [by Demello 1973].

| Therapy                          | Survival (%) |
|----------------------------------|--------------|
| Surgery                          | 0            |
| H.B.O.T.                         | 0            |
| H.B.O.T. + Surgery               | 0            |
| Antibiotics                      | 50           |
| Antibiotics + Surgery            | 70           |
| Antibiotics + Surgery + H.B.O.T. | 95           |

Studies by Riseman [99,100,101] report inhomogeneous results that can be explained by the lack of standardization of protocols and stratification for known prognostic factors, thus making it impossible to compare the results (obtained on few cases or including patients with different degrees of severity of infections).

The following table (Table 2) reports the results of clinical trials as a function of therapy used (data from the literature).

Table. 2: Results of clinical trials as a function of therapy used (data from the literature).

| Author                           | N°. of Patients | Hospital admissions (%) | Deaths (%) |
|----------------------------------|-----------------|-------------------------|------------|
| Surgery - Antibiotics - H.B.O.T. |                 |                         |            |
| Roding, 1972                     | 130             | 101 (78)                | 29 (22)    |
| Hitchcock, 1975                  | 133             | 100 (75)                | 33 (25)    |
| Hart, 1983                       | 139             | 112 (81)                | 27 (19)    |
| Darke, 1977                      | 66              | 46 (70)                 | 20 (30)    |
| Holland, 1975                    | 49              | 36 (73)                 | 13 (27)    |
| Unsworth, 1984                   | 53              | 46 (87)                 | 7 (13)     |
| Hirm, 1988                       | 32              | 23 (72)                 | 9 (28)     |
| Gibson, 1986                     | 29              | 20 (70)                 | 9 (30)     |
| Werry, 1986                      | 28              | 21 (75)                 | 7 (25)     |
| Kofoed, 1983                     | 23              | 20 (87)                 | 3 (13)     |
| Tonjum, 1980                     | 14              | 12 (86)                 | 2 (14)     |
| Total                            | 696             | 537 (78)                | 159 (22)   |
| Surgery - Antibiotics            |                 |                         |            |
| Alterneier, 1971                 | 54              | 46 (85.2)               | 8 (14.8)   |
| Hitchcock, 1975                  | 44              | 24 (55)                 | 20 (45)    |
| Gibson, 1986                     | 17              | 5 (29)                  | 12 (71)    |
| Freischiag, 1985                 | 8               | 3 (37)                  | 5 (63)     |
| Total                            | 123             | 78 (64)                 | 45 (36)    |

### Intensive Care Management of cervico-medistinal gangrene

Given the severity of the patients, especially those with overt disease stage, an assistance with mechanical ventilation or an intensive care management is frequently necessary.

The monitoring and management of the airways prior to surgical and medical treatment of the injury, is a priority [102,103]; on the other hand, the management of these patients in the critical area, even after surgery, is advisable due to the high risk of sudden obstruction of the airways, which is one of the most frequent lethal complications [104]. The patients who reach the observation for complications (in particular for sepsis and for acute respiratory distress syndrome-ARDS), require hospitalization in intensive care before surgery because the management in critical care optimizes, as far as possible, the general conditions for the purpose of surgical treatment (that in these cases becomes multidisciplinary).

Patients with continuous analgesia, should undergo a lung protective ventilation at low tidal volume and high positive end-expiratory pressure (P.E.E.P.), which has a positive impact on the survival of patients in intensive care unlike the traditional technical ventilation, with high tidal volumes and low P.E.E.P. [105]. The invasive hemodynamic monitoring allows to optimize fluid therapy, dose of vasopressors and inotropes by monitoring the ratio between peripheral oxygen availability and its use, with a drastic reduction in mortality in patients who already have a septic state [106].

A so complex and expensive management has as objective the stabilization of vital functions more quickly and effectively as possible, such as to optimize the recovery, try to improve the outcome and reduce the length of stay for patients with abscesses.

The management of cervico-mediastinal gangrene in a hyperbaric chamber requires an interdisciplinary approach between Hyperbaric Medicine and Intensive Care as the treatment of critically ill patients in a hyperbaric chamber poses particular problems of care and monitoring.

The alterations of consciousness, cardiovascular instability, respiratory failure, are the most frequently encountered problems but they should not constitute an obstacle to the practice of H.B.O.T.; of course the resuscitation therapies must be carried out with the same safety and efficacy in a hyperbaric chamber.

If a critically ill patient must undergo H.B.O.T., it is necessary to have a multiplace hyperbaric chamber with transfer lock to allow the use of the equipment necessary for assistance and monitoring of the patient, but also the entrance in the chamber of the whole resuscitation team.

The hyperbaric chamber must be equipped with the possibility of cardiorespiratory monitoring, respiratory care, oral and endotracheal suction of secretions of the patient, etc.. in order to allow the assistance and the direct control of the patient throughout the treatment, the continuation of resuscitation therapy and the ability to immediately perform all urgent therapeutic interventions that may become necessary to ensure the main patient's vital functions: endotracheal intubation and artificial mechanical ventilation, circulatory resuscitation, fluid infusion, administration of medication, etc..

Assisted ventilation requires an adaptation to the hyperbaric environment and a series of measures. In patients intubated with cuffed tubes, as the pressure changes the volume of the cuff, this one must be filled with saline in order to avoid the continuous control of the volume of the cuff during the phases of compression (air inlet) and decompression (removal of air).

It is best to choose ventilators that have been designed specifically for the use in a hyperbaric chamber.

The ideal ventilator should be a volume cycled ventilator (current volume remains acceptably constant with increases in the pressure up to 6 ATA, the respiratory frequency is constant, there is an increase in the expiratory time during and above 2.8 ATA) that is not influenced by variations of pressure that occur inside the chamber and not working on electrical current (danger of fire).

It must be remembered that the pressure antagonizes the effects of hypnotics and muscle relaxants. Prior myringotomy should be performed in coma patients to be subjected to hyperbaric therapy. Before introducing patients with respiratory disease in the hyperbaric chamber, you must be sure of the absence of pneumothorax. The presence of the transfer lock allows, in case of need, the input of further personnel in the chamber. In addition, the medical lock allows at any time, the rapid introduction into the room of everything that may be needed [107,108,109,110,111,112].

## II. RESEARCH ELABORATIONS

### Case Report

The case report regards a 22 year old man with no past medical history except for an allergy to Amoxicillin-Clavulanate, no history of use of illegal drugs or alcohol.

The patient manifested sore throat, dysphagia and fever (39,5°C). The initial diagnosis was "severe oropharyngeal infection". After two days of onset of symptoms, the patient began an empiric antibiotic therapy with Clarithromycin (500mg/die).

On 06 June, 4 days after the onset of symptoms and two days after the beginning of antibiotic therapy he was hospitalized in the department of otolaryngology because of the worsening of symptoms.

A clinical examination showed the presence of purulent exudate on both tonsils, a left laterocervical swelling with bruised and hyperemic skin. The swelling was greatly painful on palpation.

On 07 June an endoscopy of the upper airways showed edema of the left aryepiglottic fold.

The laboratory tests at the time of admission were as follows: white blood cell count 13.660/microliter with 90% of neutrophils, erythrocyte sedimentation rate (E.S.R.) 49 mm/hour. Pulse rate was 120/min.

On 07 June the TC scan with contrast of the neck showed: "an abscess, in the context of the left deep laterocervical tissue, that obliterates the left pyriform sinus and the ipsilateral laryngeal vestibule; marked and diffuse thickening and edema of the soft tissues of the left lateral cervical region of the neck and upper mediastinum, high number of lateral cervical and submandibular lymph nodes predominantly to the left. "

Broad-spectrum intravenous antibiotics were administered (Teicoplanin 400mg/die , Levofloxacin 500mg x2/die and Metronidazole 500mg x4/die). The patient underwent urgent surgery (left cervicotomy and drainage of the pharyngeal abscess).

On 08 June the patient presented worsening dyspnea, severe hypoxemia and respiratory acidosis at the blood gas analysis (pH 7.27, PCO2 57 mmHg, PO2 45 mmHg, Sat 80% with oxygen mask), at the ECG there was an elevation of ST segment, the blood pressure was 160/100 mmHg, procalcitonin (PCT) 15,66 µg/L, C-RP 53,90 mg/L.

On the same day, the patient was intubated, the femoral vein was cannulated, 1500 mL of crystalloid and colloid were administered. A neck and chest CT scan was performed; it showed: "outcomes of cervicotomy with the presence of minute air bubbles and drainage,

marked edematous thickening of the walls of the oropharynx, hypopharynx, larynx, parapharyngeal spaces and subhyoid muscles; massive phlegmon extended to all the mediastinal spaces until esophageal jato; pericardial and pleural effusion with imbibition of pulmonary interstitium and alveolar commitment. "

He was transferred to the Intensive Care Unit (I.C.U.). A new antibiotic/antimycotic therapy was started (Penicillin G sodium 45.000.000 UIx2 continous infusion, Metronidazole 500mg x4/die , Teicoplanin 400mgx2/die, Meropenem 1,5g x 4/die, Caspofungin 70mg/die). The patient had obviously a bladder catheter.

The patient was transferred to the Thoracic Surgery Unit where he was subjected to right thoracotomy with intake of 600 ml of purulent fluid,the opening of the anterior, medium and posterior mediastinum with leakage of purulent fluid, the washing of the pleural cavity, double right pleural drainage (one at the top level and another one in the anterior subapical thoracic area), single left pleural drantage and surgical tracheotomy.

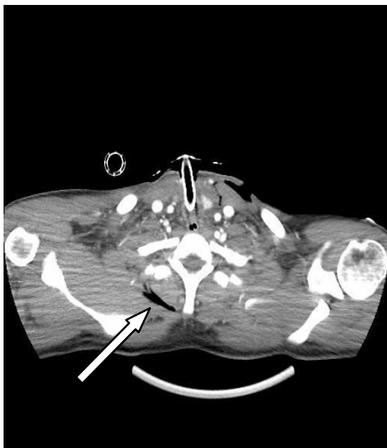
The patient fulfilled the Estrera's criteria for diagnosis of D.N.M.

The microbiological examination of the material from the abscess cavity and the pleural fluid was negative.

On 09 June he performed a CT scan with contrast that showed: "the presence of air bubbles in the bilateral parapharyngeal soft tissue, reduced mediastinal collections, unchanged pericardial collections, reduced pleural effusion with better ventilation of the lung; air bubbles in the context of the back muscles at the level of C6 extending in the subscapularis area, bubbles along the costal muscles of the anterior and lateral chest wall extending along the muscles of the abdominal wall into the pelvis together with collections of fluid material, presence of fluid in the under-mesocolic area".



Picture 1 (CT scan on 09 June): mediastinal collection, pericardial collection.



Picture 2 (CT scan on 09 June): air bubbles in the context of the back muscles at the level of C6 extending in the subscapularis area.



Picture 3 (CT scan on 09 June): bubbles extending along the muscles of the abdominal wall.

The patient underwent a surgical revision of the right lateral retropharyngeal region, a right cervicotomy with evidence of a diffuse cellulitis of the adipose tissue.

The laboratory tests were as follows: white blood cell count 10.330/microliter with 94% of neutrophils, C-reactive protein (C.R.P.) was 333 mg/L, Creatine Phosphokinase (C.P.K.) 670 UI/L, Myoglobin 1037 ng/ml.

Given the development of the CT scan and of the laboratory tests, on 09 June, after verification of fitness to the hyperbaric treatment, the patient began H.B.O.T. at 2.8 ATA in accordance with a protocol that included three treatments in the first 24 hours, then one treatments every twelve hours for the next two days, and daily in the following days. Each session contemplated the respiration of 60 minutes of oxygen (FiO<sub>2</sub> of 1) at 2.8 ATA. The choice of each treatment, as far as the air breaks concern, was influenced by the hemodynamic instability of the patient.

After the fourth session (11 June) the CT scan already revealed: "reduction of fluid collection in the lateral cervical structures and reduction of air bubbles in the parapharyngeal soft tissues. In the dorsal right area, disappearance of air bubbles in the context of the lower back muscles persisting along the muscles of the right abdominal wall and a small bubble in the pelvic region".

The laboratory tests showed an improvement: white blood cell count 8.360/microliter with 80% of neutrophils, C-reactive protein (C.R.P.) was 83 mg/L, Creatine Phosphokinase (C.P.K.) 249 UI/L, Myoglobin 200 ng/ml.

On 12 June he performed only one session of H.B.O.T. at 2.8 ATA (the second session was aborted because of problems with the hyperbaric ventilator).

After the 7th session (13 June) the TC scan highlighted: "reduced parapharyngeal bubbles, bubbles near the surgical breaches, no deep lateral cervical fluid collections, reduced the bubble in the right anterior abdominal wall. Small left average apical pneumothorax (P.N.X.)". PNx was not confirmed at the following TC scan.

The laboratory tests were as follows: white blood cell count 11.000/microliter with 80% of neutrophils, C-reactive protein (C.R.P.) was 42 mg/L.

Given the improvement, the patient began H.B.O.T. at 2.5 ATA.

Given the continuous improvement of the infection in the TC scan (performed on 15 June after the ninth session of H.B.O.T.) (no more obvious parapharyngeal bubbles, no more deep lateral cervical fluid collections, no more abdominal bubbles) and in the laboratory tests and the occurrence of frontal, sphenoid and maxillary sinusopathic complications arisen with epistaxis and otorrhagia during the last session of H.B.O.T. and, above all, pulmonary complications (a picture suggestive of pulmonary edema, pulmonary interstitial congestion, discrete pleural effusion and increased right basal pulmonary parenchymal consolidation), we decided to suspend H.B.O.T. after nine sessions in seven days.



Picture 4 (CT scan on 15 June): pulmonary edema, pulmonary interstitial congestion, discrete pleural effusion and increased right basal pulmonary parenchymal consolidation.

Upon arrival at the Hyperbaric Unit, before entering the hyperbaric chamber, the cuff of the endotracheal tube was filled with saline solution, the hyperbaric ventilator was connected to the chamber, to the pulse oximeter and to the monitor located outside the chamber; the containers of the pleural drainage had one-way valves and were clamped in compression and then declamped during the therapy and in decompression.

During the hyperbaric therapy the sedation, by continuous infusion, was increased with bolus of analgesics and curare and the continuous infusion of Penicillin G was kept on. The patient had always strong hypertension and tachycardia (in normobarism too) treated in the beginning with endovenous infusion of Clonidine then with Ramipril 5mgx2/die and Bisoprolol Fumarate 1,25mg/die.

Inside the hyperbaric chamber a hyperbaric ventilator of the type "SIARE Hyper 60-VF" was used. The Hyper-VF 60 Siare is an electronic time-cycled pneumatic ventilators (T.C.P.) able to provide constant volumes per minute (from 1 to 6 ATA).

The ventilator is equipped with a control circuit in the electro-pneumatic module that automatically modifies the initial pressure depending on the depth. The depth is measured by an absolute pressure transducer that reports, to the control modules, the intensity of the variations. An electric current at very low voltage (6 volts) is ensured by a special battery that lasts 8 hours, and that is easily replaceable. The initial differential pressure is 3.5 ATA.

The assistance inside the hyperbaric chamber was guaranteed by a hyperbaric doctor and by a nurse; an intensivist, outside the chamber, followed the vital parameters on the monitor and modified the therapies depending on the needs; the hyperbaric doctor controlled the ventilation and the arterial blood pressure (due to hypertension, frequent pharmacological interventions during hyperbaric therapy were necessary).

There was no need to aspirate the secretions from the endotracheal tube. The entrance of the intensivist in the hyperbaric chamber was never necessary. During the transports to the Hyperbaric Unit continuous monitoring of vital signs, infusion therapy and manual ventilation with "flow-inflating bag" were ensured.

During all the period of stay in the ICU, the patient underwent a lung protective ventilation at low tidal volume and high positive end-expiratory pressure (P.E.E.P.), a continuous analgosedation with Midazolam and Remifentanyl (Target: Ramsay score 2-3), fluid therapy guided by hemodynamic monitoring; the patient did not require isotropics or vasopressors, maintaining a hyperdynamic circulation. Culture tests were carried out from peripheral and central sites; all of them were negative except for bronchial secretions which were positive for *Acinetobacter Baumannii* after 10 days from the admission (the patient was treated with Colistin-Polimixine E 4.500.000 UIx2/die for 10 days and then continued the therapy in the Thoracic Surgical Unit). The body temperature was continuously monitored and treated with physical cooling (mattress) and pharmacological means; the pericardial effusion was monitored by serial echocardiography; an adequate metabolic support, protection from stress ulcers and from deep vein thrombosis (DVP) were ensured.

On 22 June the patient was in good clinical condition; he began oral feeding, the analgosedation was reduced. The laboratory tests were as follows: white blood cell count 7.250/microliter with 78% of neutrophils, C-reactive protein (C.R.P.) was 75 mg/L, Creatine Phosphokinase (C.P.K.) 129 UI/L, Myoglobin 96 ng/ml. Penicillin G sodium was suspended, Teicoplanin was reduced (400mg/die); the administration of Meropenem, Metronidazole and Caspofungin remained unchanged.

In the following days there was a progressive and unjustified deterioration: on 27 June the patient met the S.I.R.S.'s criteria for sepsis (pulse rate more than 90/min, body temperature more than 38 °C, tachypnea, white blood cell count less than 4000/ microliter) and showed leucopenia, neutropenia and thrombocytopenia (bone marrow aplasia due to Metronidazole?). The antibiotic therapy was modified (Meropenem, Teicoplanin and Caspofungin remained unchanged, Metronidazole was suspended); the patient began a therapy with Gentamicin 240mg/die and Clindamicin 600mg/die).

On 30 June CT scan showed: a reduced parapharyngeal fluid collection, reduction of air bubbles on the right side of the pharynx, of the lower mediastinal collections, regressed air bubbles in the lower anterior mediastinum, reduced pleural effusion, increased pulmonary parenchymal consolidation, thrombosis of the right internal iliac vein and of the right femoral vein.

On the same day a worsening of the laboratory tests (as far as leucopenia, neutropenia and thrombocytopenia concerned) was observed. Gentamicin, Teicoplanin and Meropenem were suspended, Clindamicin was increased to 600 mgx4/die. The patient was treated also with Linesozid 600 mg/die and Levofloxacin 500 mgx2/die.

On the 25<sup>th</sup> day of recovery in the Intensive Care Unit (on 02 July), for the persistent fever, the presence of signs of sepsis and high value of endotoxin, the patient started a therapy with Toraymyxin-Polimixine B and in the same time he underwent a C.P.F.A. (Coupled Plasma Filtration Adsorption) for five days.

On the 26<sup>th</sup> day of recovery a haemocolture showed a candidemia (even if the patient was being treated with Caspofungin 70 mg/die); the patient started a therapy with Amphotericin B 3mg/kg/die that was continued for 15 days with favorable outcome.

### III. RESULTS AND FINDING

The patient was discharged from Intensive Care Unit on 15 July, after 38 days of recovery and in good clinical conditions, and was transferred to the Thoracic Surgical Unit.

### IV. DISCUSSION

P.N.I. is a severe infection of the cervical district; it is rarely observed in clinical practice, it is fast-spreading and with a multi-regional involvement and can affect any age of life. The odontogenic origin of the infection is the most frequent, but fasciitis can also arise as a complication of inflammation of the oropharynx and any other infectious disease in the neck if neglected.

The first clinical signs and symptoms are attributable to the organ that is initially affected by the infection. The septic fever always accompanies the infection, although often the discrepancy between the inflammatory process and the general state of the patient leads to underestimate the severity of the infection.

The diagnosis as well as on clinical data must make use of CT scan, the only exam able to document the disease status and the progression of the infection. The CT scan is also useful in monitoring the progression of the disease (other foci of necrosis frequently appear after a first operation of drainage).

The surgical drainage should be performed as early as possible (no later than 24 hours from the diagnosis) when the presence of the collections has been documented, as the disease evolves in the caudal direction and then quickly affects the mediastinum and the organs contained in it.

The cervicotomy is the treatment to be carried out and may be limited to a single district if gangrene is caught at an early stage, but it must involve all levels of the neck, and even beyond, when the inflammation is wide, or is spreading to the neck or pectoral region.

The tracheotomy must accompany the cervicotomy when there is a condition of shortness of breath or when the disease state suggests that an appropriate ventilatory assistance will be necessary in a short time.

The surgical procedure should be accompanied by appropriate antibiotic therapy to be practiced, most of the times, in an empirical way as the germs responsible for the infection are rarely identified and as the initial etiological factor often remains the only cause of the gangrene. Therefore it is essential, more than the use of a single drug, the pharmacological association of drugs having elective spectrum towards Gram-positive germs with those directed to treat infections by Gram-negative germs and also anaerobes. It is important to consider the possibility of fungal associated infections sometimes with immediate onset, sometimes late-occurring probably favored by the patient's stay in the intensive care environment. A treatment in this sense must always be considered in advance.

In agreement with what was found in the literature, the bacterial culture has non been able to isolate any pathogen and thus was of no help for the etiopathogenetic aspect. The diagnosis of cervico-mediastinal gangrene was placed according to clinic and to CT scan with contrast. In this case report, many of the bubbles identified on CT scan were iatrogenic (drainage, surgery) and only few isolated bubbles (with doubtful prognostic value) were highlighted. The CT scan was performed repeatedly during the therapy to monitor the evolution of the disease. A multidisciplinary approach (surgery, antibiotics, H.B.O.T. and intensive care) has been applied. H.B.O.T. has been suspended after the ninth session for the occurrence of complications to the upper and low airways. A clinical improvement was seen after the start of H.B.O.T., but its specific role in this improvement is difficult to be estimated.

Here comes the most crucial step for your research publication. Ensure the drafted journal is critically reviewed by your peers or any subject matter experts. Always try to get maximum review comments even if you are well confident about your paper.

### V. CONCLUSION

The necrotizing mediastinitis has an insidious onset; indeed it has affected a patient without apparent risk factors who had already begun an antibiotic therapy (this fact emphasizes the remarkable antibiotic resistance). The patient fulfilled Estrera's criteria for clinical and radiological manifestation of mediastinitis. Diagnosis was possible thanks to the TC scan. A multidisciplinary approach was necessary. The cervicotomy was promptly performed, a broad-spectrum antibiotic therapy was begun and the hyperbaric therapy was carried out together with an intensive care. This multidisciplinary approach led to a favorable outcome. Hyperbaric therapy, which started according to the established protocol, continued with some changes: at the third day of treatment, for a technical problem of the ventilator, the patient underwent only one treatment. The seventh and the eighth sessions were performed at 2.5 ATA and after the ninth

session H.B.O.T. was stopped because of the upper and lower airways complications and because of the improvement of the cervico-mediastinal lesions documented with CT scan. It is not possible to estimate the exact role of H.B.O.T. in the outcome of the patient.

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# Constraints and Growth Potentials of Micro and Small Enterprises: Case from Mekelle City

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**Abstract-** This study examines the constraints and growth potentials of micro and small enterprises. To undertake this study primary data were collected through well-structured and self-administered questionnaire to a sample of 85 micro and small-scale enterprises operated in Mekelle City. In order to explore the relationship between the explanatory variables with the dependent variable different econometric models like multiple regression to examine the growth of MSEs is associated with different constraints and logit model to analyzes how and to what extent the operators' socio-economics characteristics affect the income growth potential of enterprises were applied. The study result indicated that micro and small enterprises employment growth was significantly affected by constraints like current capital, current employment level, start up employment level, access to business services, and by motivation of the enterprises. Moreover, age, sex, experience access to finance and motivation of the enterprises affect growth potential of enterprises income. Therefore, these results highlight that the growth of MSEs in the study area are highly influenced by the specified business constraints.

**Index Terms-** Growth Potential, MSEs, and Constraints

## I. INTRODUCTION

In Ethiopia, the role of micro and small enterprises (MSEs) in the socio-economic development as a means of generating sustainable employment and income is increasingly recognized. The MSEs sector is the second largest employment generating sector for the poor households following the agriculture sector. According to the Central Statistical Agency (2003), almost 50% jobs created in Ethiopia are attributable to small business enterprises. The study conducted by Aregash (2005) revealed that 98% of business firms in Ethiopia are micro and small enterprises out of which micro enterprises represent 65% of all business. According to Central Statistical Agency (2003), in Ethiopia, there were 974,676 micro and 31,863 small enterprises are established, which accounts for 99.40% and 0.46% respectively. Large and medium enterprises that hired more than ten employees were 642 accounting for the remaining 0.14%. In addition, micro enterprises and small enterprises provide employment opportunities to 89.75% and 0.91% respectively (CSA, 2003). Large and medium enterprises on the other hand accounted for about 9.34% and 0.91% of individual employment respectively (CSA, 2003). In Tigray there were around 72,259 MSEs as of 2008 and in Mekelle there were 20,409 MSEs only as of 2008 (BoTI, 2008). Female entrepreneurs' in particular own majority of MSEs that

exist in Tigray in general and in Mekelle, this accounts around 55% and 52% of MSEs in Tigray and in Mekelle respectively (BoTI, 2008).

Despite the fact that micro and small enterprises have been recognized as a major contemporary source of employment and income in a growing number of developing countries, yet relatively little is known and emphasized about the characteristics and growth of these enterprises. In a study by Eshetu and Mammo (2009) it is reported that 98% of business firms are micro and small enterprises out of which small enterprises represent 65% of all businesses. The fact that the majority of enterprises are micro and small indicates that established enterprises find it difficult to grow to the next stages of middle and large scale industries. Many of the MSEs in Mekelle are unable to realize their full potential due to the existence of different factors that inhibits their growth and performance. Thus, critical assessment of the association between growth and constraints of enterprises is needed so as to achieve the contributions of their growth to the city's economy by overcoming a series of constraints they are facing. Therefore, the objective of this study is to identify the constraints of micro and small scale enterprises and to assess the growth potentials.

## II. MATERIALS AND METHODS

### 1. Data Sources

The data for the study was collected both from primary and secondary sources. The main source of primary data was the micro and small-scale enterprises survey. Structured questionnaire was used to collect information on various aspects of enterprises. Pertinent secondary data was also collected from respective bodies.

### 2. Data Gathering Tools

Appropriate structured questionnaire was prepared and used to collect primary data through enterprises survey. The questionnaire included questions related to attributes of ownermanagers of the enterprises, enterprise characteristics, and enterprise information such as capital, business activities, competition, employment, sales, and business growth. Moreover, the survey questionnaire also included questions related to constraints and problems in business environment such as access to finance, working premises, infrastructure, business development services as well as policy environment and institutional linkage.

In this study, two stage sampling procedure was used. At the first stage, the city categorized in to seven strata based on sub

city administration. In the second stage, a representative proportional sample enterprises randomly drawn from each sub city. Hence, the data were collected from Kedamay Woyane, Adi Haki, Ayider, Hadinet, Hawelti, Quiha and Semein. The data were collected mainly from a sample of 85 enterprises. Specifically 10, 15, 12, 10, 13, 14 and 11 sample enterprises were taken respectively.

### III. METHOD OF DATA ANALYSIS

Both quantitative and qualitative data analysis techniques have been employed to analyze the data collected from primary and secondary sources. The study used statistical tools including descriptive statistics as well as econometric model for the analysis as briefly described below.

**Descriptive Analysis:** Descriptive analysis such as percentage, average and measures of central tendencies and dispersions will be used to make analysis in the form of tables or graphs. To supplement the data collected through questionnaires, qualitative information was collected through focus group discussions and key informant interviews.

**Econometrics Model:** In measuring employment growth, although theoretically alternative measurement tools such as growth rate of sales or profits could give precise results, in practice they are not as credible as the employment growth measure because of entrepreneurs' hesitation to report the true values of their sales and profits. This hesitation, which leads to measurement errors, makes the employment based measure preferable in studies considering enterprise growth. Moreover, in a relatively high inflationary economy, avoiding data in value terms is preferable, so using the employment growth rate as the measurement tool is beneficial. In addition, taking employment as measure of enterprises growth needs to be consistent with the goal set for the sector. In this study, therefore, the growth rate of the number of persons engaged is used as growth measure.

Therefore, employment is the most preferred measure of enterprise growth. So that in this part of analysis, growth in terms employment is applied. The critical issue here is how the dependent variable employment growth is defined. Thus, before specifying the model of multiple regression analysis, let's first discuss about growth measures on employment that have been used in the literature. Employment growth is defined in a number of ways. According to Liedholm and Mead (1999) there are three ways of defining employment growth. These are annual compound growth rate measured in percent, average annual growth rates measured in percent and average annual growth in jobs since start up measured in number of jobs created. The compound annual growth rate (CAGR) is a rate of growth that tells what an enterprise growth in employment over the years on an annually compounded basis is measured in percent and its formula is presented as follow:

$$[(CE / IE)1/ EA -1] \quad (1)$$

The average annual growth rate (AAGR), which is the average increase in the employment over the years since start up measured in percent, is calculated as:

$$[(CE - IE) / IE] / EA \quad (2)$$

The average annual growth in jobs since start up which is measured in number of jobs created per enterprise is calculated as:

$$[(CE - IE) / EA] \quad (3)$$

In several studies of employment growth compound annual growth rate is preferred for measuring employment growth than average, growth rates or number of changes in employment since start-up. The use of CAGR permits a much more precise assessment of the timing of employment growth effects (Liedholm and Mead 1999). Thus, in this study CAGR is employed so as to measure employment growth in particular and growth of enterprises in general.

In this part of analysis, a multiple linear regression was used to test whether or not the key independent variables were related to the dependent variable. In multiple linear regression models, the dependent variable is explained by means of a set of independent variables. The multiple linear regression analysis was chosen because growth measure, annual compound growth of enterprises, used as the dependent variable takes a continuous measure.

Now we are in a position to formulate the MSE growth model. Thus, the cross-sectional estimation for the constraints and determinants of growth is conducted through the following specifications: Enterprise growth is as a function of constraints and control variables

$$\text{Enterprise growth} = f(\text{current capital, startup capital, current employment, startup employment, finance source, motivation, access to business, family size, education, experience, sex, age}) \quad (4)$$

The general multiple linear regression model is then specified as:

$$\text{Entgrowth} = \beta_0 + \beta_1 \text{ current capital} + \beta_2 \text{ startup capital} + \beta_3 \text{ current employment} + \beta_4 \text{ startup employment} + \beta_5 \text{ finance source} + \beta_6 \text{ motivation} + \beta_7 \text{ access to business} + \beta_8 \text{ family size} + \beta_9 \text{ education} + \beta_{10} \text{ experience} + \beta_{11} \text{ sex} + \beta_{12} \text{ age} + \epsilon \quad (5)$$

Where  $\beta_0, \beta_1, \beta_2$  and  $\beta_{12}$  are parameters to be estimated, while ' $\epsilon$ ' the error term and  $\beta_0$  is constant. The terms entgrowth is enterprise employment growth, the dependent variable. And the term n stands for a respective enterprise.

Regression models that include yes or no type of response are known as dichotomous or dummy dependent variable regression model were applied in the study in which the determinants of an event happening or not happening are identified. They are applicable in a wide variety of fields and are used in survey data. Among the methods that are used to estimate such models, as indicated by Gujarati (2006) are the linear probability model (LPM), the logit model, and the probit model.

These methods are used to approximate the mathematical relationship between explanatory variable and dependent dummy variable, which is always assigned qualitative values (Gujarati, 2006; Maddala, 1999). The LPM is the simplest of the three models to use but has several limitations, namely, non-normality of the error term, and the possibility of the estimated probability lying outside the 0-1 bounds. Even if these problems are re-

solved, the LPM is not a very attractive model in that it assumes that the conditional probability increases linearly with the values of the explanatory variables. So that the fundamental problem with the LPM is that it assumes that the marginal or incremental effects of explanatory variables remain constant throughout, which seems patently unrealistic (Gujarati, 2006).

Thus, due to the limitation of the LPM there is a need to have an appropriate model in which the relationship between the probability an event will occur and the explanatory variable is non-linear. The most common probability models that fill the identified gaps in LPM are the logit and probit models, which has the S-shaped of the cumulative distribution function (CDF). The Logit model is based on the logistic CDF where as the probit model is the normal CDF and both models guarantee that the estimated probabilities lie in the 0-1 range and that they are non-linearly related to the explanatory variables. The logistic and probit formulations are quite comparable; a chief difference being that logistic has slightly flatter tails that is a normal curve approaches the axes more likely than logistic curve. Therefore, the choice between the two is one of the mathematical convenience and matter of choosing between the cumulative distributions functions (Gujarati, 2006).

To determine the relationships of business constraints that affect MSEs operator perception on growth potential of enterprises income by asking the operators about the income situation of the enterprises (that is, whether it increased, remained the same or declined). To measure the perception of respondents on income of the enterprises the dummy variable is constructed as dummy one if an enterprise experiences growth in income and zero otherwise.

Therefore, the model indicates the probability that enterprise will experience growth in income given the different explanatory variables constraints and control variables. Thus, the logit model on the conditional expectation of the growth potential of income given explanatory variables specified.

Following Green (2003), and Gujarati (2006), the logit model for extension participation determinant specified as follows:

$$P(Y_i = 1/x) = \frac{1}{1+e^{-(\beta_1 x_i)}} \quad (6)$$

For ease of the expression this can be written as follows,

$$P(Y_i = 1/x) = \frac{1}{1+e^{-Z_i}} \quad (7)$$

Where: P (Yi=1/X) is the probability that MSEs income being increased or not, Zi= the function of a vector of n explanatory variables, e- represents the base of natural logarithms and equation (7) is the cumulative logistic distribution function.

If P (Yi=1) is the probability of MSEs income being increased, then 1- P (Yi=0) represents the probability of MSEs income being constant or declining and is expressed as:

$$1- P (Yi=1) = 1- \frac{1}{1+e^{-Z_i}} = \frac{1}{1+e^{Z_i}} \quad (8)$$

$$\frac{P (Yi=1)}{1- P (Yi=1)} = \frac{1+e^{Z_i}}{1+e^{-Z_i}} = e^{Z_i} \quad (9)$$

Equation (9) simply is the odds ratio, the ratio of the probability that enterprises income being increased to enterprises income being either constant or declining. Taking the natural logarithm of equation (9), we can get:

$$L_i = \ln \left( \frac{P (Yi=1)}{1- P (Yi=1)} \right) = Z_i \quad (10)$$

Where Li, is log of the odds ratio, which is not only linear in Xi but also linear in the parameters. Finally, by introducing the stochastic disturbance term (Ui) we get the logit model that is given as:

$$Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + U_i \quad (11)$$

Where: X's = are explanatory variables that determines MSEs income growth or not, β0 is the constant term and β's are coefficients to be estimated.

In this study, therefore, the logit model is customized by the equation (11) in order to analyze how various different factors affecting MSEs income growth. The empirical model for MSE income growth or not is specified as follows:

$$P (\text{Incomegrowth} = 1 / x) = \beta_0 + \beta_1 \text{age} + \beta_2 \text{sex} + \beta_3 \text{experience} + \beta_4 \text{education} + \beta_5 \text{enterpriseage} + \beta_6 \text{accessstofinance} + \beta_7 \text{access-business} + \beta_8 \text{familysize} + \beta_9 \text{motivation} + \varepsilon$$

#### IV. DEFINITION OF VARIABLES USED IN MODEL

##### Dependant variable

In the logit model, income growth has been designated by 1 if the enterprises income increased and 0 if otherwise (when enterprises income decline and constant). In a multiple regression model the dependent variable is employment growth regressed as dependent variable with the independent variables mentioned and the hypothesized in the table below.

**Table 1: Definition, Hypothesis of Variables Used in the Model**

| Variable name | Type       | Definition   |
|---------------|------------|--|
| age           | Continuous | Age of the operators' of micro and small scale enterprise                          |
| sex           | Discrete   | Gender of the operator, It takes a value 1 if sex of respondent male, 0 otherwise. |
| experience    | Continuous | Experience of the operator measured in years, it takes a value greater than zero   |
| education     | Discrete   | Education level of the operator that is a dummy                                    |

|                            |            |  |
|----------------------------|------------|--|
|                            |            | variable takes a value 1 if the respondents are literate either from formal or informal education and 0 otherwise. |
| enterpriseage              | Continuous | Enterprise age is measured since the start of the business enterprise  |
| accessstofinance           | Discrete   | A variable takes a value 1 if the enterprises have access for finance and 0 otherwise.                             |
| accessbusiness             | Discrete   | It takes a value of 1 if an enterprise has access to business counseling and advice and 0 otherwise.               |
| familysize                 | Continuous | Family size of the operator  |
| motivation of the operator | Discrete   | Motivation =1 if the operator self motivated otherwise 0   |
| financesource              | Discrete   | Finance source of the enterprise 1 if own source 0 otherwise   |
| startupemployment          | Continuous | The number of workers at the beginning of the operation  |
| currentemployment          | Continuous | Existing number of workers   |
| startupcapital             | Continuous | Initial working financial capital  |
| currentcapital             | Continuous | Existing capital of the enterprise   |

V. RESULT AND DISCUSSION

The result and discussion parts are divided in to two: descriptive and econometric analysis. In the first section of descriptive analysis, the characteristics of micro and small scale owners' attributes and the enterprises' characteristics will be explained using the summary statistics. Then, determinants of the income and employment growth of the enterprise are analyzed based on different economic models.

1. Characteristics of Sample Micro and Small Scale Enterprises

This study focuses on the 85 micro and small scale enterprises located in Mekelle City in all seven sub city that responded to all questions. Regarding the MSEs' socio economics characters tics as shown in table 2 and 3 below, out of the total 65.88% of the enterprises were owned by women and the rest 34.12% of enterprises were operated by men. This indicates that women's participation in the business activities particularly in heading the enterprises is relatively higher than their counterparts. However, past studies indicated that only 19% of the business operators are females (G/egziabher and Demeke, 2004). This may be attributed mainly to the government's action to increase women participation in micro and small-scale enterprises that is part of growth and transformation plan. The owner lowest age is 20 while highest age is 54, and thus the mean age is 33.6. This shows that since the sector absorbs more of the young labor force as one objective of the sector, creating

employment opportunity mainly to the young is achieved. Only 28.3 % of the operators had no any school education and the majority i.e 71.77% had either formal or informal education. It obvious that as individuals makes effort on education, the possibility of being entrepreneur is very high. This is the reason why the participation of educated people in these sample micro and small enterprises revealed. The mean value of experience of owner managers is about 3.83 years. The lowest and the highest years of experience of the owner-managers are 1 and 12 respectively. Among those who have experience, some of them had related experience and some others had experience in a different sector. In most cases, having experience in business activities is the main factor for the success or failure of a particular business sector. In addition, 55.29% of the owner of micro and small-scale enterprises started their business because they wanted to be self-employed and the rest 42.35% of them engaged in micro and small-scale enterprises using the chance created by the government. Sometimes people explain their reasons why they join micro and small enterprises as there are work freedom if they are self-employed than being salaried. This could also be the reason for those who are engaged in micro and small enterprises in mekelle city. In addition, the government of Ethiopia is expanding micro and small enterprises as a panacea to reduce an employment and poverty in the country. By using this opportunity as a road to start business, many people have been participating in small and micro enterprises.

Table 2: Summary Statistics of Discrete Explanatory Variables

| Explanatory Variables | Obs. | Freq. | % |
|-----------------------|------|-------|---|
|-----------------------|------|-------|---|

|                       |            |    |    |       |
|-----------------------|------------|----|----|-------|
| <b>sex</b>            | female     | 85 | 56 | 65.88 |
|                       | male       |    | 29 | 43.12 |
| <b>education</b>      | illiterate | 85 | 24 | 28.23 |
|                       | literate   |    | 61 | 71.77 |
| <b>acesstofinance</b> | no         | 85 | 52 | 61.17 |
|                       | yes        |    | 33 | 38.83 |
| <b>accessbusiness</b> | no         | 85 | 43 | 50.58 |
|                       | yes        |    | 42 | 49.42 |
| <b>motivation</b>     | self       | 85 | 38 | 44.70 |
|                       | other      |    | 47 | 55.29 |
| <b>financesource</b>  | self       | 85 | 49 | 57.64 |
|                       | other      |    | 36 | 42.35 |

Source: own survey 2013

Table 2 shows that the mean number of workers at start-up and current time for sample micro and small scale enterprises are 7 and 9 respectively; the range varies from 1 to 23 for start-up employment and from 1 to 51 for employment at current-time. This shows that the mean of the employment currently exceeds that of employment at start up only by two employees. The mean

capital of micro and small-scale enterprise during their start-up was Br. 11,283.26 and the current average capital is Br. 29,221.63. The range also varies from Br. 400 to 130,000 for the start-up and from as low as Br. 650 to maximum of Br.650, 000 for current time.

**Table 3: Summary Statistics of Continuous Explanatory Variables**

| Variables         | Obs.* | Mean      | Std. Dev. | Min. | Max.   |
|-------------------|-------|-----------|-----------|------|--------|
| age               | 85    | 33.6      | 9.50      | 20   | 54     |
| experience        | 85    | 3.83      | 4.32      | 1    | 12     |
| enterpriseage     | 85    | 3.68      | 3.19      | 1    | 19     |
| familysize        | 85    | 3.75      | 2.06      | 0    | 11     |
| startupemployment | 85    | 7         | 4.36      | 1    | 23     |
| currentemployment | 85    | 9         | 7.05      | 1    | 51     |
| startupcapital    | 85    | 11,283.26 | 16656.95  | 400  | 130000 |
| currentcapital    | 85    | 29,221.63 | 54463.78  | 650  | 650000 |

Source: own survey 2013

## 2. Influential Factors Affecting the Income Growth of Micro and Small Scale Enterprises

Factors inhibiting the growth of micro and small Enterprises income growth were investigated in this section. Thus, a logit model analysis has applied to investigate factors that affect income growth of enterprises. Thus, a set of explanatory variables have used in this analysis. The estimation results of the binary logit regression are presented in table 4. Regarding the overall significance of the model, the computed log likelihoods, chi-square values and the corresponding probability value show

that the overall model is significant and explains the observed behavior. Having this statistically significant over all model, the estimation result of the table depicts that the first three variables age, sex and experience are significantly and positively affects the income growth potential of enterprises. These variables are statistically significant at 1%, 5% and 5% respectively. Moreover, access to finance and motivation of the micro and small-scale enterprises positively affects the income growth at 1% and 5% respectively.

**Table 4: Logit Result of Determinants of Income Growth**

Logistic regression

Number of obs = 85

LR chi2(9) = 78.80  
Prob > chi2 = 0.0000  
Pseudo R2 = 0.2483

Log likelihood = -141.09847

| Incomegrowth    | Coef.        | Std. Err. | Z     | P> z  |
|-----------------|--------------|-----------|-------|-------|
| Age             | 1.240367 *** | .4030926  | 3.08  | 0.002 |
| Sex             | .7295175**   | .3165236  | 2.30  | 0.021 |
| Experience      | 1.448586 **  | .7088618  | 2.04  | 0.041 |
| Education       | -.4482329    | .3236237  | -1.39 | 0.166 |
| Enterpriseage   | .3079663     | .342379   | 0.90  | 0.368 |
| Accesstofinance | .2689223 *** | .0907089  | 2.96  | 0.003 |
| Accessbusiness  | -.7803478    | .4799395  | -1.63 | 0.104 |
| Familysize      | -.2780106    | .4762711  | -0.58 | 0.559 |
| Motivation      | 1.01143 **   | .4815043  | 2.10  | 0.036 |
| Cons            | -2.82213 *** | .9997022  | -2.82 | 0.005 |

\* = Significant at 10% \*\* = Significant at 5% \*\*\* = Significant at 1%

Source: own survey 2013

### 3. Determinants of Micro and Small Scale Enterprises Growth

The estimation result of the multiple regressions is presented in table 5 below. Regarding the constraints of enterprises' employment growth, variables such as current capital, current employment, start up employment, finance source, motivation of the enterprises, access to business service counseling, family size

of the operator and education level of the operator, were found to be important in explaining growth of employment of the enterprises in the study area. The signs for these variables are positive, revealing strong direct relationship between the explanatory variable and employment growth of enterprises. The coefficients for these variables explain the magnitude of the constraints towards affecting the growth of enterprises.

Table 5: multiple regression result on employment growth of micro and small enterprises

F (12, 72) = 1.60;

Prob > F = 0.000;

R<sup>2</sup> = 0.7952

| Variable          | Coef.       | Std. Err. | t -score | P-value |
|-------------------|-------------|-----------|----------|---------|
| Currentcapital    | 0.238737*** | 0.019764  | 12.08    | 0.00    |
| Startupcapital    | 0.014019    | 0.021266  | 0.66     | 0.51    |
| currentemployment | 0.154134*** | 0.022907  | 6.73     | 0.00    |
| Startupemployment | 0.13813***  | 0.018899  | 7.31     | 0.00    |
| Financesource     | 0.145284*** | 0.04602   | 3.16     | 0.002   |
| Motivation        | 0.052293**  | 0.020878  | 2.5      | 0.012   |
| Accesstobusiness  | 0.143561*** | 0.018486  | 7.77     | 0.00    |
| Familysize        | 1.080896*** | 0.020955  | 51.58    | 0.00    |
| Education         | 0.095882*** | 0.017261  | 5.55     | 0.00    |
| experience        | -2.04269*** | 0.187188  | -10.91   | 0.00    |
| Age               | -1.66658*** | 0.123966  | -13.44   | 0.00    |
| Sex               | -1.50404*** | 0.289222  | -5.2     | 0.00    |
| Cons              | 1.593       | 0.618001  | 2.57     | 0.01    |

\* = nifi-10%  
Signifi-  
cant at  
\*\*\* = nifi-1%

Signifi-  
cant at  
\*\* = nifi-5%  
Signifi-  
cant at

**Source:** own survey 2013

## VI. CONCLUSION

The empirical findings of this study revealed that sex of the operator, age and experience negatively affects the employment growth potential of MSEs. Whereas, current capital, current employment, initial employment, motivation of the operator, the existing of business counseling are significant factors that positively affecting the growth potential of micro and small-scale enterprises. Thus, accesses to these constraints are important factors for the micro and small scale enterprises to perform better and to grow in order to achieve the growth and transformation plan of Ethiopia. Both approaches of enterprise growth measures and proves that accesses to business constraints are strongly affect the growth potential and performance of micro and small-scale enterprises.

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# An Economic Evaluation of Indian Tourism Industry

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**Abstract-** The paper exposes the economic viability of the Indian tourism industry by employing secondary data taken from various national and international reports, journals, books, magazines and other pertinent literature of this discipline. The Indian tourism industry is playing an important role in economic development of many sectors of our economy by generating employment both for skilled and unskilled labour force, by improving living standard, particularly of remote rural areas, foreign exchange earnings, infrastructure development, and boosts the world famous Indian traditional Art and craft. Tourism is an important catalyst in the socio-economic development of both rural and urban areas since the last two decades, contributing in several ways and strengthens the inter-connected processes. Tourism industry has potential to strengthen the inclusive economic development. It is a limitless industry with immense growth potential having clear remarkable positive impact on economic and social aspects of Indian economy.

**Index Terms-** Tourism, Development, Employment, Foreign exchange earnings.

## I. OBJECTIVES

To find out the impact of tourism industry on various economic aspects of Indian economy.

To understand the present status and scenario of Indian tourism industry.

To enumerate how tourism is important for the overall development of Indian economy.

## II. MATERIAL AND METHODS

The present study is an endeavour to find out the impact of tourism industry on various economic dimensions and parameters of Indian economy. In India Tourism industry is an important instrument in the generation of employment, development of infrastructure, foreign exchange earnings, uplift of the rural economies particularly in remote and backward areas earnings and is included among the top export sectors. As a result remarkable funds are allocated in this tertiary activity so that it may act as an important instrument to foster economic growth. For the present study the required secondary data has been collected from various old research papers, journals, books internet, some of the governmental data etc. The data has also been taken from various documents such as books, newsletters, reports, magazines, journals, newspaper, internet, as well as from existing literature to understand the importance to understand how tourism plays its role in different directions for the overall development of Indian economy. After this, pertinent statistical tools have been used to find out the necessary required results.

## III. RESULT AND DISCUSSION

The Indian Tourism industry has acted as one of the important catalyst in the socio-economic development of both rural and urban areas since the last two decades, contributing in several ways and strengthens the inter-connected processes. While it is often claimed as remedy for many evils like underdevelopment, unemployment, poverty eradication, development of rural areas, up grading living standard and so on; its contribution in creating a global and regional socio-political environment for peaceful co-existence of the cultures and societies has been equally established at various levels. Perhaps, this realisation took many scholars and planners to position tourism as one of the biggest 'peace industries', a means to strike stability of global peace process though development. If, tourism practiced in responsible and sustainable manner will bring peace and prosperity of the people and its stakeholders will share benefits in fair manner, which is a compulsory condition for the equilibrium of sharing to sustain.

Tourism in India has emerged as one of the important tool of employment generation, income and Foreign Exchange earnings and infrastructure development both in rural and urban areas. It helps in the poverty eradication and up gradation of living standard of the people around the tourist spots particularly in remote backward areas. Tourism industry has enormous economic benefits. This industry has not remained what it was in 80's and 90's, today it have not remained confined itself only to Tour operators, hotels, restaurants and sea beaches, but has touched every corner of our economy through diversification and innovation in traditional tourism structure and system in to rural areas (Rural tourism), health sector (Health Tourism) and environment (Eco-tourism) as well. Its importance as an instrument for economic development and employment generation is now recognized world over. The existing Tourism Policy, therefore provides a framework for development of tourism, with the objective of reaping its socio-economic benefit, people in rural areas by ensuring overall development of the countryside, society and the nation altogether. It contributes 6.23% to national GDP and 8.78% to the total employment in India. The tourism industry in India generated US\$100billion in 2008 and is expected to increase to US\$ 275.5 by 2018 at a 9.4% annual growth rate.

The Tourism industry of India has immense potential to reap economic benefits, if this precious fruitful resource is utilized effectively and efficiently. It has a potential to provide employment to skilled and unskilled labour force of the country. Through its strong backward and forward linkages it generates employment in different sectors of the economy both directly and indirectly. If these linkages are strengthened these will act as a positive instrument for economic growth and development and will help in inclusive growth, which is one of the important ob-

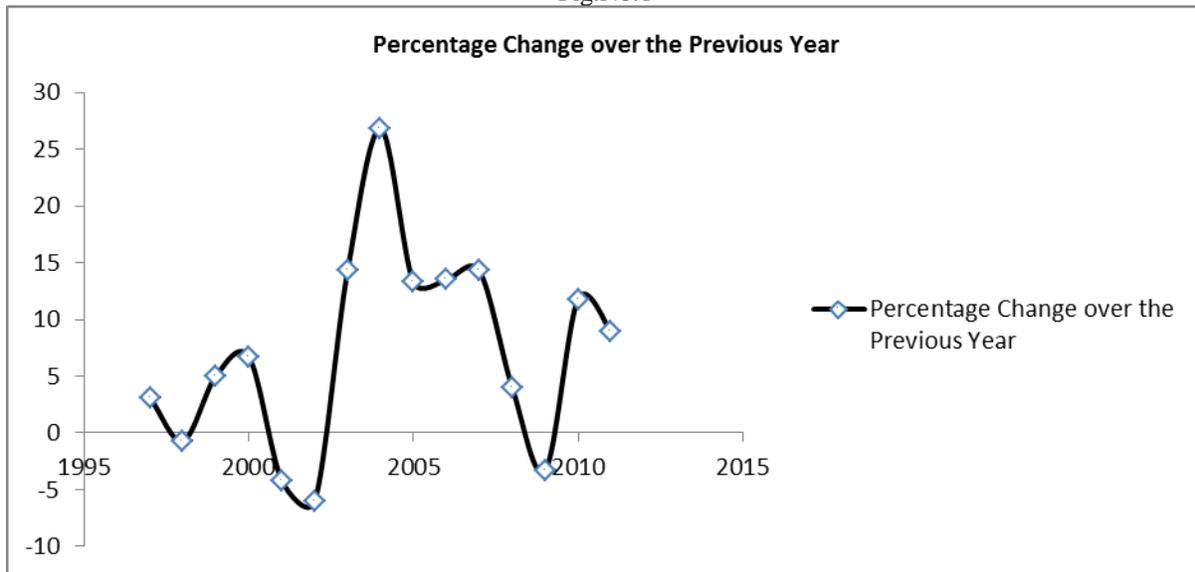
jective of five year plans. These linkages will develop with the passage of time depending up on variety of factors, such as the availability of finance, the diversity and maturity of the local economy or the quality of locally produced goods. The travel and

tourism industry contains these four elements that enable it to be a dynamic market force for sustainability in the future. It has the capacity to increase exports, bring in capital investment, boost economies GDP and create employment (Govind. P.; 2012).

Table No: 1. **Foreign Tourist Arrivals in India (Millions)**

| Year | FTAs In India ( In Millions) | Percentage Change over the Previous Year |
|------|------------------------------|--|
| 1997 | 2.73                         | 3.08                                     |
| 1998 | 2.36                         | -0.7                                     |
| 1999 | 2.48                         | 5.02                                     |
| 2000 | 2.65                         | 6.7                                      |
| 2001 | 2.54                         | -4.2                                     |
| 2002 | 2.38                         | -6.0                                     |
| 2003 | 2.73                         | 14.3                                     |
| 2004 | 3.46                         | 26.8                                     |
| 2005 | 3.92                         | 13.3                                     |
| 2006 | 4.45                         | 13.5                                     |
| 2007 | 5.08                         | 14.3                                     |
| 2008 | 5.28                         | 4.0                                      |
| 2009 | 5.11                         | -3.3                                     |
| 2010 | 5.78                         | 11.8                                     |
| 2011 | 6.29                         | 8.9                                      |

Fig.No:1

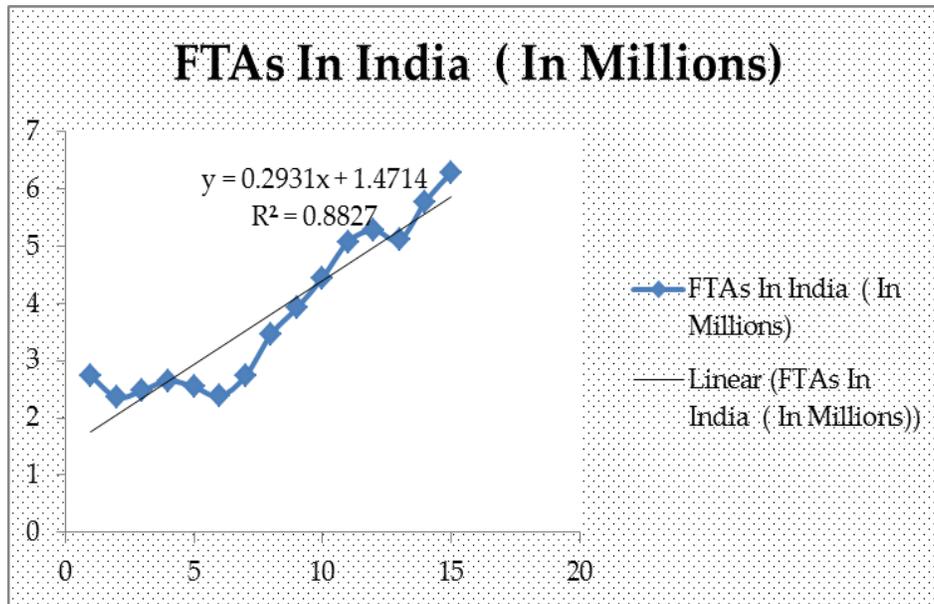


Source: (1). Ministry of Tourism government of India (2009-2010)  
 (2). Indian tourism statistics 2011 at a glance

Both Table No. 1 and Fig. No. 1 shows the trend of foreign tourist inflow in India from 1997-2011. The foreign tourist arrivals was 2.37 million in 1997 which with a little fluctuation decreased to 2.38 million in 2002 after 20002 it shows a persistent

rise which reached to 4.5 billion in 2006. After this tourist inflow shows a negative (-3.3) percentage change in 2009, this decrease is due to the negative impact of 2008 global economic recession accelerated by outbreak of AN1H1 influenza virus.

Fig.No:2 **Trend Lines of Foreign Tourist Arrivals (1997-2011)**



**OLS model is:**

**Foreign Tourist in flow = f (X)**

$Y = \alpha + \beta x + v_i$  ..... (1)

Y = Foreign Tourists, X = Time,  $v_i$  = error termes

$\alpha, \beta$  = parameters

**Model Summary**

| Model | R                 | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics |          |     |     |             |
|-------|-------------------|----------|-------------------|----------------------------|-------------------|----------|-----|-----|-------------|
|       |                   |          |                   |                            | R Square Change   | F Change | df1 | df2 | Sig. Change |
| 1     | .940 <sup>a</sup> | .883     | .874              | .49590                     | .883              | 97.795   | 1   | 13  | .000        |

a. Predictors: (Constant), VAR00001

**Coefficients<sup>a</sup>**

| Model |            | Unstandardized Coefficients |            | Standardized Coefficients | t     | Sig. | 95% Confidence Interval for B |             |
|-------|------------|-----------------------------|------------|---------------------------|-------|------|-------------------------------|-------------|
|       |            | B                           | Std. Error | Beta                      |       |      | Lower Bound                   | Upper Bound |
| 1     | (Constant) | 1.471                       | .269       |                           | 5.461 | .000 | .889                          | 2.054       |
|       | VAR00001   | .293                        | .030       | .940                      | 9.889 | .000 | .229                          | .357        |

a. Dependent Variable: VAR00002

From the above regression model it is clear that time explains 88% of the tourist inflow while the remaining is explained by some unknown variables. We can conclude that there is a significant relationship between tourist inflow and time. Keeping other things constant the increase in tourist inflow with the passage of time can be used as an important indicator in demand forecasting for the required supply of goods and services which will satisfy the needs of both domestic and foreign tourists. Tourism has an inbuilt capacity that it could contribute remarkably and in minimum time duration in poverty alleviation through job creation and productive employment by offering labour-intensive jobs and small-scale business opportunities that generally employ a high proportion of women and unskilled youth. In

addition to this tax revenue from tourism could be used to improve infrastructure, health and education development, all of which are important for poverty alleviation. In the long run, tourism promotes understanding among people of different nations, thus contributing to world peace and understanding. It is often claimed that tourism is the 3rd largest earner of foreign exchange in India, after gems/jewellery and ready-made garments.

After giving priority and pumping huge financial resources to Tourism industry it is necessary that it must act as a catalyst for socio-economic development and for achieving this important objective, appropriate and sensible policies must be formulated by the government to ensure that the benefits are widely spread, adverse impacts are reduced, especially on fragile natural envi-

ronment. In addition to this necessary support must be given to foster the sound and sustainable development of this economically profitable industry. All those agencies that are involved in this industry must be capable of designing and implementing effective measures to foster sustainable tourism development and enhance the contribution of tourism to socio-economic development. This does not mean that the stakeholders should be set completely free in a manner which will cause deterioration to sustainable tourism but it means that stakeholders should be given freedom to that extent which on one side will accelerate the benefits for present generation from this industry but at the same time will not place at risk the longer-term prosperity and quality of life of future generations.

Tourism industry is a limitless industry with immense growth potential. It has tremendous positive impacts on economic and social aspects in developing countries. This is why every country is trying with each other to woo more domestic and international tourist and India is not an exception though here achievements are not astonishing. According to the latest Tourism Satellite Accounting (TSA) research released by the WTTC and its strategic partner oxford economics in March 2009. The demand for travel and tourism in India is expected to grow by 8.2

per cent between 2010 and 2019 and will place India at the 3<sup>rd</sup> position in the world. India's travel and tourism sector is expected to be the 2<sup>nd</sup> largest employer in the world, employ 40,037,000 by 2019. In addition to this capital investment in India's travel and tourism sector is expected to grow at 8.8 per cent between 2010 and 2019.

Tourism in India has emerged as an instrument of income and employment generation, poverty alleviation and sustainable human development. Almost more than 20 million people are now working in the Indian tourism industry.

India is a country of diverse culture, language, religion and climate. It is known for its diversity all over the world. There is something for everyone. It is also known for its tourism attraction and infrastructure which is in par with those in UK, USA and Europe. Tourism is playing its important role in overall economic development of the country. The wages in this sector are higher than the other sectors of our economy and thus attracting and providing employment to a very huge group of labour force. Medical tourism and domestic tourism is acting as a shield from many shocks like the global economic recession. There is very little fluctuation in the domestic tourism the growth of which is increasing continuously with the passage of time.

Table No: 2 Domestic Tourist visits

| Years | Domestic Tourists visits (millions) | Percentage (%) change |
|-------|-------------------------------------|-----------------------|
| 1999  | 190.67                              | 13.4                  |
| 2000  | 220.11                              | 15.4                  |
| 2001  | 236.47                              | 7.4                   |
| 2002  | 269.60                              | 14.0                  |
| 2003  | 309.04                              | 14.6                  |
| 2004  | 366.27                              | 18.5                  |
| 2005  | 391.95                              | 7.0                   |
| 2006  | 462.31                              | 18.0                  |
| 2007  | 526.56                              | 13.9                  |
| 2008  | 562.98                              | 6.9                   |
| 2009  | 669.02                              | 18.8                  |
| 2010  | 747.70                              | 11.8                  |
| 2011  | 850.86                              | 13.8                  |

Source: (1). Ministry of Tourism government of India (2009-2010)  
(2). Indian tourism statistics 2011 at a glance

The above table shows that the Domestic tourists arrivals shows an uninterrupted increase from 190.67 million tourists in 1999 to 366.27 million in 2004. The arrivals further shows a continuous increase from 391 million in 2005 and reached 850.86 million in 2011. The table reveals that no doubt there is fluctua-

tion in the percentage in tourist arrivals from one period to another period but there is no negative percentage growth from 1999 to 2011, which is a positive indication of bright future of tourism industry.

Fig.No:3

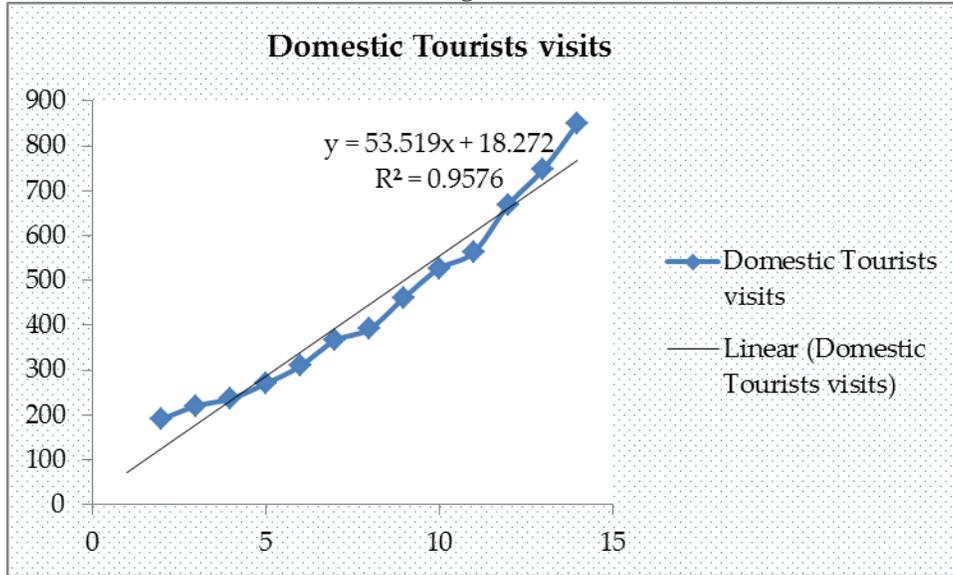
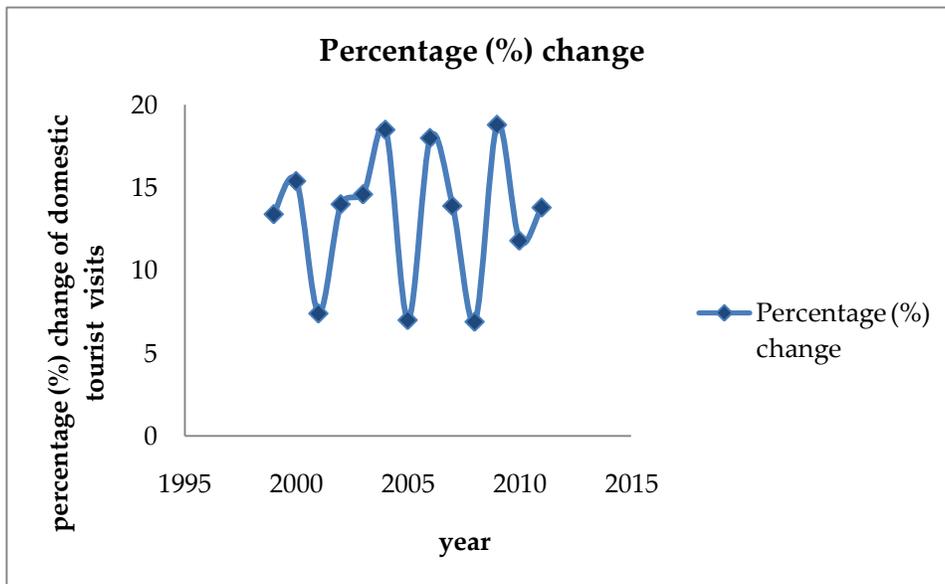


Fig.No:4



We should appreciate and encourage the fast growing and vibrant Indian tourism industry, which with the passage of time has emerged an assured channel of financial flow to the country. Besides significant contributions to the foreign exchange of the country, India's tourism is also a major source of employment for labour-surplus economy like India. With its strong forward and backward linkages with a host of sectors directly or indirectly like transport, Hospitality, Agriculture, Education, Handicraft, Health, Banking etc. there is every possibility that India can reap full potential of this vibrant sector. Therefore, effective and efficient efforts are made by the government under the five-year and other special plans to minimize negative effects and dominance of positive fruitful effects. But the pressure of lingering problems in the Indian economy – mainly transport bottlenecks – coupled with the emerging commitments and challenges under General

Agreements on Trade in Services (GATS) is already being felt. So the need of the hour to solve the problems and address the challenges confidently and squarely not only to build up the tourism sector but also boost the tertiary sector, in general.

In both developed and developing countries government authorities have identified tourism as a means of generating employment and income in vulnerable economies. For example it was noted that among the 49 least developed countries surveyed by the world tourism organization (WTO) in 2001, in 7 cases tourism was leading source of foreign exchange earnings, while in 10 others tourism earnings were among the top three sources of foreign exchange income. Nonetheless such countries account for only of total international 0.59% of total international air passenger kilometers (Chris Ryan, 2006). It is of very great importance to understand that how such small market share indi-

icates the level of progress that can be made with carefully planned small tourism flows.

The estimates show that direct employment in the Indian economy in 1999-2000 due to Foreign Tourists was about 20.46

lakh and in 2002-2003 due to Foreign and Domestic tourists were 17.44 lakh and 37.33 lakh respectively, i.e. employment has doubled in the domestic sector compared to foreign sector.

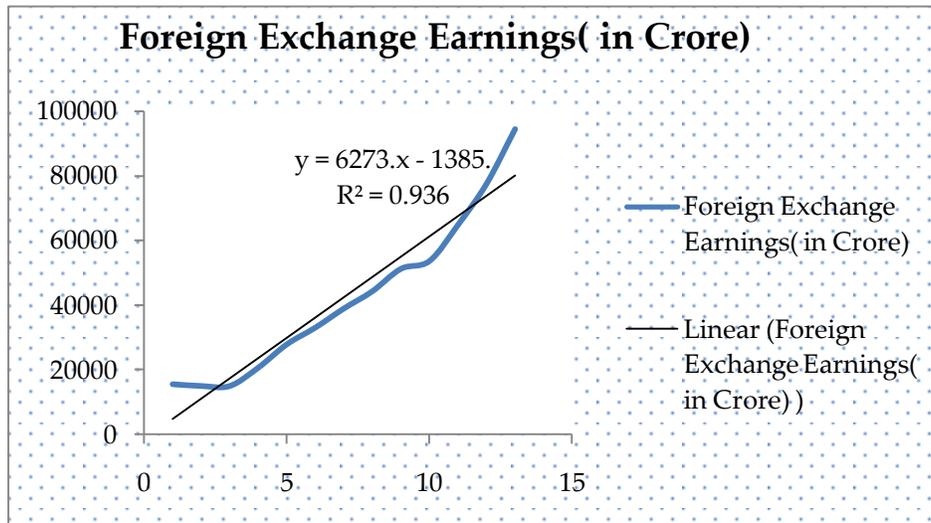
**Table No: 3 Foreign Tourist Arrivals and Foreign Exchange Earnings During the years 2000-2012**

| Year | Foreign Tourist Arrivals | Percentage Change Over Previous Year | Foreign Exchange Earnings( in Crore) | Percentage Change Over Previous Year | Foreign Exchange Earnings (Million US\$) | Percentage Change Over Previous Year |
|------|--------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--|--------------------------------------|
| 2000 | 26,49,378                | 6.7                                  | 15,626,                              | 20.6                                 | 3,460                                    | 15.0                                 |
| 2001 | 25,37,282                | -4.2                                 | 15,083                               | -3.5                                 | 3,198                                    | (-)7.6                               |
| 2002 | 23,84,364                | -6.0                                 | 15,064                               | -0.1                                 | 3,103                                    | 3.0                                  |
| 2003 | 27,26,214                | 14.3                                 | 20,729,                              | 37.6                                 | 4,463                                    | 43.8                                 |
| 2004 | 34,57,477                | 26.8                                 | 27,944                               | 34.8                                 | 6,170                                    | 38.2                                 |
| 2005 | 39,18,610                | 13.3                                 | 33,123,                              | 18.5                                 | 7,493                                    | 21.4                                 |
| 2006 | 44,47,167                | 13.5                                 | 39,025                               | 17.8                                 | 8,634                                    | 15.2                                 |
| 2007 | 50,81,504                | 14.3                                 | 44,360                               | 13.7                                 | 10,729                                   | 24.3                                 |
| 2008 | 52,82,603                | 4.0                                  | 51,294                               | 15.6                                 | 11,832                                   | 10.3                                 |
| 2009 | 51,67,699                | -2.2                                 | 53,700                               | 4.7                                  | 11,136                                   | (-)5.9                               |
| 2010 | 57,75,692                | 11.8                                 | 64,889#                              | 20.8                                 | 14,193#                                  | 27.5                                 |
| 2011 | 63,09,222                | 9.2                                  | 77,591#                              | 19.6                                 | 16,564#                                  | 16.7                                 |
| 2012 | 66,48,318                | 5.4                                  | 94,487#                              | 21.8                                 | 17,737#                                  | 7.1                                  |

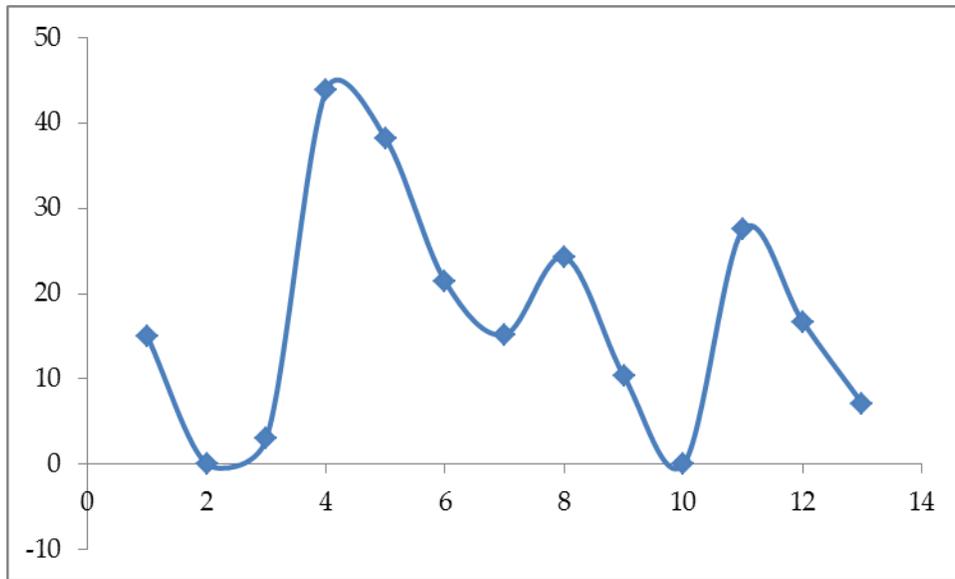
#Advance Estimates

**Source:** Ministry of Tourism, Annual Report 2012-13

**Fig.No:5**



**Fig.No:6 Percentage Change in Foreign Tourist Arrivals over Previous Year**



The above table No.3 shows that the foreign exchange earnings increased continuously with the increase of foreign tourist inflow. In 2000 FEEs was Rs. 15, 626 crore, which increased and reached Rs.77, 591 crore during 2011, with a growth of 19.6%, as compared to the FEEs of Rs.64, 889 crore (provisional) during 2010. During 2012, the Foreign Exchange Earnings from tourism registered a growth of 21.8% from Rs.77, 591 to Rs.94, 487 crore (provisional) when compared to FEEs during 2011.

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#### IV. CONCLUSION

Tourism industry has emerged as an important instrument in the economic development of Indian economy, particularly in remote backward rural areas. Due to its strong backward and forward linkages it generates employment in different profiles and thus increases living standard of people who are directly or indirectly linked with this economically profitable activity. The Indian tourism has a clear bright future because the demand for travel and tourism in India is expected to grow by 8.2 per cent between 2010 and 2019 and will place India at the 3<sup>rd</sup> position in the world. Besides huge foreign exchange earnings and escalation of world class infrastructure development India's travel and tourism sector is expected to be the 2<sup>nd</sup> largest employer in the world, employ 40,037,000 by 2019..keeping in view its socio-economic impacts of Indian tourism the need of hour is that supply of tourism Products and services must regularly be upgraded to meet the changing needs of the market, which is necessary for continuous in flow and optimum satisfaction of tourists. I want to conclude that tourism can be used as a catalyst for socio-economic development if Government and other people involved in tourism pursues sustainable development of tourism in a comprehensive and planned manner and formulate appropriate market demanding policies.

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# Hand Gesture Recognition Techniques For Human Computer Interaction Using OpenCv

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**Abstract-** A few decades ago, usage of computer was so tough and complicated that none but scientists could use it. But now with the passage of time and to cope with the demand of our every sphere of life, usage of computer has become so easy that everyone can use it. At present, mouse or keyboard is being used to interact with the computer. But sometimes it seems uncomfortable because people don't want to get off from where they are sitting or lying. This paper proposed a technique for man-machine interaction which is based on gesture recognition using openCV technology which provides basic data structures for image processing with most favorable efficiency [1]. A hand image is taken as input to detect the hand easily in this system. In this paper, all the hand gesture images are captured from a single web camera. The proposed algorithm also helps to locate the palm and fingertip in hand gesture.

**Index Terms-** Human Computer Interaction, Hand Gesture, Contour, Convex-Hull, Convexity Defects.

## I. INTRODUCTION

Human Computer Interaction (HCI) is one of the most outstanding inventions which works to find more effective method to develop the current system. Among them, the system of using a mouse or a keyboard is the most popular. But now a new technology has been arrived for Human Computer Interaction (HCI) which is based on gesture recognition means a move to convey intention or to evoke response. Actually gesture technique is used who can understand it and is being used today to control the computer instead of mouse or keyboard. This paper presents three new interactive methods which will make the system more reliable [2][9][10]. The paper also describes an effective hand based interaction method that needs preprocessing means conversion of the user's hand image from one form to another form for implementation that makes a connection with the next step which leads to hand detection. As many new technologies have been arrived to do our work and among them hand gesture based technology is the latest, so its usage is very limited. This technique is being used in television, computer, and robots without using remote control, joystick to complete the least job [5][6]. It will also be used in some applications such as holographic technology, gadgets like phone, editing and copying data, creating programs etc. Section II contained the method and steps of how hand gesture process works. Section III contained the simulation part of hand detection and described the result. Section IV included the future work of hand gesture recognition and section V contained the conclusion part of this paper.

## II. METHODOLOGY

The whole systems are based on contour of hand. Contours are the line or surface of which no part is straight or flat connecting all the continuous points throughout the boundary. This process is executed after thresholding. A simple hand image is taken which is in RGB format captured by a web camera. Some preliminary process need to be performed to generate a binary image which provides information of hand contour [3]. Here binary image is used to determine the contour and convex-hull of contour. The convex-hull of a set of points is the smallest outline of a closed figure encircling the points. It is drawn on all sides of contour of hand as if every contour point is in the limits of convex-hull. It creates a folded paper container around contour of hand. A defect is seen in the hand gesture when convex-hull is drawn on every side of contour of hand which fits sets of contour points of the hand. It uses maximum positions to construct the hull to assemble every contour point inside. Convexity defects give set of values in the vector form [7][8]. The fingertip position is detected from contour of hand and palm position is determined by the information which is extracted from convex-hull [9]. As computation geometry algorithm performed, so computation cost is low in this system.

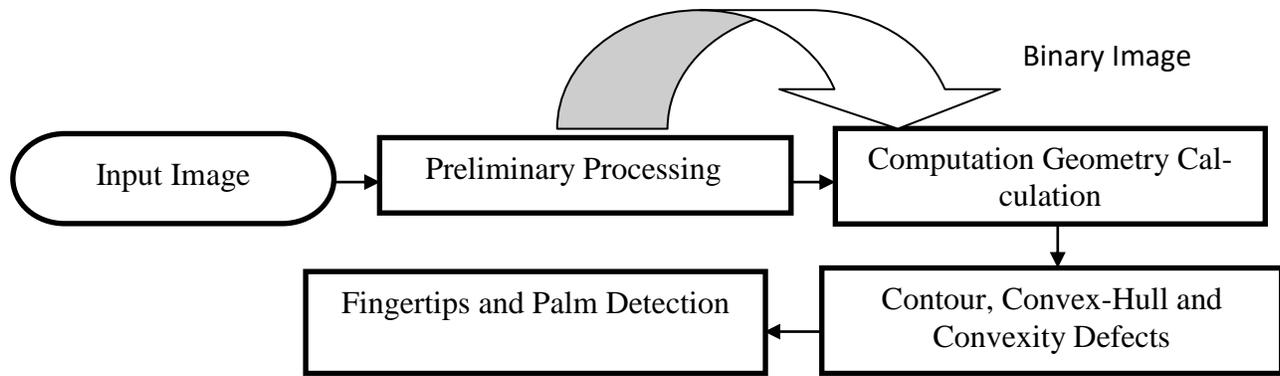


Figure 1: The flow diagram of implemented algorithm

### III. SIMULATIONS AND RESULTS

#### A. Hand Segmentation

Hand segmentation is an important step before hand detection which is used to remove the hand image from background portion. This process is accomplished by using preliminary process which is transformation and thresholding. In this algorithm, at first RGB image taken as input from a web camera. Then RGB image is converted into YCbCr image. At last output of thresholding can be found from converting YCbCr image to binary image that consists of 0 and 1. So where there is hand image, '1' will be putted and where there is background, '0' will be putted there [10].



Figure 2: Input Image Frame and YCbCr Image



Figure 3: Threshold Image

In Figure 3, hand color turns into white and background color turns into black. This type of image is easy to detect the shape of boundary.

## B. Hand Detection

### Contours

A hand image and its shape of user is detected and recognized by using contours analysis [4]. In the hand image, a contour is a series of points which are the boundary pixels of an area that is shown in Figure 4.



Figure 4: Detected Contour of Input Image

### Convex-Hull

Figure 5 shows an example of convex-hull that connects lines of continuous points which never exceed the contour of hand. The heptagon in the figure is the convex-hull of set. These seven points that forms the heptagon are known as hull points.



Figure 5: Convex-Hull of Input Image

### Convexity Defects

Figure 6 illustrates the convexity defects of a hand image. The grey lines on the contour indicate the convex-hull of the hand. The regions in ash color are contained in the convex-hull. But they are not contained in the hand image. These regions are so called convexity defects and the yellow colored points shows the defect [6].

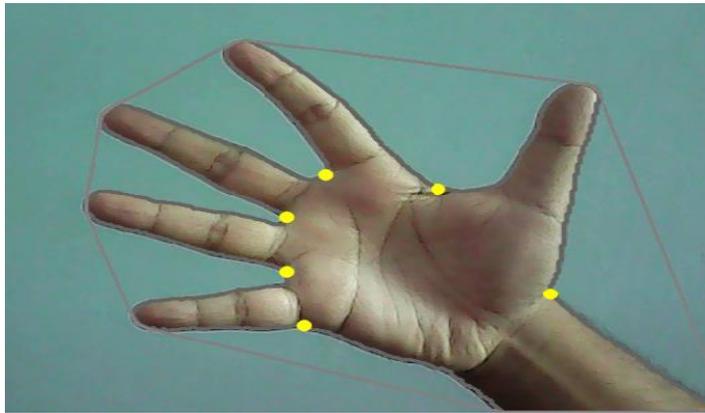
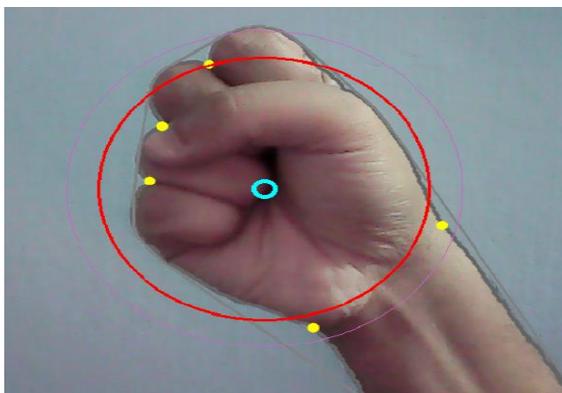


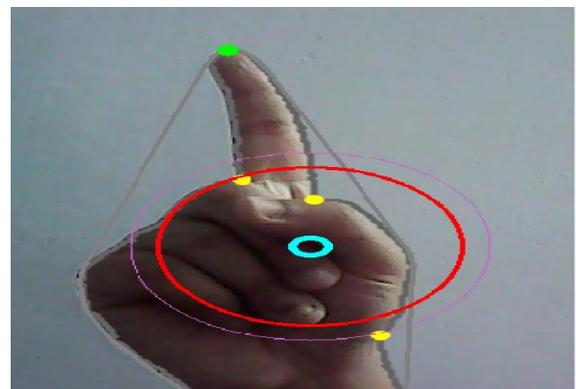
Figure 6: Convexity Defects of Input Image

### Fingertip and Palm Area Detection

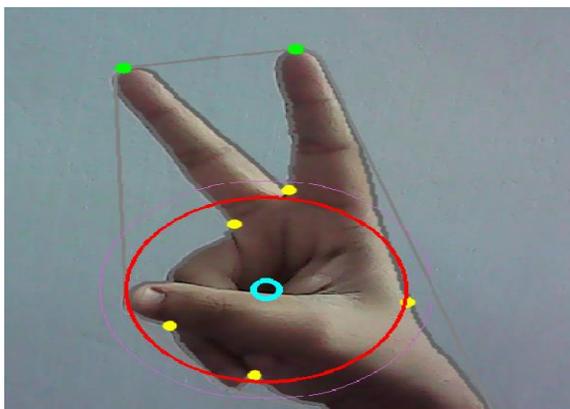
In this method of interaction [9], fingertip and palm area of hand image is determined by making the use of defect points present in the hand gesture. In the Figure 7, green color indicates fingertip, yellow color indicates defects point and blue circle shows palm position.



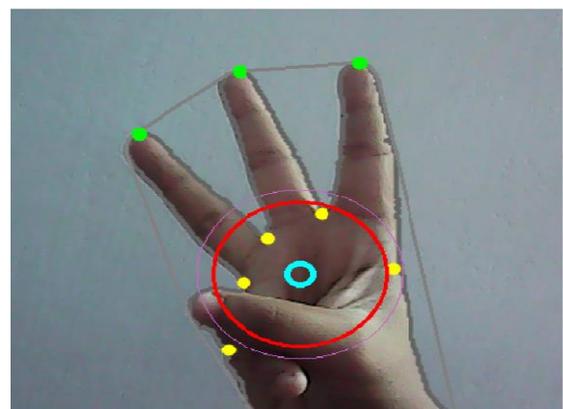
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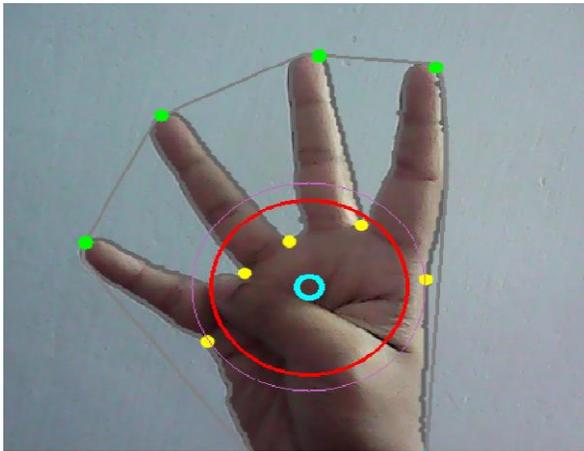
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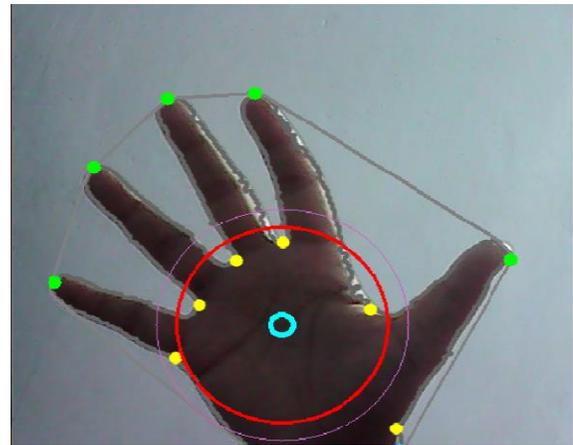
Showing 2



Showing 3



Showing 4



Showing 5

Figure 7: Detected Fingertip and Palm of the hand

#### IV. FUTURE WORK

The system or technology, that we use now, still neither flawless nor applicable in every required situation properly, though it is the latest technology. Future development or research in the sector determines to remove all these flaws so that it can be more efficient and reliable.

#### V. CONCLUSION

In this system, different effective techniques for man-machine interaction are observed. A few systems for preprocessing of input image are presented. This paper also introduced about fingertip and palm detection in the hand gesture which increases the freedom of usability. These methods are going to use in different applications in future.

#### ACKNOWLEDGMENT

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# Floristic Studies of Lajkura Coal Mines Area Jharsuguda, Odisha: An Overview

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**Abstract-** The opencast mining has resulted to destruction of habitats which is essential for maintaining ecological balance. In the present study, attempts have been made to assess the floristic composition and biomass accumulation of ground flora. The study revealed that the number of tree species was low in all the mining sites. The present study designed to explore the floristic composition of the Lajkura coal mining area, Jharsuguda and to analyze the impact of coal mining on plant diversity. The record of plant species was organized on the source of field trips conducted in winter, summer and monsoon during the year 2013-14. A total of 144 plant species (36 tree, 36 herbs, 34 shrubs, 17 small tree, 11 climber, 8 grasses and 2 rhizomes) were documented. Dominant families were Apocynaceae, Fabaceae, Moraceae, Poaceae, Euphorbiaceae, Asteraceae and Lamiaceae.

## I. INTRODUCTION

India has abundance of coal resources and is the 3rd largest coal producing country after China and USA. It spreads over eight States in India (Jharkhand, West Bengal, Orissa, Chhattisgarh, M.P, U.P, Maharashtra and Assam) and operates in 473 Mines (Under Ground: 283, Open Cast: 155, Mixed: 35). Orissa's resource of Coal is formidable constituting approximately 25% of the total resources of the country (Noronha et al., 2009; Dash, 2005). More than 65% of electricity generation units are coal based. The mining industry accounts for a major percentage of the gross national product of many countries. But the removal of vegetation, top soil, overburden/waste and ore brings about the inevitable natural consequences, which manifest in many ways, deforestation, climatic change, erosion, and air and water pollution leading to serious health hazards. Ecosystem disturbance caused due to mining is an evitable fall out of industrialization and modern civilization. Forest ecosystems have important functions from an ecological perspective and provide services that are essential to maintain the life-support system on a local and global scale (Rao & Pant, 2001). Mining of coal both surface and sub-surface causes enormous damage to the flora, fauna, hydrological relations and soil biological properties of the systems. Destruction of forests during mining operation is invariably accompanied by an extensive damage and loss to the system. Unscientific mining of minerals poses a serious threat to the environment, resulting in reduction of forest cover, erosion of soil at a greater scale, pollution of air, water and land and reduction in biodiversity (UNESCO, 1985). Mining operations, which involve minerals extraction from the earth's crust tends to, make a notable impact

on the environment, landscape and biological communities of the earth (Down & Stocks, 1997 and Bell *et al.* 2001). Open cast mining of coal deposits involves removal of overlying soil and rock debris. This debris is heaped in the form of dumps and is called mine spoil. These dumps change the natural land topography and affect the drainage system of the mining area (Chaulya *et al.* 2000). Lack of vegetation cover on such dumps often leads to acute problem of soil erosion and environmental pollution (Singh *et al.* 1996). Therefore, development of vegetation on the dumps is essential for the conservation of biodiversity and stable environment in the coalfield area (Singh *et al.* 2002). Besides, specific use of native and indigenous species for revegetation of mine spoil has also been suggested (Banerjee *et al.* 1996; Jha & Singh 1993). Hence an attempt was made for the floristic study in and around the mining area of the Lajkura coal mine of Jharsuguda, Odisha.

## II. MATERIALS AND METHODS

Nationalisation of coal industry was done in 1973, which is now a part of western coals limited (WCL) having head quarters at Nagpur. In 1986 it came under South Eastern Coalfields Limited (SECL) having HQ at Bilaspur. In 1992, it came under Mahanadi Coalfield Limited (MCL) having HQ at Jagriti Vihar, Burla, Dist. Sambalpur (Odisha). Prior to nationalization, three underground mines were operational. Post nationalization, the IB valley Opencast Mines were opened from 1984 onwards. At present IB Valley Area consists of three Opencast Mines namely Lajkura Opencast mine, Samleswari Opencast mine and Lilari Opencast mine. The IB valley coalfield is located in south-eastern part of NW-SE trending Mahanadi basin belt between 21°30' to 83°37'N and 83°37' to 84°10'E. It touches the Himgir sub-basin in the north and the Rampur sub-basin in the south. The Ib-river is tributary of the Mahanadi. It lies entirely within the state of Orissa and covers parts of Sundargarh, Jharsuguda and Sambalpur district. The present study area is mainly confined to the Lajkura mining area which is situated between latitudes 21° 48' 39" & 21° 49' 55" N and longitudes 83° 53' 15" and 83° 54' 50" E as shown in figure 1. Survey of composition of naturally occurring plant species and planted species was conducted during 2013-14.

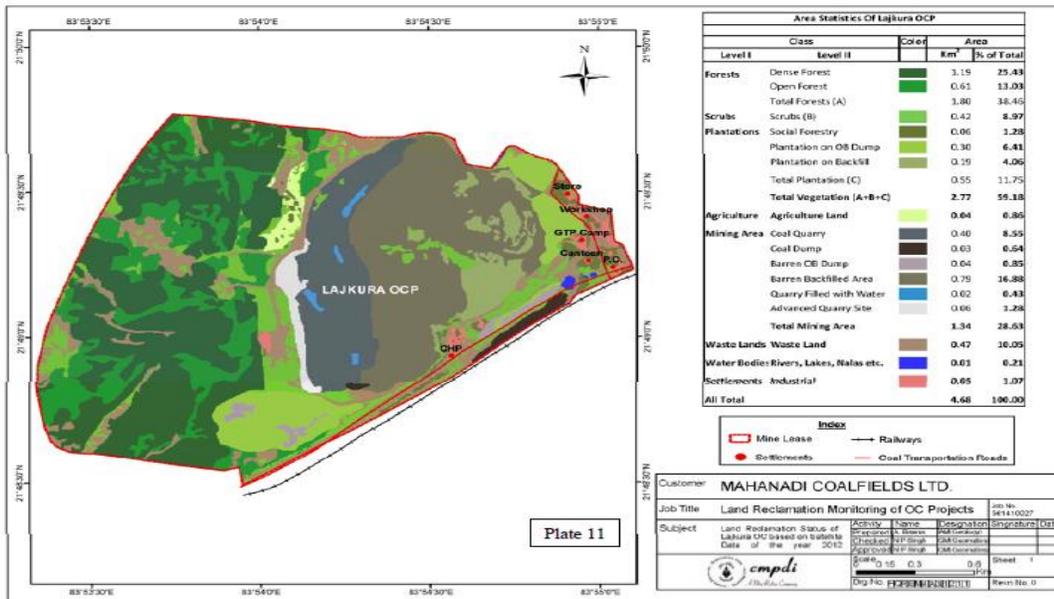


Fig 1: Study area

Plant specimens were collected in the sets of four preferably in flowering stage or at least in fruiting stage inside polythene bags. On spot floristic information on phenology, habit, habitat, vernacular names, local use were documented. Then the plant samples were dried and stored for further requirement as and when necessary. The voucher specimens were brought to the laboratory and processed for herbarium specimen [7-8] and identified with the help of available floras and literatures [9]. The

specimens were deposited in the Herbarium (RRL-B), Environment and Sustainability, Department of CSIR-Institute of Minerals & Materials Technology, Bhubaneswar for future references. The data were spread on an excel sheet to summarize and to identify various proportions like plant families, habit as presented in the table 1.

Table 1: List of plants collected and its data

| SL NO. | BOTANICAL NAME                           | FAMILY        | HABIT |
|--------|--|---------------|-------|
| 1      | <i>Adhatoda zeylanica</i> Medic.         | Acanthaceae   | Shrub |
| 2      | <i>Artocarpus heterophyllus</i> L.       | Moraceae      | Tree  |
| 3      | <i>Anthocephalus cadamba</i> (Roxb.)Miq. | Rubiaceae     | Tree  |
| 4      | <i>Argemone mexicana</i> L.              | Papaveraceae  | Herb  |
| 5      | <i>Azadirachta indica</i> A.Juss.        | Meliaceae     | Tree  |
| 6      | <i>Aegle marmelos</i> (L.) Corr.         | Rutaceae      | Tree  |
| 7      | <i>Annona squamosa</i> L.                | Annonaceae    | Shrub |
| 8      | <i>Ailanthus excelsa</i> Roxb.           | Simaroubaceae | Tree  |

|    |  |                  |            |
|----|--|------------------|------------|
| 9  | <i>Abrus precatorius</i> L.                                | Fabaceae         | Climber    |
| 10 | <i>Anacardium occidentale</i> L.                           | Anacardiaceae    | Small Tree |
| 11 | <i>Aristolochia indica</i> L.                              | Aristolochiaceae | Climber    |
| 12 | <i>Achyranthes aspera</i> L.                               | Amaranthaceae    | Herb       |
| 13 | <i>Acacia mangium</i>                                      | Fabaceae         | Tree       |
| 14 | <i>Atylosia scarabaeoides</i> (L.) Benth                   | Fabaceae         | Climber    |
| 15 | <i>Agave sisalana</i> ex Engelm.                           | Agavaceae        | Rhizome    |
| 16 | <i>Asparagus racemosus</i> Willd.                          | Liliaceae        | Climber    |
| 17 | <i>Acorus calamus</i> L.                                   | Araceae          | Herb       |
| 18 | <i>Andrographis paniculata</i> (Burm.f.)Wall.ex Nees       | Acanthaceae      | Herb       |
| 19 | <i>Adina cordifolia</i> Hook.F.ex brandis                  | Rubiaceae        | Tree       |
| 20 | <i>Anogeissus latifolia</i> Wall.ex Guill.& Perr.          | Combretaceae     | Tree       |
| 21 | <i>Acacia auriculiformis</i> (Roxb.ex.DC) A.Cunn.ex Benth. | Fabaceae         | Small Tree |
| 22 | <i>Blumea lacera</i> (Burm.f.) DC.                         | Asteraceae       | Herb       |
| 23 | <i>Bougainvillea spectabilis</i> willd.                    | Nyctaginaceae    | shrubs     |
| 24 | <i>Bauhinia purpurea</i> L.                                | Caesalpinlaceae  | Small Tree |
| 25 | <i>Butea monosperma</i> (Lam.) Taub.                       | Fabaceae         | Small Tree |
| 26 | <i>Borassus flabellifer</i> L.                             | Arecaceae        | Tree       |
| 27 | <i>Barleria cristata</i> L.                                | Acanthaceae      | Shrub      |
| 28 | <i>Bulbostylis barbata</i> (Rottb.) C..B.cl                | Cyperaceae       | Climber    |
| 29 | <i>Canthium glabrum</i> Blume.                             | Rubiaceae        | Small Tree |

|    |  |                 |             |
|----|--|-----------------|-------------|
| 30 | <i>Croton sparsiflorus</i> Morong.                       | Euphorbiaceae   | Herb        |
| 31 | <i>Carica papaya</i> L.                                  | Caricaceae      | Small Tree  |
| 32 | <i>Calotropis procera</i> (Ait.)R.Br                     | Asclepiadaceae  | Shrub       |
| 33 | <i>Citrus aurantifolia</i><br>(Christm.& Panz.)Swingle   | Rutaceae        | Shrub       |
| 34 | <i>Cassia occidentalis</i> L.                            | Caesalpinlaceae | Erect Herb  |
| 35 | <i>Careya arborea</i> Roxb.                              | Lecythidaceae   | Small Tree  |
| 36 | <i>Cassia fistula</i> L.                                 | Caesalpinlaceae | Small Tree  |
| 37 | <i>Cucurbita pepo</i> L.                                 | Cucurbitaceae   | Climber     |
| 38 | <i>Costus speciosus</i> (Koeng) Sm.                      | Zingiberaceae   | Herb        |
| 39 | <i>Cajanus cajan</i> (L.)Huth                            | Fabaceae        | Erect Shrub |
| 40 | <i>Cassia tora</i> auct.non L.                           | Caesalpinlaceae | Herb        |
| 41 | <i>Cuscuta reflexa</i> Roxb.                             | Cuscutaceae     | Creeper     |
| 42 | <i>Cleistanthus collinus</i><br>(Roxb.) Benth.ex Hook.f. | Euphorbiaceae   | Tree        |
| 43 | <i>Curculigo orchioides</i> Gaertn.                      | Hypoxidaceae    | Herb        |
| 44 | <i>Cynodon dactylon</i> (L.) Pers.                       | Poaceae         | Grass       |
| 45 | <i>Catharanthus roseus</i> (L.) G.Don                    | Apocynaceae     | Herb        |
| 46 | <i>Celastrus paniculata</i> Willd.                       | Celastraceae    | Shrub       |
| 47 | <i>Centella asiatica</i> (L.) Urban                      | Apiaceae        | Herb        |
| 48 | <i>Clerodendrum inerme</i> (L.) Gaertn.                  | Verbenaceae     | Shrub       |
| 49 | <i>Curcuma longa</i> L.                                  | Zingiberaceae   | Rhizome     |
| 50 | <i>Cascabela thevetia</i> (L.) Lippoid                   | Apocynaceae     | Small tree  |
| 51 | <i>Cyperus squarrosus</i> L.                             | Cyperceae       | Grass       |

|    |   |                |            |
|----|---|----------------|------------|
| 52 | <i>Cleome monophylla</i> L.                           | Cleomaceae     | Herb       |
| 53 | <i>Dendrocalamus strictus</i> (Roxb.)Nees             | Poaceae        | Grass      |
| 54 | <i>Dalbergia sissoo</i> Roxb.                         | Fabaceae       | Tree       |
| 55 | <i>Diospyros melanoxylon</i> Roxb.                    | Ebenaceae      | Tree       |
| 56 | <i>Evolvulus alsinoides</i> (L.) L.                   | Convolvulaceae | Herb       |
| 57 | <i>Emblica officinalis</i> Gaertn.                    | Euphorbiaceae  | Tree       |
| 58 | <i>Eucalyptus tereticornis</i> Sm.                    | Myrtaceae      | Tree       |
| 59 | <i>Eragrostis coarctata</i> Stapf                     | Poaceae        | Grass      |
| 60 | <i>Evolvulus nummularius</i> (L.)L.                   | Convolvulaceae | Herb       |
| 61 | <i>Eupatorium odoratum</i> L.                         | Asteraceae     | Herb       |
| 62 | <i>Urena lobata</i>                                   | Malvaceae      | Herb       |
| 63 | <i>Euphorbia hirta</i> L.                             | Euphorbiaceae  | Herb       |
| 64 | <i>Eugenia jambolana</i> Lam                          | Myrtaceae      | Small Tree |
| 65 | <i>Erioglossum rubiginosum</i> (Roxb.)Bl.             | Sapindaceae    | Small Tree |
| 66 | <i>Ficus benghalensis</i> L.                          | Moraceae       | Tree       |
| 67 | <i>Ficus racemosa</i> L.                              | Moraceae       | Tree       |
| 68 | <i>Ficus hispida</i> L.f.                             | Moraceae       | Tree       |
| 69 | <i>Ficus religiosa</i> L.                             | Moraceae       | Tree       |
| 70 | <i>Glochidion lanceolarium</i> (Roxb.)Dalz.           | Euphorbiaceae  | Small Tree |
| 71 | <i>Hibiscus rosa- sinensis</i> L.                     | Malvaceae      | Shrub      |
| 72 | <i>Holarrhena bubescens</i> (Buch.Ham.) Wall.ex G.Don | Apocynaceae    | Tree       |
| 73 | <i>Hemidesmus indicus</i> (L.)R.Br                    | Apocynaceae    | Climber    |

|    |  |                |            |
|----|--|----------------|------------|
| 74 | <i>Heliotropium indicum</i> L.                       | Boraginaceae   | Herb       |
| 75 | <i>Homonoia riparia</i> Lour.                        | Euphorbiaceae  | Shrub      |
| 76 | <i>Helicteres isora</i> L.                           | Malvaceae      | Shrub      |
| 77 | <i>Ixora pavetta</i> andr.                           | Rubiaceae      | Shrub      |
| 78 | <i>Ipomoea carnea</i> Jacq.                          | Convolvulaceae | Shrub      |
| 79 | <i>Jatropha gossypifolia</i> L.                      | Euphorbiaceae  | Shrub      |
| 80 | <i>Ludwigia adscendens</i> (L.) Hara                 | Onagraceae     | Herb       |
| 81 | <i>Lantana camara</i> var. <i>acullata</i> (L.) Mold | Verbenaceae    | Shrub      |
| 82 | <i>Leucas mollissima</i> Wall.ex Benth.              | Labiatae       | Herb       |
| 83 | <i>Lagerstroemia parviflora</i> Roxb.                | Lythraceae     | Shrub      |
| 84 | <i>Lawsonia inermis</i> L.                           | Lythraceae     | Shrub      |
| 85 | <i>Lygodium flexuosum</i> (L.) Sw.                   | Lygodiaceae    | Fern       |
| 86 | <i>Lagerstroemia indica</i> L.                       | Lythraceae     | Tree       |
| 87 | <i>Madhuca indica</i> Gmel.                          | Sapotaceae     | Tree       |
| 88 | <i>Murraya Koenigii</i> (L.) Spreng.                 | Rutaceae       | Shrub      |
| 89 | <i>Mangifera indica</i> L.                           | Anacardiaceae  | Tree       |
| 90 | <i>Moringa oleifera</i> Lam.                         | Moringaceae    | Small Tree |
| 91 | <i>Mimosa pudica</i> L.                              | Fabaceae       | Herb       |
| 92 | <i>Musa paradisiacal</i> L.                          | Musaceae       | Shrub      |
| 93 | <i>Manihot esculenta</i> Crantz                      | Euphorbiaceae  | Shrub      |
| 94 | <i>Microstegium ciliatum</i> (Trin.) A.camus         | Poaceae        | Grass      |

|     |   |                 |            |
|-----|---|-----------------|------------|
| 95  | <i>Mimosa himalayana</i> Gamble                       | Mimosaceae      | Shrub      |
| 96  | <i>Mitragyna parvifolia</i> (Roxb.)Korth.             | Rubiaceae       | Tree       |
| 97  | <i>Mimusops elengi</i> L.                             | Sapotaceae      | Tree       |
| 98  | <i>Merremia tridentata</i> (L.)Hall.f.                | Convolvulaceae  | Creepers   |
| 99  | <i>Mentha piperita</i> L.                             | Lamiaceae       | Herb       |
| 100 | <i>Nerium oleander</i> L.                             | Apocynaceae     | Shrub      |
| 101 | <i>Nouchali stellata</i> Willd                        | Nymphaeaceae    | Herb       |
| 102 | <i>Oxalis corniculata</i> L.                          | Oxalidaceae     | Herb       |
| 103 | <i>Oxal scandens</i> Roxb.                            | Oxalaceae       | Shrub      |
| 104 | <i>Osbeckia chinensis</i> L.                          | Melastomataceae | Herb       |
| 105 | <i>Ocimum basilicum</i> L.                            | Lamiaceae       | Shrub      |
| 106 | <i>Phoenix sylvestris</i> (L.)Roxb                    | Arecaceae       | Tree       |
| 107 | <i>Psidium guajava</i> L.                             | Myrtaceae       | Small Tree |
| 108 | <i>Polyalthia longifolia</i> (Sonn.) Thw.             | Annonaceae      | Tree       |
| 109 | <i>Pithecellobium saman</i> (Jacq.)Benth.             | Fabaceae        | Small Tree |
| 110 | <i>Pergularia daemia</i> (Forssk.)Chiov.              | Apocynaceae     | Climber    |
| 111 | <i>Peltophorum pterocarpum</i> (DC.)Baker ex. K.Heyne | Caesalpinaceae  | Tree       |
| 112 | <i>Polygonum barbatum</i> L.                          | Polygonaceae    | Herb       |
| 113 | <i>Parthenium hysterophorus</i> L.                    | Asteraceae      | Herb       |
| 114 | <i>Phyllanthus emblica</i> L.                         | Euphorbiaceae   | Tree       |
| 115 | <i>Quisqualis indica</i> L.                           | Combretaceae    | Shrub      |

|     |  |                   |            |
|-----|--|-------------------|------------|
| 116 | <i>Rouvolfia tetraphylla</i> L.                          | Apocynaceae       | Shrub      |
| 117 | <i>Richardia scabra</i> L.                               | Rubiaceae         | Herb       |
| 118 | <i>Syzygium cumini</i> (L.) Skeels                       | Myrtaceae         | Tree       |
| 119 | <i>Sesamum indicum</i> L.                                | Pedaliaceae       | Herb       |
| 120 | <i>Schleichera oleosa</i> (Lour.)Oken                    | Sapindaceae       | Tree       |
| 121 | <i>Solanum lycopersicum</i> L.                           | Solanaceae        | Herb       |
| 122 | <i>Smilax macrophylla</i> Roxb.                          | Smilacaceae       | Shrub      |
| 123 | <i>Streblus asper</i> Lour.                              | Moraceae          | Tree       |
| 124 | <i>Scoparia dulcis</i> L.                                | Scrophulariaceae  | Herb       |
| 125 | <i>Shorea robusta</i> Gaertn.f.                          | Dipteraocarpaceae | Tree       |
| 126 | <i>Solanum torvum</i> Sw.                                | Solanaceae        | Shrub      |
| 127 | <i>Tamarindus indica</i> L.                              | Fabaceae          | Tree       |
| 128 | <i>Terminalia tomentosa</i><br>(Roxb.ex DC.)Wight & Arn. | Combretaceae      | Tree       |
| 129 | <i>Tectona grandis</i> L.f.                              | Verbenaceae       | Tree       |
| 130 | <i>Terminalia bellirica</i> (Gaertn.)Roxb.               | Combretaceae      | Tree       |
| 131 | <i>Tridax procumbens</i> L.                              | Asteraceae        | Herb       |
| 132 | <i>Thysanolaena maxima</i> (Roxb.)Kuntze                 | Poaceae           | Grass      |
| 133 | <i>Typha angustata</i> Bory & Chaub.                     | Typhaceae         | Herb       |
| 134 | <i>Tephrosia purpurea</i> (L.)Pers.                      | Fabaceae          | Grass      |
| 135 | <i>Thuja orientalis</i> L.                               | Cupressaceae      | Small Tree |
| 136 | <i>Crotolaria juncea</i> L.                              | Fabaceae          | Shrub      |

|     |   |                  |            |
|-----|---|------------------|------------|
| 137 | <i>Trichosanthes tricuspidata</i> Lour.                   | Cucurbitaceae    | Climber    |
| 138 | <i>Tripogon bromoides</i> R & S                           | Poaceae          | Grass      |
| 139 | <i>Toddalia asiatica</i> (L.)Lam.                         | Rutaceae         | Shrub      |
| 140 | <i>Vitex negundo</i> L.                                   | Lamiaceae        | Shrub      |
| 141 | <i>Valeriana chinensis</i> L.                             | Hydrocharitaceae | Herb       |
| 142 | <i>Wendlandia heynei</i> (Roem. & Schult.) Sant. & Merch. | Rubiaceae        | Small Tree |
| 143 | <i>Woodfordia fruticosa</i> (L.)Kurz                      | Lythraceae       | Shrub      |
| 144 | <i>Ziziphus oenoplia</i> (L.) Mill                        | Rhamnaceae       | Shrub      |

III. RESULTS AND DISCUSSION

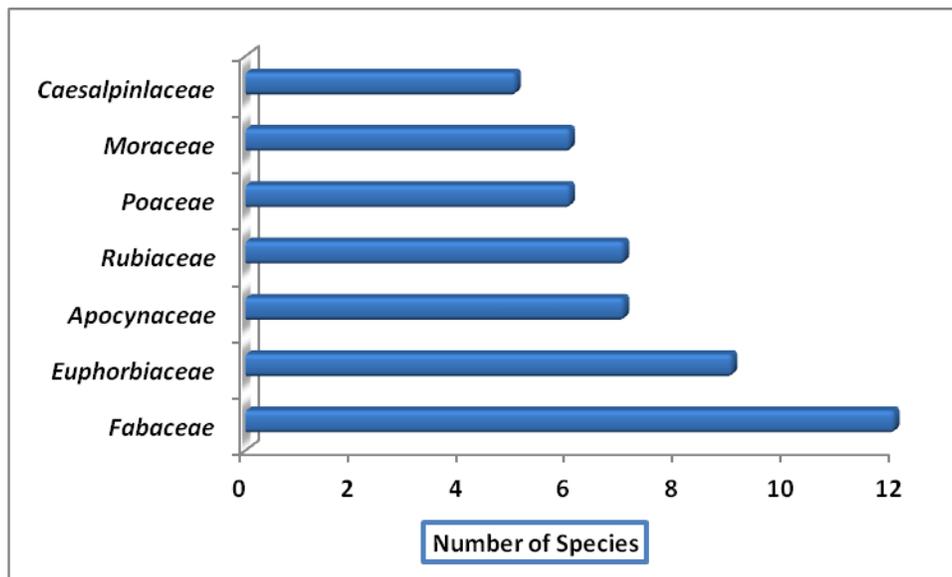


Figure 2: Graph showing number of species in families

Despite of harsh climate a total of 144 plant species (36 tree, 36 herbs, 34 shrubs, 17 small tree, 11 climber, 8 grasses and 2 rhizomes) were documented from the nearby areas of Lajkura coal mine. Dominant families were Apocynaceae, Fabaceae, Moraceae, Poaceae, Euphorbiaceae, Asteraceae and Lamiaceae as shown in figure 2. The grasslands of the area comprise the grasses like *Cynodon dactylon*, *Eragrostis coarctata*, *Bulbostylis neglecta*, *Microstegium ciliatum*, *Thysanolaena maxima*, *Tehrosia*

*purpurea* and *Tripogon bromoides*. Tree species like *Cassia fistula*, *Eucalyptus tereticornis*, *Ficus carica*, *Ficus religiosa*, *Mangifera indica*, *Madhuka indica*, *Phyllanthus emblica*, *Solanus crispum*, *Tectona grandis* and *Tamarindus indica* are the keystone species in that area. Plant species like *Cynodon dactylon*, *Cyperus rotundus*, *Heliotropium strigosum* and *Parthenium hysterophorus* were exotic in nature.

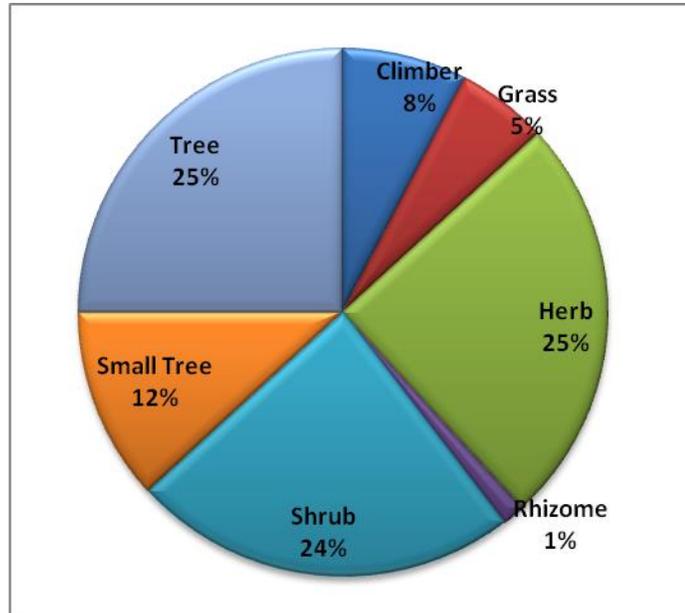


Figure 3: Graph showing the plant type

This study will be of great help to the state government, particularly the forest department in developing a strategy and action plan for the management of this biodiversity rich forest area. Rare, Endangered, and Threatened plants obtained from the present investigation may help the scientists, conversationalists and environmentalists for conserving and protecting the natural resources. It would be the moral and ethical duty of the local people and government organization to protect the plant resources.

#### IV. CONCLUSION

Extensive coal mining in the study area has led to shrinkage of land use/land cover and created a landscape dotted with mine spoils. The study reveals that the natural floristic composition of the mine area is dominated by the tree species followed by shrub and herb. It is evident from the study that the mining activities are detrimental to the plant diversity. Thus it is advisable that such activities have to be strictly regulated to avoid further damage to the species and scientific mining has to be taken up in a proper manner to minimize further damage to the vegetation. Hence appropriate and proper management plan was necessary for the reclamation of mined affected areas.

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# Third Gender in Indian Films with a special Reflection on Chitrangada

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**Abstract-** The paper is to highlight on the depiction of third gender issue in Indian Film with a special focus on film Chitrangada. With an understanding of gradual representation of third gender in world cinema it tries how the issue has made its road to Indian Films. It explores various issues on problems related to third gender portrayed in the film Chitrangada.

**Index Terms-** Third gender, films, Chitrangada, homosexuality

## I. INTRODUCTION

While there are various issues that are becoming the basis of film making, the issue of third gender has not occupied much space in Indian films as compared to mainstream films. The main stream films in India have showed the third gender very often as part of a film, sometimes to introduce humor content in the films as *Chhakke*, *Hijra* etc, but the films have not dealt much with the third gender question, which shows the lack of acceptability of third gender in the mainstream Indian films. The Bengali film *Chitrangada* in this light can be regarded as one of its type which deals with homosexuality raising many epistemological questions on homosexuality. The paper thus tries to discuss the portrayal of third gender issue in films with a special focus on Indian film *Chitrangada*.

## II. THIRD GENDER AND ITS SOCIAL POSITION

Third gender can be described as a category of people who neither fall under feminine gender nor under masculine gender straight way. Many of whom have certain physical characteristics which are expressed in morphology, and many have some hormonal or genital characteristics. Again it also includes people of opposite sexual orientation than what they are. The different categories of third gender can be described as below:

- Eunuch: an historic English term for a man who has been castrated to perform special social functions.
- Intersexual : a term referring to people who are born with a mixture of both male and female hormonal, chromosomal and genital characteristics( historically referred as hermaphrodite)
- Hijra : A term originating in south India referring to a person usually born male or intersex, but who uses female pronouns as dresses in feminine /women's attire
- Transsexuals : a term referring to someone who changes their sex through medical ( surgical and / hormonal) procedure
- Transgendered: a term referring to someone whose gender identity is different from the one traditionally as-

signed to their sex category ( people are born into sex categories of male and female , many but not all then become gendered masculine or feminine and into men and women). Thus transgendered person both in the female sex category may identify with the gender category man . This may or may not involve surgical operations.

- Drag : a term that comes out of gay culture, involving someone temporarily performing a gender not usually associated with their sex ( through dress gesture and so on ). Ironic humor and extravagant campiness is often involved.
- Transvestite/Cross dresser: these are older terms with meaning and histories—and often the term is used in a derogatory fashion. In terms of practice though, cross-dressers are often not gay, but straight men who simply enjoy dressing up as women.

While third gender constitutes a significant percentage of world population but in terms of social recognition the category of people suffer from diverse experiences of social exclusion. According to UCLA School, 3.8 percent Americans identify them as LGBT. The institute also found bisexuals make up 1.8 percent of population, 1.7 percent as gay or lesbian, transgendered adults make up 0.35 of the population. In Britain, 1.55 percent of populations are gay. It is around 726,000. An Estimate of transgender persons in India is 1:400.India has the highest gay population in the world. It has 2.5 million gays of which 7.5percent are HIV positive<sup>xii</sup>. (14 March 2012, BBC News India).

While third gender comprised of a significant proportion of population yet it suffers from deprivations and exclusion. It is observed that LGBT people face harassment in school, colleges and in workplace too. They are looked down upon by the mainstream genders i.e., men and women. For a longer period the third gender people faced difficulty of various kinds. They are not allowed to have sex with their partner of same sex; they are not permitted to adopt a child. They are not allowed to marry each other. The third gender category also suffers from discrimination in employment and housing. Though there is myriad change in case of their social standing in many countries as many countries have recognized homosexuality still it has not equal recognition irrespective of societies wherever they are present. Around 13 countries recognized same sex marriage, in many countries there are anti LGBT workplace discrimination law. Yet the third gender deprivation is still observed in diverse ways in many countries. In India the recognition of third gender passes through complex stages while a High Court verdict of Delhi rec-

ognized same sex, the recent ruling by Supreme Court against same sex shows how the fate and status of third gender of the country with largest number of people of third gender awaits legal and thereafter its social recognition.

### III. THIRD GENDER IN WORLD CINEMA

The visibility of third gender in world films has passed through the same stages as the very issue of third gender has passed through in getting recognition in society. It has been seen that the straight art films were not hospitable to gay films from the very inception of the portrayal of homosexuality in films. Though homosexuality has been part of many films, the regular portrayal of homosexuality was observed mainly with the decade of 1970s and afterwards. The film on homosexuality though started with William Dickson's Motion Picture in 1895, where two men were shown dancing, 'Different from the Others' can be considered as the first gay right movie that was produced in 1919. While gay issues are portrayed in different countries in different points of time, the frequent production of gay films are highly observed with the culmination of gay right movement in the decade of 1970s and 80s and thereafter. The visibility as politics<sup>xiii</sup> became one of the major strategies of gay right movement which is observed in the development of film and screening of films in different countries. A number of film festivals were organized by different organizations e.g., BFI London LGBT film festival, San Francisco International Film Festival, New York Lesbian and Gay Experimental Film Festival and its counterpart New York Lesbian and Gay Film Festival. These festivals emerged as one of the major platforms for gay films and gay right movements.

The gay issues have got considerable place in many films of Britain, France, Germany, Canada and the U.S.A. To mention a few gay films in the nineteenth century are: the British films - *The Leather Boys*(1961), *Sunday Bloody Sunday* (1971), *the Nighthawks* (1978), French Films- *Un chant d'amour*, *Orphee* (1950) *Une robe d'e'te'*(1996), American Films as *Longtime Companion*(1989) *Damned If You Don't* (1987) *Boys Don't Cry* (1999) and *Black Swan* (2010).

In the beginning gay role did not get prominence where gays were portrayed with part representation of the fact some times as gender role reversal, flamboyant etc. The gay issue became the theme in many movies mainly during 1920s when filmgoers were less in number because of economic depression. So, controversial theme was the subject matter of many films to have more shockwaves in audience.

Initially the gay films were synonymous with experimental films. But the films started to get momentum in 1990s when a number of film festivals were frequently organized in the decade. The amplification of gay issues in film took place in 2000s. It is to be mentioned that in 2007, two million people joined the Madrid hosted Europride<sup>xiv</sup>, unlike 1995 when it was joined by 5000 people only. In India the first mainstream Gay Film Festival was held in the year 2010, in the month of April.

The recent decades show multiple varieties of gay films. It can be noted that IMDb<sup>xv</sup> lists 94 popular gay movies in 2012 and 76 gay movies in 2013. This shows how third gender has gradually shown its visibility in different countries. Gay issue also caught the attention of the Disney which is bringing the first

animated full length film on gay. Thus the gradual popularity of the gay films in terms of its production, screening and viewing shows the gradual acceptance of third gender issue in the societies over the world.

### IV. THIRD GENDER IN INDIAN FILMS

While the film making on gay issue was observed century ago, India opens its account in late eighties of twentieth century. Though like many other countries it shows gay visibility in 2000s when a number of gay films are produced. The first film known to focus on gay sex is *Bomgay* which is a short film of 12 minutes. The film was not released in India as the maker believed that it may not get certificate from Censor Board. The *Desatanakkili Karayarilla* is the first Malayalam film which showed love between two school girls who decided to elope from the school and to be together to take revenge against their teacher who used to harass these girls. The film is positively critiqued for its portrayal of same sex orientation very beautifully. The films on third gender are largely found mainly with 1996. It is the year when *Fire* was produced but was released in India in 1998 which met with huge protests by different organizations and thereafter has set a stage to debate on homosexuality. Directed by Deepa Mehta, it can be considered as the first mainstream film where Lesbianism got a clear and comprehensive visibility. While the twentieth century marked the visibility of few gay films or other third gender films as *Fire*(1996) *Tamanna* (1997), *Darmiyaan* (1997), *Daayraa* (1996), *Dostana*(1998), *Bombay Boys*(1998) etc. the twenty first century gradually added to the issue further with its increased number of films and increased representation in terms of dimension and content. It is interesting to note that the year 2009 onwards the number of films on third gender has increased more. The year has seen two gay films *My Son is Gay* a Hindi film and *Ritu*, a Malayali film. While *My Son Is Gay* is based on a story of an orthodox mother and her Gay son who struggle to accept the gay identity. In 2010 a good number of films were made on gay theme. While the year 2009 and 2010 are important for third gender in India because it is to be noted the Delhi High Court verdict on permission of marriage between two homosexuals took place in 2009 and the year 2010 marked the first International Gay Film Festival in India. The 2010 itself has produced at least five films on gay issue as *I Am* (Hindi), *Arekti Premer Golpo* (Bengali), *Donno—Y—Na Jane Kyou* (Hindi), *Goa* (Tamil), *Pankh* (Hindi). While *I Am* is a compilation of four short films, where gay theme becomes the focus of one part of the film. *Arekti Premer Golpo* is the first film on homosexuality after the decriminalization of the homosexuals in India in 2009.

### V. CHITRANGADA AND THE QUESTION OF THIRD GENDER

The film *Chitrangada* was released in 2012 and is directed and starred by Rituparno Ghosh. The film explores multiple dimensions of the problem of being a third gender. The desire of being a different sex is highlighted in the film as the choreographer wants to introduce the theme of *Chitrangada* as wish of one individual to change its sex as it finds the existing sex identity as undesirable and unbearable. The naming of the film *Chitrangada*

is purposefully selected which has multiple dimensions. It is seen that the heroine had to play a sex role reversal as her father wished her to be so. The king who had a wish for a male child, the most desired sex a patriarchal society wishes for a child to be, discovers that the child he is blessed with is a girl. So he asks her to play a role of a boy. Accordingly, the princess continues to grow up as a boy. When she met Arjun, who went to her dynasty in the north east part of present India she had fallen in love with Arjun. As a result she finds it difficult to keep her womanhood in disguise and decides to throw her sheath of man hood and express her love for Arjun.

Film *Chitrangada* is based on Rabindra Nath Tagore's dance drama *Chitrangada* the source of which is the Great epic Mahabharata . The film talks about how third gender is a social reality that suffers from social exclusion in diverse ways. It digs into various issues related to third gender.

The first issue is the acceptance of third gender identity within the institution of family. Very often it is reported that whenever a third gender unveils its identity the family members react to it very strangely. The real experience of third gender as shown in T.V. shows tells the similar story. The film portrays the mother as ready to accept the reality, and father is shown to be huddled with difficulty in accepting the fact.

The film also shows the difficulty that lies to start a conjugal familial life by the people of third gender. Rudie who discovered the desire to have a child in Partho, only made his mind to go for a sex reassignment surgery so that it can help them to adopt a child. Rudie set to do so because he knew that the society and law will never permit two men to adopt a child. Hence to be a woman physically he decided to change his sex.

The suffering of the third gender is also shown to have another dimension when his boyfriend Partho left Rudie to marry a real woman. Partho gave an explanation that he wants to marry a natural being not an artificial woman as Rudie is going to be after the surgery.

The film has got a philosophical dimension too. It brings into certain epistemological question on the nature of body, its form and formation and finally the permanency of it. The very being homosexual according to the film is a reality which transcends the concept of manhood and womanhood. Rudie brings up all these questions when his father asked him when he will become a girl after the sex reassignment and whether there is any possibility of change of his name after the surgery. As change of sex and name may pause some technical problems in inheriting the parental property by Rudie. The very dialogue was meaningful to capture the realities of sexuality. It also reflects how becoming a sex is a physical process. It is never an end but an ongoing process. The sexuality is not a two dimensional reality rather a human being can be a man, woman or any other sexual entity. So one should not give a full stop to understand sex from two perspectives i.e., man and women but a third perspective can also be equally meaningful in that.

## VI. CONCLUSION

Indian Films on third gender shows similar trend as other films on third gender depicts, over the world. The fact that film as a reflection of society can better be understood here in the context of production and screening of third gender films. The

production of film on third gender went along with the movement for recognition of third gender in the society. This is highly observed throughout the world e.g., in Spain after third gender category got legal recognition in 2003, shows the visibility of gay in terms of production of films and its viewing. India also showed similar scenario. The issue appears prominently in the films as it appeared prominently in the society. The decriminalization of homosexuality in India can be considered as one of the major causes of production of third gender films and the screening.

The film *Chitrangada* which was released in 2012 starred and directed by Rituparno Ghosh is one of the films which brings the issue of the third gender in minute detail. It focuses on the multiple dimension of the issue of the problem a member of third gender community faces. Starting from the issue of acceptability and non acceptability of the matter by different members of the family, the technical hurdle of adaptation of a child and marriage of two gay men without proper mainstream sex code, all are shown with detailed analysis. The film also shows a mixed recognition of third sex and third gender with depiction of difficulties faced by third gender.

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# Strengthens and Challenges for utilizing Indian soft power: a comparative study with the United States of America

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**Abstract-** India has used its own potentials and capabilities in terms of culture, religion, economy and politics since Indu-Nimna civilization as means of its soft power. Even though India has successfully applied its soft power within the region; she has not successfully extent its power beyond the region to encompass other states in the world. On the other hand the United States of America (USA) has succeeded to embrace the world although they have a more brief history and un-unique history compared with India. In fact, it is obvious that soft power of the United States is being used throughout the world since the independence concurrently with comprehensive understanding of the current phenomena. Therefore, the main intention of this research paper is to investigate reasons and challenges of India being unable to become a hegemonic power in the world. Apart from that, this anticipates to analyze the practice of American soft power as a successful bench mark according to Joseph Nye's view as a comparative study together with India.

The main research problem of this paper is *why is India unable to extend its soft power beyond the South Asia even though it has stronger tools than the United States*. In that sense the research objective is to find whether India has a potential to establish hegemony with their soft power tool. This paper is driven by the hypothesis of *"India is very much infirm to apply her existing soft power tools to build hegemony"*. The author has depended on secondary resources to investigate on this problem.

Since international arena is altering minute by minute, the significance of this research paper is to interpret the Indian utilization of soft power as an emerging country from the International Relations' point of view as a comparative study with the United States.

**Index Terms-** Soft Power, Hard Power, Hegemonic power

## I. INTRODUCTION

India has used its own potentials and capabilities in terms of culture, religion, economy and politics since Indu-Nimna civilization as means of its soft power. Golden history, Indian film industry (Bollywood), Yoga, Ayurada, Pluralistic diversity, tolerant secularism, Indian diaspora<sup>29</sup>, democracy and etc can be identified as soft power elements. Even though India has successfully applied its soft power within the South Asian region, she

has not successfully extent its power beyond the region to encompass other states in the world. On the other hand the United States of America (USA) has succeeded to embrace the world although they have a briefer and un-unique history compared with India (America means the United States of America hereafter).

In fact, it is obvious that soft power of the United States is being used throughout the world since the independence concurrently with comprehensive understanding of the current phenomena. Therefore, the main intention of this research paper is to investigate reasons and challenges of India being unable to become a hegemonic power in the world or at least to realise the obstacles that India is unable to extent its soft power in this unipolar world. Apart from that, this anticipates to analyze the practice of American soft power as a successful bench mark according to Joseph Nye's view as a comparative study together with India.

## 1.2 PROBLEM STATEMENT AND RESEARCH PROBLEM

It is apparent that though India has potentials to extent its soft power beyond the South Asian region, India is infirm to do so. Therefore, the research statement of this research is *India has not extent its soft power beyond the South Asian region*.

According to the research statement has stated above, the main research problem of this paper is *why is India unable to extend its soft power beyond the South Asia even though it has stronger tools than the United States*.

## 1.3 SIGNIFICANCE OF THE RESEARCH

Since international arena is altering minute by minute, the significance of this research paper is to interpret the Indian utilization of soft power as an emerging country from the International Relations' point of view as a comparative study with the United States.

## 1.4 HYPOTHESIS

This paper is driven by the hypothesis of *"India is very much infirm to apply her existing soft power tools to build hegemony"*.

## 1.5 RESEARCH OBJECTIVES

The initial research objective of this research is to find whether India has a potential to establish hegemony with their soft power elements. The secondary research objectives are;

1. To realise the American utilization of soft power throughout the world as a successful benchmark of the world.
2. To understand the challenges and obstacles that India is confronting when extending its soft

<sup>29</sup>Thussu, DayaKrishan(2013). "India Abroad: The DiasporicDevidend." In *Communicating India's Soft Power: Buddha to Bollywood*, 90-93. New York: Palgrave Macmillar.

power elements beyond the South Asian region.

### 1.6 METHODOLOGY

Type of research which has been used was qualitative. Whole idea of using qualitative research was to gain in depth understanding about the problem interested. When conducting qualitative research several tools were used. Primary data were gathered through discussions with experts and secondary data were gathered using case study research methods using books, journals, magazines and official websites of relevant parties.

## II. THEORETICAL AND CONCEPTUAL ANALYSIS

As the discipline of International Relations defines power is the capacity of affecting others to get the outcomes one wants through material sticks and carrots (Coercion and payments), thus power can affect to the preferences of others and can attract them to what it wants.<sup>30</sup> As this definition elaborates, power can be influenced to the behaviour of others in several ways such as coerce with threats, induce with payments or attract and co-opt to obtain outcomes what require to attain.

Moreover, the schools of Realists, Structural Realists and Neo- Realists have explicated the nature of anarchical International System with relate to the concept of Power.

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<sup>30</sup>Nye, Joseph S. "The Changing Nature of Power." In *Soft Power: The Means to Success in World Politics*, 2-30. New York: Public Affairs Books, 2004.

|                    | <b>Realist</b>  | <b>Structural Realist</b>  | <b>Neo Realists</b>   |
|--------------------|---|--|---|
| <b>Elements</b>    | Power and Statecraft  | Power  | Power and threats   |
| <b>Objective</b>   | States requires ensuring their survival and security.   | Maximization the power of states through self help.  | States act according to the logic of self-help--states seek their own interest and will not subordinate their interest to another's.  |
| <b>Perspective</b> | In order to attain above mentioned objective as independent entities, states increase power. The realist tradition explicates international politics as a 'state of nature', an importantly anarchic system in which each State is forced to help itself and give priority to its own national interests. | States are basic units of anarchical international system and they pursue power as a central concern for dominating other countries in order to thrive and ensure power. War and conflicts are obvious consequences of this process. | States develop <a href="#">offensive military</a> capabilities, for <a href="#">foreign interventionism</a> and as a means to increase their relative power. Security dilemma is obvious since lack of trust is enhancing on each states. The desire and relative abilities of each state to maximize relative power constrain each other, resulting in a ' <a href="#">balance of power</a> ', which shapes international relations. |

Table 2.1.1<sup>31</sup>

<sup>31</sup>Purushothaman, Uma (2010). "Shifting Perceptions of Power: Soft Power and India's Foreign Policy." *Journal of Peace Studies* 17, no. 2&3, 1-3.

As above table denotes, many states in the world exercise the concept of power in different ways. According to the present phenomena states not only intends to utilize and gain hard power but also states utilize and gain soft power from various ways. Since this paper specifically focus on the Indian utilization of soft power, this attempts to identify soft power tools and role of soft power by means of Indian context.

## 2.2 SOFT POWER IN INTERNATIONAL SYSTEM

The concept of soft power has been discussing since the cold war period increasingly. Joseph Nye expressed the term of Soft Power for the first time to the world from his book called "Bound to Lead: The Changing Nature of American Power". According to him Soft Power means the ability to obtain what you want through attraction rather than coercion or payments<sup>32</sup>. In fact soft power can be arisen due to the attractiveness of a country's culture, political ideals, and policies which are 'real but intangible'. Interestingly, soft power elements are thoroughly different from hard power elements.

Moreover the success of utilization of soft power depends on the reputation of the states in the international system as well as the utilization of diplomacy between states. If Further explains, it is not important even though states have effective soft power elements unless states use and publicise its soft power through diplomacy in productive manner.

In fact, soft power is frequently related to the rise of globalization and neoliberal theory. Popular culture and media is identified as sources of soft power since those can extent national language, or a particular set of normative structures. Therefore the nation with a large amount of strength of soft power and determination of winning other states' inspiration will avoid the requirement for expensive hard power expenditures. From other words, even though soft power cannot produce results as soon as hard power it is less expensive than hard power. The difference between hard power and soft power is clearly indicated in table 2.1.2

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<sup>32</sup>Schouten,P (2008), 'Theory Talk#7: Joseph Nye on Teaching America to be more British', *Theory Talks*, <http://www.theory-talks.org/2008/05/theory-talk-7.html>. (Accessed 30.10.2014).

|                        | <b>Hard Power</b>                        | <b>Soft Power</b>                           |
|------------------------|--|---|
| Spectrum of Behaviours | Command<br><i>Coercion</i>               | Co-<br><i>opt Agenda Setting Attraction</i> |
| Most likely Resources  | Force<br>Sanctions<br>Payments<br>Bribes | Institution – Values<br>Culture<br>Policies |

table 2.1.2<sup>33</sup>

<sup>33</sup> Nye. *Soft Power: The Means to Success in World Politics* . 8.

According to the above table it is evident that hard power elements are utilized through force, sanctions, payments and bribes in order to obtain what a country requires to attain. However, soft power elements is about co-opt and it sets up agendas to attract other countries to feel them to follow the agendas what they have made. Although the intensity of using force is lesser in soft power, it is very much effective and productive of displaying power and encompassing others into it via attraction.

Moreover as Joseph Nye stated soft power is essential of daily democratic politics since the ability to establish preferences tend to be associated with intangible assets such as culture, attractive personalities, political institutions, economic strategies and etc<sup>34</sup>. Persuasion is the inevitable result of these intangible soft power assets. American cultural exports such as Hollywood movies, Coca-Cola, and MacDonal'd's can be stated as elements of soft power.

### III. THE ELEMENTS AND UTILIZATION OF INDIAN SOFT POWER

This fragmentation is reserved for identifying the elements and understanding the utilization of Indian soft power. For a convenient study this section is being arrayed to following sub headings.

#### 3.2 CULTURE

Indian culture is the one of the oldest, most diverse as well as a popular soft power element which assists to build the image of India positively. The Indian [culture](#) is described as "SaaPrathamaa Sanskrati Vishvavaaraa" which means the *first* and the *supreme* [culture](#) in the world<sup>35</sup>. Thus, all the behaviours and learning of India have been formatted with based on its culture. Specifically the classical music, Indian dancing, language diversity, yoga, spiritual practices, Bollywood film industry, diaspora, arts and food of India are effective elements that are able to make a difference in this world.

India has had a long history of civilizational and cultural links with countries as far-flung as Iran, Rome and South East Asia<sup>36</sup>. As results of that Countries in Southeast Asia still have remnants of Indian traditions: the Angkor Vat temple in Cambodia, temples and pagodas in Thailand and Myanmar<sup>37</sup>. Not only that but also the presence of several Sanskrit words in languages like Bahasa Indonesia prove the influence of Indian culture on these countries.

Moreover Indian diaspora can be stated as the riches asset of Indian soft power since the diaspora has expanded across countries like Fiji, Guyana, Malaysia, Mauritius, Surinam, South Africa, Sri Lanka and Trinidad<sup>38</sup>. Importantly, Countries like Fiji and Mauritius have large Indian communities with people of Indian Origin holding important political positions. In addition Indian population who have settled in the USA is another im-

portant factor of Indian soft power since those Indo American community attempts to upturn their identity with lobbying and influencing.

Yoga is another spiritual and physical practice which is a by-product of Indian soft power and it is very famous all over the world, specially- West. People engage in Yoga to release the tension and stress. Apart from that Indian food that are used endemic and delicious spices and herbs also play an important role in utilizing Indian soft power and particularly, these cuisines are very famous in the United Kingdom<sup>39</sup>. Interestingly, most of Indian restaurants can be seen in Asian and western countries.

Another weighty factor of Indian soft power is Indian movies and it is the larger film industry after Hollywood film industry. Indian movies along with Indian music are popular and are watched by South Asian countries as well as Middle Eastern, African and Europe countries. Many Bollywood artists like Amitabh Bachchan, Aishwarya Rai and Shah Rukh Khan have become the icons of Indian soft power that are capable to attract others to Indian culture. Remarkably, India has won three Oscar awards 40 after 1982 as a milestone of Indian film industry.

In addition As Uma Purushothaman mentioned when India Indian writers win international awards like the Man-Booker prize, when India becomes the guest of honour at international book fairs like the Frankfurt Book Fair, When Indian movies are screened at International Film Festivals like Cannes and when Indians win awards like the Nobel and Magsasay awards, India's soft power is being built gradually<sup>41</sup>.

In that sense it is undoubtedly to say that Indian cultural aspects play a significant role in order to attract others to Indian soft power elements. However, when concerning about the utilization, it is noticeable that India have encompassed all South Asian countries through its cultural aspects and South Asian countries are practicing them so far continuously as well as these cultural elements have become the part of themselves since most of South Asian cultures have fed from Indian culture. Nevertheless the extension of Indian culture beyond the South Asian region is an unsuccessful land mark of India.

#### 3.3 ECONOMY

Indian economic sector has widely expanded since independence. India's diverse economy encompasses traditional village farming, modern agriculture, handicrafts, a wide range of modern industries, and a multitude of services. With the liberalised economy India has able to maintain its economic growth around 7% since 1997 and Gross Domestic Product (GDP) rate are composited with 17.4%, 25.8% and 56.9% in agricultural, industrial and service sector respectively<sup>42</sup>. Among them Indian work force is ranked in the second place after China and India has capitalized on its large educated English-speaking population

<sup>34</sup>ibid.

<sup>35</sup>Akhand Jyoti, "Foundational Elements of Indian Culture (Bharatiya Sanskriti Ke Adharabhuta Tatva)". <http://www.akhandjyoti.org/?Literature/Vangmaya/Vol-34.3>. (Accessed November 02, 2014.)

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<sup>37</sup>ibid.

<sup>38</sup>ibid., 5

<sup>39</sup>Shashi Tharoor (2007). "Making the Most of India's Soft Power". The Times of India. 28<sup>th</sup> January 2007

<sup>40</sup>Bhopatkar Tejashree. "The Times of India."

<http://timesofindia.indiatimes.com/entertainment/hindi/bollywood/news/Bollywood-and-Oscars-over-100-years-of-Cinema/articleshow/19693992.cms>. (Accessed November 11, 2014).

<sup>41</sup>Purushothaman Uma (2010). "Shifting Perceptions of Power: Soft Power and India's Foreign Policy. 6.

<sup>42</sup>Central Intelligence Agency. "The World Factbook." <https://www.cia.gov/library/publications/the-world-factbook/geos/in.html>. (Accessed November 11, 2014).

to become a major exporter of information technology services, business outsourcing services, and software workers<sup>43</sup>.

Even though the big picture of economic statistics of India is relatively healthy, when observing the depth of the Indian economy it indicates a grey picture. For instances the inflation rate is 9.6% in 2013 and poverty line below population in 29% in 2013<sup>44</sup>.

### 3.4 POLITICS AND GOVERNANCE

The sub section is divided into two segmentations such as internal political policy and foreign policy.

Despite India confront many challenges India is successfully functioning its democracy and it is the biggest asset of India in terms of soft power. On the other hand Indian democracy is the world's largest democracy. Specifically India has proved functioning democracy is a realistic thing even in poor and illiterate countries as well. Since the independence India has held free and fair elections to select public representatives to the Congress though India has marginalised society in terms of multi caste, multi religion, and multi languages. Women participation in politics is also an outstanding feature of Indian soft power. In fact, the nearest countries like Nepal and Bhutan recent transfer to democracy denotes the influence of Indian democracy. Indian representation and assistance on behalf of democracy further enhance Indian soft power.

Most interestingly, freedom to press and freedom to express opinions are spectacular features that are able for thriving Indian soft power. Indian population do not ever hesitate to take their accusations to the court and challenge to the decisions of the government. The independent judiciary plays an active role in India by taking up many sensitive and current issues which directly affect to the public on the open forum. These implications clearly indicate that India is practicing not only democracy but also balance of power (the concept of check and balance) and good governance in some extent. In fact it is noteworthy mention Indian commitment to build and remain its democracy causes to enhance the moral power as well as soft power of India.

When considering about the foreign policy of India, it has been based on moral values from the time of Prime Minister Jawaharlal Nehru<sup>45</sup>. As Joseph Nye expresses that a country's foreign policy can increase its soft power if its foreign policy is perceived by other countries and people to be legitimate and having moral authority<sup>46</sup>. Gandhi begun *Non Violence Movement* to achieve independence peacefully and it is named as a soft power element since non violent methods have influenced to develop the area of peace studies. Aftermath Nehru consolidated this soft power strategy as a foreign policy agenda.

Moreover India attempts to keep its 'big brother' role within the South Asian region by resolving disputes and interfering to regional matters which have a spill over effect. As Uma Purushothaman has quoted Wagner, he argues that India's regional policy after the 1990s has been characterized by greater emphasis on soft power strategies<sup>47</sup>. For an instance Gujral doc-

trine introduced the principle of non-reciprocity which is emphasizing that India not only had a bigger responsibility, but should give more to the smaller neighbours than she would receive. This doctrine echoed domestic changes in India, especially the economic liberalisation post-1991<sup>48</sup>.

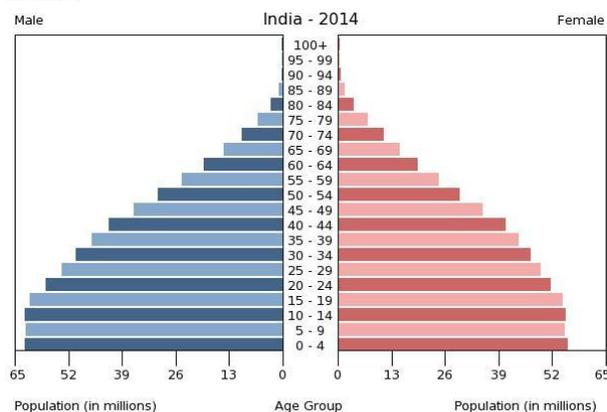
Apart from, at the institutional level India remains and are recognized as a quite a bit of institutional power due to its leadership of the G-77, G-22 and Non Alignment Movement. However, Indian wished to achieve a permanent seat in the UN Security Council displays its soft power significantly.

In precisely, this would say that Indian public diplomacy along with cultural diplomacy and neighbourhood diplomacy are very much effective soft power elements that India is utilizing.

### 3.5 SOCIAL ASPECTS

Not only cultural, economic, political and governance but also aspects of India can be identified as soft power elements. Specifically, education, demography, infrastructure and sports are elaborated.

According to the CIA factbook data by July 2014 Indian population is 1,236,344,631<sup>49</sup> and India is only second to China. Therefore India has a good workforce in order to obtain economic development since literacy rate of India is 62% in 2013 would become a plus point for India. As below population graph illustrates the young work force of India is above 50% and this proves the capability of utilization of Indian soft power in various manner.



Source: CIA factbook:

<https://www.cia.gov/library/publications/the-world-factbook/geos/in.html>

Moreover, cricket specifically Indian Premier League causes to build strong relations between India and some other Asian nations beyond its immediate neighbourhood. Since players from western countries also participate in this League, cricket fans all around the world have attracted. The October 2010 Commonwealth Games in Delhi in spite of gross organizational shortcomings proved a meaningful selling point with the many Asian and Pacific Commonwealth countries<sup>50</sup>.

<sup>43</sup>ibid.

<sup>44</sup>ibid

<sup>45</sup>Purushothaman Uma (2010). "Shifting Perceptions of Power: Soft Power and India's Foreign Policy, 6-7.

<sup>46</sup>Nye Jr., Soft Power: *The Means to Success in World Politics*. 11.

<sup>47</sup>Purushothaman Uma (2010). "Shifting Perceptions of Power: Soft Power and India's Foreign Policy, 7.

<sup>48</sup>Aneek Chatterjee (2010). "International Relations Today: Concepts and Applications". Arete Publishing, New Delhi, 220.

<sup>49</sup>Central Intelligence Agency. "The World Factbook." <https://www.cia.gov/library/publications/the-world-factbook/geos/in.html>. (Accessed November 11, 2014.)

<sup>50</sup>Melon M. David. "Soft Power in Indian Foreign Policy". *Economic and Political Weekly*. Vol.36, 03 September 2001, 36.

India's youth is a crucial asset in Asia. Amazingly, in Singapore, the finance and information technology (IT) sectors welcome young Indians and many companies, banks and financial institutions have started visiting top Indian campuses for recruitment purposes<sup>51</sup>. Electricity generation of India is another crucial factor in term of soft power since India is ranked in sixth place in electricity production.

#### IV. THE UNITED STATES OF AMERICAN CONTEXT OF SOFT POWER

This sub section mainly focuses on the elements and utilization of American soft power as a benchmark.

The United States of America utilizes its cultural and public diplomacy in order to encompass the world as soft power methods. As Milton E. Cumming defines, 'Cultural Diplomacy' is the exchange of ideas, information, art and other aspects of culture among nations and their peoples to foster mutual understanding<sup>52</sup>. And cultural diplomacy is an effective tool in diplomatic relations since it has a potential to attract other nations to them conveniently. Thus, cultural diplomacy is a prime example of 'soft power', or the ability to persuade through culture, values, and ideas as opposed to 'hard power', which conquers or coerces through military might<sup>53</sup>.

American culture it is not a unique one since it has been influenced by the cultures of Native Americans, Latin Americans, Africans and Asians. American culture is described as 'melting pot' which it was fostered from various cultures<sup>54</sup>. Even though American culture was influenced by other cultures before, American culture influences to other countries today. Hollywood, Burgers, Coca-Cola, Google, Apple, Jazz and hip hop music, American English, Rock and Rolls dancing, American clothing and etc can be mentioned as examples.

If elaborates one by one, Ralph Lauren, Calvin Klein, Michael Kors and Victoria Secret are some well-known American clothing brands which have already embraced by the world. Hamburgers, hot dogs, potato chips, macaroni and cheese and meat loaf are enhancing the soft power of America in terms of food. "As American as apple pie" has come to mean something that is authentically American. McDonalds is the super famous hamburger pot for all people all around the world currently.

The United States is broadly popular as a leader in mass media production, including television and movies in the world. The television broadcasting industry took hold in the United States in the early 1950s<sup>55</sup> and American television programs are shown around the world. The United States also has a vivacious movie industry, namely Hollywood which is popular throughout the world. Thus, American music is varying as it is consisted with rhythm and blues, jazz, gospel, country and western, blue-

grass, rock 'n' roll and hip hop. People have been attracted by this music around the world. American foot ball and base ball are popular sports that are also famous in the world as well as those two sports are originated from America.

Social aspects of America are also considered as an element of soft power. American society is liberal and open which admires freedom a lot. American population is 318,892,103 (as estimated by 2014) and population growth is 0.77%. Although America is ranked in fourth place from population, its population growth rate is very low. American education is also in a higher place which is providing student exchange programmes and scholarships to foreign students to study in the USA annually. American green card lottery is another important factor that indicates the demand of American branding and it further illustrates the soft power utilization of American in the world.

Economy is another significant factor of American soft power since America still utilizes this element to make other states' attraction towards America. As CIA factbook denotes America has world largest and most technological economy of the world with the composition of GDP rates 1.1%, 19.5% and 79.4% by 2013<sup>56</sup> in agricultural, industrial and service sectors respectively. While service sector contributes a lot to country's growth, 37.3%<sup>57</sup> of labour force is in managerial, professional and technical fields. In addition America exports agricultural products (soybeans, fruit, corn) 9.2%, industrial supplies (organic chemicals) 26.8%, capital goods (transistors, aircraft, motor vehicle parts, computers, telecommunications equipment) 49.0%, consumer goods (automobiles, medicines) 15.0% and America is ranked in third place after China and European Union in exporting goods<sup>58</sup>. Stock of Foreign Direct Investments (FDI) in other countries is very high are America has ranked as number one country<sup>59</sup>.

In this market-oriented economy, private individuals and business firms make most of the decisions, and the federal and state governments buy needed goods and services predominantly in the private marketplace. US business firms enjoy greater flexibility than their counterparts in Western Europe and Japan in decisions to expand capital plant, to lay off surplus workers, and to develop new products.<sup>60</sup>

As above statement indicates with the liberal and open market America has been growing since independence and America is able to expand its products and brands throughout the world with its diplomacy.

In addition mass media and network of America play a major role in order to enhance American soft power. In 2012, four out of the five top entertainment corporations in the world were American based<sup>61</sup>. Specially, since America has technological knowledge from satellite to telecommunication networks and from cyber space to "total spectrum dominance" to dominate the world's network and communication under American brand. Hollywood, MTV, Disney, ESPN, CNN, Discovery, Time,

<sup>51</sup> ibid

<sup>52</sup> Schneider P. Cynthia (2004). *Culture Communicates: US Diplomacy That Works*. Netherlands Institute of International Relations 'Clingendael'. 1.

<sup>53</sup> Nye Joseph (2002). *The Paradox of American Power*. Oxford University Press. 8-9.

<sup>54</sup> Ryan Kevin, Coope James (2010). *Those Who Can, Teach*. 12<sup>th</sup> edition. Boston. Wadsworth Cengage Learning. 61.

<sup>55</sup> Kim Ann Zimmermann. "American Culture: Traditions and Customs of the United States". 22 April 2013. <http://www.livescience.com/28945-american-culture.html>. (Accessed 11 November 2014).

<sup>56</sup> Central Intelligence Agency. "The World

Factbook.", <https://www.cia.gov/library/publications/the-world-factbook/geos/in.html>. (Accessed November 11, 2014.).

<sup>57</sup> ibid.

<sup>58</sup> ibid.

<sup>59</sup> ibid.

<sup>60</sup> ibid.

<sup>61</sup> Thussu Daya (2014), *De-Americanizing Soft Power Discourse?*. Figueroa Press. Los Angeles.6.

Google, YouTube, Facebook, Twitter are the world famous American brands which have already possessed to America.

When concerning American politics and governance as a soft power element, it is undoubtedly to say, politics and governance plays a major role to expand the name and brand of America throughout the world and to obtain the attraction to them.

If further elaborates, America expanded its name through politics and governance since President Washington's era. Openness, mobility, individualism, pluralism, voluntarism, and freedom are sophisticated elements which are also relating to the American politics and governance. The way America utilizes the democracy by holding fair and free election, securitising sovereignty of people and balancing powers among main three organs of the government namely legislative, executive and jurisdiction provides an idea to the world regarding American internal politics.

As Abraham Lincoln expresses democracy can be stated as a government of the people, for the people and by the people. As [Armstrong Williams](#) has mention in his web article American system of Government truly makes it great<sup>62</sup>. Individualism, Majority rule, popular sovereignty, popular consent, equality, personal liberty, federalism, Separation of powers, popular political culture, pluralism, capitalism and rule of law can be identifies as characteristics of American democracy<sup>63</sup>. These characteristics are not only important to America but also most of the countries in the world have enfolded from these and it is proved that how has America promoted its politics and governance throughout the world as soft power elements.

Some of actions of foreign policy of America increases American soft power and some of strategies decline the attractiveness of American soft power. Therefore this segment is allocated to explain only plus points of American foreign policy as an element of soft power. Government can alter or control foreign policy of a country in order to attain the interest of the state. American Presidents utilize this method by means of attaining and achieving American state interest. For an instance, the Council on Foreign Relations recently suggested the formation of a Corporation for Public Diplomacy modeled on the U.S. Corporation for Public Broadcasting<sup>64</sup>. In addition America utilizes its foreign policy to promote its economy and political philosophy around the world. Specifically, America uses its financial stability to function International organizations like UN, World Bank, IMF, UNESCO and etc. Consequently, America has been able to attract other countries through financial support.

<sup>62</sup>Williams Armstrong. America's Unique Democracy. TownHall.com. 12 July 2011.

<http://townhall.com/columnists/armstrongwilliams/2011/07/12/americas-unique-democracy/page/full>. (Accessed 08.11.2014)

<sup>63</sup> Jeffrey D. Greene (2005). *Public Administration in the New Century: A Concise Introduction*. Belmont, CA: Wadsworth.

<sup>64</sup> Nye Jr Joseph. *Think again Soft Power*. FP.23 February

2003. [http://www.foreignpolicy.com/articles/2006/02/22/think\\_again\\_soft\\_power](http://www.foreignpolicy.com/articles/2006/02/22/think_again_soft_power). (Accessed 08.11.2014)

In conclusion, it would mention that America has potentials and America is able to maximize its potentials by branding its name throughout the world successfully though some of times its attractiveness was declined by them through interference the internal politics of countries unnecessarily.

## V. COMPARATIVE ANALYSIS

Elements and utilization of soft power of both countries are explained above with proves and the intension of this sub section is to analyze these two countries comparatively to explore the hypothesis.

If considers the elements of both countries it is needless to say, elements are capable in order to influence or change the world. From other words those elements are very much attractive to expand the soft power of each country. The best example is Hollywood and Bollywood industries. Both of these industries have massive fans. Then Ashypothesis denotes that why is India very much infirm to apply her existing soft power tools to build hegemony like America.

If certainly look at the elements one by one, American popular culture and Indian rich culture are the major elements that both countries have to promote their soft power. In comparison, Indian culture is not hugged by other countries like American culture. The American notion of Disneyland, hamburgers, pop music, ice cream corns are popular among the nations of the than Indian films, cuisines and music.

Specially, Indian bollywood movies have westernized since millennium. Not only movies but also Indian music has become more modernised. Bollywood music currently contains more modern themes and uses the English language. *Race*, *Wanted*, *Body Guard*, and *Student of the year* can be states as examples. Therefore modern Indian films are less relatable to Indian culture and those reflect western culture and attempt to please and win foreign audience as consequences.

Ironically, Indian film industry has been started as a weapon during the nation's struggle against British colonialism. But this industry now has altered their intension of establishing the industry. This can be defined as "black splash" on Indian film and music industry as well since this trend undermines Indian identity. Finally, India has become a bullet of American soft power weapon instead of being an original soft power weapon to promote country.

When concerning about the economy it is obvious that American economy has already encompassed the world with their giant marketing and media strategies. Specially, since 1776 (after independence) American chose "Isolationism" as their foreign policy and they attempted to enlarge their economy gradually. They did not engage in any World Wars till they were attacked. By producing weapons and technological alliances America reached its economic growth. They actually interfere to the world functions during the cold war period as they have strengthened their economic capacity to do so.

As denoted previously, American GDP is 16.9% (by 2013), the percentage of population below poverty line is 15% (2010) and inflation is 1.5% by 2013. This reflects clearly that American people enjoy the economic status perfectly since inflation and poverty is less. But though India has 7% of GDP, the population below poverty tine is 29.8 by 2013 and inflation rate is 9.6%.

These statistics indicate that India has internal economic challenges like poverty and disparity though the GDP is good. Thus India attempts to conquer and attain world economy without concentrating internal economic issues. But America attempts to same thing after they strengthened their economy.

In addition America has clearly identified the difference between marketing and management and they are using marketing tactics to maximize its economic benefits and mass media strategies to publicise and promote American brand names like McDonalds, face book, coca cola, Nike and etc all around the world. From other words American soft power is being enhanced with these strategies and tactics.

Politics and governance of both countries are attractive. Specially, Indian charismatic leaders have potentials to display their soft power to the world. But as the author thinks the Politics and governance of India has failed to expand its soft power due to internal issues that they confront in economics, politics and

social. But America has financial capacity to overcome their internal issues than India because of that American politics and governance more outstanding in terms of soft power strategy. In social aspects, India is infirm to expand its soft power due to challenges like brain drain, growing population, less facilities in health care and etc. These all are internal issues that India should address carefully in order to strengthen its soft power.

## VI. CONCLUSION

Soft power is all about attraction. In sophisticated phenomena soft power can utilize to obtain relative gains and balance the power. When analyzing soft power utilization of India with a comparative study on America all the research finding can be coincided in a table below.

| Element of Soft power<br>(considered according to the research focus) | Capability                       | India   | The United States of America  |
|---|----------------------------------|---|---|
| <b>Culture</b>  | India - Yes<br>USA – Yes         | Modernised due to Westernization                      | Powerful as an attractive asset   |
| <b>Economy</b>  | India- Relatively No<br>USA- Yes | Disparity is the major challenge                      | Powerfully exercised internally and externally  |
| <b>Politics and Governance</b>  | India- Yes<br>USA- Yes           | This doesn't powerful due to internal issues.         | Popular and powerful since the financial basis is strong                                |
| <b>Social</b>   | India- Relatively No<br>USA- Yes | Due to some reasons social aspects are less powerful. | Social aspects are very much popular and influential in both internally and externally. |

Source: author

As this above table shows that India has capabilities in terms of culture, politics and governance in order to expand its soft power. But utilization of the elements is really less than American. Interestingly, though American culture is popular, it is not rich as India.

Moreover, though America does not have much attractive assets of soft power, America uses marketing and media strategies to promote, expand and enhance the insufficient elements of soft power to establish hegemony and remain their hegemony for a long time. And also American hard power capacity can be a foundation to build, exercise and publicise American soft power. On the other hand as Joseph Nye explains American soft power/attractiveness can be declined due to its hard power utilization<sup>65</sup>. Thus, westernization, globalization, brain drain, India is known as a developing state, bilateral and multilateral internal and external issues can be identified as challenges that India confronts. Those challenges prevent India to enhance and expand their soft power.

However, the hypotheses of this research is fully proven with the research findings because from one hand India is confronting many challenges in order to maximize its soft power elements to build a hegemony and the other hand India does not realize their capacities of elements of soft power to make them more attractive.

## VII. RECOMMENDATION

Since the research finding prove that India is very much infirm to apply her existing soft power tools to build hegemony, author intends to provide some recommendations with regard to enhance and expand Indian soft power.

1. Indian Diaspora can perform as a driving force to expand Indian identity as a soft power strategy.
2. If India uses an inward policy instead of outward, it will be effective to address internal issues which influence to enhance soft power of India.
3. India should have a comprehensive understanding on contemporary trends of the world and should set up their strategies (utilizing better marketing and media

<sup>65</sup>Nye Jr Joseph (2004). "Soft Power and American Foreign Policy". The Academy of Political Science. <http://www.jstor.org/stable/20202345>. (Accessed: 12/11/2014).

tactics) in line with trends. But India should not compromise their identity.

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# Techniques for Plant Species Retrieval using Various Shape Methods

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**Abstract** -It is important to identify plant species because plants has variety of medicinal and healthy food properties. Several methods have been introduced by researchers to identify objects . Shape is an important aspects in identifying plants. Moment invariants have been most probably used as features extraction for shape recognition. Moment invariants are computed based on the contours and interior portion of leaf. In this research three method were studied to identify plants using shape features was accomplished. Out of them two approaches i.e zernil moments and polar transforms were never been used in plat identification.

**Keywords** -Moment invariant, zernik moments, plant identification, shape recognition

## I. INTRODUCTION

It is well known that many of the plant species on earth have medicinal value or carries significant amount of information for the development of human society. So in order to conserve and preserve correct plants, firstly recognize it, is important step. Plants are usually recognize by their shape, color textures and structure of their bark, flower, leaf and seedling. But it is quite difficult to identify shape of flower and seedling as it is 3D image if based on only 2D images. Color of the leaf changes as per atmospheric change and nutritional measures. So shape methods are more reliable to recognize plants. In this research we have discussed techniques for recognizing plants using various shape methods. Through this study we intend to deliver is the ideal approach in plant classification and recognition that not only applicable to real world but also acceptable in the laboratory.

## II. LITERATURE SURVEY

According to C. L. Lee , S. Y. Chen [1] past research in recognizing objects can be broadly classified into two categories : a) contour based and b) region based approaches. The disadvantage of the contour based feature is the difficulty on finding the correct curvature points. Based on the contour of leaf, features were extracted to differentiate species. However contour of leaves have variation even in the same species. For plants identification purpose Wu, et al[2] used shape slimness, defined as ratio of length to width of leaves, shapes roundness, defined as ratio of area of leaf image and perimeter of leaf contour, and shape solidity, defined as ratio of the internal area connecting to valley points and the external area connecting the top points. A paper by Ji- Xiang Du, Xiao-Feng Wang, Guo-Jun Zhang [3] introduce how to extract digital morphological features. The features are

extracted from the contours of leaf. The digital morphological features(DMF) generally include geometrical features(GF) and invariable moment features(MF). A paper by Cholhang Im, Hirobumi Nishia and Tosiyasu L. Kunii[4], a method that normalizes shapes of leaves is presented using symmetry of each leaflet with respect to its vein. According to Najjar and Zagrouba [5] had used region based feature for proposed method in order to classifying the leaf. According to C.S Sumathi and A.V.Senthil Kumar in plant classification, the leaf shape plays a significant role. In machine intelligence, the most significant part essential for both decision making and data processing is shape recognition. Valliammal and Geethalakshmi [6], who stated in their publications that leaf image could be categorized based on color, texture, shape or combination of these properties. Later Zhang and Zhang[7] was enhanced that the properties for these features such as surface area, surface perimeter and the disfigurement are inherited from the shape features, variance of red, green and blue channels are belonging to the color features and texture energy. Other research was also used aspect ratio and other basic geometric features to recognize plants. Du,Wang and Zhang used Aspect ratio,rectangularity, area ratio of convex hull,perimeter ratio of convey hull and sphericity [3].

## III. TECHNIQUES

In this paper, we have studied four methods for plant species retrieval using shape features. This study is helpful for further researches. Out of the four methods , two of the methods i.e Zernike moments and Polar Fourier Transform are never used in plant species retrieval.

### A. *Moment Invariants*

Moment invariants have been frequently used as features for image processing, remote sensing, shape recognition and classification. Moments can provide characteristics of an object that uniquely represents its shape. Invariant shape recognition is performed by classification in the multidimensional moment invariant feature space. several techniques have been developed that derive invariant features from moments for object recognition and representation. These techniques are distinguished by their moments definition, such as the type of data exploited and the method for deriving invariant values from the image moments. It was Hu(Hu,1962), that first set out the mathematical foundation for two-dimensional moment invariants and

demonstrated their applications to shape recognition. Hu defines seven of these shape descriptor values computed from central moments through order three that are independent to object translation, scale and orientation. Translation invariance is achieved by computing moments that are normalized with respect to the center of gravity so that the center of mass of the distribution is at the origin. Size invariant moments are derived from algebraic invariants but these can be shown to be the result of a simple size normalization . from the second and third values of the normalized central moments a set of seven invariant moments can be computed which are independent of rotation. Accordingly , we consider using these Hu moment invariants as classification feature in this paper. Their values can be calculated from the contours using Chen’s improved moments [8] as follows :

The chen’s improved geometrical moments of order(p+q) are defined as

$$M_{pq} = \int_c x^p y^q ds,$$

Where p,q = 0,1,2,...  $\int_c$  is the line integral along a closed contour C and ds =

For the purpose of practical implementation ,Mpq could be computed in their discrete form

$$M_{pq} = \sum x \sum y x^p y^q$$

Then the contour central moments can be calculated as follows :

$$\mu_{pq} = \int_c (x-x)^p (y-y)^q ds,$$

$$x = M_{10}/M_{00}, Y=M_{01}/M_{00}$$

For the discrete case, the above  $\mu_{pq}$  becomes

$$\mu_{pq} = \sum x \sum y (x - x)^p (Y - Y)^q$$

Where  $y = p+q/2 + 1, p+q = 2,3,4,.....$

These new central moments are further normalized using the following formula :

$$n_{pq} = \mu_{pq} / \mu_{00}$$

Consequently, a set of seven invariant moments can be derived from the normalized central moments

$$\begin{aligned} Hu1 &= n_{20} + n_{02}, \\ Hu2 &= (n_{20} - n_{02})^2 + 4n_{11}^2, \\ Hu3 &= (n_{30} - 3n_{12})^2 + (n_{03} - 3n_{21})^2, \\ Hu4 &= (n_{30} + n_{12})^2 + (n_{03} + n_{21})^2 \\ Hu5 &= (n_{30} - 3n_{12})(n_{30} + n_{12}) [ (n_{30} + n_{12})^2 - 3(n_{30} + n_{21})^2] \\ &\quad + (3n_{21} - n_{03})(n_{21} + n_{03}) [3(n_{30} + n_{12})^2 - (n_{03} + n_{21})^2] \\ Hu6 &= (n_{20} - n_{02}) [n_{30} + n_{12})^2 - (n_{03} + n_{21})^2] + 4n_{11} (n_{30} + n_{12}) (n_{03} + n_{21}), \end{aligned}$$

$$\begin{aligned} Hu7 &= (3n_{21} - n_{03})(n_{30} + n_{12}) [(n_{30} + n_{12})^2 - 3(n_{03} + n_{21})^2] \\ &\quad + (3n_{12} - n_{30})(n_{21} + n_{03}) [3(n_{30} + n_{12})^2 - (n_{03} + n_{21})^2] \end{aligned}$$

*B .Zernik moments*

Zernik moments form part of the general theory of the geometrical moments. They were introduced initially by F. Zernik in 1934[9]. These momens have been used in several applications such as face detection, fingerprint recognition [10] and character recognition [11]. Zernike moments are the mapping of an image onto a set of complex zernike polynomials. Since zernike poly are orthogonal to each other, Zernike moments can represent the properties of an image with no redundancy or overlap of information between the moments. Zernike moments are significantly dependent on the scaling and translation of the object in an ROI. Nevertheless, their magnitudes are independent of the rotation angle of the object. Hence we can utilize them to describe shape characteristics of the objects. Zernike moments have rotational invariance and can be made and translational invariant, making them suitable for many applications. Zernike moments are accurate descriptors even with relatively few data points. Reconstruction of Zernike moments can be used to determine the amount of moments necessary to make an accurate descriptor.

*C.Polar Fourier Transform*

For analyzing the results polar fourier transform is very popular method in image processing. The advantage of analyzing image in spectral domain over analyzing shape in spatial domain is that it is easy to overcome the noise problem which is common to digital images. However , direct applying 2-D FT on a shape image in Cartesian space to derive feature descriptors is not practical due to property of FT that is not rotation invariant. To overcome that problem , there are 2 kinds of PFT proposed by D.Zhang. one of them is defined as follow :

$$PF_2(\rho, \theta) = \sum_r \sum_{\theta_i} f(\rho, \theta_i) \exp [ j2\pi(r/R \rho + 2\pi/T \theta )]$$

Where

- $0 \leq r < R$  dan  $\theta_i = I (2\pi/T) (0 < i < T)$ ;  $0 \leq \rho < R, 0 \leq \theta < T$ ,
- R is radial frequency resolution
- T is angular frequency resolution

How to compute PFT described as follow. For example , there is an image  $I = \{ f(x,y); 0 < x < M, 0 < y < N \}$  Firstly, the image is converted from Cartesian space to polar space  $I_p = \{ (f(r, \theta); 0 < r < R, 0 < \theta < 2\pi) \}$ , where R is the maximum radius from center of the shape. The origin of polar space becomes as centre of space to get translation invariant. The centroid(xc,yc) calculated by using formula:

$$X_c = 1/M \sum_{x=0}^{M-1} x, Y_c = 1/N \sum_{y=0}^{N-1} y,$$

In this case,(r,  $\theta$ ) is computed by using :

$R = \sqrt{(x-x_c)^2 + (y - y_c)^2}$  ,  $\theta = \arctan y - y_c/x - x_c$   
 Rotation invariance is achieved by ignoring the phase information in the coefficient . consequently, only the magnitudes of coefficients are retained. Meanwhile, to get the scale invariance,

the first magnitude value is normalized by the area of the circle and all the magnitude values are normalized by the magnitude of the first coefficient. So the fourier descriptors are :

$$FD = \left\{ \frac{PF(0,0)}{2\pi r^2}, \frac{PF(0,1)}{PF(0,0)}, \dots, \frac{PF(0,n)}{PF(0,0)}, \dots, \frac{PF(m,0)}{PF(0,0)}, \dots, \frac{PF(m,n)}{PF(0,0)} \right\}$$

Where m is the maximum number of the radial frequencies and n is the maximum number of angular frequencies.

#### D. Geometric Features

Researcher Du, Wang and Zhang has introduce how to extract digital morphological features. The features are extracted from the contours of leaf. The digital morphology features (DMF) generally include geometrical features(GF) and invariable moment features(MF). The geometrical features consist of aspect ratio,rectangularity,area ratio of convexity,perimeter ratio of convexity,spericity and form factor[3].

##### Aspect Ratio

The aspect ratio is the ratio between maximum length  $D_{max}$  and minimum length  $D_{min}$  of the minimum bounding rectangle

$$AR = D_{max} / D_{min}$$

##### Rectangularity

The rectangularity, representing the ratio of ROI area and the MBR area, is calculated by

$$R = A_{ROI} / D_{max} * D_{min}$$

##### Area ratio of convex hull

The area ratio of convex hull, representing the ratio of the ROI area  $A_{ROI}$  and the convex hull area  $A_C$ , is calculated by

$$CA = A_{ROI} / A_C$$

##### Perimeter ratio of convex hull

The perimeter ratio of convex hull, representing the ratio of the ROI perimeter  $P_{ROI}$  and the convex hull perimeter  $P_C$  is calculated by

$$CP = P_{ROI} / P_C$$

The author of [3] has proposed that , besides the above features, the moments are also widely used as the features for image processing and classification, which provide a more geometric and intuitive meaning than the morphological features. So author has implemented geometrical features with invariant moment feature derived by Hu.

## IV. CONCLUSION

Here in this research we have studied several shape methods available for plant species retrieval. Based on the study of several shape methods geometrical features has a good chance to be included in plants recognition using feature extraction, Further researches, other aspects, such as colours and textures, should be incorporated to increase the performance of identification system. By incorporating colours the performance of system recognition can be improved.

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# Survey on reusable protocols of WSN

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**Abstract-** Use of wireless sensor network (WSN) has resulted in many revolutionary changes in human life. But research community has not been able to create a common platform which will enable the implementation of different range of applications easy using that platform. "SWiFiNet" is task distributed reusable system architecture. In this architecture complex functionality has been transfer to the second tire devices of the system. This survey paper aims to analyze various reusable wireless sensor networks and concept related to "SWiFiNet".

**Index Terms-** SWiFiNet, Reusable architecture.

## I. INTRODUCTION

Use of wireless network is increasing in every field, day by day. WSN is extensively use where wired network cannot be deployed or is expensive to deploy. WSN opens many ways for research community to further enhance wireless communication efficiency and productivity. Many protocols and algorithms has been developed to addressed many kind of issues related to WSN. But most of these protocols and algorithms concentrate on routing, energy efficiency, reliability and congestion control.

No more research is done on creating some integrated network architecture that will make the implementation of any WSN application easy. It means to make the components of the WSN system reusable. The main focus of WSN is on creating more and more efficient wireless interfaces. The wireless sensor network generally developed for specific work. These work include climate reporting, military applications, fuel level indicator and many more. While creating such system one has to start from the scratch and it becomes burdensome.

So, for all these difficulties, one solution is to create reusable WSN framework. This kind of framework is developed in "SWiFiNet". It is a task distributed System Architecture for WSN.

This paper provides overview of "SWiFiNet" and reusable architecture for WSN. In first section provided introduction about WSN and "SWiFiNet". Second section provides related work regarding task distributed network architecture. Third section provides design goals of reusable architecture. Fourth section provides WSN architecture along with "SWiFiNet" architecture comparison. Fifth and last part concludes the paper

## II. RELATED WORK

There has been attempts to make task distributed reusable wireless sensor network architecture. The different applications related to reusable WSN architecture is as follows:-

The ReWINS research initiative is an attempt to develop such an end-to-end solution with support for incremental deployment through a transparent lower layer implementation and control architecture and a user-friendly application interface.

Wireless Integrated Network Sensors or the WINS project and NIMS project at University of California, Los Angeles is about ad-hoc wireless sensor network research dealing mainly with building micro-electronic mechanical sensors (MEMS), efficient circuit design, and design of self-organizing wireless network architecture. Though these projects have been successful in demonstrating a network of self-organized sensor wireless nodes, they seem to have a bias towards environmental and military applications. Also they use proprietary RF communication technology and hence the solutions are restrictive for wide scale deployments in industries.

Motes and Smart Dust project at University of California, Berkeley involved creating extremely low-cost micro-sensors, which can be suspended in air, buoyed by currents. Crossbow Inc. has commercialized the outcome of this project. Here again the solution is restrictive, as proprietary communication technologies have been used to achieve inter-device communication. Further, the focus has been on development of sensors and their interaction rather than how the sensors will be integrated to form systems (simple or complex). This is generally termed as the "bottom-up" approach, which may not be suitable for building complex systems.

Pico-Radio – A group headed by Jan Rabaey at University of California, Berkeley is trying to build a unified wireless application interface called Sensor Network Service Platform. An attempt is to develop an interface that will abstract the sensor network and make it transparent to the application layer. A preliminary draft describing the application interface has been recently released [4]. They believe in a "top down approach" (from control to sensor nodes) for building sensor networks which is probably more suitable for building complex systems.

Recently, there have been several initiatives like TinyDB , Cornell’s Cougar etc. to develop a declarative SQL-like language to query sensors and define certain standard query services. Here the implementation is sensor-interface specific and not a generic or abstracted sensor networking platform. These query services can be implemented with ease on top of our (developed) wireless interface and sensor networking platform and can be made generic by extending them for other sensors. Other research initiatives in this field include MIT’s  $\mu$ AMPS , Columbia University’s INSIGNIA , Rice University’s Monarch. Though there have been a lot of research efforts in developing ad-hoc wireless networks, the focus has been on developing smart wireless sensor interfaces and not much attention has been paid to the actual application integration. Typical approach has been to develop powerful smart wireless interfaces, which supports the important features/requirements for a particular class of applications (like military, environment sensing or more focused applications like fuel-level control in automobiles). The result is a number of wireless interfaces appropriate for a certain class of application; but almost no interoperability between them. We believe that the deployment of wireless infrastructure in industries will occur in incremental stages and thus interoperability (between different sensor-networks) and extendibility (according to application needs) will form the basic requirements of any prospective solution. A prospective good solution would be an end-to-end solution, which is modular and extendable.

All of the above applications were the forward steps towards the making of reusable network architecture.

| Sr. No | Application/Project                | Purpose of Application/Project   | Limitation  |
|--------|------------------------------------|--|---|
| 1      | ReWins                             | To develop such an end-to-end solution   | The main focus is given on industrial scenarios.                                |
| 2      | Wireless Integrated Network Sensor | Building efficient circuit design, and design of self-organizing wireless network architecture | These project seems to have bias towards environmental and military application |
| 3      | Motes and smart dust project       | Creating low cost micro sensor which can suspended in air                                      | The focus is on sensors rather how they will be integrated                      |
| 4      | Pico-Radio                         | To make sensor network transparent to application layer  | Suitable for building complex systems only                                      |
| 5      | TinyDB                             | To develop declarative SQL-like language to query sensor                                       | Not a generic or abstracted sensor networking platform                          |

### III. GUIDELINE PRINCIPLES OF REUSABLE ARCHITECTURE FOR WSN

In “SWiFiNet” the complicated functionality is deployed on the second tire devices of the hierarchical Network. The end nodes leave with the simple functionality of sensing and forwarding the data.

The guideline principles of reusable architecture for WSN are as follows:

1. Network Architecture:-

As mention earlier “SWiFiNet” provides hierarchical network architecture, which is one of the required guiding principle for reusable WSN architecture. There are mainly two types of network architecture. First is flat network architecture. In flat Network architecture all nodes will have same functionality. While in hierarchical network architecture, functionality is divided into number of tiers. Each tire will have different set of nodes having different functionality. By doing this we can build more efficient networking system and also can forms clusters, which are useful for handling complicated network.

2. Network Dynamics:-

The network can have different types of nodes like static, Dynamics or scattered. As the application demand changes, Network dynamics changes. One of the desirable feature of reusable WSN framework is, it should be easy to add node or to delete node form the network weather it is static, dynamic or scattered. In “SWiFiNet” the more functionality is provided on second tire of network.

3. Node centric system architecture:-

Nodes are the most important part of any wireless sensor network. There are different types of sensor nodes available in the market. Nodes are basically lightweight, less processing power, less memory, small size and less cost device. The main function of these sen-

sensor devices is to sense the background and forward data to the sink node. In “SWiFiNet” the functionality of sensor node has been limited to sense data and forward it to parent node. They need not do any additional work.

#### 4. Network Lifetime

The life of the network is last valuable message sent by node to its desired destination. Network lifetime is very important and that's why communication overhead must be made minimum in reusable network framework. The sleep wake up cycle should be adjusted so that it will provide optimum result for the network. Network lifetime will change according to the application.

#### 5. Data transmission Model:

There are three types of data transmission models available. First one is periodic data transfer, in which data that is sensed by the node and will be sent periodically to the sink node. The second model is event driven model. In this model when any activity crossed threshold, nodes get activated and send data to the sink node. The third data transmission model is queried data transmission model in which sink node will raise the query to the end node, which in response will provide relevant data to sink node. These models can be used according to the need of application.

6. As given earlier, in network architecture hierarchical network is desirable feature of reusable network architecture. In this hierarchical network model, two tier devices are provided more resources. So an overlay infrastructure is created which will act as message catching layer for the data packets. Most of the complex functionality should be deployed on this layer.

### IV. Distributed System Architecture

“SWiFiNet” follows bottom up approach. It means first the end nodes will be designed and then the rest of the system will be developed according to the requirements. In “SWiFiNet” the focus is on distributed system architecture and reusability of the components. “SWiFiNet” follows hierarchical architecture having master node, router node and sink node. Detail functionality of these components are as follows:-

**Sensor node:** The task of sensor node is restricted to sensing background and connecting the neighboring nodes or the master node. When the packet is handed over to any parent node, then it is the responsibility of the parent node to transfer the packet to the master node. In this node's layer architecture, the network layer will have the addresses of the parent devices. It will be stored in the table. Two types of addresses are present in the table. First one is primary parent address and the other is secondary parent address. If primary address parent is not available then secondary parent address will be tried by the node.

If network layer doesn't contain any table then a 'Hello' packet request is broadcast into the network. Then the neighboring device will issue the join request. The join request will be accepted if the device meets LQI threshold criteria.

**Router Node:** - The main functionality of the router node is to provide a connection between end node and the sink node. In “SWiFiNet” distributed architecture the functionality of the router node has increased remarkably. The complex implementation of any application or protocol will be deployed on the router nodes. The router node network layer also maintains the table containing entries of the parent devices to the router node. It can be router node again or router will send the information directly to the master node.

**Master Node:-** The complete topology information of the network is maintained by the master node. When there is queried transmission model, master node will generate query and send it in the network. Whenever the routing tables are updated in end nodes or router nodes will send the information to the master node.

**SWiFiNet Architecture:** - The architecture of the “SWiFiNet” is having similarities to the model explained above. But it is having some major difference compared to the general system architecture. The main difference is distributed system architecture is based on 802.11a while “SWiFiNet” is based on 802.15.4 which is short range communication protocol. It also requires less bandwidth compared to 802.11a. It simplifies the functionality of the mac/physical layer. Sleep wakeup call is application dependent. Due to this the life of the nodes can be determined and they can be used efficiently. As sleep wakeup call is predefined the message communication reduces and also the complexity of network. By using this architecture we can easily implement application with different functionality background. By reconfiguring some of the parameters we can have desired system. So we no longer need to start from the scratch. Again the main functionality of the network is deployed on the second tier devices of the network.

#### Conclusion:-

The survey paper provides a detailed comparison and description of the well-known projects and applications which are developed from reusable architecture point of view. "SWiFiNet" is basically a task distributed generic reusable architecture for WSN. The functionality of sensor node is reduced and has been transferred to the second tier devices like router node. By doing so sensor nodes are restricted to gather information and connecting to neighboring nodes. As time synchronization overhead is not present the lifetime of the network increase.

This reusable architecture can be used for various range of applications and can be configured accordingly.

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# Effective human resource utilization for service delivery improvement: The need to re-balance organizational and an employee's objectives realization.

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**Abstract-** The paper presents an analysis on human resources utilization and the need to re-balance the realization of organizational and employee's objectives. A sample of 40 employees was drawn for the purpose of the study of which 10 respondents were drawn from Local Government Training Institute (LGTI) and 30 from Prime Minister's Office-Region Administration and Local Government (PMO-RALG).

Questionnaires and interview guides were employed in collecting primary data. Also, secondary data were collected from various sources with the aim of identifying the gaps to fill in. The data were analyzed through the use of SPSS version 11.0.

The findings in a great extent revealed ineffective human resource utilization in government offices, the drivers being the least utilized. The reasons include inter-alia:- assignment of inadequate works to employees, Perdiems allowance triggering employees to keep on soliciting for the same and truancy accompanied with lack of clear close follow up.

Moreover, it was learned that government offices do not balance the realization of organizational and employee's objectives. The organizations had not identified employees' needs; there were no clear and reliable incentive schemes. Furthermore, training which could have been perceived as an attempt to balance between the two, was affected by lack of transparency in selecting the candidates, hence, it was rather depending on dyadic relationship between the two.

In order to address the above situation, the following are among the recommended steps:- development of clear and reliable incentive schemes; undertake job descriptions reviews to widen the scope and identification of employees' objective and preparation of plans for its realization.

**Index Terms-** Effectiveness, human resource utilization, service delivery improvement, Re-balancing the organizational and employee's objectives.

## I. INTRODUCTION

Employees are very important assets of an organization whose well management together with commitment and employment of other assets of the organization, facilitate to the realization of the organizational objectives. It is through their deliberate efforts other assets like machines can be used to produce the expected products. In other words, no matter how much is invested in technology and other modern assets, the achievement of organizational goals and realization of its objectives, highly de-

pends on the effective utilization of qualified and committed human resource as drivers of other resources.

In Tanzania the emphasis on the importance of human resources as a key source of development in the country was put forward by the first president of the country who pointed out that *"everybody wants development; but not everybody understands and accepts the basic requirements for development. The biggest requirement is hard work. Let us go to the villages and talk to our people and see whether or not it is possible to work hard.... It would be more appropriate for us to spend time in the village showing the people how to bring about development rather than going on so many long and expensive journeys abroad in search of development money"* (Nyerere, 1977:32).

On the basis of the above views, hard work, accompanied by increasing the number of working hours is among the indispensable requirements for development. The focus by then was to utilize the idle manpower in the search of development. However, despite the above fact, yet there are various problems hindering the effective utilization of an employee in the organization. This has been supported by David Hume, of the 18<sup>th</sup> century, as quoted by URT (2004), who declared that the main problem with the Africans is that they don't have what it takes to get organized.

In other words ineffective human resources utilization by various organizations results from inability to organize and sensitize the human resources for achievement of organizational goals.

Since independence, various government departments, agencies and institutions have been committing and spending enormous amount of money in training to improve human resource productivity which would in turn lead to service delivery improvement in particular and poverty alleviation in general, yet service delivery improvement has not been realized. This is supported by Maliyamkono and Manson (2006:372) who pointed out that a third of Tanzanians are living in absolute poverty, while some 20% in abject poverty.

In conjunction with the training, other deliberate efforts undertaken by various organizations in the world include among other things: - how to treat, perceive and manage employees of the organization.

In attempt to realize the above, management of employees in the organizations started in 19<sup>th</sup> and early 20<sup>th</sup> century by employers with paternalist outlook who appointed welfare officers to manage series of initiatives designed to make life less harsh for their employees through the designing and provision of un-

employment benefits, sick pay leave and subsidized housing (Torrington, 2008:11).

Other factors led into the need to manage employees in organizations included the need to increase labour productivity during the first world war; development and recognition of personnel management as a valuable discipline in 1960s and intense business competition which led to great dependence on technologies leading to the need of employing multi skilled labour to apply the said technology in the production of goods and services (Graham and Bennett, 1998:3). Generally, these led to development and recognition of personnel management as important discipline in managing organizations.

However, personnel management faced the following weaknesses;- regarding organizational employees and categorizing them like any other factors of production and regarding employees' training as a cost, rather than investment. It did not recognize the importance of employees as sources of production, organizer and mover of factors of production.

As a result, human resources management concepts were introduced in 1990s with a focus to reverse the above situation. Armstrong (2005:23) points out that today, many pressures are demanding a broader, more comprehensive and more strategic perspective with regards to the organization's human resources. These pressures create a need for a longer term perspective in managing people and consideration of people as potential assets rather than merely variable costs; they are valued assets and are sources of competitive advantage, through their commitment, adaptability and high level skills, improved performance can be realized. It is a management function that helps managers to recruit, select, train, and develop members for an organization (Aswathapa, 2008:5).

Skipping the application of human resource management can lead into the following problems:- hiring wrong persons for vacant posts; experience higher turnover; employees not doing their best; waste time with useless interview; breach of laws; have some employees thinking their salaries are unfair and inequitable relative to others in the organization ( Desler, 2008:3).

Human resource managers are first concerned with ensuring that the business is appropriately staffed and thus able to draw on human resources it needs. It involves designing organization structure, identifying under what types of contracts employees will work, before recruiting, selecting and developing the people required to fill the roles: the right people with the right skills to their services when needed (Torrington, 2005: 7).

However, human resource management is regarded by some personnel managers as just a set of initials or wine in new bottles. It could indeed be no more and no less than another name for personnel management; but as usually perceived, at least it has the virtue of emphasizing the virtue of treating people as key resources, the management of which is a direct concern of top management as a part of strategic planning process of the entire enterprise (Armstrong, 2006:18).

According to Torrington (2005: 4), managing resourceful human, requires a constant re-balancing between meeting the human aspiration of the people and meeting the strategic and financial needs of the business.

Walton as quoted by Armstrong (2005:25) points out that human resource management is composed of policies that promote mutuality; mutual goals, mutual influence, mutual respect,

mutual rewards and mutual responsibility. The theory is that policies of mutuality will elicit commitment which in turn will yield both greater economic performance and greater human development. Moreover, Graham and Bennett (1998:3) emphasized that resources should be used in such a way employer obtains the greatest possible benefits from their abilities and the employees obtain both materials and psychological rewards.

Organizations hire employees in order to tap their capabilities and potentialities for achievement of organizational goals and realization of the objectives. On the other hand, employees accept the offer of employment on the assumption that in due course of their employment, they will realize their objectives. It is the management role to ensure that they direct their employees to the realization of the organizational objectives while at the same time facilitating the realization of individual's objectives.

In other words, human resource management is not an end itself but rather only a means to assist the organization with its primary objective. On the other hand, there are individual employee objectives associated with the achievements of the organizational objectives. According to Aswathapa (2008:8), personal objectives are to be met if workers are to be maintained, retained and motivated. Otherwise, employees' performance and satisfaction may decline and employees may leave the organization.

Organization managers and supervisors have the major role of ensuring that there is a deliberate effort to balance the organizational with the individual employee objectives. It is through it that the organizer of other resources becomes committed and hence, strives to achieve the organizational objective. In this regards, Purcell (2003) as quoted by Armstrong (2005:5) points out that the enhancement of motivation and commitment of human resources has to be concerned with discretionary behaviour, which refers to the choices that people at work often have the way they do the job and the amount of effort, care, innovation and productive behaviour they display. Torrington (2008:20) defines psychological contract as the expectations that employees have about the roles that they play and what the employer is prepared to give in turn. It comprises broader but undocumented expectations.

In cases where management does not carefully manage human resources, notable divergence from organizational objective realization may occur. In such a situation, there is a likelihood that employees can concentrate towards realizing individual objectives, with little or no effort at all in realization of organizational objective. On other hand, in case employers focus and direct the employees towards realization of organizational objectives with little or no consideration to employees' objectives, employees' commitment is hard to realize. Therefore, there is a need for management to constantly manage their employees in a way that there is congruence between individual and organizational goal/objective.

Despite the fact that many authors are debating about getting employees' commitment, only few of them, including Nyerere, the father of Tanzania nation who discussed about the necessity of increasing working hours. He pointed out that *it would be appropriate to ask our farmers, especially the men, how many weeks a year they work. Many do not work even for half as many hours as the wage earner does* (Nyerere, 1977:29).

### ***1.1 Statement of the Problem and justification***

Organizations hire employees in order to tap their capabilities and potentialities for achievement of organizational goals and realization of the objectives. On the other hand, employees accept the offer of employment on the assumption that in due course of their employment, they will realize their objectives. It is therefore, the management role to ensure that they direct their employees to the realization of the organizational objectives while at the same time facilitating the realization of individual's objectives. However, so far there are no researches on the organization attempts to rebalance the realization of both individual employee objectives and those of an organization as a way of motivating the employees to work hard.

Therefore, the paper focused on assessing whether or not there was rebalancing between organizational and employee objectives realization.

## II. MATERIALS AND METHODS

The study was conducted at LGTI and PMO-RALG in Doda. A total sample of 40 people was drawn, of which 10 respondents were from LGTI and 30 from PMO-RALG. Both random and purposive sampling techniques were used to get a sample for data collection. A sample 40 respondents was selected from both LGTI and PMO-RALG. Out of this sample, purposive sampling technique was applied to 12 respondents, which included the Rector of the Institute, two deputy rectors, registrar, Head of Departments and Sections of:- Local Government Administration and management, Local government Finance, Quality assurance, Short course, research and consultancy, Human Resource Management, Procurement and supplies unit, Registry and head driver.

On the other hand, random sampling technique was employed to collect data from 28 respondents including 10 members of academic staff and 6 non academic staff of the institute. Also,

the technique used to collect data from 8 PMO-RALG officers and 4 supporting staffs.

This study relied on both primary and secondary data. Documentary reviews on human resources management was made from various literatures. Moreover, administered questionnaires and interviews were employed for collecting primary data on the effective human utilization and the need to re-balance between the organizational and individual objectives (Adapted from field data 2010).

The primary data were coded, entered, verified and cleaned before analyzing through the use of Statistical Package for Social Sciences (SPSS) 11.0. With the use descriptive statistics, computations were made to find distribution of responses among respondents including frequency and percentages.

## III. RESULTS AND DISCUSSIONS

In order to examine whether there was effective human resources utilization in service delivery improvement or not and the need to re-balance between organizational and an employee's objective realization, data were collected, presented and discussed as follows:-

### 3.1 Human resources utilization in service delivery

Table 1 provides a summary of responses on whether employees were fully engaged in service delivery or not. The data were collected through structured interviews and questionnaires from 40 respondents amongst being operational staffs (Drivers, Office attendants, Secretaries and security guards), academic staffs (Tutorial Assistants, Assistant Lecturers, Lecturers and Senior Lecturers) and Officers from both Local Government Training Institute and Prime Minister's Office - Regional Administration and Local Government.

**Table 1: Employees' utilization in service delivery**

| Responses (n = 40) | Percentage   |
|--------------------|--------------|
| Yes                | 35.0         |
| No                 | 65.0         |
| <b>Total</b>       | <b>100.0</b> |

Source: Field data, 2010

According to the findings summarized in table 1, in the basis of saying yes or no, it was noted that 65% of the total respondents said that they were not effectively engaged in service delivery in their respective areas of specialization. The findings tally with Kissick, W (1968) who pointed out that traditionally there has been underutilization of qualified manpower by "capital-poor institutions," such as universities and hospitals, in the service. On the other hand, 35% of them confirmed that there was effective human resource utilization in the organization.

On the basis of the findings in table 1, majority of human resources in the organizations are not fully utilized in service delivery.

### 3.2 Reasons for ineffective Human resource utilization

Table 2 provides a summary of responses on reasons for ineffective human utilization in the organization. The data were collected through structured interviews and questionnaires from 40 respondents amongst being operational staffs (Drivers, Office attendants, Secretaries and security guards), academic staffs (Tutorial Assistants, Assistant Lecturers, Lecturers and Senior Lecturers) and Officers from both Local Government Training Institute and Prime Minister's Office - Regional Administration and Local Government.

**Table 2: Reasons for ineffective Human resource utilization**

| Responses (n = 40)  | Percentage   |
|---|--------------|
| Some employees cadre have few works   | 35.0         |
| Due to high rate of Perdiems , workers like field work rather than office works | 22.5         |
| Truancy and presentism behaviour ( Lack of monitoring system)                   | 30.0         |
| Professionalism is not observed   | 12.5         |
| <b>Total</b>  | <b>100.0</b> |

Source: Field data, 2010

According to the findings on Reasons for ineffective Human resource utilization, 35% of the total respondents had a view that ineffective human resources utilization in the organization was caused by inadequate assignment of works to certain category of employees. In an interview with them to clarify the matter, it was pointed out that most of workers had no job descriptions and most of the time they were dealing with adhoc issues. Moreover, 30% of the respondents pointed out that truancy and presentism behaviour accompanied by lack of monitoring system led into ineffective human resources utilization. On top of it, 22.5% of them stated that high rate of per diem allowances triggered employees to constantly keep searching for field rather than office works.

Basing on the above findings, reasons for ineffective human resources utilization in government organizations include inter-alia:- few works to be undertaken by certain category of employees, truancy and presentism behaviour and high rate of per diem triggering workers to scramble for field rather than office works. Moreover, the findings seem to correspond with David Hume (2004) who declared that the main problem with the Africans is that they don't have what it takes to get organized.

**Table 3: Numbers of hours spend by different categories of employees in service delivery**

| Responses (n = 40) | Officers     | Office attendants | Drivers      |
|--------------------|--------------|-------------------|--------------|
|                    | Percentage   | Percentage        | Percentage   |
| 1-2 hours          | 2.5          | 5.0               | 40.0         |
| 3-4 hours          | 15.0         | 65.0              | 27.5         |
| 5-6 hours          | 70.0         | 12.5              | 12.5         |
| 7-8 hours          | 12.5         | 17.5              | 10.0         |
| Above 8            | -            | -                 | 7.5          |
| No response        | -            | -                 | 2.5          |
| <b>Total</b>       | <b>100.0</b> | <b>100.0</b>      | <b>100.0</b> |

Source: Field data, 2010

The findings on Numbers of hours spend by different categories of employees in service delivery shows that 70% of the total respondents confirmed that officers of all levels were fully engaged in service delivery for an average of 5 to 6 hours per day. It was also explained that the remaining hours were spent in attending personal issues such as conversation with other employees, tea and lunch break. Also, 15% of the respondents were of the view that officers worked for average of 3 to 4 hours per day. However, 12.5% of the respondents pointed that officers worked for an average of 7 to 8 hours.

Moreover, table 3 also shows that 65% of the total respondents asserted that office attendants worked effectively for an average of 3 to 4 hours per day. On the other hand, 12.5% respondents

The findings in table 2 imply that there is ineffective Human Resource utilization; hence it is difficulty to realize the Organizational goals.

### 3.3 Numbers of hours spend by different categories of employees in service delivery

In order to identify human resource utilization, responses were sought on the number of hours each category of employees was fully engaged in service delivery. The focus was not the number of hours one was at workplace, but rather, the number of hours per day an employee is fully engaged in service delivery. Table 3 provides a summary of responses on the number of hours officers, office attendants and drivers were fully engaged in service delivery. The data were collected through structured interviews and questionnaires from 40 respondents amongst being operational staffs (Drivers, Office attendants, Secretaries and security guards), academic staffs (Tutorial Assistants, Assistant Lecturers, Lecturers and Senior Lecturers) and Officers from both Local Government Training Institute and Prime Minister's Office - Regional Administration and Local Government.

ents declared that office attendants in public office worked for about 5 to 6 hours per day.

Furthermore, the findings show that 40% of the respondents declared that drivers in government offices were effectively utilized in service delivery for about 1 to 2 hours per day. On the other hand, 27.5% of them perceived that drivers were effectively utilized in service delivery for almost 3 to 4 hours per day. However, 10% of them asserted that drivers were fully engaged in service delivery for about 7 to 8 hours per day.

The research findings noted among other things that there was wastage of time due to poor management in some work category. The least effectively utilized work category include drivers, whose effective utilization could be enhanced by managers reviewing their job descriptions to include other works such as that of messenger and registry. The findings tally with Ashke-

nas, R. and Schaffer, R. (2011) who said that although managerial time wasting was recognized as enormous long before any one thought of quality circles. The problem remained unsolved due to the fact that managers attend long – meetings, unnecessary telephone calls and tasks that could be turned over to their subordinates or secretaries. As a result, managers failed to perform strategic decisions of the Organization.

On the basis of the above explanations, hours in which employees were fully engaged in service delivery are as follows:- drivers were ineffectively utilized (1 to 2 hours) followed by office attendants 3 to 4 hours per day and officers of all level (5 to 6 hours per day). The findings confirm with the Nyerere’s views who pointed out that *it would be appropriate to ask our farmers, especially the men, how many weeks a year they work; many do not work even for half as many hours as the wage earner does* (Nyerere, 1977:29). Furthermore, the findings show that

not only farmers, but also government employees fall in the same trap.

### 3.4 Limited scope of job descriptions influencing working hours

Table 5 provides a summary of responses on whether or not limited scope of job descriptions influences the number of hours employees spend at workplaces. The data were collected through structured interviews and questionnaires from 40 respondents amongst being operational staffs (Drivers, Office attendants, Secretaries and security guards), academic staffs (Tutorial Assistants, Assistant Lecturers, Lecturers and Senior Lecturers) and Officers from both Local Government Training Institute and Prime Minister’s Office - Regional Administration and Local Government.

**Table 5: Limited scope of job descriptions influencing working hours**

| Responses (n = 40) | Percentage   |
|--------------------|--------------|
| Yes                | 50.0         |
| No                 | 10.0         |
| Not known          | 40.0         |
| <b>Total</b>       | <b>100.0</b> |

Source: Field data, 2010

The findings on limited scope of job descriptions influencing working hours show that 50% of the respondents confirmed that limited scope of job descriptions were among the factors influencing few working hour. This was supplemented by examining the job description of a driver which was found to include the following task: - driving the government vehicle; ensuring the security of the vehicle; undertaking minor maintenance and keeping proper records on the use of vehicle by filling in the logbook. On the basis of it, there is adequate evidence that drivers’ job description is among the cause for spending few hours at workplace. On the other hand, 40% of the respondents were unaware on whether or not limited scope of job description influenced the number of hours an employee spends at workplace.

From the above analysis, it is concluded that limited scope of job descriptions hinders effective utilization of certain work category of employees including drivers. The findings tally with the study of McNemar, T. (2011) who concluded that effectively

developed job descriptions are communication tools that are significant in any Organization’s success. Poorly written employee job descriptions, on the other hand, add to work place confusion and make people feel as if they don’t know what is expected from them.

### 3.5 Suggestions on soliciting employees' commitment

Table 6 summarizes respondents’ suggestions on ways through which employees’ commitment to expand working hours in particular and service delivery improvement in general. The data were collected through structured interviews and questionnaires from 40 respondents amongst being operational staffs (Drivers, Office attendants, Secretaries and security guards), academic staffs (Tutorial Assistants, Assistant Lecturers, Lecturers and Senior Lecturers) and Officers from both Local Government Training Institute and Prime Minister’s Office - Regional Administration and Local Government.

**Table 6: Suggestions on soliciting employees' commitment**

| Responses (n = 40)                | Percentage   |
|-----------------------------------|--------------|
| Increase of salary and allowances | 15.0         |
| Appreciation and other rewards    | 17.5         |
| creating good working environment | 22.5         |
| Enhance job satisfaction          | 27.5         |
| Frequent training                 | 17.5         |
| <b>Total</b>                      | <b>100.0</b> |

Source: Field data, 2010

According to the findings on suggestions on soliciting employees' commitment 27.5% of the total respondents reveals that job enhancement among the employees would contribute to so-

liciting employees’ commitment towards expanding their working hours and service delivery improvements. Also, 22.5% of the total respondents mentioned good working environment is among the conditions for imploring employees’ commitment in

an organization. Moreover, 17.5% of them state that appreciation, recognition and rewards would influence workers commitment in job performance. On top of it, the other 17.5% mentioned frequent training as a factor for improving employees' commitment. On the other hand, 15% of them were of the views that salary and other allowance increase would lead to the attainment of the same.

The findings tally with Amstrong, M. (2005:25) who pointed out that human resource management is composed of policies that promote mutuality; mutual goals, mutual influence, mutual respect, mutual rewards and mutual responsibilities. The theory is that policies of mutuality will elicit commitment which in turn will yield both greater economic performance and greater human development.

**Table 7: Balancing organizational and employee's objective realization**

| Responses (n = 40) | Percentage   |
|--------------------|--------------|
| Yes                | 40.0         |
| No                 | 60.0         |
| <b>Total</b>       | <b>100.0</b> |

Source: Field data, 2010

The findings on balancing organizational and employee's objective realization depicts that 60% of the total respondents said the public organizations did not make attempts to balance between organizational and employee objective realization. However, 40% of them were of the views that the organizations made attempts to rebalance between organizational and employees' objectives realization.

Basing on table 7, although there seems to be an attempt to balance the two, majority of the respondents didn't visualize it. Thus, this contends also that there were no attempts made by employers' to balance the realization of Organization and individual goals, hence this lead to conflict of interest in goals realization.

The findings of the study does not tally with Torrington, D. e tal (2005:25) who emphasized the need to constantly re-balance

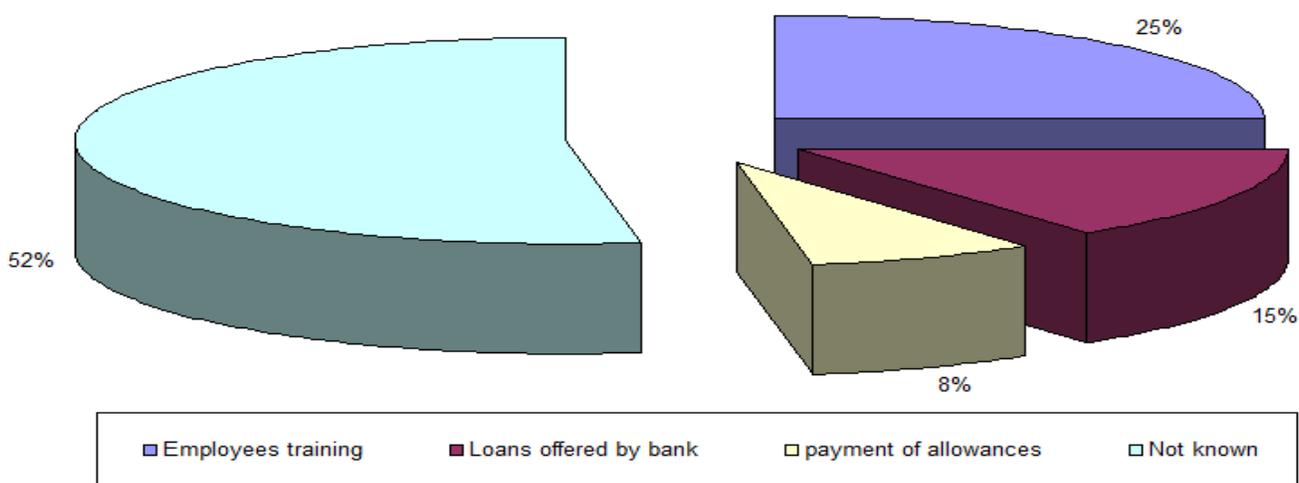
**3.6 Balancing organizational and employee's objective realization**

Table 7 provides a summary of responses on whether the organizations balance the realization of organizational and employee objectives. The data were collected through structured interviews and questionnaires from 40 respondents amongst being operational staffs (Drivers, Office attendants, Secretaries and security guards), academic staffs (Tutorial Assistants, Assistant Lecturers, Lecturers and Senior Lecturers) and Officers from both Local Government Training Institute and Prime Minister's Office - Regional Administration and Local Government.

between meeting human aspiration of the people and meeting the strategic and financial needs of the Organization.

**3.7 Organizational attempts to balance objectives realization**

Figure 2 summarizes the responses concerning organizational attempt to balance between organizational and individual objectives realization. The data were collected through structured interviews and questionnaires from 40 respondents amongst being operational staffs (Drivers, Office attendants, Secretaries and security guards), academic staffs (Tutorial Assistants, Assistant Lecturers, Lecturers and Senior Lecturers) and Officers from both Local Government Training Institute and Prime Minister's Office - Regional Administration and Local Government.



**Figure 2: Organizations' attempts to balance objective realization**

Source: Field data, 2010

Quarter (25%) of the total respondents pointed out that employees' training supported by the organizations is among the attempts made by the Organization to balance between the two (organizational and individual objectives realization). The main argument was although training leads to the achievement of organizational goals, but at the same time knowledge, skills and attitude acquired in the training are useful to an individual employee in terms of promotion and search for greener pastures. On the other hand, 15% mentioned loans offered by financial institutions guaranteed by organizations as another obvious attempt by the institutions to balance between the two. However, 52.5% of the total respondents were not aware of any attempt made by the institutions in its effort to balance between the organizational and employee objectives realization.

### 3.8 Suggestions on striking the balance

Table 8 recaps the responses on the suggestions to strike the balance between the organizational and an employee objectives realization. The data were collected through structured interviews and questionnaires from 40 respondents amongst being operational staffs (Drivers, Office attendants, Secretaries and security guards), academic staffs (Tutorial Assistants, Assistant Lecturers, Lecturers and Senior Lecturers) and Officers from both Local Government Training Institute and Prime Minister's Office - Regional Administration and Local Government.

**Table 8: Suggestions on striking the balance**

| Responses (n = 40)   | Percentage   |
|--|--------------|
| Development of clear and reliable incentive schemes reflecting employees needs | 15           |
| Review JDs, identify employees objective and prepare plans for implementing it | 62.5         |
| Establish effective two ways communication                                     | 17.5         |
| Those who did not answer   | 5            |
| <b>Total</b>   | <b>100.0</b> |

Source: Field data, 2010

According to the findings on suggestions on striking the balance in table 8, 62.5% of the total respondents pointed out that reviews of job descriptions, identification of objectives or needs and preparation of plans to accomplish the same as among the ways of striking the balance between organizational and an employee objective realization. Moreover, 17.5% of them mentioned establishment of effective two ways communication to be among the suggestions for striking the balance between the two. Also, 15% of the total respondents cited development of clear and reliable incentive scheme reflecting employees' needs as a means of striking the balance between the two.

On the basis of data in table 8, review of job descriptions, identification of objectives or needs and preparation of plans for accomplishment, establishment of effective two ways communication and clear and reliable incentive scheme reflecting employees' needs are among the ways through which a balance between the two can be realized.

## IV. CONCLUSIONS AND RECOMMENDATIONS

### 4.1 Conclusions

On the basis of the above findings, it was learned that human resources in the public organizations are not fully utilized in service delivery. The reasons for it include inter-alia: - few tasks assigned to certain category of employees, truancy and presentism behaviour, limited scope of job descriptions and Perdiems allowance triggering workers to scramble for field rather than office works. Such allowance is in most cases discriminative, leaving majority demoralized.

The ineffective human resource utilization is reflected but not limited to among other things, the number of hours employees do spend in actual service delivery. The findings show that officers are fully engaged in service delivery for an average of 5 to 6 hours and office attendant work for average of 3 to 4 hours per day. Furthermore, assuming they are not on safari and only engaged government activities, drivers are fully engaged in service delivery for an average of 1 to 2 hours per day.

Moreover, it was noted that although organizations provide training to their employees, guarantee bank loans and pay allowances to the employee as a way of contributing to the objective realization, yet majority of respondents did not conceive them as attempts to balance between the two. It was explained that the organizations neither carried out survey to identify employees' needs/objectives nor established reliable incentive schemes for the employees.

### 4.2 Recommendations

In order to address the above situation, the paper recommends that the employers (especially human resource officers) should review employees' job descriptions so as to widen their respective scope. In case of drivers, their job descriptions should include extra driving activities such as: - driver-cum messenger, clerical activities and receptionist. Failure to abide to it, implies that public organizations will continue to have a large number of employees who are paid only for attending at their respective workplaces rather than for their performance.

Also, per diem allowances should reasonably be reduced to carter only for necessary payments such as hotel accommodation, daily traveling and meal allowance. Such, will discourage unnecessary scrambling for traveling and leave enough resources for other organizational activities.

Moreover, in order to motivate, retain and contribute to the realization of organizational objectives, there should be a balance between the two. To achieve it, respondents suggested the following: - clear and reliable incentive schemes reflecting employees needs should be developed; job descriptions be reviewed; employees objective identified and plans for implementing be prepared and establishment of effective two ways communication.

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# Analysis of Optimum Solution to Enhance Utilization of ICT services at the Grassroots Community: The Case Study of Dodoma Municipal Council in Tanzania.

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**Abstract-** The study intended to analyze the optimum solution to enhance utilization of Information and Communication Technology (ICT) services to the grassroots community in Dodoma Municipal Council (DMC) in Tanzania. The specific objectives of this study were to: identify the availability and use of ICT infrastructures for service delivery at grassroots level; identify possible Local Government Authorities (LGAs) services/products offered through the use of ICT services; identify challenges that LGAs face in using ICT infrastructures for service delivery and recommend the best solution to enhance utilization of ICT services to the grassroots community for efficiency and effectiveness of service delivery to the grassroots community.

The study findings points out that a variety of ICT tools and services have not been used in the Dodoma Municipal Council (DMC) for service delivery and communication to the grassroots community. The following are the factors that were identified why ICT has not been used for service delivery to the grassroots community: - inadequacy of ICT infrastructures; lack of necessary skills; lack of awareness of ICT services; lack of an ICT policy; lack of proper planning for the embracing ICT technologies in DMC and lack of ICT education on how to use ICT equipments.

Therefore, recommendations were made on the optimum solutions to enhance the utilization of ICT services to the grassroots community which includes: - Installation of ICT infrastructures and ICT technologies to the DMC as well as to grassroots community.

**Index Terms-** Information Technology and Communication (ICT), Grassroots Community.

## I. INTRODUCTION

Information and Communication Technologies (ICT) is a compound term that is used to refer to the convergence of a wide array of new computer-based communication technologies that are presently being developed and used in the creation, processing and transmission of information by electronic means such as radio, television, cellular phones, computer and network hardware and software and satellite systems (Blessing M. et al, 2011).

Information and Communications Technologies (ICT) advances since the end of the 20<sup>th</sup> Century have led to multiple convergences of content, computing, telecommunications and broadcasting. They have brought about changes in other areas, particularly in knowledge management and human resources

development. Increasing capacity of ICT has further been empowered by the growth of a global network of computer networks known as the Internet. It has impacted the way business is conducted, facilitated learning and knowledge sharing, generated global information flows, empowered citizens and communities in ways that have redefined governance, and have created significant wealth and economic growth resulting in a global information society (D.N. Gupta, 2008 & URT, 2003).

The rapid development of ICT, particularly the Internet, is one of the most attractive factors in the development of many countries around the world particularly in the area information dissemination and communication. ICT powers our access to information, enables new forms of communication and serves many online services in the world of business, communication, education, advertisements and entertainment. It is used as a tool for service delivery to the citizens; for efficiency and effectiveness of service delivery to the community at any time anywhere with affordable cost, to be available 24hrs/7days. The use of ICT has made a big step in the development of the economy in many countries all over the world. Such countries include inter-alia: - Finland, Singapore, Sweden, Netherlands, Norway, Switzerland, United Kingdom, Denmark, United States, Germany, Israel, Japan, Australia, South Africa; South Africa; Egypt; Cape Verde; Rwanda; Morocco; Kenya; Ghana; Botswana; Uganda; Namibia and Zambia (Janet, K, 2004, Patricia J, 2003, WEF, 2010 & Yonazi et al, 2010).

Tanzania like any other developing countries embarked on the use of ICT in 1990s as a part of both Public Service and Local Government reform. Since then, Tanzania has made remarkable progress in its development by deploying Information and Communication Technologies (ICT) in various sectors of the economy. This progress has been well received by the citizens and service providers who are striving to address unmet demand and competition in newly liberalized markets. Most of government ministries, departments, agencies and institutions (MDAs) and LGAs have deployed ICT infrastructures, yet still most of services are offered manually, such services include:- Business registration; Business license; business tax; tendering and procurement services; Government housing services; payment of different government taxes (URT, 2003).

Local government authorities (LGAs) are sub national level of government that are operating within a specified local area of jurisdiction, their main function is to provide services to the grassroots community in a participatory manner. The grassroots community refers to the beneficiaries of all services that are offered by LGAs. The grassroots community currently is using

manual way of accessing services in LGAs. It is expensive and time consuming to access manually services from LGAs. There are many challenges that are facing LGAs in provision of quality services to the grassroots community and stakeholders. Most of LGAs have installed ICT infrastructures, yet they still provide services to the community manually. As a result, they experience inefficiency in service delivery and information sharing (Yonazi et al, 2010).

For these reasons there was a need of finding a best way of solving these problems in order to improve quality of service delivery at Dodoma Municipal Council (DMC) to the grassroots community. Embracing ICT services is best solution to overcome these problems; since it is the powerful tool for providing information faster and at affordable price, more flexibly and more concisely than it would be possible without the respective tool.

## II. RESEARCH ELABORATIONS

### 2.1 Study area

The study was conducted at Dodoma Municipal Council (DMC) in Dodoma region. Dodoma region comprises of nine councils (Dodoma Municipal Council, Dodoma district Council; Kongwa District Council; Chamwino District Council; Bahi District Council; Mpwapwa District Council; Kondoa District Council and Kondoa Township Authority and Chemba District Council). Dodoma Municipal Council was selected due to its fastest growing area in terms of increased number of higher learning institutions; government offices including parliament and its nomination as capital city of the United Republic of Tanzania. Such increased number of government institutions implies that there is increased demand of ICT use.

### 2.2 Sampling techniques

In this study both random and purposive sampling method were used to select a sample of 50 respondents from both DMC's staff and members from grassroots community. Random sampling refers to sampling whereby all members in the population have an equal chance of being selected to form a sample and Purposive sampling refers to sampling whereby the researcher consciously selects particular elements or subjects for addition in a study so as to make sure that the elements will have certain characteristics pertinent to the study, normally targets a particular group of people (Adam, J and Kamuzora, F., 2008).

Random sampling technique was used only in selecting wards as well as villages and Streets to be sampled out of thirty seven (37) wards, one hundred sixteen hundred (116) Streets and forty nine (49) villages (Census, 1988/2002). In this case, 37 pieces of paper were prepared in which each was written a name of one ward. The pieces of papers was sealed and put in a container, in which they were mixed and thereafter one piece of paper was selected randomly to obtain four wards and then the exercise continued until the required sample of eight (8) Streets/Village was obtained.

Therefore, in this case the following four wards were selected as a sample: - Hazina ward; Kilimani ward; Kizota ward and Hombolo ward, of which two (2) Streets/Village were selected to make a total sample of eight (8) Streets/Village, where by 5 respondents were selected from each Streets/Village to make a total of 40 respondents.

On other hand, purposive sampling technique was applied to 10 respondents which included the Municipality Director, Municipality Human Resource Officer, Municipality Planning Officer, Municipality Treasure, Municipality Community Development Officer and five members from ICT section.

### 2.3 Types of Data

The study employed both primary and secondary data; both interviews and semi structured questionnaires were used for collecting primary data on the optimum solution to enhance utilization of ICT services at the grassroots community from both grassroots community and DMC's staff. Secondary data was collected from field through documentary analysis such as books, academic journals; professional journals, magazines, internet, government publications, different official annual reports, research reports as well as other publications related to optimum solution to enhance utilization of ICT services at the grassroots community (Kothari, C.R 2006).

### 2.4 Data Analysis and Presentation

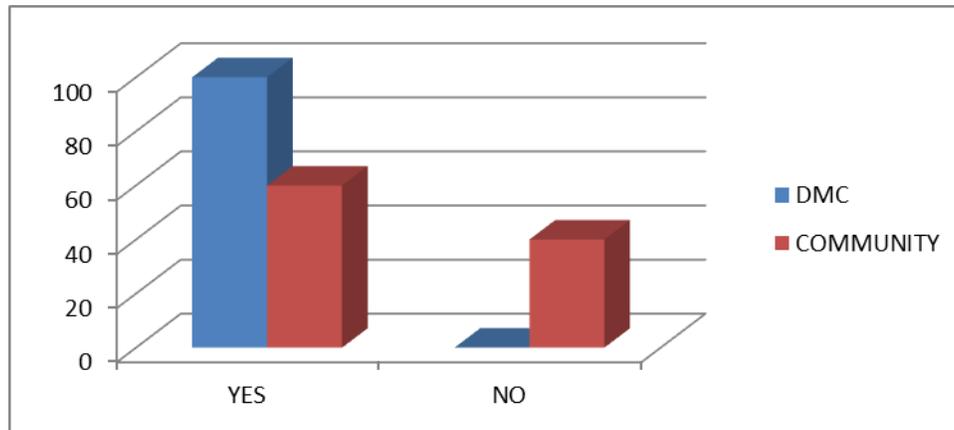
Collected data were coded, entered, verified and cleaned before analysis. Collected data were analyzed by using Statistical Package for the Social Sciences (SPSS) 21.0 version. The analyzed data were summarized in frequencies and percentages and then presented in tables, graphs and figures; thereafter were interpreted and discussed. Therefore, after discussions of findings, conclusion and recommendations were made basing on the interpretation of data in the tables, graph and figures.

## III. RESULTS AND DISCUSSION

In order to identify whether ICT services are being utilized in service delivery at LGAs or not, data were collected, presented and there after discussion and conclusions were made. The findings were obtained from: - Awareness in the ICT; Installed ICT infrastructure in DMC; Computer facilities connected to the Internet at DMC and finally Services offered by DMC through the use of ICT services.

### 3.1 Awareness in the ICT

Figure1: Provides a summary of responses on whether grassroots community and DMC employees have awareness of ICT or not. The data were collected through structured interviews and questionnaires from 40 respondents from the grassroots community and 10 respondents from DMC. Respondents were requested to tick the correct answer.



**Figure1:** Respondent's Awareness on the ICT  
**Source:** Field data, 2011

According to the findings summarized in figure 1, it can be noted that 20 (50%) of the total respondents from the grassroots community argued that they have heard about ICT while all 10 (100%) respondents from DMC said that they have heard about ICT. On other hand, 50 (50%) of the respondents from the grassroots community said that they have not heard about ICT.

On the basis of the above findings, majority in the grassroots community were aware with the ICT, only few of them were not aware of ICT. On the other hand, all respondents from DMC had heard about ICT. This means that there are many people in DMC and its surrounding who are aware of ICT than those who are not aware. Hence, the usability of ICT services in the grassroots

community is possible since there is high acceptability of ICT services around.

**3.2 Installation of ICT Infrastructure at DMC and at Community Level**

Table1, below shows responses on the installed ICT infrastructures in DMC and at the grassroots community. The data were collected through structured interviews and questionnaires from 40 respondents from the grassroots community and 10 respondents from DMC. Respondents were asked to tick the correct type of network installed at DMC as well as at grassroots community.

**Table1:** Installation of ICT Infrastructure at DMC and at Community level

| Grassroots Community |           |            | DMC       |            |
|----------------------|-----------|------------|-----------|------------|
| Responses            | Frequency | Percentage | Frequency | Percentage |
| Local Area Net work  | 15        | 37.5       | 2         | 20         |
| Wide Area Network    | 20        | 50         | 1         | 10         |
| Not Applicable       | 5         | 12.5       | 7         | 70         |
| Total                | 40        | 100        | 10        | 100        |

**Source:** Field data, 2011

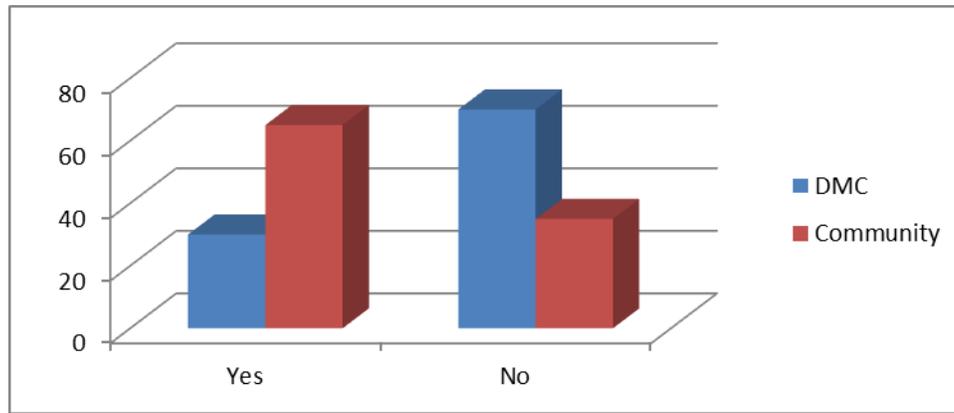
According to the findings on table1 above majority (37.5% and 50%) of the respondents from the grassroots community pointed out that in their living and work places there were installations of ICT infrastructures such Local Area Network and Wide Area Network, while at DMC only 10% and 20% of the respondents pointed out that there was installations of Local Area Network and Wide Area Network respectively.

Basing on the above analysis, it can be concluded that majority of respondents from the grassroots community said that there were ICT infrastructures installation in their living and working places while at DMC majority of the respondents argued that

there were few installations of ICT infrastructures in some offices, hence poor communication and service delivery to the grassroots community.

**3.3 Computer Facilities Connected to the Internet at DMC and at Community Level**

Figure 2: Reviewing responses on the computer facilities connected to the Internet. The data were collected through structured interviews and questionnaires from 40 respondents from the grassroots community and 10 respondents from DMC.



**Figure 2: Computer Facilities Connected to the Internet**

Source: Field data, 2011

The finding from the grassroots community shows that 26 (65%) of total respondents confirmed their computer facilities were connected to the Internet, while 3(30%) respondents from DMC pointed out that their computer facilities were connected to the Internet through the use modem. Moreover, 14 (35%) respondents from grassroots community pointed out that their computer facilities were not connected to the Internet while, 7(70%) of the respondents from DMC pointed out that their computer facilities were not connected to the Internet since the DMC does not have Internet facilities.

Hence, on the basis of the above analysis, the majority of the respondent’s from both grassroots community and DMC confirmed that their computer facilities were not connected to the Internet. This shows that Internet accessibility is still a great problem in both DMC and grassroots community. Hence, poor

service delivery to the grassroots community at anytime anywhere at affordable price.

**4.4 Services offered by DMC through the use of ICT services**

Table2: Gives summarizes of responses on types of services offered by DMC through the use of ICT. The data were collected through structured interviews and questionnaires from 40 respondents from the grassroots community and 10 respondents from DMC. In this case, the total items of the type of services offered by DMC through the use of ICT Services to the grassroots community were 12 in total of which some of them were mentioned with more than one respondent and make a total 135 responses from the grassroots community and 30 from DMC.

**Table2: Services offered by DMC through the use of ICT services**

| Grassroots Community                  |            |              | DMC       |              |
|---------------------------------------|------------|--------------|-----------|--------------|
| Responses                             | Frequency  | Percentage   | Frequency | Percentage   |
| Payment of different taxes            | 1          | 0.7          | 0         | 0.0          |
| Biding tenders                        | 4          | 3.0          | 0         | 0.0          |
| Business License                      | 4          | 3.0          | 0         | 0.0          |
| Purchasing or ordering goods/services | 4          | 3.0          | 0         | 0.0          |
| Health information                    | 1          | 0.7          | 0         | 0.0          |
| Government reports and policies       | 11         | 8.1          | 0         | 0.0          |
| Agricultural information              | 10         | 7.4          | 0         | 0.0          |
| Education information                 | 11         | 8.1          | 5         | 16.7         |
| Government housing services           | 2          | 1.5          | 0         | 0.0          |
| Job advertisement                     | 11         | 8.1          | 10        | 33.3         |
| Project reports                       | 7          | 5.2          | 5         | 0.0          |
| Not applicable                        | 69         | 51.1         | 10        | 33.3         |
| <b>Total</b>                          | <b>135</b> | <b>100.0</b> | <b>30</b> | <b>100.0</b> |

Source: Field data, 2011

According to the findings from the grassroots community, 69(51.1%) of the respondents which was the majority said it was not applicable meaning that there were very few services from DMC that were offered through the use of ICT services, where by 11(7.4%) of them said that ICT services were used for job advertisement and government reports and policies. However,

few respondents 10(33.3%) from DMC pointed out that there were very few government services that were offered online.

On the basis of the above findings, majority of the respondents agreed that there were very few services from DMC that are delivered to the grassroots community through the use of ICT

services. This implies that very few government services at DMC offered through the use of ICT services.

#### IV. CONCLUSIONS AND RECOMMENDATIONS

##### 4.1 Conclusions

The study findings points out that a variety of ICT tools and services have not been used in the Dodoma Municipal Council for service delivery and communication to the grassroots community. The following are associated factors the use of ICT in service delivery to the grassroots community: - inadequacy of ICT infrastructures; lack of necessary skills; lack of ICT technologies like web technology, e-government and community information centers; lack of awareness of ICT services; lack of an ICT policy; lack of proper planning for the embracing and distribution of ICT in LGAs and lack of ICT education on how to use ICT equipments.

The level of the respondents in the use of ICT services in receiving services from the DMC to the grassroots community was very poor. The interaction with some of the ICT services like Website, community information centers, video conferencing; electronic learning; electronic business and electric government was very poor as well as all electronic services, while the use of ICT such as computers; fixed line phone; Television; radio; fax machines, mobile phones, video, modem, mobile phones, and e-mail was very high.

##### 4.2 Recommendations

Majority of the respondents argued that the optimum solution of enhancing the utilization of ICT services in service delivery to the grassroots community can be made through the installation of adequate ICT infrastructure and ICT technologies.

Therefore, in order for DMC to enhance the utilization of ICT services in service delivery to the grassroots community and vice versa, it must deploy effective combination of ICT technologies such technologies includes: - Web technology; electronic government (e-government) and Community Information Center at Ward level.

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# More than a decade of decentralization in Tanzania: Its implications on Pro-poor service delivery. The case of primary education and health services

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**Abstract-** The paper investigated on an assessment of decentralization and its implication on pro-poor service delivery for primary education and basic health services for more than a decade ago. The services are delivered by the local government authorities, institutions that are closets to service beneficiaries. The study relied on secondary data to assess decentralization and its impacts on pro-poor service delivery. Decentralization related documents were reviewed and documented to synthesize the implication of decentralization in service delivery.

It was noted that government of Tanzania has taken various notable steps to improve service delivery to beneficiaries. The steps included inter-aria:- amendment of the laws to incorporate decentralization aspects; establishment of opportunities and obstacles to development; a participatory planning methodology used by local government, abolishing school fees in primary education in order to enhance accessibility and affordability for all even the poor segment of the society and the exemption in health service provision for old people, expectant mothers and children aimed at pro-poor service delivery.

The study found that despite of the government's efforts to enhance pro-poor education and health services, yet achievements are far behind the expectations since there are no mechanisms to incorporate multitude community priorities into council plans. With limited own sources of revenue, primary education has quantitatively expanded although there is inability of taking care of physically challenged pupils, thus this increase illiteracy rate to pupils. Also exemption in health facilities has little impacts for poor people since medical supplies in government facilities are out of stock something which forces them to seek the service from private health facilities at market price.

On the basis of the above, the study concluded that although the government amended laws, established tools for community participation and made efforts such as abolishing school fees and exemption, yet education and health services are not much pro-poor service. In order to combat the situation the study recommended that the government should establish mechanism to ensure community plans are incorporated into council plans; enhance the availability of adequate local government own sources of revenue for provision of community felt needs; ensure both quantitative and qualitative improvement in service delivery and adequate availability of medical supplies in public health facilities.

**Index Terms-** Decentralization, implications and pro-poor service.

## I. INTRODUCTION

Decentralization in its various forms is now a common feature of reform in both developed and developing countries. It is taken as a political strategy for improving service delivery. Factors triggering the introduction of decentralization differ from one country to another (World Bank, 1990). In some countries for example Pacific countries, decentralization resulted from demand of regional or local groups for increased local autonomy. In most of developing countries, it has been introduced as a result of pressure from the centre (Sohag, Wajidi and Miankhel, 2013, Kolehmainen-Aitken, 2004, Devas, 2005 and World Bank 1990).

Decentralization is highly linked with establishment of local government authorities which in most of the developing countries for example Tanzania, Kenya, Uganda and Zambia were for the first time introduced during the colonial time particularly in preparation for independence. The established local government based either in British or French local government model. It meant to facilitate the provision of certain services to respective communities.

In Tanzania, decentralization can be traced back during the British rule in which various efforts to establish local government were undertaken starting with introduction of self rule, Native authorities, municipal council and establishment of local government training school for training native authority workers and the councilors (Marx, 1991). The effort meant to provide room for indigenous participation in managing their fellow citizens and minimizing people's resistance to British rule.

The independent Tanganyika inherited the British colonial local government and made some changes from time to time. The changes included abolishing native authorities in 1963 and establishment of council and uniform election system for both rural and urban local governments (Warioba, 1999). Local Governments were officially abolished in 1972 as a result of its inability to provide services to the community. Decentralization by deconcentration was established in its place. In this context, planning and implementation of the development plans were executed by employees of central government allocated in regional and district level.

The current decentralization by devolution was introduced in 1990s after the re-introduction of local government authorities in 1983 and became operational in 1984 after the election of the councilors. It is a vehicle of reforming local government with the focus to transfer some of political, financial and administrative powers to local government. It also, focused on changing central-local relation from that of command into negotiation between

the two (United Republic of Tanzania [URT], 1998). Decentralization is meant to realize article 146 of the Constitution of United Republic of Tanzania of 1977. The article provides for the purpose of establishing local governments in the country, that is to transfer powers to the people and local governments are required to establish conducive environment for people's participation in planning and implementation of development plans (URT, 2008).

Decentralization by devolution focuses on service delivery improvement through addressing community felt needs reflected by affording them opportunities to participate in planning and implementation of development plans. It aimed at enhancing poor and vulnerable group needs to be addressed.

In order to realize the objective, the government amended laws to incorporate decentralization, established Opportunities and Obstacles to Development (O&OD); a community participatory planning methodology launched in 2006 and increased central government transfers. However, little is known on what are the implications of decentralization in pro-poor service delivery in the country. Therefore, the study intended to bridge this knowledge gap by reviewing and incorporating literature into the document.

### 1.1 Statement of the problem and Justification of the study

In order to assess implications of decentralization on pro-poor service delivery in Tanzania for a decade or so, a desk study was carried out focusing on primary education and basic health services in local government Authorities. There are five national policy priority areas in the country comprising of primary education, basic health care, water, road maintenance and agricultural extension services. Under decentralization system, actual delivery of these services is made by local government authorities. Out of the total budget of local governments, 70% is allocated for primary education and 18% allocated to basic health care and 7% allocated jointly to local road maintenance, water and agricultural extension services (Boex, 2003).

Primary education (70%) and basic health care (18%) are comparatively highly prioritized services on the ground that healthy and aware population is the basis for social and economic development (Tibaijuka, 1991). On the basis of the importance attached to primary education and basic health services in terms of their perceived impacts and significant allocation of the resources, the study dwell to examine implications of decentralization of these services to poor segment of the Tanzanian society.

For realization of the focus of the study, the following aspects were included: - community participation, accountability mechanisms to ensure service delivery reach beneficiaries and conclusion and recommendations.

## II. MATERIALS AND METHODS

The study relied on secondary data to assess decentralization and its impacts on pro-poor service delivery. Decentralization related documents were reviewed from various literatures and documented to synthesize the implication of decentralization in service delivery.

The study on implications on Pro-poor service delivery was limited to some *Mitaa* in Dodoma Urban where primary education and health centers were found. In order to supplement the secondary sources of data the study interviewed 5 MEO'S and

*Mitaa* residents ranging between 567 and 574 to suit the purpose. The study area was selected because of data access, availability of data to meet objectives specified since primary education and health centers are scattered in almost all Dodoma Urban district.

## III. RESULTS AND DISCUSSIONS

Decentralization by devolution is a pro-poor strategy to improve service delivery in the country through improved community participation and enhanced accountability to ensure resources are efficiently and effectively spent to deliver public services. Local government authorities being the institution which are closest to service beneficiaries are expected to capture people felt needs in the respective plans and in turn people would demand quality service delivery from supply side. Therefore, in this part the emphasize is to analyze literature on both community participation and accountability mechanisms in local government authorities in the country and the implications of each of these in pro-poor service delivery for primary education and basic health services.

### 3.1 Community participation

Decentralization focuses on service delivery improvement particularly for the poor through community participation. It is expected to result from increased allocate efficiency by better matching public service provision to felt needs of the respective community (World Bank, 2001 and Antwi, Analoui and Cusworth, 2008).

The government of Tanzania came up with mechanisms and tools to enhance community participation. Legal frameworks were established to enhance decentralization and community participation in planning and implementation of development plans. It started with the amendment of the constitution of United Republic of Tanzania of 1977 to incorporate local government and decentralization. It provides peoples participation as a sine quo non condition for existence of local governments in the country; amendment of local government laws to incorporate Decentralization by devolution; preparation of local government bylaws which among others provide statutory meeting at grass-roots levels and the use of Opportunities and Obstacles to Development (O&OD), an authorized community participatory planning methodology used by local governments in Tanzania (URT, 2003; URT, 2004 and URT, 2008). The statutory meeting and use of O&OD are important means through which community participation is made possible in the country. Therefore, in the next part of the paper analysis is made on how each of these contributes to community participation.

#### 3.1.1 Opportunities and Obstacles to Development

O&OD methodology is an intensive consultative planning process that uses participatory tools to come up village/mtaa plan (URT, 2004). It is a participatory bottom-up planning in which community plans of either village or mtaa are compiled at ward level and later each ward submits its plan to form a part of the respective local government headquarter plan. It applies participatory tools including village maps; institutional analysis, gender resource map, wealth ranking in a village and seasonal calendar to collect data for planning purposes. With jointly collected data, it enables the community to identify opportunities at disposal and obstacles for utilization of available opportunities. It enhances

the community to forge mechanism of utilizing the available opportunities in overcoming the obstacles.

Ideally, community Plans are to be incorporated into the LGA Plan, but no practical system to do so has been established. Since a typical rural LGA is composed of 60 to 100 villages, it is not difficult to understand the difficulty faced by the LGA officers to incorporate such plans (PMO-RALG, 2008).

Moreover, community participation is very minimal in both planning and implementation of development plans. For example table 1 show a summary of Mitaa Executive Officers' (MEOs) responses on the study conducted in 2008 regarding community involvement in preparing mitaa plans.

**Table 1: MEOs' views on community involvement in planning process by percent**

| Response by MEOs   | Frequencies | Percent |
|--|-------------|---------|
| Non involvement in Economic, Planning and Finance Committee      | 4           | 80      |
| Adequate involvement in Economic, Planning and Finance Committee | 1           | 20      |

**Table 2: Residents' Priorities by percent**

| Response by <i>Mitaa</i> residents                              | Frequencies | Percent      |
|---|-------------|--------------|
| Roads, trenches, nearby Health Centre and Markets               | 188         | 33.2         |
| Reliable source of water  | 136         | 24.0         |
| Building teamwork spirit in solving <i>mitaa</i> problem        | 18          | 3.2          |
| Environmental cleanliness along the streets                     | 9           | 1.6          |
| Police Station and reduce price of commodities                  | 33          | 5.8          |
| Increase on the number of classrooms of Primary School          | 40          | 7.1          |
| Employment and loan with soft conditions                        | 74          | 13.1         |
| Establishment of industries and centers for conducting business | 33          | 5.8          |
| <i>mitaa</i> leaders should apply participatory planning        | 15          | 2.6          |
| Protection of women and children against thieves and rapists    | 21          | 3.7          |
| <b>Total</b>  | <b>567</b>  | <b>100.0</b> |

Source: Field data, 2008

According to findings on Table 2, 33.2% of respondents listed *mitaa* roads, trenches, nearby health centers and market to be priorities of their respective *mitaa*. But 24% of respondents pointed reliable sources of clean and safe water as their priority. Also, about 13.1% of respondents indicated the need for provision of employment opportunities and loan with soft conditions to *mitaa* residents to be among the *mitaa* priorities while 7% of respondent's added increase in the number of classrooms for primary school is priorities of their respective *mitaa*.

Basing in the findings on Table 2, it shows that construction of classrooms for secondary school was one of the major

|              |          |            |
|--------------|----------|------------|
| <b>Total</b> | <b>5</b> | <b>100</b> |
|--------------|----------|------------|

Source: Field data, 2008

According to the study, 80% of *mitaa* executive officers argued that there was no involvement of people in the Economic, Planning and Finance process since there were no detailed *mitaa* plans and 20% of them had views that there were adequate involvement of people in the Economic, Planning and Finance process. Generally, findings correspond with the study conducted by Chaligha and colleagues (REPOA, 2005). They revealed that the depth of implementation of bottom-up planning in the studied council differed from one council to another. Also in most cases, it was undertaken by few experts who did not reach people (Ibid). They considered it to be top-down rather than bottom-up. Findings confirm that community involvement in preparing the *mitaa* plans was still minimal.

This can also be reflected by examining community identified priorities in planning process through the use of O&OD and the actual plan approved plan details. Table 2 summarizes the findings on community identified priorities in planning process through the use of O&OD.

projects that were implemented at the ward level. Such findings reflect that council was not responding positively to residents' priorities. The findings concur with findings by Braathen and colleagues (REPOA, 2007). Moreover, the findings to some extent tally with grassroots views at the Zone workshop about poverty reduction that mentioned, among others, poor roads and lack of market to contribute to income poverty reduction in agricultural sector. Findings revealed that priority projects in *mitaa* were roads, trenches, nearby health centers, water sources and markets.

**Table 3: Projects implemented as per *mitaa* Strategic Plans by percent**

Table 3 presents summary of responses on the projects or activities implemented since 2006 to date as per *mitaa* plans.

| Response by <i>Mitaa</i> residents                         | Frequencies | Percent      |
|--|-------------|--------------|
| Not known  | 38          | 6.6          |
| No project   | 258         | 44.9         |
| Road, and trenches Maintenance                             | 1           | 0.2          |
| Construction of classrooms for Secondary School            | 202         | 35.2         |
| Fish keeping   | 1           | 0.2          |
| Refugee collection   | 44          | 7.7          |
| Connection and payment of water bills for Primary Schools. | 30          | 5.2          |
| <b>Total</b>   | <b>574</b>  | <b>100.0</b> |

Source: Field data, 2008

Findings on table 3 above shows that, 44.9% of the total respondents explained that there were no projects implemented as per *mitaa* plan. On the other hand 35.2% of them mentioned construction of classrooms for secondary schools as *mitaa* projects implemented for that time. Also, 0.2% of them confirmed that roads and trenches maintenance were the main projects implemented at that time. In addition, 0.2% of respondents added to the list fish keeping among the *mitaa* projects that were implemented during that period.

Furthermore, findings from documentary reviews provided that under the Local Government Capital Development Plan Indicative planning Figure, 50% of the Capital Development grant could be planned at the District/Urban council level and 50% of the remaining sums at the sub-district level, ward and village/*mitaa* (URT, 2004). However, additional findings through interviews with MEOs and WEO revealed that such plans were not implemented at the area. Respondents pointed further that formerly *mitaa* had no bank account, but in February 2008, municipal director directed *mitaa* to open bank accounts. Moreover, respondents argued that if such funds had been directed to meet residents' priorities as per guidelines, *mitaa* roads, trenches and nearby health centers would have been constructed and rehabilitated because they were residents' priorities.

Study findings relates to those from the study conducted by Fisher (2007) who argued that key forest management objectives in the study area were always set by Government or bureaucracy. Thus, local community participation tended to be limited (Ibid). On the basis of the findings, the study substantiates that there are insignificant number of projects implemented at *mitaa* level and

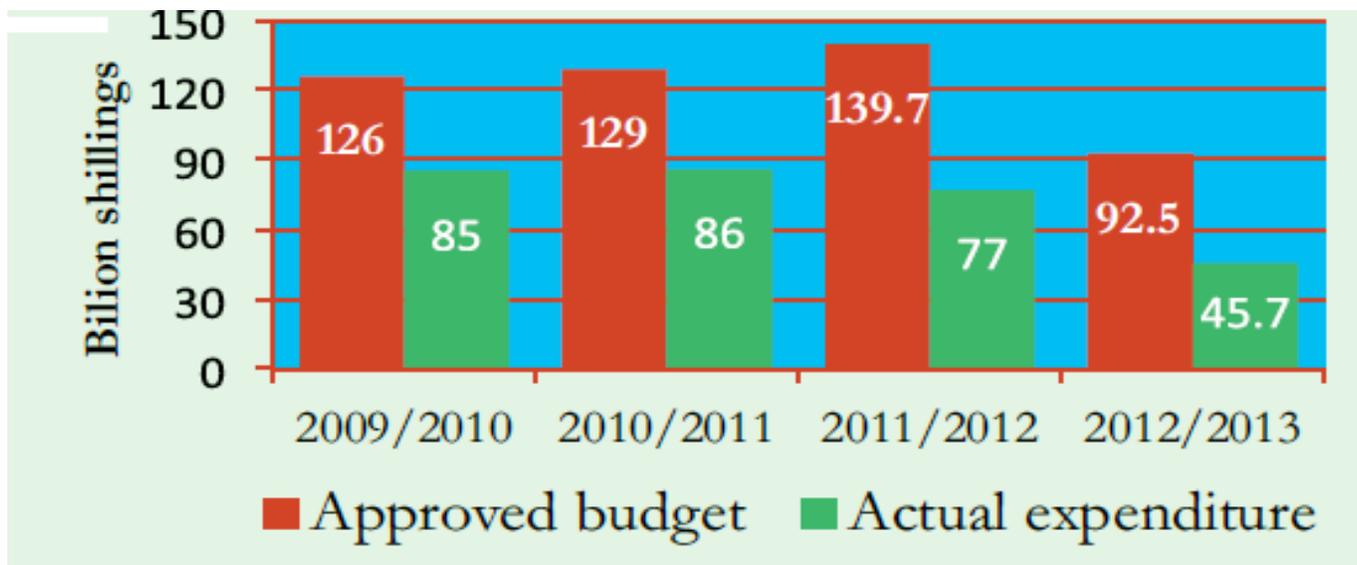
most of them result from the council's plan. The council was not positively responding to the residents' needs.

#### IV. EDUCATION SERVICE

Since 2001, Tanzania relying on the National Education policy of 1995 has been taking major strides to revamp its primary and secondary education sectors. The Primary Education Development Plan (PEDP, 2002-2006) and the Secondary Education Development Plan (SEDP) implemented starting in 2004 led into significant improvements in provision of basic education in the country. The plan focuses to realizing goal 2 of Millennium Development Goal which aims at Universal primary education by 2015 (UN, 2013). In attempt to realize it and make primary education pro-poor, the government abolished both primary school fees and contributions.

As a result, quantitative improvement of primary education is reflected by increased Net Enrolment Rate (NER) from 66% in 2001 to a peak of 97% in 2007 and 2008. Overall, gender parity in access to primary education has been achieved. However, since 2008, the NER has steadily declined to 94% in 2011 (URT, 2011). Moreover, budget allocation for the service increased from year to year. However, the challenges rest on the under spending of the allocated funds. The red bars in figure 1 shows the allocated budget and the green ones show the spent budget (Policy Forum, 2013). The under spending is a common phenomenon in all four years implying failure to achieve the set targets and it is a reflection of lack of accountability mechanisms.

Figure 1: Allocations versus expenditure development budget of education from 2009/2010-2012/2013



Source: Policy Forum, 2013

However, quantitative expansions do not match with qualitative improvements. For example, a large-scale national survey conducted in 2011 revealed alarmingly poor numeric and literacy skills among primary-aged children. The findings indicated an urgent need to improve the quality of tuition, which in turn, will depend on the increased and equitable deployment of qualified teachers and resources to all areas of the country (URT, 2012). The other problems associated with the quality of primary education were identified by Uwezo Tanzania including: - inability to read in both Kiswahili and English language; inability to solve basic mathematics and frequent absence of teachers from work. For example the findings highlighted that only 3 in 10 standard three pupils can read basic story in English and Kiswahili and only 3 in 10 standard 3 pupils can solve basic mathematics. Ladunuri (2012), although his conclusion of the study highlighted factors hindering improved performance in secondary education, some of them also affect primary education. Such factors include:- inadequate facilities and inadequate of qualified teachers.

In 1994 the Tanzanian Government ratified the Salamanca Statement. The statement emphasizes the need to provide children with special needs basic education, and sees this as an indispensable step to reach the goals set at the first Education for all (Krohn-Nydal, 2008). However, there are immense challenges remained un tackled to make education inclusive to physically challenged pupils. Tanzania disability survey as quoted by URT (2012) found that 41.7% of people with disabilities had no formal education compared with 23.5% of individuals without disabilities. The rate of illiteracy among disabled Tanzanians was 7.6%, almost double the proportion among non-disabled Tanzanians. The disparity in primary-level education was less marked; 49.4% of people with disabilities had attended primary school compared with 59.2% of people without disabilities.

Tanzania Disability Survey (2008) highlighted inhibiting factors for pupils with disability to enroll and sustain ably continue with education in the country. The factors included: - household chores facing children; inability to meet expenses related with schooling and negative attitude towards education. Moreover, Krohn-Nydal (2008) noted some challenges facing inclusive primary education in Tanzania include: - Inadequate

training provided to teachers on inclusive education; inadequate support from government for acquisition of important facilities; lack of transport to disabled children (some of them due to the type of disability need assistance to reach both school and home); lack of food for pupils and unfriendly infrastructures like classrooms and toilets.

#### V. HEALTH SERVICE DELIVERY

Health services delivery is among the priority service next to primary education in terms of budget allocation. URT (2003) and Sikika (2013) provide that district health services and other levels of it are provided by district council. The other levels of district hospital include health centre (first referral level) and dispensary (the first entry point for a patient). Health service provision is emphasized on the ground that good health is a major resource essential for poverty eradication and economic development. Health services refer to both curative and preventive services.

The provision of health services in the country is guided by the National Development Vision 2025 which in this area focus is directed to accessibility of primary health care; access to quality reproductive health care and reduction of infant and maternal mortality rate (URT, 1995). Moreover, Tanzania has adopted Millennium Development Goals to improve health service delivery. Goal 4 focuses on reducing child mortality; goal 5 concerns the improvement of maternal health and goal 6 focuses on combating HIV/AIDS, malaria and other diseases (MDGs, 2013). The government incorporated these three goals into the targets of the National Strategy for Growth and Reduction of poverty for operationalizing purposes. More specifically, the targets focused on:- reduced child (under five) mortality from 154 in 2008 to 79 in 2010 per 1000 live births; reduced infant mortality from 95 in 2002 to 50 in 2010 per 1,000 live births and reduced maternal mortality from 529 in 2008 to 265 in 2010 per 100,000 live births (URT, 2010).

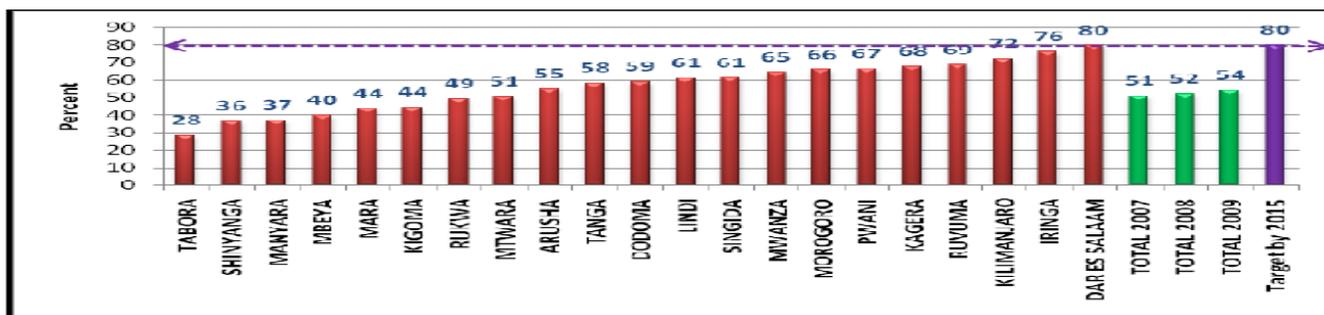
The country provides exceptions to the vulnerable groups to ensure accessibility of health services to the poor people. This

includes children, expectant mothers and old people (URT, 2013). However, this might not mean accessibility of the services to vulnerable groups because in most cases essential drugs are out of the stock and then they are bought from private hospitals and pharmacy. Sikika (2013) emphasizes on this by pointing out that in Tanzania essential medicines, medical supplies and equipment are poorly available in most of the public health facilities, leading to unnecessary suffering and even deaths of innocent citizens.

The results of evaluation of implementation of MKUKUTA targets show among other things that: - infant and under five year mortality rate have dropped by 45%, from 147 deaths per 1,000 births in 1999 to 81 deaths per 1,000 births in 2010 (MKUKUTA target for 2010 was 79); infant mortality rate decreased from 99

to 51 deaths per 1,000 births over the same period (only marginally missing the MKUKUTA target of 50); and marginally reduction in maternal mortality rate from 578 per 100,000 live births in 2008 to 454 deaths per 100,000 in 2010 (missing MKUKUTA target of 193 deaths per 100,000 live births).

From the evaluation of implementation of MKUKUTA targets, the government has a long way to go to achieve reduced maternal mortality rate, the section of the society that is conceived as marginalized ones. There are immense factors inhibiting reduction of maternal mortality rate in the country. One of these factors is inability to attend health facilities for birth service. **Figure 2** provides a summary of births attended in Health facilities by region.

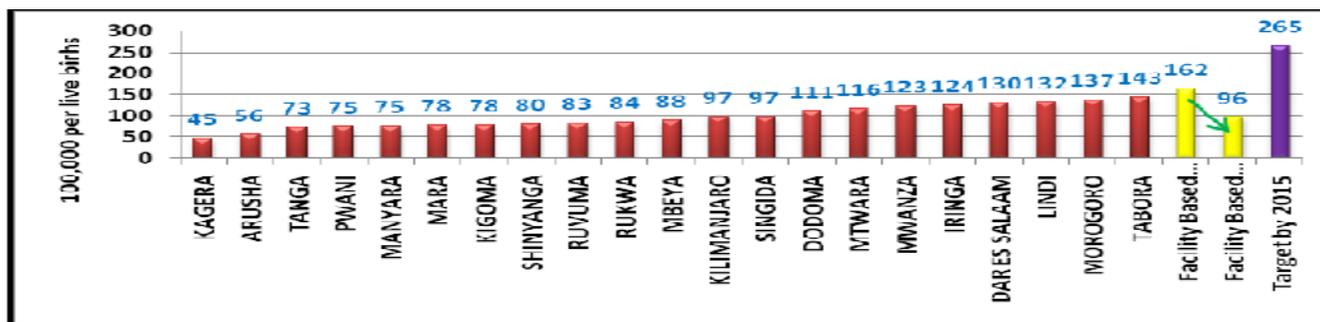


**Figure 2:** Births Attended in Health facilities by region  
**Source:** URT, 2010:16

From figure 2 above, Tabora region has the lowest level of births attended by health facilities (28%) followed by Shinyanga region (36%). It implies that 72% of births in Tabora and 64% of births in Shinyanga are attended by traditional midwives or through self help initiatives. This is highly associated with high maternal and infant mortality rates as it is difficult to deal with complicated cases of pregnancy in general and delivery in particular. This in turn results into higher maternal mortality rate. Dogba and Fournier (2009) confirms this by estimating that there are 529, 000 annual maternal deaths worldwide, 99% of

them occur in developing countries, making maternal mortality a major health and development challenge. Moreover, among women who avoid maternal death, approximately 10 million suffer from complications related to pregnancy and childbirth. The risk of dying during pregnancy is 1/6 in the poorest countries compared with 1/30 000 in Northern Europe.

There are statistically correlations between low births attendance in health facilities and high maternal mortality rate. Figure 3 below shows some of these correlations.



**Figure 3:** Maternal mortality ratio by Region  
**Source:** URT, 2010:10

In figure 3 Tabora region register highest mortality rate followed by Morogoro and Lindi regions. However, no explanations are provided on why Shinyanga region does not register

higher mortality rate because it has low births attended in health facilities. Implied it might mean that there is a problem of poor records regarding maternal death. That means many maternal deaths go unrecorded.

According to Human resources for health (HRH), a crisis which has grown into common phenomenon in the sector is high-

ly associated with maternal deaths. URT (2013) points out that HRH crisis is recognized as a major impediment to achieving Millennium Development Goals (MDGs), particularly those related to maternal and child health (URT, 2013).

Other associated problems regarding low birth attendance at health facilities include: - distance from home place to health facilities; taboos or traditional practices related to pregnancy and childbirths; unsatisfactory health services (abusive language by Health workers) habits and inability to afford transport cost (Semfukwe, 2008). Moreover, unfriendly services due to bad behavior of healthcare provider, presence of traditional birth attendants, and only one had no anybody to escort her to health facility were identified as inhibiting factors for births attendance at health facilities (Samson, 2012).

## VI. CONCLUSION AND RECOMMENDATIONS

On its side Tanzanian government has made notable efforts to provide improved social service delivery to the poor by amending laws, transferring powers to local government authorities, establishing opportunities and obstacles to development, abolishing school fees in primary education and exempting old people, expectant mothers and children from health cost sharing. However, there are numerous challenges which hampered poor service delivery. The challenges includes, inability of councils to incorporate community based plans with multitude felt needs; inadequate councils' own sources of revenue; quantitative expansion of primary education accompanied by dropping down literacy rate, inability of education sector to establish adequate friendly infrastructures for physically challenged children; inadequate medical supplies in public health facilities and exemptions for cost sharing in health services become meaningless as the poor people get the same in private health facilities at market price.

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# The student portal performance- comparative study (GSM-IIUM)

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**Abstract-** One of the important services that universities currently depend on is a student portal where students can check information related to their study and affairs. This service is one of the knowledge management tools. This article compares the student portal performance of the Graduate School of Management (GSM) and International Islamic University- Malaysia (IIUM). GSM belongs to IIUM but their administrations and student portals are totally different. Many complaints have been raised against some of their student portals' services. This article has examined whether student portal users played their role to provide feedback to the administrators or not.

## I. BACKGROUND

In the era of technology, vast amount of information and knowledge are being produced every day. Gaining knowledge, learning new science and contributing to the society by continuously sharing the experience and knowledge we have are no longer limited to the boundaries of a class room. Currently, the number of those who can access the Internet is dramatically increasing even in countries with poor economic performances. That has led to acceleration in producing and transforming information processes.

Universities are considered mainly among the top learning institutions which growingly deal with various types of specializations and sciences. It is recommended for each and every university to ease the access into the scientific articles, researches and latest knowledge updates for its students. This could be achieved by designing and having an online website which is usually subscribed to many other research websites. In addition, and as a response to the growing number of university enrolled students, there is a basic need to organize the information related to the different students' affairs and to enable them doing their important activities. Thus, a sub university website called student supporting system or student portal usually exist in most of universities websites. Some of the utilities students can do are; adding and dropping courses, checking exams' results, checking the confirmation slip, reviewing the study plan and many other things.

## II. STATEMENT OF THE PROBLEM

Students who have done their bachelor degree in international Islamic university- Malaysia (IIUM) and then joined

Graduate School of Management (GSM) to complete their master degree can experience the different level of performance of their student portals. Many of them believe that their current student portal performance is not up to their expectation. Additionally, there are some complains about IIUM student portal services which have been shared on Facebook.

## III. SIGNIFICANCE OF THE PROBLEM

In our competitive world, every organization is recommended to have core competencies where it can offer something different and unique compared to other rivals. This factor might result in attracting more customers eventually contribute to the achievement of organization's goals. There are many private and governmental universities and schools in Malaysia, and to ensure sustainability and growth for them, huge concerns should be paid to the quality management in order to satisfy the customers' needs as much as possible. One of the general universities students' needs is to have an effective, yet, a friendly user student supporting system. If this need is continuously not being fulfilled in a good way, a school's reputation might be negatively affected; this is especially with the availability of other good alternatives. If GSM administration keeps their current student portal as it is and does not work on improving it, there are possibilities of a decline in the number of students who are thinking to join this institution in the near future as they would be advised by their senior friends. Thus, this research is very important for GSM management in order to realize the undesirable consequences they may have in case their student supporting system remains the same.

## IV. RESEARCH QUESTIONS

This research is trying to answer the following questions:

- 1- How student portal service performance is being perceived by its users in IIUM and GSM?
- 2- To what extent student portal users are willing to provide feedback for their respective university management office?
- 3- How student's perception regarding current student portal would affect your advice to other new students who consider enrolling in your university?

## V. LITERATURE REVIEW

People in general and even some studies tend not to clearly being aware of the differences between data, information and knowledge (Bigliardi, 2010). Data and information in particular are often used as synonymous terms. However, data has no functionality or benefits unless human interpretation is being involved in transferring these data into information that is useful and has functionality. Furthermore, information aims at reducing the level of uncertainty by making people informed and having knowledge about things, from this point it can be said that information is knowledge but not all knowledge is information (Borglund, Engvall, 2014). Different authors have different views when it comes to distinguish between information and knowledge. According to Bigliardi, Galati, Petroni (2014), knowledge is information where it is considered as seeds that aim eventually to modify or change events or something, as well as changing human being either to the better or even to the worse. Quintane Casselman Reiche and Nylun (2011) believe that there are no differences between ideas, information and knowledge if we talk about organizational and institutional level. Knowledge in the organization is the existing information and the existing information comes through ideas.

Knowledge management in learning institutions is the process of making use of shared lessons, practices, activities, procedures and materials related to the stakeholders' interest or students' affairs efficiently (Massingham, 2014).

## VI. INSTITUTIONAL PORTAL

Jin and Peng (2009) have done a study on Shanghai Jiao Tong University Library aimed to assess its integrated services, functions and resources to meet information needs for students. They came out with a framework that summaries the roles of student portal and its importance in delivering needed information and knowledge to students. The framework consists of four elements which are; Library services, Subject services, Feedback and future work and Personalization services in which the last eases for students to get information related to their study affairs such as course administration and grades checking. Laouar, Hacken and Miles (2009) have established a conceptual model of web portal for the University of Tébessa in Algeria. In explaining this model, they regarded three main functions for the student portal. The first is information portal where it enables students to access documents, articles, case studies and external and internal database. The second function is the application portal which provides students with their information profile. The third is standby portal. Its objective is to make students able to enhance the database.

Not all different located universities have the same willingness to have student portal. Some of universities do not have at all any student supporting system. A study was conducted to examine the usage of student portal for the Southern African Development Community universities. The finding of this study was that every one out of ten universities has a student portal. The remaining universities have only general websites which aim at attracting new students to be enrolled in their universities (Jain and Joseph, 2013). However, the case is different in Malaysia where most of the universities have student portal. Masrek, Jam-

aludin and Mukhtar (2010) have specifically taken the University of Technology MARA in Malaysia as case study to evaluate the effectiveness of library portal in providing the services for its students. The study administrated that library portal met the students' expectations in terms of providing accurate, reliable, timely and comprehensive information.

(Al-Busaidi, 2012) has conducted a study in Oman to investigate the impacts of having corporate portal in academic institutions on their performance. The study's result based on questioners being distributed among the institutional academic instructors. The researcher had six hypotheses which assumed that the portal usage will eventually result in enhancing effectiveness, efficiency, innovation, learning, adaptability and satisfaction of the learning institutions. All of these hypotheses were supported after conducting the research. On other the other hand, some studies have showed that having student portal does not necessarily imply the good performance of learning institutions. A comparative study was conducted on three Iranian universities to assess the impact of using student portal on the general universities performance. The study results were considered as shocks for researchers as they found that the awareness of students in these three universities was less than the average universities students' awareness in terms of using integrated digital portal. The both factors, training students on how to properly use supporting system plus providing a proper student portal will contribute to enhance the university performance (Babalhavaeji an Anaraki, 2013).

## VII. FEATURES REQUIRED

Universities' Students look for portals that bring together different sources of information related to their affairs and matters and be easy to access (Singh and Mahajan, 2010). Many beneficial lessons were gained from the research that was conducted on Tébessa portal. (Laouar, Hacken and Miles, 2009) summarized the most three essential functions they seek which are; content management, federated searching and authentication. They have found that there are other interesting feathers to gain in the future, one of these features is the adaption to all students profiles and easing the access for all authorized users to integrate into scalable system. They intended to have this feature as the Tébessa portal had no specific online storage related to their personal information and integration.

A wide study was done in Emirate University to examine the preferences that students seek in regards to the course administration. The study indicated that students want to easily access the web by keying in the user name and password once, add and drop courses, receive notification related to courses from instructors and administrators, easy to save information and updates, uploading material related to courses and lastly being able to modify information in your profile (Zaneldin, 2011). Nevertheless, (Neubauer and Piguet, 2009) in their study concluded that there is no clear and particular standards for required student portal features. They believe that users themselves are the only people who should decide on the features and portal design required. Users' opinions and needs should be taken from the users directly via different instruments such as interviews or questionnaires.

## VIII. STUDENT SATISFACTION

(Masrek, Jamaludin and Mukhtar, 2010) explained in their study that a student satisfaction refers to the level of the pleasure or displeasure that a student feels when his/her needs being met or not. The more fulfilled students' needs are the higher level of satisfaction students have. The study showed that UiTM students got more satisfied with the library portal because it helped them to more improve and increase their study productivity and performance. Students in general do not concern about instruments being used to achieve their requirements as much as they concern about getting things achieved. The strongest element of having students satisfied in School of Nursing and Midwifery is the good perception that students had toward the academic staff who is interested in helping their students throughout their learning progress. Achieving student needs increase their satisfaction level as well as their productivity (Smith and Rogers, 2011).

Universities students' needs can be explained in many different aspects. They might be related to the human factor or even to technological one. A study was conducted in Bangladesh to assess students' satisfaction in two public universities in regards of the usage of the electronic information resources. The finding administrated that all students are not satisfied at all about their supporting academic system. They identified several main problems which embodies in the very limited number of computers and having very poor IT infrastructure. Lacking to provide the required basic electronic needs had led to have students much less capable to access the library and student portal. The consequences of the above mentioned factors have made student unwilling and unsatisfied to use the information sources (Ahmed, 2013). However, the results of another study which aimed basically to evaluate the level of postgraduate students were totally different compared with two examples mentioned of Bangladeshi universities. (Ahmed and Amjad, 2014) conducted their study in two Pakistani universities. The results clearly showed that more than 80% were very satisfied with the information sources systems. The study emphasizes that the more the students satisfied is the more a university productive.

## IX. RESEARCH METHODOLOGY

### Research design

This study aims to broaden our knowledge about the quality performance of student portal among students. Initially, It is concerned to compare the different student portal performances of International Islamic University- Malaysia (IIUM) and the Graduate School of Management (GSM) by interviewing users (students) of both student portals.

### Population and Participants

The participants of this research are 40 students. 20 of them are currently master students in graduate school of management (GSM). They use a student portal that is created for GSM students only. The other 20 students are undergraduate students currently studying in faculty of Economic and Management Sciences. They are using a student portal that has been created for all IIUM students. That is why we find it logical not to specify

our study for post-graduate students only. This is because we are mainly concerned about the usage of both student portals regardless of the academic level of students.

This study applied the quantitative method where Questionnaire survey was designed and distributed among a random sample. This survey contains questions that analyze the perception of students towards their student portal and provides answers which are based on their own understanding and experience.

### Data Collection

Pilot test of 4 students was done where the questionnaire survey was improved 4 times. The final draft involve 25 items that basically aim to get answers related to the student portal performance, the students' feedback given to management and the impact of having good or bad student's portal on new students who think of where to enroll for their undergraduate and master studies. The questionnaire survey was printed on 2 pages and distributed as hard copies. We approached some students who were having group discussions and other students sitting in the GSM resource room. It took almost 5 minutes from each participant to fill up the survey.

### Data Analysis

In this research, we used SPSS software as an instrument to analyze collected data. We did key in all data into the SPSS software and we managed to find the *Significance*, *Mean* and *Standard Deviation* of every item included in the survey questionnaire.

### Data measurement scale

Among the 25 items included in the survey, there were 11 items assessing the quality services in the two comparative institutions. Participants had to choose on how good each service is based on the 5 scales which are very good, good, average, bad and very bad. Another 10 items used the same 5 scales but this time to assess how important each service is to them. The scale starts with very important followed by, important, average, unimportant and very unimportant. The remaining items were formed in a way that can be answered as Yes or No answers.

### Findings

**H<sub>1</sub>: student portal of GSM does not meet its users' expectations.**

Answers obtained from our designed questionnaire answered all questions stated in the problem statement. Moreover, we had to ask our respondents some related questions which we believe would help us in making our analysis and come up with a meaningful conclusion. The frequency of using students' portals among IIUM students tends to be more than that of GSM students in a daily basis (15% against 5%). Results show an equal response from students in both institutions when it comes to weekly use of student portal (45% each). The percentage of IIUM students who use their student portal in a monthly basis is 8% which is quite higher than that of GSM students who have a percentage of 6% only. Finally, GSM tend to have some students who actually refer to their student portal once per trimester which cannot be applied on IIUM students because all of them actually tend to use their portals more than one time per semester. In conclusion, IIUM students have the tendency of using their student portals more than GSM students. This is based on the percentage obtained from daily using basis.

The second part of our questionnaire measures how IIUM and GSM students perceive various services provided in their

students portals. The table below shows how different attributes are graded by students from both institutions. For illustration, the availability of examination timetable for IIUM students' respondents has a *Mean* of 3.90 out of 5.00 which is quite different than GSM students' respondents who have a *Mean* of 3.00 out of 5.00. Another illustration is in terms of the ability to add and drop courses provided in student portals, whereas, IIUM students

have a *Mean* of 2.15 out of 5.00 and GSM students have a *Mean* of 3.60 out of 5.00 which shows significant different perceptions over this particular service. In conclusion, IIUM respondents show a *Mean* of 3.55 out of 5.00 as their own overall perceptions on IIUM student portal quality and GSM respondents show a *Mean* of 3.30 out of 5.00 of their own.

|  | student | N  | Mean | Std. Deviation | Std. Error Mean |
|--|---------|----|------|----------------|-----------------|
| Easy to access                               | IIUM    | 20 | 3.80 | .696           | .156            |
|  | GSM     | 20 | 3.40 | .883           | .197            |
| Ease of link address                         | IIUM    | 20 | 3.70 | .657           | .147            |
|  | GSM     | 20 | 3.15 | 1.040          | .233            |
| Design attractiveness                        | IIUM    | 20 | 3.55 | .686           | .153            |
|  | GSM     | 20 | 2.75 | 1.020          | .228            |
| Availability of examination timetable        | IIUM    | 20 | 3.90 | .641           | .143            |
|  | GSM     | 20 | 3.00 | 1.026          | .229            |
| Availability of feedback from academic staff | IIUM    | 20 | 2.90 | .788           | .176            |
|  | GSM     | 20 | 2.75 | .967           | .216            |
| Ability to drop and add courses              | IIUM    | 20 | 2.15 | 1.089          | .244            |
|  | GSM     | 20 | 3.60 | .681           | .152            |
| Accuracy of personal information             | IIUM    | 20 | 3.80 | .768           | .172            |
|  | GSM     | 20 | 3.25 | .851           | .190            |
| Updates of academic results                  | IIUM    | 20 | 3.75 | .967           | .216            |
|  | GSM     | 20 | 3.55 | .686           | .153            |
| Clearness of study plan                      | IIUM    | 20 | 3.45 | 1.050          | .235            |
|  | GSM     | 20 | 3.00 | .918           | .205            |
| Updates of personal information              | IIUM    | 20 | 3.30 | .865           | .193            |
|  | GSM     | 20 | 3.20 | .894           | .200            |
| Overall quality                              | IIUM    | 20 | 3.55 | .686           | .153            |
|  | GSM     | 20 | 3.30 | .657           | .147            |

### Group Statistics 1

As for the third part of our questionnaire, we tried to measure the level of importance of most services provided in IIUM student portal as well as that of GSM. The table below shows to what extent students from both institutions perceives services provided as important or unimportant. For instance, IIUM students have a *Mean* of 4.65 out of 5.00 according to how they see Updates of academic result is important to them, moreover, GSM

students have a *Mean* of 4.10 out of 5.00 in the level of importance of the very same service provided. Another example is given by students from IIUM and GSM who perceive the availability of feedback from academic staff as relatively important; 3.80 and 3.75 out of 5.00 respectively. In conclusion, most of the services provided in IIUM as well as GSM student portals are perceived as important to students from both institutions

|  | student | N  | Mean | Std. Deviation | Std. Error Mean |
|--|---------|----|------|----------------|-----------------|
| Easy to access                               | IIUM    | 20 | 4.55 | .999           | .223            |
|  | GSM     | 20 | 4.00 | 1.257          | .281            |
| Design attractiveness                        | IIUM    | 20 | 3.60 | .995           | .222            |
|  | GSM     | 20 | 3.70 | .923           | .206            |
| Ease of link address                         | IIUM    | 20 | 4.50 | .761           | .170            |
|  | GSM     | 20 | 4.00 | 1.026          | .229            |
| Availability of examination timetable        | IIUM    | 20 | 4.50 | 1.000          | .224            |
|  | GSM     | 20 | 4.15 | .988           | .221            |
| Availability of feedback from academic staff | IIUM    | 20 | 3.80 | 1.240          | .277            |
|  | GSM     | 20 | 3.75 | 1.070          | .239            |
| Ability to drop and add courses              | IIUM    | 20 | 4.75 | .910           | .204            |
|  | GSM     | 20 | 4.30 | .979           | .219            |
| Accuracy of personal information             | IIUM    | 20 | 4.40 | 1.046          | .234            |
|  | GSM     | 20 | 3.90 | 1.021          | .228            |

|                                 |      |    |      |       |      |
|---------------------------------|------|----|------|-------|------|
| Updates of personal information | IIUM | 20 | 4.35 | 1.040 | .233 |
|                                 | GSM  | 20 | 3.85 | 1.137 | .254 |
| Clearness of study plan         | IIUM | 20 | 4.50 | 1.051 | .235 |
|                                 | GSM  | 20 | 3.95 | 1.146 | .256 |
| Updates of academic results     | IIUM | 20 | 4.65 | .933  | .209 |
|                                 | GSM  | 20 | 4.10 | 1.071 | .240 |

**Group Statistics (2)**

The fourth section of our questionnaire showed quite interesting results. We asked our respondents whether or not they have experienced giving any feedback related to student portal to their respective management office. Only 5 IIUM respondents out of 20 said that they have, and the remaining 15 said they have not. Amazingly, the same scenario took place with GSM students, whereby, also 5 respondents out of 20 said that they have the experience of providing management office with feedback and the rest said they have not. However, in section five, we tried to measure the tendency of reaction made by management office towards feedback provided by students. We found that 4

IIUM respondents out of 5 experienced no reaction taken by management office towards their feedback given, only one respondent out of those 5 experienced a reaction. As for respondents from GSM, 4 out of 5 students said that they have experienced a reaction taken by their management office with regard to their feedback given; however, only 1 respondent said he experienced no change whatsoever. The table below shows both Means of respondents in regard to reactions taken by management office towards students' feedback over student portal services.

|                        | student | N | Mean | Std. Deviation | Std. Error Mean |
|------------------------|---------|---|------|----------------|-----------------|
| Reaction from feedback | IIUM    | 5 | 1.60 | .548           | .245            |
|                        | GSM     | 5 | 1.20 | .447           | .200            |

**Group Statistics (3)**

The final part of our questionnaire measures the tendency of students who would consider the student portal service provided before suggesting their respective institutions to their friends to be enrolled at. 26 respondents out of 40 believe that their per-

ception on current student portal has an effect on the advice they give to new students on whether or not to enroll in IIUM or GSM. Below is a table shows both Means for both groups of respondents.

|                       | student | N  | Mean | Std. Deviation | Std. Error Mean |
|-----------------------|---------|----|------|----------------|-----------------|
| enrolment_new_student | IIUM    | 20 | 1.30 | .470           | .105            |
|                       | GSM     | 20 | 1.40 | .503           | .112            |

**Group Statistics (4)**

**X. CONCLUSION**

Quality of student portal services provided for IIUM as well as GSM students have a significant impact on how students perceive their educational institution at large. Technical factors such as; type of service provided as well as managerial factors such as; reacting to feedback received from students are critical in shaping students' overall perceptions on their respective institution. This is so because student portals are essential for all students to be used one time or another and the experiences they go through when using them usually lasts for long. It is important for IIUM as well as GSM to better their understanding of the services needed by their students, creating an encouraging system for feedback to be given by students and finally making use of received feedback the most effective and efficient way possible.

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# The Study on Female Undergraduates' Attitudes toward and Perceptions of Entrepreneurship Development (Comparison Public and Private Universities in Ethiopia)

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**Abstract-** Female entrepreneurship is considered an important tool in enabling female empowerment and emancipation. The main objective of this study is to investigate female undergraduate students' attitudes toward and perceptions of entrepreneurship (Comparison Ethiopian Public and Private Universities). In the light of recent world events, this has become a crucial area to study and understand – especially with respect to, attitudes toward entrepreneur, motivations, constraints and consequences. The reason why final year female undergraduates are chosen for the current study is because they are at a period in their career development where they are considering different career routes and are therefore, a potential source of future female entrepreneurs. For research design; cross-sectional, descriptive and inferential designs study were used in the study. In the study both primary and secondary data were used. Pertaining to data analysis the researchers had used both qualitative and quantitative data analysis techniques mainly descriptive analysis using percentages, tables and graphs deployed. While for inferential statistics like distribution based analysis for nominal data type, chi-square, and multi-regression were used to test the statistically significant difference (independency) of variables, impacts of independent variables on dependent variable.

As per output of this finding there were different barriers those affects female undergraduates for not entering into entrepreneurship. The major barriers expected were, the responsibility of running a business too difficult, lack of a ability to know how to access business information, difficult to obtain the finance necessary and lack of a good business idea as an inhibitor to entrepreneurship, worry lack of experience needed to run a business and lack of the business skills required to run their own business.

Therefore, in order to change their worries from different barriers, entrepreneurship subject and training on entrepreneurs' successful characteristics are highly needed

**Index Terms-** Female entrepreneurship, undergraduate students, attitude, Ethiopian Public and Private Universities

## I. INTRODUCTION

Female entrepreneurship is considered an important tool in enabling female empowerment and emancipation. It has been suggested by Weeks (2007) that women-led businesses can make a significant contribution to the economy. Allen, Langowitz, Elam and Dean (2007) further substantiated the importance of

female entrepreneurial activity on economic development, finding investment in female entrepreneurship an important way for a country to exponentially increase the impact of new venture creation. Furthermore, they noted women are more inclined to share the benefits gained through entrepreneurship with members of their family and the wider community.

A national survey conducted by the Ethiopian Welfare Monitoring Unit (2002) shows, although women entrepreneurs contribute significantly to the national economy in terms of job creation, skills development and the alleviation of abject poverty among men and women alike, the literature clearly explains that small businesses and enterprises operated by women entrepreneurs are not being provided with adequate strategic support in terms of policy, access to finance, tax assessment, skills development and managerial training, technological transfer and infrastructural development (Berhanu, Abraham & Van der Berg, 2007). Although MSMEs operated by women cater for the poorest of the poor and make a sizeable contribution to the national economy, the level of support and recognition given to them has been minimal historically (Mogues, 2004). Businesses and enterprises operated by women contribute for economic dynamism, diversification, productivity, competition, innovation and economic empowerment of the poorest of the poor.

Self-efficacy is one of the main motivations of entrepreneur as it creates job satisfaction. Job satisfaction, in turn, is considered as an attitude toward one's job (Brief, 1998; Weiss, 2002). In the case of entrepreneurs, they do not have jobs in the traditional sense. Nevertheless, they indeed have jobs or tasks when they start and run a new business (Brief, 1998; Weiss, 2002, Bird, 2002 cited in Edgar and Marc, 2010).

According to a survey conducted in the Gullele sub-city of Addis Ababa illustrate, women in the cluster area estimated 39% were self workers while men constitute the remaining 61% were self workers (HK Hailu, 2010,P.53). Furthermore, as different past researches' report in Ethiopia shows, the majority of women had little education and find employment in the lower sections of the formal employment market. For example, in 1999/00 there were only 30.75% of women in the Civil Sector ('Shadow Report' 2003, p. 14) among which the majority, 98.2%, was concentrated in low status and low paying jobs (Aster *et al* 2002, p. 69). The level of unemployment is higher for women than for men among any section of society. In 1998, the Bureau for Labour and Social Affairs estimated the percentage of female unemployed at 58.6 and for males 41.4 in Addis Ababa (Alemnesh 2001, p. 97). According to age group, the unemployment level is

higher among women than men in the age group 15-19 years with 16.8 % for women and 6.4% for males. This percentage increases slightly among the age group 20-24 with 17.8% of women and 7.4 % of males (Teshome 2004, p. 27 cited in Indrawatie, 2011).

The Shadow Report, which was compiled by the Ethiopian Women's Lawyers Association and the Network of Ethiopian Women Associations on the platform for action of the Beijing +10 Conference, revealed that the majority of Ethiopian women are employed in the informal sector (64.93%) ('Shadow Report' 2003, p. 14). This includes petty trade, handicrafts, selling food items, vegetables, locally produced drinks, domestic services, charcoal, firewood, second-hand clothes and so on ('Shadow Report' 2003, p. 14, Aster *et al* 2002, p. 70, Alemmesh 2001, p. 98 cite in Indrawatie, 2011, pp.170-171). The dominance of women in this sector illustrates the many factors leading to this. Such as; characteristics of the female entrepreneur, family background, personal & work experience, role models, the nature of female entrepreneurship, female barriers to entrepreneurship, educational influences on female entrepreneurship.

Additionally, as the result of study on women entrepreneurship in micro, small and medium enterprises was shows, the majority of businesses that failed were operated by women (78%). Businesses that failed were characterized by inability in obtaining loans from formal money lending institutions such as commercial banks, inability to convert part of profit back into investment, poor managerial skills, shortage of technical skills, and low level of education. Businesses operated by women were 2.52 times more likely to fail in comparison with businesses operated by men (Eshetu and Zeleke, 2008, p.1).

The current research has been undertaken to examine female undergraduates' attitudes towards and perceptions of entrepreneurship. This is necessary in order to obtain more knowledge and a better understanding of why so few female undergraduates consider entrepreneurship as a career and majority of businesses that failed were operated by women. This is important as the topic of female entrepreneurship and in particular female undergraduates and their views on entrepreneurship is a seriously neglected and under developed research area. An examination of literature shows there is little known about their needs, motivations and reservations concerning business ownership. The reason why final year female undergraduates are chosen for the current study is because they are at a period in their career development where they are considering different career routes and are therefore, a potential source of future female entrepreneurs.

## II. LITERATURE REVIEW

### 2.1 Characteristics or traits of entrepreneurs

Due to the difficulty in coming to a universally acceptable definition of the entrepreneur, researchers have attempted to distinguish different factors that influence the individual towards entrepreneurship (Dyer, 1994). Efforts have been made to identify some of the characteristics or attributes possessed by the entrepreneur (Kao, 1990), and this is often referred to as the trait school of thought. Carson *et al* (1995) believed that entrepreneurial traits distinguish entrepreneurs from other groups in society. Delmar (2000) identified the most common of these traits as a need for achievement, internal locus of control, risk-taking pro-

pensity, tolerance for ambiguity, over-optimism and the need for autonomy. These characteristics and traits have been acknowledged by many authors and are seen as an important factor when calculating a person's propensity towards entrepreneurship (McClelland, 1961; Scott and Twomey, 1988; Gibb, 1990; Morrison, Chell, Hawthorn and Brearly, 1991; Carson *et al*, 1995; ;Garavan *et al*, 1997 ; Morrison, 1998; Rimmington and Williams, 2000). Gasse (1990) also believed motivation, energy and perseverance are important traits, with Plaschka (1990) including innovation as an important characteristic of the entrepreneur. McCarthy (2000) found risk-taking propensity to be associated with personality traits, subsequently arguing that research on traits is of extreme importance in any serious attempt to understand entrepreneurship. However, despite this, Delmar (2000) argued that with the exception of the need for achievement, it has been difficult to link any specific traits to entrepreneurial behavior.

The importance of examining entrepreneurial traits and characteristics in relation to the current research is to help establish the basic characteristics associated with the entrepreneur. However, not everyone agreed with the trait school of thought. Carson *et al* (1995) found four main criticisms of the trait approach: first, the inability to differentiate clearly between entrepreneurial small business owners and equally successful professional executives. Second, the assumption that by identifying the supposed key trait or characteristic of the entrepreneur, you can identify the entrepreneurial personality. Third, the lack of recognition of entrepreneurship as a continuously changing process in which the entrepreneur will also change. Finally, the lack of empirical evidence to connect entrepreneurial characteristics with actual entrepreneurial activity and the inability to acknowledge an individual's situation and the effect it has on new venture creation. Basically, the trait approach cannot be used alone to explain entrepreneurial behaviour. Therefore, there is a need to look at what entrepreneurs do and why they do it (Martin *et al*, 1998).

### 2.2 Antecedent influences

Current researchers are increasingly trying to understand how entrepreneurs perform and why some engage in entrepreneurial behavior and others do not (Delmar, 2000).

The socialization process is one such area of study, and is often referred to as social learning theory. This school of thought tries to establish what influence factors such as interaction with the environment, dealing with life experiences and social relationships have on forming our attitudes and values and therefore influencing our behaviour (Morrison *et al*, 2000). Social learning theory, while acknowledging the genetic influence on personality traits, emphasizes the importance of each individual's personal situation and the influence the environment has on the individual and, in turn, the influence the individual has on the environment (Garavan *et al*, 1997). Consequently, social learning theory recognises the influence that society has on encouraging entrepreneurship (Morrison, 1998).

Carson *et al* (1995) see the entrepreneur as being embedded in a complex set of social networks that will either facilitate or hinder the potential of the individual to enter into entrepreneurship. Examples include family and social background, education, religion, culture, work and general life experiences. Morrison, Rimmington and Williams (2000) further expanded on these so-

cial influences by adding availability of appropriate role models, career experience ranging over the complete life-cycle, deprived social upbringing, sibling order within the family, entrepreneurial family background, level of educational attainment, negative and positive peer influence, position in society and being uncomfortable with large bureaucratic organizations.

These influential factors are often referred to in entrepreneurial literature as antecedent influences, and can have an impact on a person's motivation, perception, skills and knowledge.

Dyer (1994) found working for an entrepreneur or knowing an entrepreneur had a positive impact on entrepreneurial career choice. Matthews and Moser (1995) found work experience an important factor in the encouragement of entrepreneurial activity, especially in small businesses. Madsen, Neergaard and Ulhøi (2003) agreed with this, recognising the importance of work experience in the development of a business idea.

It is suggested by Carter and Cachon (1988), as cited by Morrison (1998), that entrepreneurs often share common features and experiences of a social context, which distinguish them from other individuals. Nevertheless, there is a need to recognise the heterogeneous and diverse nature of entrepreneurship (Carson *et al*, 1995). Especially, as much of the knowledge about entrepreneurship is based on studies of the male entrepreneur (Brush, 1992).

As the current research involves female undergraduates, it is necessary therefore, to look at the female entrepreneur. Female entrepreneurial activity in most of the developed countries of the world is significantly lower than their male counterparts, even

though it is argued they are influenced by many of the same factors (Minnitti, Arenius and Langowitz, 2004).

### **2.3 Female entrepreneurship**

It has been suggested by Weeks (2007) that women-led businesses can make a significant contribution to the economy. US statistics have shown that over the last twenty years women-owned businesses have grown at a rate of nearly two to one of other businesses and, interestingly, have made more of a significant impact on employment figures and revenue intake than is actually suggested by these figures (Centre for Women's Business Research, 2007). Allen, Langowitz, Elam and Dean (2007) further substantiated the importance of female entrepreneurial activity on economic development, finding investment in female entrepreneurship an important way for a country to exponentially increase the impact of new venture creation. Furthermore, they noted women are more inclined to share the benefits gained through entrepreneurship with members of their family and the wider community.

However, in Ethiopia the economy has yet to achieve substantial benefit from women led businesses as, in comparison with other countries, the level of female entrepreneurship is particularly low; for example in Portugal, Austria, and France female entrepreneurship can account for 41% of all new start-up's (Henry and Kennedy, 2003; Gender Equality Unit, 2003; Fitzsimons *et al*, 2003; Fitzsimons and O'Gorman, 2004).

**Model of Female Entrepreneurship**

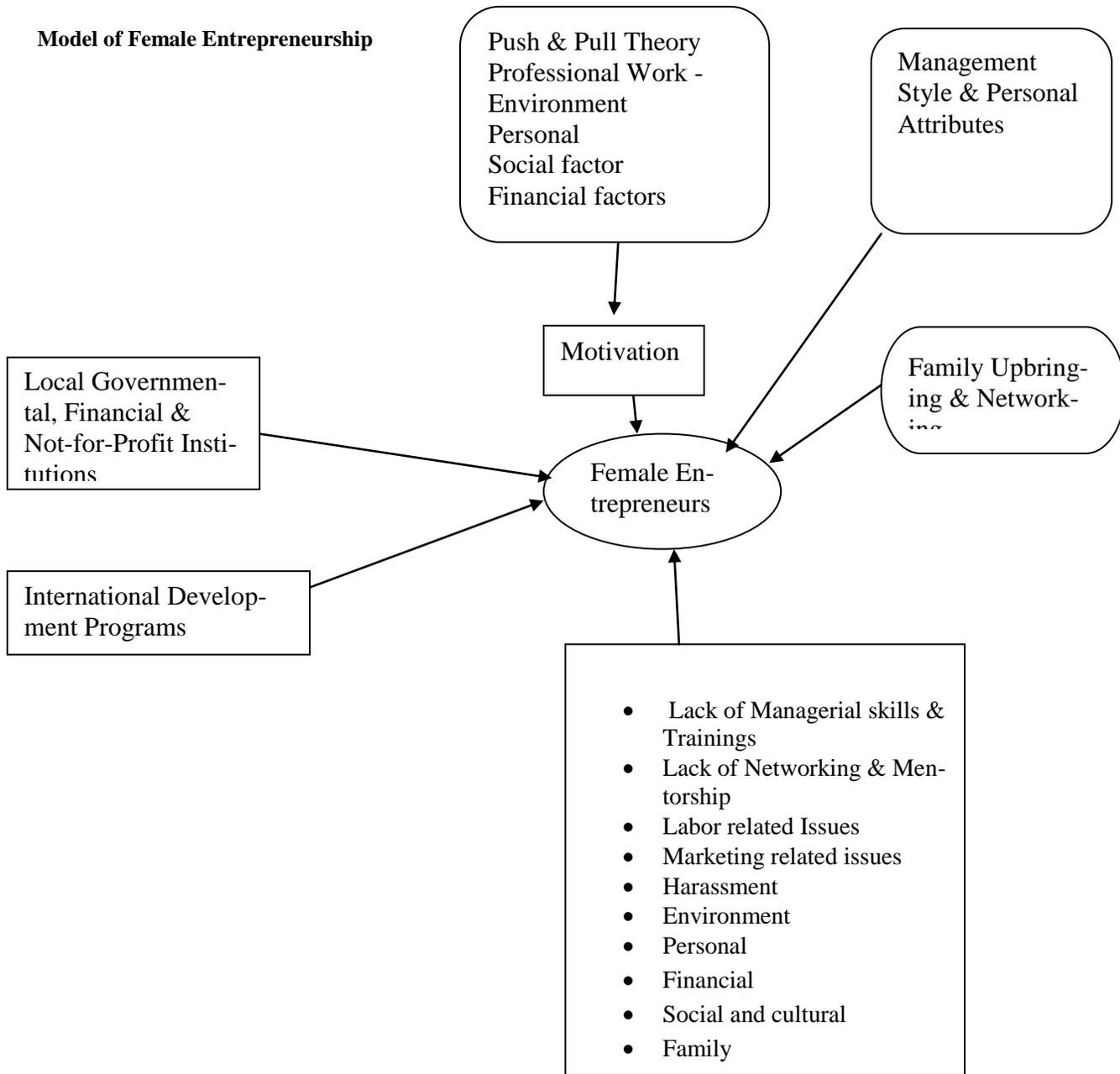


Fig: 2.1 Model of Female Entrepreneurship  
(Sources: Muhammad A and, Dr. Amber G,2011)

**2.3.1 Characteristics of Female Entrepreneurs**

Women entrepreneurs are not a homogenous group *per se*, but they often share common characteristics and therefore it is possible to build up a general profile of the typical female business owner (Still and Walker, 2006). According to Sarri and Trihopoulou (2005), the female entrepreneur is 43 years old, and is usually older than her male counterpart. This demographic of women entering entrepreneurship at a later age than men is well recognised in entrepreneurial literature (Goodbody, 2002; Madsen *et al*, 2003). She is often married with children, and enters entrepreneurship when the children are older (Madsen *et al*, 2003; Sarri *et al*, 2005). However, there is a trend towards wom-

en entering entrepreneurship at a younger age (Birley, Moss and Saunders, 1987; McClland, Swail, Bell and Ibbotson, 2005; Still *et al*, 2006). This development of women entering into entrepreneurship at a younger age has also been noted in Ireland with research showing the average female business owner to be 38 years of age and is only slightly older than her male counterpart (Fitzsimons and O’Gorman, 2007).

**Family Influence**

Research has suggested there is a strong correlation between family background and participation in entrepreneurial activity (Morrison, 2000). Some researchers consider sibling order in the family an important family demographic (Hisrich *et al*, 1984;

Hagan *et al*, 1989; Brush, 1992; Buttner, 1993). Watkins *et al* (1984) believe firstborn children, including only children have a more positive attitude than their siblings and display a sense of responsibility and a need for achievement that are often correlated with entrepreneurship. These authors found sixty percent of the female entrepreneurs participating in their research were eldest or only children. Hisrich and Brush (1984) had a similar finding with fifty percent of the female entrepreneurs surveyed being first-born children. However, Nearchou-Ellinas *et al* (2004) found that birth order played no significant role in female entrepreneurial activity.

According to Hagen *et al* (1989) Orhan and Scott (2001) and Mattis (2004) family influence is particularly important for women as women are more inclined to seek family advice than their male counterparts (Kirkwood, 2007). Some authors put a particular emphasis on the importance of fathers in the encouragement of women towards entrepreneurship (Hisrich *et al*, 1984; Birley *et al*, 1987; Kirkwood, 2007).

### **Role Models**

Hisrich (1989) recognised the positive impact of parents as role models for female entrepreneurs, with Watkins *et al* (1984) finding that a mother was at least as influential as a role model as a father. However, it has also been suggested that role models other than parents can be influential in the encouragement of entrepreneurship as a chosen career route (Matthews *et al*, 1995). Hagan *et al* (1989) and Minniti, Arenius and Langowiz (2004) acknowledged the importance of the female role model in the promotion of female entrepreneurship, indicating a successful female entrepreneur can act as a role model for other female entrepreneurs and hence impact on the success of future female entrepreneurs. This, Buttner (1993) believed helps “to dissipate the enduring perception that entrepreneurship is a predominantly male domain”

Therefore, the media has an essential part to play in the promotion of then equality of women particularly with a view to informing and raising awareness of equal opportunities among young people in present day society (European Parliament, 2006). The influence of media is especially significant for women as it is understood that “women who believe that there is a great deal of positive media coverage are much more likely to be entrepreneurs” (Fitzsimons *et al*, 2006).

### **Work Experience**

Work experience is also found to be an important factor in the encouragement of successful female entrepreneurial activity (Brush *et al*, 1991). Previous research shows if a women starts a business in an area she has previous work experience she has a much better chance of running a successful business than a woman without previous experience in her business area (Brush *et al*, 1991; Buttner 1993). Henry *et al* (2003) also found in their study of Irish female entrepreneurs that prior work experience was considered extremely useful when setting up their business however, for many of them the work experience was in a different area than their business start up.

### **Family Responsibility**

The need to balance family responsibilities and career is a major factor for female entrepreneurship (Cromie, 1987; Buttner *et al*, 1997; Stills and Walker, 2006). This is often cited as one of the greatest differences between the female and the male entrepreneur, with the unequal division of domestic labour (Still and

Timms, 2000), leading to a disproportionate share of family responsibilities resting with the woman (Buttner *et al*, 1997).

Furthermore, Bruni *et al* (2004) claimed that the integrated roles of women business owners is a disadvantage to women, as it stereotypes them as being unable to distinguish their private lives from their business lives. Bruni *et al* also suggest this amalgamation of roles may reduce the credibility of women when starting a business.

### **The Importance of Profit**

Brush (1992) believed the assessment of business performance for women owned businesses should include intrinsic goals such as quality of work, customer service and work life balance as women often consider these objectives more important than making a profit. Buttner (1993); Hisrich *et al* (1984) and Buttner *et al* (1997) agreed with this view suggesting that men start a business for economic reasons whereas women start a business to aid work-life balance.

According to Brindley (2005) the definition of success based on the male perspective of equating success with financial accomplishment, may diminish the achievement of a woman led-business, who measures her success on other factors such as quality of work and life balance. However, contrary to many other studies Sandberg (2003) and Carter and Marlow (2007) found no clear evidence to suggest that women are less profit orientated than men, or are more likely to value intrinsic goals.

### **2.4 Obstacles to Female Entrepreneurship**

Welter (2004) has indicated that the participation of women in entrepreneurship has been hindered by the value that society places on women in employment, believing that as a result of past social norms women are still being stereotyped according to their gender thus limiting opportunities and creating occupational segregation.

Hisrich *et al* (1984) also acknowledged the difficulties that woman face when starting a business stating that the risk and effort entailed in starting a business from scratch is perhaps even greater for a woman entering a male dominated arena. Carter *et al* (2007) suggested that women lack finance and capital assets during the start-up period and argued that one of the key debates within female entrepreneurial research is how these barriers at the start-up stage affect the long-term business performance of women business owners.

### **Confidence Issues**

Lack of confidence can be a major problem in the area of female new venture creation (Minniti *et al*, 2004; Chowdhury and Endres, 2005). Brindley (2005) agreed lack of confidence can have a negative effect on women entering into entrepreneurship. However, she believed that as a woman’s confidence grows, her fear of risk diminishes.

Still *et al* (2000) specifically found women were less confident than men in matters relating to the management of staff, with lack of information and training being considered to be the principal reasons why women expressed less confidence in these areas. The subject of confidence is of significant interest to this research as it could have a crucial impact on the female undergraduate and her consideration of entrepreneurship as a career.

### **Educational Factors**

The female entrepreneur has a high level of education with some studies indicating that she often reaches a higher educational standard than her male counterpart (Madsen *et al*, 2003).

Brush *et al* (1991) recognised the importance of subject choice in enhancing the success of a female led business venture. Watkins *et al* (1984) believed subject choice is what differentiates between the male and female entrepreneur. Menzie *et al* (2003) and Madsen *et al* (2003) also recognized this difference in subject choice finding women were less inclined to study science and computer subjects and were more likely to major in health and natural science.

Consequently, a woman, due to her lack of business training especially in the areas of engineering and science is at an immediate disadvantage to entering traditionally male dominated areas such as construction and science (Hisrich *et al*, 1984).

## 2.5 Education and Entrepreneurship

Matthews *et al* (1995) acknowledged the significance of education and the part it plays in entrepreneurial activity, stating that it is critical to attract the young and educated to entrepreneurship, especially as current industrial trends are towards a knowledge-based environment (Henderson and Robertson 2000; Postigo, Lacobucci, and Tamborini, 2006).

Carter *et al* (1999) and Gibb (1996) agreed with the importance of education to entrepreneurship, believing that ambitious, educated, young people can be equally encouraged into new venture creation as opposed to a large organisation, especially as the long-term supply of well educated and qualified entrepreneurs is essential to a strong modern society (Scott *et al*, 1988).

Therefore, it is of interest to note that Fitzsimons *et al* (2007) found a direct correlation between education and entrepreneurship finding entrepreneurial activity highest amongst those with a third level qualification. However, Wang and Wong (2004) in contrast suggested that education might be a deterrent to entrepreneurship as honour students show less interest in starting their own business, speculating that a longer time spent in education assimilating more business knowledge does not necessarily lead to higher interest in entrepreneurship.

## Entrepreneurship as a Career Choice

Without doubt the choice of career for the undergraduate can be a complex and difficult process, with this decision-making process becoming even more intricate when the career path chosen is that of starting your own business (Nabi *et al*, 2006).

This can lead to entrepreneurship not readily being considered as a career choice (Henderson *et al*, 2000). Despite this, Wang *et al* (2004) acknowledged that undergraduates show a high level of interest in entrepreneurship, as a career.

## Entrepreneurial Model

Scott *et al* (1988), recognizing the particular difficulties surrounding undergraduates and their entry into entrepreneurship designed an entrepreneurial model suggesting the main variables that influence students towards entrepreneurship. These variables are presented as follows:

**Pre-Dispositional Factors:** These include an individual's personality traits, antecedent influences with a particular emphasis on family role models and relevant work experience, confidence in one's own abilities and a preference to work in the SMEs sector.

**Trigger Factors:** These depend on the individual situation and include the effects of looking for work, availability of career guidance and the prospect of being unemployed.

**Possessing a Business Idea:** This is considered the main factor in choosing entrepreneurship as a career. Although the previous factors are important in encourage entrepreneurial activity and may help in prompting a business idea, possessing a business idea alone may inspire new venture creation and is seen as an independent pull into entrepreneurship. Wong *et al* (2002) and Phan, Wong, and Wang (2002) agree with Scott *et al* (1988) that having a business idea is a vital trigger factor when considering entrepreneurship. Madsen *et al* (2003) are in agreement with this. However, they also agree with the importance of work experience and its help in developing a business idea.

## 2.6 Entrepreneurial Traits

Louw, Van Eeden, and Bosch (2003) claim the age of the undergraduate plays a significant role in how students perceive their own entrepreneurial qualities finding the older the undergraduate the higher they assessed their level of entrepreneurial traits. Eeden Van, Louw and Venter (2005), while recognising the importance of entrepreneurial traits, also believed that these traits can be acquired through education, life experience and the entrepreneurial process. Interestingly, Scott *et al* (1988) noted undergraduate students who came from an entrepreneurial family background were more likely to believe they had entrepreneurial characteristics than students that did not come from an entrepreneurial family.

## Perceived barriers

Financial risk is considered a major barrier to starting your own business with over fifty percent of university students in a study conducted by Robertson *et al* (2003) stating it as a problem. However, they claimed it was not fear of failure as in social embarrassment but the need for security, with many respondents citing having to pay back a student loan as a difficulty. Goodbody (2002) found fear of failure along with bankruptcy, the hard work involved, a small Irish market, difficulties accessing finance and lack of business information as undergraduate's main barriers to starting a business. Wang *et al* (2004) agreed with the fear of failure but added inadequate preparation and insufficient business knowledge to the list of perceived barriers. Lack of a business idea is also perceived as a barrier throughout literature on student entrepreneurship (Carter *et al*, 1999; Klapper, 2004), with Robertson *et al* (2003) finding twenty-two percent of students citing the lack of a business idea as a reason for not starting a business.

Interestingly, Oakey *et al* (2002) noted that if a network of support systems were put in place to assist when starting a business, the undergraduates that had previously dismissed the idea of entrepreneurship as a career said they would reconsider entrepreneurship as a career option.

## Family Influence

Oakey *et al* (2002) and Wang *et al* (2004) found that the lack of information on entrepreneurship to be a problem for the undergraduate, noting, students coming from a family with no entrepreneurial background are perceived as being at a considerable disadvantage having less access to relevant information. Scott *et al* (1988) also believed family background to be important finding undergraduate students coming from a family involved in entrepreneurship have a higher preference to own their own business than undergraduates from a family with no entrepreneurial background.

## 2.7 The Female Undergraduate

Even though trends show that women are becoming more involved in entrepreneurship, “little is known about what female youth either understand or think about entrepreneurship” (Kourilsky and Walstad, 1998, p78). Therefore, the reason for the present research is to add to this scarce body of knowledge by undertaking an exploration of female undergraduates' attitudes towards and perceptions of entrepreneurship

In one of the few studies involving female undergraduates Menzies *et al* (2006) found that female students were a lot less likely to take an entrepreneurial module than male students and were even less likely to take a degree in entrepreneurship. The most popular reasons given by female undergraduates for not choosing to study entrepreneurship was they did not feel it fitted their personality. Menzies *et al* (2006) also suggested that female undergraduates see entrepreneurship as male dominated and therefore decide they are the wrong sex for this type of career, noting this may be due to a lack of suitable role models to help inspire young female students. Brooksbank *et al* (2005) also recommend a gender specific approach within higher education, believing this is necessary as a means to help promote entrepreneurial activity amongst women.

Therefore, the reason for the present research is to add to this scarce body of knowledge by undertaking an exploration of female undergraduates' attitudes towards and perceptions of entrepreneurship

#### Perceived Barriers

Lack of a business idea and obtaining finance were perceived as the most difficult barriers to starting a business. However, Louw *et al* (2003) noted that even though the female undergraduate perceives her interpersonal skills as good she believes herself to be less skilled in the practical areas of business.

Wang *et al* (2004) found the female undergraduate considered her lack of business knowledge to be a barrier. Kourilsky *et al* (1998) noted this lack of business knowledge as a constraint to both male and female students however their study found female students were more aware of this omission than male students.

Chowdhury *et al* (2005) found belief in one's own ability was lower in the female undergraduate than her male counterpart, and that women with the same level of education as men believed themselves to have less perceived knowledge than the men.

Gender Equality Unit (2003) and Hazlett, Henderson, Hill and Leich (2007) also found female undergraduates expressed less self-confidence than male undergraduates. Kourilsky *et al* (1998) suggested this lack of confidence expressed by female students in their entrepreneurial abilities might result in less interest than their male counterparts to start a business. However, Chowdhury *et al* (2005) noted there is a positive correlation between the higher the level a women is educated and a woman's belief in her own ability to start her own business.

#### Subject Choice

Hagen *et al* (1989) and Minniti *et al*, (2004) suggested the educational system as well as the social environment should encourage more women to study engineering, science, technical or business related subjects. This deficiency of women taking technical subjects is given an Irish perspective by Goodbody (2002) who noted the lack of female students pursuing science, engineering and technology qualifications, citing these subject choices as having particular importance because they often lead to

entrepreneurial activity. However, Madsen *et al* (2003) noted in a Danish study that despite an active campaign to encourage female students to undertake technical subjects this has not yet been reflected in an increase of females entering into entrepreneurship in the high-tech sector.

#### 2.8 Entrepreneurial Intentions

Entrepreneurial intent refers to the intent to perform entrepreneurial behavior. Entrepreneurial intention has been defined as the intention to start a new business (Krueger and Brazeal, 1994; Zhao *et al.*, 2005), the intention to own a business (Crant, 1996), or the intention to be self-employed (Douglas and Shepherd, 2002; Kolvereid, 1996). For the purpose of the this study, entrepreneurial intention is defined as an individual's intention to be self-employed.

Several researchers have successfully utilised intentions models to examine entrepreneurial intentions and its antecedents (Bird, 1988; Boyd and Vozikis, 1994; Chen *et al.*, 1998; Crant, 1996; Douglas and Shepherd, 2002; Katz and Gartner, 1988; Kolvereid, 1992; Kolvereid *et al.*, 2006; Krueger and Brazeal, 1994; Krueger and Carsrud, 1993; Krueger, Reilly and Carsrud, 2000; Peterman and Kennedy, 2003; Shapero and Sokol, 1982; Zhao *et al.*, 2005).

These studies are listed alphabetically by author in Table 2.1 below highlighting their focus and contribution.

| Author(s)                      | Focus  | Level/Contribution                |
|--------------------------------|--|-----------------------------------|
| Bird (1988)                    | Entrepreneurial intention  | Individual (theoretical)          |
| Boyd and Vozikis (1994)        | Entrepreneurial intention  | Individual (theoretical)          |
| Chen <i>et al.</i> (1998)      | Intention to start a business  | Individual (empirical)            |
| Crant (1996)                   | Intention to own a business  | Individual (empirical)            |
| Douglas and Shepherd(2002)     | Self-employment intention  | Individual (empirical)            |
| Katz and Gartner (1988)        | Entrepreneurial intention  | Organisational (theoretical)      |
| Kolvereid (1996)               | Self-employment intention  | Individual (empirical)            |
| Kolvereid <i>et al.</i> (2006) | Self-employment intention  | Individual (empirical)            |
| Krueger and Carsrud(1993)      | Entrepreneurial intention  | Organisational (theoretical)      |
| Krueger and Brazeal(1994)      | Entrepreneurial intention  | Individual (theoretical)          |
| Krueger <i>et al.</i> (2000)   | Entrepreneurial intention<br>Comparing and testing intentions models | Individual (theoretical)          |
| Peterman and Kennedy(2003)     | Entrepreneurial intention  | Individual (empirical)            |
| Shapero and Sokol (1982)       | Entrepreneurial event formation                                      | Individual or Group (theoretical) |
| Zhao <i>et al.</i> (2005)      | Intentions to start a business                                       | Individual (empirical)            |

Work by Katz and Gartner (1988) and Krueger and Carsrud (1993) looked at organisation level entrepreneurial intentions in relation to organizational emergence and considered the influence of institutional factors to better understand their impact. Moving to individual-level entrepreneurial intention, Bird (1988) linked the new venture's context with the entrepreneur's intentions and subsequent action. Her model of intentional action included the entrepreneur's thinking style (rational and intuitive) impacted by the entrepreneur's personal history, personality and abilities, and the state of the environment.

Furthering this theoretical work by Bird (1988), Boyd and Vozikis (1994) included the concept of entrepreneurial self-efficacy into their intentions models to better explain antecedents to entrepreneurial intentions. Empirical studies by Chen et al. (1998) and Zhao et al. (2005) continued with the inclusion of entrepreneurial self-efficacy in their intentions models and found a significant relationship between entrepreneurial self-efficacy and entrepreneurial intention. Zhao et al. (2005) also found empirical support for the positive impact of formal academic course participation on intentions to start a new business. In addition, they recommended future researchers employ a quasi-experimental design to evaluate such effectiveness and the research in this thesis takes this recommendation into account.

Peterman and Kennedy (2003), using Shapero's Entrepreneurial Event model, (Shapero and Sokol, 1982), examined the effect of participation in an enterprise education program on intentions to start a business using a sample of secondary school

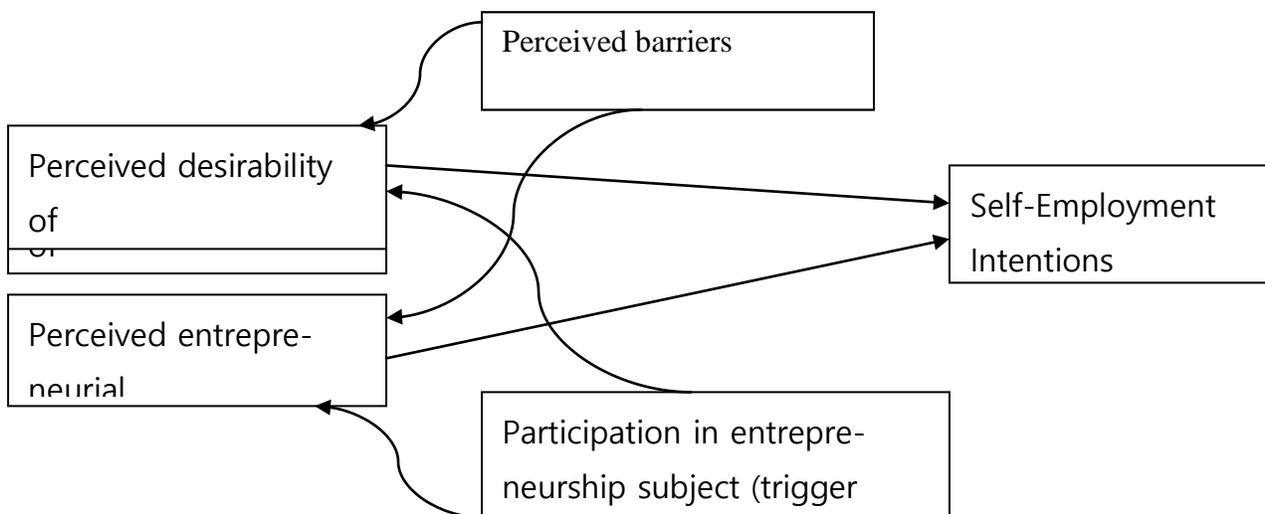
students. Positive changes in student's perceptions of the desirability and feasibility of starting a business were evidenced.

Individual's degree of change in perceptions was related to the positiveness of their prior experience and to the positiveness of their experience in the enterprise education program.

### Self-employment intentions

Phenomena such as on-line internet business and globalisation have created a plethora of new opportunities for the self-employed (Spoonley et al., 2004) and we have a generation of young adults who possess an unprecedented amount of technological know-how (Olson, 2007). Individual's career patterns no longer follow traditional work norms (Lewis, 2005) and as a result, experience gained through age is not necessarily a predictor of success. It follows that youth is not a barrier to entry to self-employment and that the tertiary students of the twenty-first century may consider self-employment as a viable career option following graduation.

Previous empirical research supports the view that early vocational aspirations are generally good predictors of later occupational choices (Schoon, 2001; Schmitt-Rodermund, 2004) and it is plausible that tertiary students with an interest in entrepreneurship will be likely to seek self-employment. The research in this study focuses on undergraduate students' intentions to be self-employed.



**Fig. 2.1 Modified self-employment intentions and impact of entrepreneurship education model**

The research model suggests that self-employment intentions are formed by perceived desirability of self-employment by perceived entrepreneurial self-efficacy and Perceived barriers ; the basic tenant being that intention is formed when students perceive that self-employment is desirable and that they believe they are capable of actually being self-employed. Participation in the entrepreneurship subject is highlighted as a positive 'trigger

event' as theorised by Shapero and Sokol (1982) to be an event that stimulates a change process. Participation in the entrepreneurship subject is shown as influential to the relationship between both perceived desirability of self-employment and perceived entrepreneurial self-efficacy, and self-employment intention. This means entrepreneurship education will enhance these

relationships however is not essential for the formation of self-employment intentions.

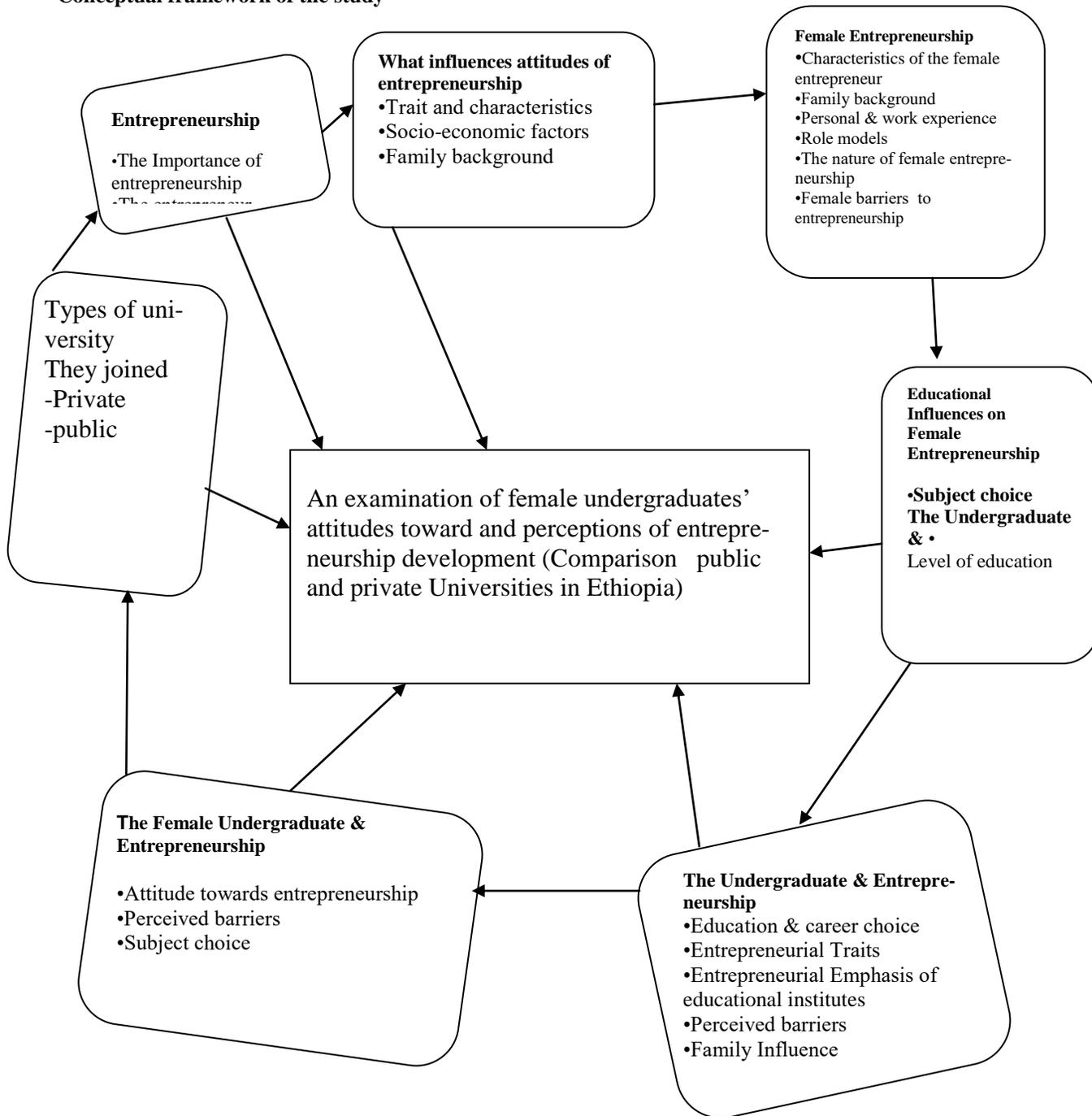
### **Entrepreneurship Education**

Studies about entrepreneurship education focus on enterprise education and consider course content, pedagogy, entrepreneurial learning, and assessment (Greene and Rice, 2007). The need to evaluate the effectiveness of entrepreneurship programs has been made evident by several researchers (Block and Strumpf, 1992; Porter and McKibben, 1988). Garavan and O'Connell (1994) present an analysis of six European entrepreneurship programs concluding with a call for increased evaluation of the effectiveness of programs worldwide.

A wide range of entrepreneurship training programs are offered worldwide and given the heterogeneity of such programs, measurement and comparison of their effectiveness is problematic (Fayolle and Klandt, 2006). Bechard and Toulouse (1998) suggest the goal of entrepreneurship education training programs should be specific to the target clientele and in turn evaluation

should be adjusted accordingly. Students' attitudes toward entrepreneurship can be changed over time (Hatten and Ruhland, 1995), and a useful approach to the measurement of entrepreneurship programs, as used in the research in this thesis, is to evaluate participants' changes in attitudes and perceptions of entrepreneurship and the impact of these on their entrepreneurial intentions. We know that key attitudes and intentions toward behaviour are driven by perception and as such can be influenced (Ajzen, 1991). That said, entrepreneurship education is a tool that is available to increase individual's key attitudes, perceptions and intention towards self-employment (Kolvereid, 1996a). Little empirical evidence supporting the theoretical claims of the benefits of entrepreneurship education exists (Krueger and Brazeal, 1994; Souitaris et al., 2007)

**Conceptual framework of the study**



**Fig2.2 Conceptual framework (Source: Current Research)**

III. SAMPLING METHOD (TECHNIQUE) AND SAMPLING SIZE

In public: Jimma University, Addis Ababa University, and Wollega University while among private universities; Rift-Valley Universities at wollega and Adama Campus, Unity University at AA campus and New generation at Nekemte campus were taken as a sample of representative by convenience method with consideration of location of both private and public universities those found in the same cities to reduce cost.

And respondents were taken from selected Universities by disproportional method because of the size of students found in them are vary as follow.

Table 3.1 Sample Size from Each Stratum

| Colleges and Universities          | Number of students |
|------------------------------------|--------------------|
| Addis Abeba University             | 100                |
| Jimma University                   | 150                |
| Wollega University                 | 100                |
| Rift Valley Adama & Nekemte campus | 120                |
| Unity campus                       | 80                 |
| New generation Nekemte campus      | 80                 |
| Total                              | 630                |

Hence, to identify the necessary information, 630 samples were proposed to be selected by simple random from all selected sample Universities and colleges.

Model specification

In this study, the chi-square test for independence will be used to test for association. Cross tabulation was also done to show the distribution of respondents while multiple regression analysis the cause of factors on perception self –employment Model:  $SEI = \beta_0 + \beta_1 * (PF) + \beta_2 *(PEE) + \beta_3 *(CA) + \beta_4 *(EM) + \beta_5 *(M) + \epsilon$

Independent Variables

- ✓ PF=parents and family
- ✓ PEE =Participation in entrepreneur education

- ✓ CA= career advisers
- ✓ EM= Entrepreneurs as model
- ✓ M=Media

Dependent Variable

- ✓ SEI=Self-employment perception (start your own business)

$\beta_0$  is the intercept,  $\beta_1$  and  $\beta_2$  are the population parameters and  $\epsilon$  is the natural variation in the model. The researchers tests for the significance of the linear regression relationship between the dependent variable, , and the independent variables, by testing unstandardized coefficients beta (B).If  $\beta_1$  and  $\beta_2$  relatively zero, there is no significant linear model or relationship between the dependent variable, and the independent variables . If  $\beta_1$  and  $\beta_2$  are not both equal zero, a significant linear relationship or model does exist between Y and the two independent variables (Neter et al., 1993, cited in Brett, 2005, pp.62-63).

IV. DATA ANALYSIS

4.1The relationship between family background and female to start their own business

Families play an important role in female entrepreneurship; recent studies reveal two opposing pictures in this respect. In some cases, families are very supportive (Halkias, 2011 Muhammad A and, Dr. Amber G,2011) and play an important and supportive role in helping females to develop business ideas (Jamili, 2009). On the other hand, females consider families as a constraint. They receive no appreciation for their work and in most cases they are discouraged (Itani *et al.*, 2011 cited from Muhammad and Amber 2011).

According to different researches’ finding shows family background has impact on female entrepreneurship while others are opposing this idea. Therefore; the following table is going to test whether there is independency between family background and female starting small business.

Table 4.1 the relationship between family background and parents discourage female to start their own business

| would your parents discourage you to start your own business |       | Family background |          |          | Total |
|--|-------|-------------------|----------|----------|-------|
|  |       | agriculture       | employed | Commerce |       |
| yes  | Count | 68                | 84       | 58       | 210   |
|  | %     | 34.7              | 39.6     | 50.0     | 40.1  |
| no   | Count | 90                | 98       | 46       | 234   |
|  | %     | 45.9              | 46.2     | 39.7     | 44.7  |
| Do not know  | Count | 38                | 30       | 12       | 80    |
|  | %     | 19.4              | 14.2     | 10.3     | 15.3  |
| Total  | Count | 196               | 212      | 116      | 524   |
|  | %     | 100.              | 100      | 100.     | 100.0 |

Df=4,  $\chi^2 = 9.31$  N=524, p=0.05

The above table depicts, 40.1% of respondents responded that as their family discourage female students to start their own business and 44.7% responded as their parents encourages them as they start their own business while 15.3% of them responded as their parents were neutral. This reflects that as the majority of the parents encourages their female students as they start their own business in future.

According to the finding of (Itani *et al.*, 2011) feeling of being discouraged by parents persuades women to think about self-employment in order to prove themselves. Those females who come from an entrepreneurial background - either one or both of their parents is or has been self-employed - are very confident in their business approach (Mordi *et al.*, 2010).

Hence, the following hypothesis were developed to test whether there is independency between family background and discouraging female as they start small business.

Ho: parents background and discourage female students to start small business are independent.

Ha: parents background and discourage female students to start small business are not independent

As per the chi-square test made, the result shows that equal to the significance level ( $p=0.05$ ), since we cannot accept the null

hypothesis. Thus, we conclude that there is a relationship between parents' background and discouraging female students as they start their own small business. This supports the finding of (Itani *et al.*, 2011) that stated females receive no appreciation for their work and in most cases they are discouraged by their parents.

#### 4.2 The impact of entrepreneurial education on self-employment intentions

Studies about entrepreneurship education focus on enterpr-ise education and consider course content, pedagogy, entrepreneurial learning, and assessment (Greene and Rice, 2007). The need to evaluate the effectiveness of entrepreneurship programs has been made evident by several researchers (Block and Strumpf, 1992; Porter and McKibben, 1988). Garavan and O'Conneide (1994) present an analysis of six European entrepreneurship programs concluding with a call for increased evaluation of the effectiveness of programs worldwide.

There is also some agreement over the educational system and whether it encourages young people to enter entrepreneurship as seen in the table.

**Table 4.2 Need of entrepreneurial education**

| would you like more entrepreneurial education |       | Types of University |         | Total |
|---|-------|---------------------|---------|-------|
|   |       | public              | private |       |
| yes   | Count | 280                 | 190     | 470   |
|   | %     | 86.4                | 84.8    | 85.8  |
| no  | Count | 44                  | 34      | 78    |
|   | %     | 13.6                | 15.2    | 14.2  |
| Total   | Count | 324                 | 224     | 548   |
|   | %     | 100                 | 100     | 100   |

As the above table shows, 86.4% of female students in public Universities and 84.8% of them from private university college would like more entrepreneurial education/knowledge included in their 3rd level education. In total 85.8% of respondents were expressed the intention as they need entrepreneurial education to start a business.

In addition, as per the interview and focus group discussion held with some female students shows, the two groups of students, with the students that want to start a business expressing a greater desire for more entrepreneurial education to be included in their 3rd level education and they have positive attitude towards the influence of the education system on the encouragement of students to start their own business.

This implies that as participating female students' in entrepreneurship education have positive impact on their self-

employment intentions. This is similar to the findings of (McCelland *et al.*, 2005 cited in Eileen 2008) in which it was found that most of their respondents had established their business in an area that had no connection to the subject area that they had studied.

#### 4.3 Entrepreneurial Intentions

Entrepreneurial intent refers to the intent to perform entrepreneurial behavior. Entrepreneurial intention has been defined as the intention to start a new business (Krueger and Brazeal, 1994; Zhao *et al.*, 2005), the intention to own a business (Crant, 1996), or the intention to be self-employed (Douglas and Shepherd, 2002; Kolvereid, 1996).

**Table 4.3 Females' Students Intend To Start Their Own Business at Some Stage**

| Do you intend to start your own business at some stage |       | Types of University |         | Total |
|--|-------|---------------------|---------|-------|
|  |       | public              | private |       |
| Yes  | Count | 260                 | 176     | 436   |
|  | %     | 81.8                | 80.0    | 81.0  |

|       |       |      |      |      |
|-------|-------|------|------|------|
| No    | Count | 58   | 40   | 98   |
|       | %     | 18.2 | 18.2 | 18.2 |
| Total | Count | 318  | 220  | 538  |
|       | %     | 100. | 100  | 100. |

$\chi^2=5.83, df=3, N=536, P=0.120$

The above table portrays that 81 % of sample respondents replied as they intend to start their own business at some stage. According to chi-square test made ( $P=0.120$ ), there is no statis-

tically significant difference between the perception of the female students from public universities and private Universities intend to start their own business.

**Table 4.4 influential in the encouragement or discouragement of starting female students their own business**

| Influencers                 | a. Essential Influence |      | b. Mainly Positive |      | c. No Influence |      | d. Mainly Negative |     | a+b= Positive influence. (encouragement) |
|-----------------------------|------------------------|------|--------------------|------|-----------------|------|--------------------|-----|--|
|                             | freq                   | %    | freq               | %    | freq            | %    | freq               | %   | %  |
| Parents & Family            | 188                    | 35.6 | 196                | 37.1 | 114             | 21.6 | 30                 | 5.7 | 72.7                                     |
| Educational System          | 176                    | 34.8 | 226                | 44.7 | 70              | 13.8 | 30                 | 5.9 | 79.5                                     |
| Career Advisers             | 136                    | 27.0 | 250                | 49.6 | 92              | 18.3 | 26                 | 5.2 | 76.6                                     |
| Friends                     | 134                    | 26.8 | 230                | 46.0 | 106             | 21.2 | 30                 | 6.0 | 72.8                                     |
| Entrepreneurs that you know | 194                    | 39.0 | 198                | 39.8 | 90              | 18.1 | 16                 | 3.2 | 78.8                                     |
| Media                       | 174                    | 35.5 | 200                | 40.8 | 90              | 18.4 | 26                 | 5.3 | 76.3                                     |

In response to the question about whom or what influences female graduates to start their own business, 79.5% of the respondents replied that they would be (are) influenced by educational system they have taken. 78.8% of respondents also indicated that they were influenced by entrepreneurs they know. 76.6% of respondents were stated as career advisers were positively influences female graduates to start their own business while relatively 73% of respondents replied as friends, parents & family influences female graduates as they start their own business. Generally, the above finding shows as all parents & family, educational system, career advisers, friends and entrepre-

neurs that they know had a positive influence on their decision to become an entrepreneur

**4.4 Motivation to female for becoming an entrepreneur**

The motives behind female entrepreneurship are many and are classified as necessity (push factors) and opportunity (pull factors). It is reported by GEM (2008) that generally, for both male and female it is more common to find individuals who are pulled into entrepreneurship rather than pushed into it.

Furthermore, the following table indicates the perceived motivations of female undergraduates for entering into entrepreneurship

**Table 4.5 Factors motivates female as they start their own business**

| I would like to start my own business because             | a. Strongly disagree | b. disagree | c. neutral | d. agree  | e. Strongly agree | % (d+e) |
|---|----------------------|-------------|------------|-----------|-------------------|---------|
| It would gain me respect from others N=500                | 22(4.4)              | 54(10.8)    | 36(7.2)    | 268(53.6) | 120(24.0)         | 77.6    |
| It would give me better work / life balance.N=512         | 26(5.1)              | 46(9.0)     | 44(8.6)    | 250(48.8) | 144(28.1)         | 76.9    |
| I would be able to use my business idea(s).N=522          | 28(5.4)              | 60(11.5)    | 50(9.6)    | 224(42.9) | 160(30.7)         | 73.6    |
| It would enable me to work in the area of my choice.N=522 | 20(3.8)              | 70(13.4)    | 52(10.0)   | 238(45.6) | 142(27.2)         | 72.7    |
| It would enable me to pick my own working time.N=524      | 34(6.5)              | 56(10.7)    | 50(9.5)    | 258(49.2) | 118(22.5)         | 71.7    |
| It would enable me to make a lot of money N=524           | 34(6.5)              | 72(13.7)    | 46(8.8)    | 264(50.4) | 108(20.6)         | 71      |

|  |            |           |            |            |           |      |
|--|------------|-----------|------------|------------|-----------|------|
|  |            |           |            | )          | )         |      |
| It would give me the flexibility to combine my career with my family life.N=514        | 26(5.1)    | 56(10.9)  | 68(13.2)   | 220(42.8)  | 144(28.0) | 70.8 |
| It would enable me to make best use of my personal skills and competencies. N=534      | 44 (8.2)   | 56(10.5)  | 60(11.2)   | 274(51.3)  | 100(18.7) | 70   |
| I want to be my own boss. N=502  | 64 (12.7%) | 98(19.5)  | 48(9.6)    | 208(41.4)  | 84(16.7)  | 58.1 |
| I would be able to use my education to the best advantage N=526                        | 22(4.2)    | 90(17.1)  | 116(22.1)  | 222(42.2)  | 76(14.4)  | 56.6 |
| I have an assertive strong personality that is necessary for business ownership. N=526 | 40 (7.6)   | 76 (14.4) | 120 (22.8) | 216 (41.1) | 74 (14.1) | 55.2 |

As the above table shows, different questions were asked female students the reason why they would like to start their own business.

Accordingly, majority (77.6%) of students' believed that entrepreneurship (by starting their own business) as a way of gaining respect from others as was. This finding supported by result of study from by the Fitzsimons and O'Gorman (2006). There was also high positive response to the idea that by starting their own business it would enable to give them better work / life balance with 76.9% of the students believing this. While 73.6% of students were responded as starting their own business it would be able to use their business idea and business skills.

In addition, 72.7% of undergraduates female students agreed that entrepreneurship would allow them to work in the area of their own choice were seen as an essential reason for starting their own business. This is in line with Oakey, Mukhtat and Kipling (2002) who noted 'flexibility of choice in the work environment' as an important feature for those wanting to start their own business. This need for freedom of choice was given further credence with 71.7% of the entrepreneurial-minded undergraduate agreeing entrepreneurship would enable them to pick their own working time. This finding is in agreement with Krueger and Carsrud (1993) who noted the desire to pick their own working time was an important motivator for starting a business.

Similarly, 71% of students were responded as making a lot of money is also one of the main reasons they want to start their business and 70.8% of students expressed the belief that by choosing entrepreneurship as a career it would give them flexibility to combine their career with their family life and self-fulfilment. This corresponds with findings from studies conducted by (Buttner and Moore, 1997, Gasse, Camion, Ghamgui and Tremblay, 2006 and Eileen, 2008) in which self-fulfilment and a challenging career were considered highly motivational when starting your own business. While 70% of the respondents agreed that to start their own business would enable them to make the best use of their personal skills and competencies.

Furthermore, 58.1% of the students believed either strongly agreed or agreed that they would like to start their own business because it would permit them to be their own boss. This finding similar with the findings of (Brindley and Richie, 2000 and Eileen, 2008) who acknowledged that being your own boss was a key positive feature for the undergraduate when considering starting their own business. 56.6% of students also believe that by starting their own business it would enable them to use their education to the best advantage. Finally, 55.2% of respondents believed the other reason they want to start their own small

business is because of they had the assertive strong personality necessary for business ownership.

The findings suggest that for women, the motives for becoming an entrepreneur is not a clear cut situation but is rather a complex set of mixture of different factors. When question regarding the reasons for starting a business, most respondents mentioned both pull and push factors at the same time.

For furthermore study, some interview were held with some students. As expressed by some interviewees some of them want to start their own small business because of they want: flexibility, gain respect from others, indepeny, to generate their own income while others have raised reason they want to start their own business were because of they expect as there is no job opportunity by government, they will not satisfied working with in either government office or private company.

In addition, one of female student stated choosing entrepreneurship is because of challenge, independence (opportunity) and frustration at work (necessity) I have heard and observed from my parents. "My families have been working in private organization for about 17 years and I was looking forward to for long while they were doing. They were very frustrated and their work was not so challenging anymore and besides they had little autonomy. They used to vent their anger at home. They realized that they were not being fair to their family or to me. Because of these I decided that I should start something of my own and knew that I will do it. It is true that I do not have much time to myself as they had before but I am much happier and I will be now my own boss".

Generally, the result of this study leads to believe that women often choose entrepreneurship not only because they expect the idea to have greater return. And they want to start their own business seemed a good choice as it also enabled them to be more independent

#### 4.5 Regression analysis on self-employment perception against dependent variable

In linear multiple regression, adjusted R square (adj. R<sup>2</sup>) is usable rather than the simple R square, since the latter may overestimate the extent to which the researchers sample data explain the variance in the dependent variable, thereby indicating whether the model is good predictor of the dependent variables, partly because simple R square affected by the number of variables included in the model (Meorgen, 2007, p.192). Therefore, in this study a stepwise multiple linear regression analysis was computed at significant level of (p=0.00) in order to examine which constructs of factors or variables could be the most determinant variable to ensure self-employment perception.

Model:  $SEI = \beta_0 + \beta_1 * (PF) + \beta_2 *(PEE) + \beta_3 *(CA) + \beta_4 *(EM) + \beta_5 *(M) + \epsilon$

- ✓ CA= career advisers
- ✓ EM= Entrepreneurs as model
- ✓ M=Media

**Independent Variables**

- ✓ PF=parents and family
- ✓ PEE =Participation in entrepreneur education

**Dependent Variable**

SEI=Self-employment perception (start your own business)

**Table: 4.6 Regression analyses on self-employment perception**

| Model |                             | Unstandardized Coefficients |            | Standardized Coefficients | t      | Sig. |
|-------|-----------------------------|-----------------------------|------------|---------------------------|--------|------|
|       |                             | B                           | Std. Error | Beta                      |        |      |
| 1     | (Constant)                  | 1.212                       | .169       |                           | 7.175  | .000 |
|       | parents and family          | -.107                       | .050       | -.110                     | -2.113 | .035 |
|       | Educational system          | .123                        | .053       | .123                      | 2.333  | .020 |
|       | career advisers             | -.047                       | .058       | -.043                     | -.805  | .421 |
|       | Entrepreneurs that you know | -.013                       | .057       | -.012                     | -.228  | .819 |
|       | Media                       | .095                        | .052       | .093                      | 1.832  | .068 |

Dependent variable: SEI, R= .172 , R<sup>2</sup> =.030 , adj. R<sup>2</sup> =.018, F (5, 417) =2.522, P<0.001

**Table 4.7 Model Summary**

| Model | R                 | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------------------|----------|-------------------|----------------------------|
| 1     | .172 <sup>a</sup> | .030     | .018              | .85171                     |

a. Predictors: (Constant), Media, parents and family, career advisers, Educational system, Entrepreneurs that you know

**Table 4.8 ANOVA<sup>b</sup>**

| Model |            | Sum of Squares | df  | Mean Square | F     | Sig.              |
|-------|------------|----------------|-----|-------------|-------|-------------------|
| 1     | Regression | 9.149          | 5   | 1.830       | 2.522 | .029 <sup>a</sup> |
|       | Residual   | 298.870        | 412 | .725        |       |                   |
|       | Total      | 308.019        | 417 |             |       |                   |

a. Predictors: (Constant), Media, parents and family, career advisers, Educational system, Entrepreneurs that you know

b. Dependent Variable: start your own business

The table 4.8 indicates the results on the relationship between media, educational system, career advisers, entrepreneurs that female students know and parents &family against self-employment perception model. It is clear that this model has the adjusted R<sup>2</sup>, .030 that shows 3 % of the variation in self-employment perception is explained by this model. This model is statistically significant F (5, 417) =2.522, p <0.001. It is possible to conclude that there is sufficient evidence that implies negative linear relationship between parents and family ( $\beta = -0.107$ ), career advisers ( $\beta = -0.047$ ) and entrepreneurs that female students know ( $\beta = -0.013$ ) with self-employment perception. While media ( $\beta = 0.095$ ) and educational system ( $\beta = 0.123$ ) have positive relationship with self-employment perception.

Here, although, parents & family has negative relationship with self-employment perception, both parents and family and educational system have statistically significant effect on self-employment perception factors when considered in this model.

**4.6 Reliability**

**Cronbach’s Alpha ( $\alpha$ ) Reliability Coefficient Scores female undergraduates’ attitudes toward and perceptions of entrepreneurship development variables**

According to Nunnally (1967, p.71), a coefficient alpha of 0.7 or greater is acceptable in terms of scale reliability in social science. In addition, Meorgen (2007,p.127) stated alpha that based on a correlation matrix which should be positive and usually greater than 0.7 in order to provide good support for internal consistency reliability. Hence, Cronbach’s alpha reliability coefficients were calculated to estimate the reliability of the female undergraduates’ attitudes toward and perceptions of entrepreneurship development instrument. Accordingly, the average Cronbach’s alpha reliability coefficient for the female undergraduates’ attitudes toward and perceptions of entrepreneurship development instrument for 47 items is 0.962, which are very good internal consistency and the result for the four for female undergraduates’ attitudes toward and perceptions of entrepreneurship development are given in table below.

**Table 4.8 Cronbach’s Alpha ( $\alpha$ ) Reliability Coefficients for female undergraduates’ attitudes toward and perceptions of entrepreneurship development**

| Variables   | CRONBACH’S ALPHA( $\alpha$ ) REILABILITY COEFFICIENT | NO OF ITEMS | EVALUATION OF INTERNAL CONSISTENCY |
|---|--|-------------|------------------------------------|
| Motivation to female for becoming an entrepreneur                 | .809   | 11          | Good                               |
| Students’ attitudes towards and perceptions of entrepreneurship   | .875   | 9           | Good                               |
| Influential factor of starting female students their own business | .893   | 6           | Good                               |
| barriers of female not entering into entrepreneurship             | .908   | 14          | Good                               |

The purpose of reliability testing is to make sure that each class of the variables is above 0.7 on Cronbach alpha test to make sure those questions is measuring the entity property. As per above table, barriers of female not entering into entrepreneurship, Influential factor of starting female students their own business, Students’ attitudes towards and perceptions of entrepreneurship and Motivation to female for becoming an entrepreneur displayed the highest internal reliability (alpha = 90.80%, 89.3.10% , 87.50% and 80.9 % )respectively.

Generally, the above table shows that the entire coefficient alpha for female undergraduates’ attitudes toward and perceptions of entrepreneurship development variables is greater than acceptable in terms of scale reliability in social science. Thus implies that the reliability and internal consistency of items included in the questionnaire were good.

## V. CONCLUSION

While undertaking the present study it became evident there is very little known about female undergraduates and their views on entrepreneurship. Therefore, there is a need to gain more knowledge about the young educated women and their views on entrepreneurship. It would also be of interest to do a comparative study of higher-level institutions across the different private and public universities, in order to see if there is any difference in attitude of the female undergraduate towards entrepreneurship depending on where the respondents are types of university situated. This would add more information to a seriously under researched topic by gaining an overall picture of the female undergraduate attitudes towards and perceptions of entrepreneurship.

However, different female undergraduate students have different attitudes towards self employment because of many different factors influence women perception to start their own small business.

Families play an important role in female entrepreneurship; this study reveal half of family female students discourage to start their own business while some parents encourages them as they start their own business.

Both female students in public Universities and private university college would like more entrepreneurial education/knowledge and were expressed the intention as they need

entrepreneurial education to start a business. Majority of female students in both public Universities and private university college were expressed their intention as they need entrepreneurial education to start a business

Minority of students expressed their immediate intentions after the completion of their degree course as they want to start their own business. While majority of them were want to continue further with their education, want to work with in a company and obtain a professional qualification and want work within a large company.

As this finding present that the student who expressed their wish to start their own small business in public Universities are no more different from female students those private Universities College want to start their own small business. Students with a strong favorable attitude toward self-employment would be more likely to develop strong self-employment perception. The motives for becoming an entrepreneur is not a clear cut situation but is rather a complex set of mixture of different factors

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# Prostate Adenocarcinoma: are EGFR-targeted drugs of therapeutic relevance for castrate-resistant patients?

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**Abstract-** The progression of normal prostatic epithelium to androgen-dependent cancer and, eventually, castrate-resistant prostate cancer is a complex process involving many different growth regulatory signals. Activation of epidermal growth factor receptor (EGFR) has been implicated in prostate cancer cell growth.

## Patients and Methods

The study was conducted in CHUM Research Centre/Montreal Cancer Institute, Montreal, Quebec, Canada. Tumor tissue sample collection started in January, 2011 and was completed in July, 2012. Specimens were obtained from 58 Moroccan castrate-resistant patients with prostate cancer, and all patients had given informed consent. Patient characteristics were retrieved from medical records, and membrane-specific EGFR expression was evaluated immunohistochemically. A statistical analysis was performed using Epi-Info software.

## Results

EGFR overexpression, defined as complete membrane staining in more than 10% of tumor cells, was observed in 36 of 58 tumors (62,06%). There was a significant association between EGFR overexpression and Gleason score and TNM stage, but no correlation with PSA level was found.

## Conclusion

EGFR is predominantly expressed in castrate-resistant patients, suggesting that EGFR-targeted drugs could be of therapeutic relevance in this otherwise difficult to treat subset of prostate cancer. However, since these markers are only expressed in a fraction of advanced tumors, patients selection needs to be realized based on the EGFR profile of their tumors.

**Index Terms** EGFR expression, Prostate cancer, Immunohistochemistry

## I. INTRODUCTION

Prostate cancer is the most commonly diagnosed malignancy and the second leading cause of men cancer mortality. Androgen withdrawal is the only effective therapy for patients with advanced disease. Approximately 80% of patients achieve symptomatic and/or objective response after androgen ablation. However, progression to androgen independence ultimately occurs in almost all patients. Although numerous non-hormonal agents have been evaluated in patients with castrate-resistant prostate cancer, these agents have limited antitumor activity with an objective response rate <20% and no demonstrated survival benefit [5]. Therefore, the identification and selected inhibition of molecular targets that mediate the progression of prostate cancer

will have gear impact on future treatment concepts. Possible targeted therapies include molecules that block specific proteins and pathways or gene therapy for insertion of wild-type genes to restore the function of defective tumor-suppressor genes [6].

Both clinical and experimental data have established the importance of the epidermal growth factor receptor (EGFR) in carcinogenesis and progression of various types of solid tumors including prostate cancer [1]. Many studies have suggested that the progression to castrate-resistant disease may be associated with epidermal growth factor receptor (EGFR), epidermal growth factor (EGF), amphiregulin, and/or transforming growth factor- $\alpha$  (TGF- $\alpha$ ) [2]. TGF- $\alpha$  and EGF bind to EGFR, which initiates tyrosine kinase activity, which then leads to the activation of the intracellular signaling pathway. This activation can lead to gene expression, cell proliferation, and cell survival [3]. Previous investigations have provided support for the contention that EGFR may be responsible for prostate cell growth. It has been suggested that monoclonal antibodies and tyrosine kinase inhibitors that target EGFR may prove to be effective in reducing the progression of some solid tumors [4].

Evidence that over-expression of EGFR in castrate-resistant prostate cancer may provide a rationale for new therapeutic strategies. The major aims of this study were: (a) to determine whether EGFR protein is expressed in human prostate cancer specially in castrate-resistant patients; (b) to assess whether EGFR expression increases with cancer progression toward androgen independence; (c) to evaluate the association between patterns of EGFR expression and standard clinicopathological parameters; and (d) to define the potential prognostic effect of EGFR.

## PATIENT AND METHODS

### Specimen collection and patients

The study was conducted in CHUM Research Centre/Montreal Cancer Institute, Montreal, Quebec, Canada. Tumor tissue sample collection started in January, 2011 and was completed in July, 2012. Specimens were obtained from 58 consenting Moroccan castrate-resistant patients, 46 with a localized prostate cancer and 12 with distant metastasis.

H&E-stained slides from each biopsy/radical prostatectomy case were reviewed, and a Gleason grade and pathological stage were assigned. Tumors were classified as high grade when the combined Gleason score was  $\geq 7$  and as low grade when the combined score was  $\leq 6$ . Serum prostate-specific antigen (PSA) levels were obtained from the patient's medical records in every case.

Other patient characteristics that were also retrieved were age, lymph node status and presence of distant metastasis.

Tissue microarrays

Tissue microarrays were constructed following standard methodology. After selection of donor areas by microscopic examination, 0.6 mm punches were placed in a receptor block measuring 25x 35 mm. One microarray block containing all punches and duplicates of each tumor was produced. The block was sectioned at 3µm and the sections were floated out on a water bath at 45°C and picked up onto sequentially numbered slides. The slides were dried at room temperature overnight prior to staining.

#### Immunohistochemistry

EGFR Antibody specificity was confirmed by western blotting prior to staining. TMAs were incubated with the EGFR mouse monoclonal antibody (Santa Cruz Biotechnology, CA, United States of America (USA)) diluted 1:100 in antibody diluent (Ventana Medical Systems Inc., USA). Signal was developed using the UltraView DAB detection kit (Ventana Medical Systems Inc., USA) and counterstaining was performed with hematoxylin and bluing reagent.

#### Staining quantification

At least two uropathologists, blinded to clinical data, scored each sample. A third investigator reviewed discordant cases. The samples analyzed were from tissue microarrays with 0.6 mm tissue cores, and the entire tumor area was used for quantification. Immunoreactivity for EGFR was interpreted without previous knowledge of any of the clinicopathological parameters. EGFR cell membrane immunoreactivities for the EGFR protein were categorized as undetectable (zero) to 3. A score of zero was defined as undetectable staining or membrane staining in less than 10% of the tumor cells. A score of 1+ was defined as faint, incomplete membrane staining in more than 10% of the tumor cells. A score of 2+ was defined as weak to moderate, complete membrane staining in more than 10% of the tumor cells. Finally, a score of 3+ was defined as strong, complete membrane staining in more than 10% of the tumor cells. EGFR protein expression was then classified as negative (scores 0 and 1+) or positive (scores 2+ and 3+).

Statistical analysis was performed using the Chi2-test. A p-value less than 0.05 was considered statistically significant. No adjustments were made.

#### RESULTS

We are the first to report EGFR expression in Moroccan patients with prostate cancer. The study included 58 hormone-refractory patients. All cases were evaluated by IHC analysis. The patients' clinicopathological characteristics are listed in Table 1. The mean age of patients is 61 years (range, 50–90 years), and the mean preoperative PSA level is 12.4 ng/ml (range, 1.6–87.8 ng/ml). Of the 58 PACs, there were 10 (17.24 %) low-grade (Gleason score ≤6) and 48 (83.07%) high-grade (Gleason score ≥7) tumors. At prostatectomy, there were 37 (63.79%) organ-confined tumors (stages I and II) and 21 (36.21%) in advanced stage (III and IV) tumors.

As for EGFR expression (Figure 1), it was detectable in 36 of 58 tumors (62.06%). Table 2 shows that EGFR expression exhibited higher levels of protein expression in PSA level over than 10 ng/mL without any statistical significance. As for Gleason score, EGFR expression was significantly higher in high-grade cancer tissues (66, 66%) compared with low-grade.

Our results also show a significant high EGFR expression in advanced TNM stages (T3a, T3b) with a 95, 23% rate.

As for lymph node and distant metastases, a strong expression localization of EGFR (score 2+/3+) was seen in 80% and 80, 33% of patients with positive-metastases, respectively.

#### DISCUSSION

With the availability of monoclonal antibodies and small-molecule tyrosine kinase inhibitors as potential therapeutic agents in the management of many solid cancers, the investigation of EGFR, as a possible target, has been conducted in many solid tumors including carcinomas of the colon, lung, breast, bladder, head and neck. The results of these investigations have suggested that agents that target EGFR may prove to be effective in reducing the progression of some solid tumors [7; 8; 9]. Due to its grave prognosis, additional treatment options for androgen-independent prostate cancer are sorely needed. Evidence that overexpression of EGFR occurs in castrate-resistant prostate cancer may provide a rationale for new therapeutic strategies.

In our present study of EGFR expression in tumors from hormone-refractory patients, we found that 36 of 58 cases (62.06%) stained positively for EGFR protein. These findings support the notion that EGFR gene over-expression may play a significant role in the pathogenesis of such malignancies, and suggest that therapy directed against this aspect of the malignancy may prove beneficial. Trials of anti-EGFR therapy have begun in patients with castrate-resistant prostate cancer. One group of investigators treated a group of castrate-resistant prostate cancer patients with a combination of therapeutic agents including gefitinib, estramustine, and docetaxel [10]. They demonstrated that gefitinib combined with estramustine and docetaxel had acceptable and predictable tolerability. Another group of investigators found that gefitinib had only minimal single agent activity in forty castrate-resistant patients [11].

Previous studies have established links between EGFR over-expression and castrate-resistant behavior in prostate cancer. Di Lorenzo et al. found that EGFR expression increases in prostate cancer as it becomes progressively more aggressive [12]. They compared the immunohistochemical expression of EGFR in prostate cancers from patients unexposed to hormone therapy to EGFR expression in cancer samples from patients treated with androgen ablation (by LHRH and anti-androgen), and from patients with clinically castrate-resistant prostate cancer. EGFR was expressed in 41% of cancers that had not been exposed to hormone therapy, in 76% in those exposed to LHRH and anti-androgen therapy, and in 100% of cancers from patients with metastatic hormonal-refractory disease [12].

We also concluded in our a significant high EGFR expression in advanced TNM stages (T3a, T3b) with a 95, 23% rate, which is in accordance with the results of Di Lorenzo's and Shuch's studies. Our results also show that EGFR expression exhibited higher levels of protein expression in PSA level over than 10 ng/mL without any statistical significance. As for Gleason score, EGFR expression was significantly higher in high-grade cancer tissues (66, 66%) compared with low-grade. However, in the study by Shuch and co-workers, a significant relationship was found between the EGFR gene expression and PSA but not with grade [13]. Other authors reported a significant relationship between PSA, grade, and stage of the disease and postoperative positive margins with EGFR gene expression [14].

It remains to be demonstrated if EGFR therapeutic targeting may optimize patient outcome [15], the association between EGFR expression and high Gleason scores and advanced TNM stages suggests that EGFR may be a valuable prognostic factor. However, EGFR prognostication needs to be more fully assessed in the framework of prospective studies and future studies are needed to evaluate the overall significance of the expression of EGFR and its potential use in anti-EGFR therapies.

#### CONCLUSION

Summing up, our study shows that EGFR is predominantly expressed in castrate-resistant patients, suggesting that EGFR-targeted drugs could be of therapeutic relevance in this otherwise difficult to treat subset of prostate cancer. However, since these markers are only expressed in a fraction of advanced tumors, it will be necessary to assess the efficacy of EGFR targeted therapy in relation to the marker expression in the individual patients rather than looking at a raw overall efficacy. Patients selection needs to be realized based on the EGFR profile of their tumors.

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Tables

TABLE1. Clinicopathological characteristics of patients with prostate adenocarcinomas (n = 58).

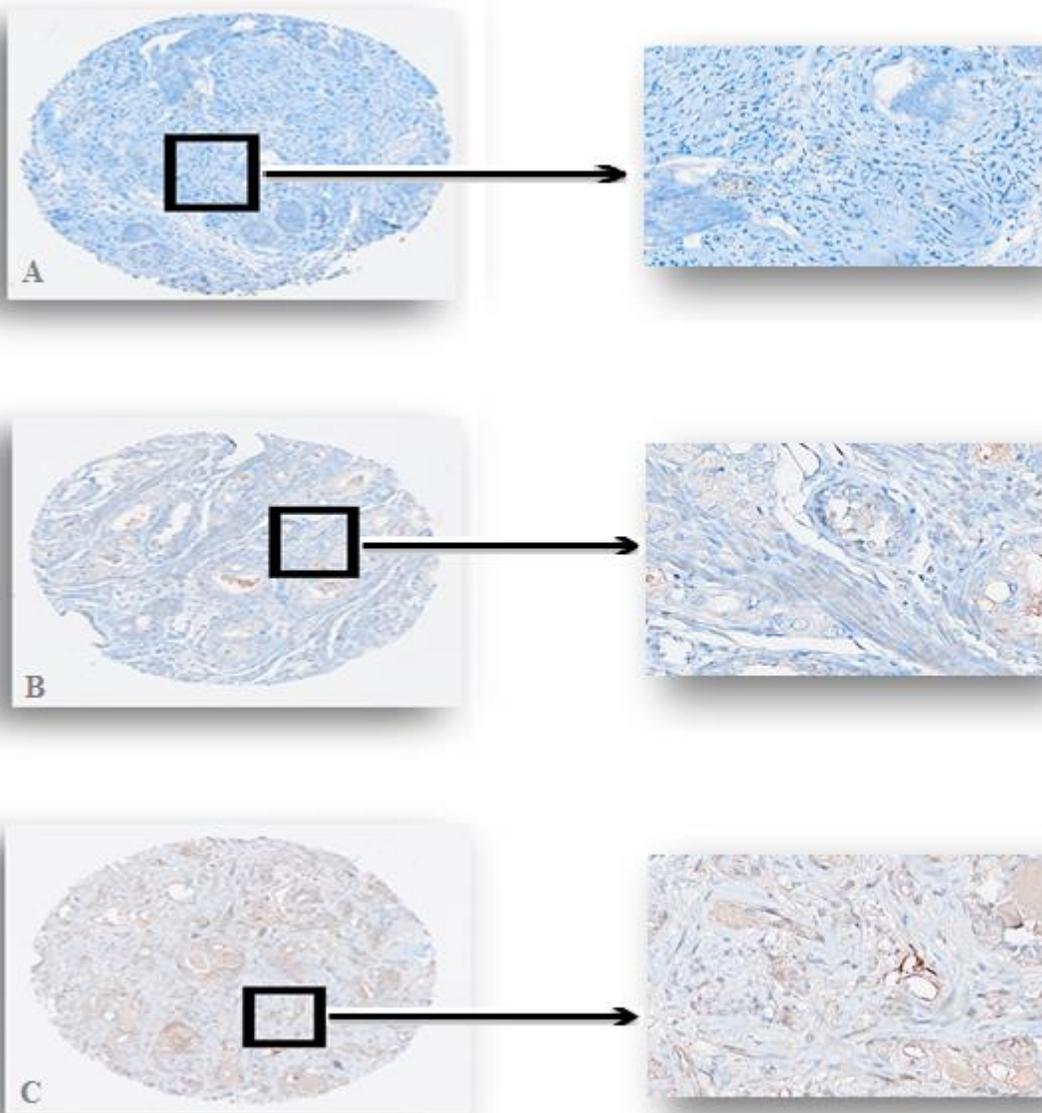
|               | Clinico-pathological parameters | N  | %     |
|---------------|---------------------------------|----|-------|
| PSA level     | ≤10 ng/ml                       | 6  | 10,34 |
|               | >10 ng/ml                       | 52 | 89,66 |
| Gleason score | <3+3                            | 10 | 17,24 |
|               | 3+4                             | 20 | 34,48 |
|               | 4+4                             | 8  | 13,79 |
|               | 4+5                             | 20 | 34,48 |
| TNM Stage     | Organ confined (T2a, T2b)       | 37 | 63,79 |
|               | T2a                             | 24 | 41,38 |
|               | T2b                             | 13 | 22,41 |
|               | Advanced (T3a, T3b)             | 21 | 36,21 |
|               | T3a                             | 13 | 22,41 |
|               | T3b                             | 8  | 13,79 |
| pN            | N0                              | 48 | 82,76 |
|               | N+                              | 10 | 17,24 |
| pM            | M0                              | 46 | 79,31 |
|               | M+                              | 12 | 20,69 |

TABLE 2 . Epidermal Growth Factor (EGFR) Immunostaining in patients with positive-prostate cancer in comparison with clinico-pathological parameters

| Clinico-pathological parameters | EGFR immunostaining |    |       |    | p-value |      |
|---------------------------------|---------------------|----|-------|----|---------|------|
|                                 | EGFR -              | %  | EGFR+ | %  |         |      |
| PSA level                       | ≤10ng/ml            | 4  | 66,67 | 2  | 33,33   | 0,33 |
|                                 | >10ng/ml            | 18 | 34,61 | 34 | 65,38   |      |

|                      |                           |    |       |    |       |        |
|----------------------|---------------------------|----|-------|----|-------|--------|
| <b>Gleason score</b> | Low score $\leq 3+3$      | 6  | 60    | 4  | 40    | < 0,05 |
|                      | High score $\geq 3+4$     | 16 | 33,33 | 32 | 66,66 |        |
| <b>TNM Stage</b>     | Organ confined (T2a, T2b) | 21 | 56,57 | 16 | 43,24 | < 0,05 |
|                      | Advanced (T3a, T3b)       | 1  | 4,76  | 20 | 95,23 |        |
| <b>pN</b>            | N0                        | 20 | 41,66 | 28 | 58,33 | < 0,05 |
|                      | N+                        | 2  | 20    | 8  | 80    |        |
| <b>pM</b>            | M0                        | 20 | 43,47 | 26 | 56,52 | 0,46   |
|                      | M+                        | 2  | 16,66 | 10 | 83,33 |        |

**Figures**



**Figure 1:** Expression of EGFR in prostate cancer tissues: **A)** Faint/barely perceptible membranous reactivity in tumor cells (original magnification,  $\times 400$ ) **B)** Weak to moderate complete, basolateral, or lateral membranous reactivity in tumor cells (original magnification,  $\times 400$ ) **C)** Complete, basolateral, or lateral membranous reactivity of strong intensity in tumor cells (original magnification,  $\times 400$ ).

# Measurement and disclosure about costs Environmental quality and its impact on the financial statements published

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## I. RESEARCH PROBLEM

Environmental Costs quality, measured and disclosed in financial statements has not yet reached the required level in the sugar industries requires the development of scientific framework of the concept of the environment and environmental pollution and the nature of the costs of environmental quality and to identify the foundations of measurement, disclosure and analysis of the costs of environmental quality and the statement of its role in increasing the effectiveness of accounting information. Where the current application of cost accounting only limit the cost elements associated with the facility without taking into account the costs of environmental quality, leading to the emergence of profit is real and therefore the results of the business of the financial statements are not true, which in turn leads to a weakening of confidence in the accounting information provided, as it through the achievement of the facility for its objectives is damage or environmental pollution, so the tab cost component of industrial raw materials, labor and services is no longer reflect the value of factors of production, depleting already in the production of a certain size of the products due to the fact that the environment has become one of the factors involved in production is featured here the need for disclosure and measure the cost of using the environment in production and that cost is called the cost of environmental quality

## II. RESEARCH OBJECTIVES

The research aims to have access to how to measure the costs of environmental quality and their disclosure in the financial statements of companies, sugar industry and take advantage of the results of the analysis and measurement of the beneficiaries, taking into account the environmental impacts and obligations, costs, through a field study to identify current practices by these companies. To achieve this goal through the following points:

1 / Formula proposed for disclosure and to measure and analyze the costs of environmental quality companies to the sugar industry.

2 / To identify approaches and methods used to measure the costs of environmental quality.

3 / Determine the importance of measuring and analyzing the costs of environmental quality.

4 / Demonstrate the importance of the cost of quality environment for the preparation of the necessary measures to do any other projects for the sugar industry in the future, and footage of this cost in both studies for these projects.

5 / Formula to provide an accounting of the environmental remediation and show this treatment in the financial statements.

6 / Bridging the gaps that arise about the sanitation of the environment, perfecting and taking into account the restriction through laws associated prevent and limit pollution of the environment with consideration and monitoring of the elements of the environment in the cost of refining industry financially.

The importance of research:

Represents the importance of research in the following points:

1 - Companies need for the sugar industry to increase environmental awareness through recognizing the importance and the role of measurement and analysis of the costs of environmental quality to help the beneficiaries in decision-making and performance evaluation.

2 - Increased attention to all the companies working in the sugar industry and the pollution that occurs in the environment need to preserve the environment from pollution and access to high quality products.

3 - Expanding the scope of accounting to include all divisions of companies that operate within those companies to the attention of the costs of environmental quality.

4 - The effectiveness of accounting information through scientific research and the process for measuring and analyzing the costs of environmental quality.

5 - Creating the opportunity for companies operating in the field of other sugar industry to improve its image within the community in which you conduct business.

6 - That the disclosure and measurement and analysis of the costs of environmental quality will help the sugar industry on the improvement and continuous development and performance evaluation.

Research Methods:

So that the researcher from achieving the goals of research adopted in this research on several approaches: A deductive approach in determining the dimensions of the problem and formulate hypotheses

1 - Inductive approach to test hypotheses

2 - The historical method to review and analyze and evaluate the previous studies associated with the subject of research.

3 - Descriptive approach using the method of case study to illustrate the interest of companies, the sugar industry of environmental costs and show it in the financial statements

#### Hypotheses:

To achieve the objectives of this research according to the previous methodology has been formulated the following hypotheses:

#### The first hypothesis:

The existence of an accounting system and practice of the concept of the nature of the costs of environmental quality in the sugar industry in the provision of data and information necessary for the rationalization of the environmental performance of companies.

#### The second hypothesis:

A relationship between the accounting system and areas of corruption, environmental pollution and increase in the business environment due to its ability to measure the costs of environmental quality for the sugar industry is quantitative.

#### The third hypothesis

A relationship between the analysis and control and disclosure of the costs of environmental quality and improve the environmental performance of companies and rationalization of the sugar industry.

The concept of quality costs of environmental concepts related to environmental pollution, and the interdependence between the concept of quality environment and accounting, although increased awareness of facilities for environmentally irresponsible led to the need for attention accountants and decision makers to the problem of the quality of the environment and knowledge of different aspects so that measurement of the costs borne by enterprises to reduce or deal with the damage caused for the costs of environmental quality, firms operating in the sugar industry or inactive would pollute the environment, it must disclose the information costs of environmental quality in order to meet the demand of stakeholders on this information, allowing them to assess their decisions past or assistance in making decisions current or future.

### III. PROPOSED MODEL TO MEASURE THE COSTS OF ENVIRONMENTAL QUALITY

Based on the progress of previous experience in the field of accounting is that the researcher suggests the measurement and disclosure of information on the costs of environmental quality in the financial statements for the Kenana Sugar Company to include the measurement and disclosure of environmental three parts:

The first measurement and disclosure of environmental costs

The second measurement and disclosure of environmental liabilities

The third measurement and disclosure of general information on environmental accounting

Will be displayed for the components of each of these three parts as follows.

1 / Measurement and disclosure of the costs of environmental quality

Measurement and disclosure of items that the company considers environmental quality cost, which often lead to im-

proved operational efficiency and environmental efficiency together and therefore the company must identify items that fall within the environmental costs.

Download to disclose the environmental costs that are included in the income statement between operating costs and non-operational and analyzed in a manner commensurate with the nature and size of the company's activity. Environmental costs may include a set of items such as:

- The cost of liquid waste treatment
- The costs of solid waste treatment
- The cost of treating off-gas harmful
- The cost of repairing environmental damage and depreciation of fixed assets associated with nature to preserve the environment

2 / Measurement and disclosure obligations in environmental quality:

Must disclose the company's independent of the obligations in the environmental quality in the balance sheet and in the explanatory notes should also disclose the method used to measure these liabilities may be measured using (the style of the current value or the style of the current cost) and is to disclose the environmental costs and is calculated on the list of financial position and the value is equal so as not to adversely affect the price of the product is also clearly do not affect profits.

Must also be disclosed for each item of substantial commitments as follows.

- Brief description of the nature of the obligation.
- The timing and terms of the settlement of the obligation.
- In case you are not sure of the amount or timing of the commitment must be settled to say about it.

If a measurement of the value of environmental commitment using the method of the present value must disclose all assumptions affecting the estimation of future cash flows and liabilities recorded in the financial statements, including:

A - Determination of the ongoing costs required to settle the obligation.

B - A long-term estimated rate of inflation used to estimate the value of commitment.

C - The estimated cost to settle the obligation in the future

D - discount rates used.

3 / Measurement and disclosure of information relating to public accounting in the quality of the environment must disclose any accounting policies followed by the company specifically relating to accounting for obligations and environmental costs.

Reveal the nature of the obligations and environmental costs recognized in the financial statements includes the disclosure brief description of any environmental damage and any laws or regulations needed repaired, as well as a statement of any changes expected to be made to those laws or the methods specu-

lative used to repair what is reflected in the costs of reform must also disclose the environmental issues that may affect the company or the industry to which they belong and includes these topics:

- A - policies and programs pursued by the company.
  - B - No amendments have been introduced in key areas related to the environment.
  - C - The extent to which environmental protection measures provided for by government legislation.
  - D - What are the government incentives may acquire the company for compliance with the laws protecting the environment, such as grants or tax concessions.
- This provides that disclosure of general information for the users of financial statements of the company's ability to assess the impact on environmental performance.

Proposed budget numbers including the environmental costs:

The purpose of preparing the annual budget for the Kenana Sugar Company, a team of accounting costs will arrange for after rooming management directives that normally are as follows: -

- 1 / plan yearly production target (Products types and volume of products).
- 2 / light that define the expected production quantities and cost of materials used in production.
- 3 / Also determine other direct costs and indirect and overhead costs by volume of activity.
- 4 / To the competent authorities of the existing environment to develop appropriate financial estimates for research and development work and mechanisms to measure damage to the environment and the fight against environmental pollution and all the necessary protection of the environment within the annual budget of the company until the approval and disbursement of when the necessary.

5 / Then calculated the cost of generating unit and with an additional profit margin to determine the selling price to know the size of the total profits of the company during the year to achieve

This budget is a road map for each company's products are clarified proceeds of the sale and the cost of production and the total volume of profitable and which also illustrates the production costs and the costs of other service departments and marketing costs and the quality of the environment and then see net profit is estimated to achieve Top of Form

#### IV. RESULTS

After the theoretical study and empirical study researcher concluded the following results:

- 1 - The results of the field study on practice accounting system for the costs of environmental quality are clearly within the Kenana Sugar Company until realized the following benefits:
  - A - Calendar right for the investment project and see the reflection of the costs of environmental quality on inflows and outflows of the project, because the omission of the cost of quality of the environment when studying and evaluating new projects may result in non-economic repercussions.
  - More efficient use of the elements of input activity and operating input selection, which improved environmental performance.
  - D - Rationalization of many decisions such as determining

the type of product, choose a product design, production method and appropriate packaging alternative best suited of hazardous waste.

E / Control and reduce the costs of environmental performance, which in turn lowers the total cost of the facility and this in turn instructs the administration in the development of marketing and price policies that support its competitive position and improve profitability and consequently improve the reputation and value in the capital market.

2 - The results proved to study the lack of metrics appropriate accounting to measure the costs of environmental quality on the activities that caused the industry in the correct identification of the cost of these products and thus check the interview sound between revenues and costs of each product and the proper identification of each product, which led to most of the industrial units within the Kenana Sugar Company not interested in perfecting their environmental costs.

3 - Also confirmed the results on the non-existence of disclosure accounting of the costs of environmental quality within the Kenana Sugar Company start of combat hazardous waste and harmful (flammable materials, gases, vapors,) and that to measured and download environmental costs and reduced and this in turn deliver the State set of responsibilities including, a comprehensive inventory of all waste and classified by type and sources and then by order of priority in terms of prevention and control. Study and evaluate various alternatives for the treatment and control of these residues and lineage test (technically and financially) to conditions and spatial established. This result reached proving the invalidity of the third hypothesis Mechanism to obtain ISO 14001 certification

An entity shall establish and maintain a system of environmental management according to the requirements of the specification. This includes the following steps and stages:

1- Documented environmental policy of the company to cover all the processes, products and services, and adoption of the highest levels of management.

2- Environmental auditing, so study the environmental aspects of operations and products offered by the company. Can range this review process of a simple assessment of environmental aspects and the environmental impact could be extensive evaluation process are examined energy consumption, and the use of raw materials.

3- Planning and through the identification of environmental problems and opportunities for environmental improvement, and put it in a clear framework covers:

- A) environmental aspects and environmental impact.
- B) Legal requirements and other requirements.
- C) The objectives and timing of completion.
- D) Environmental management programs.

4- Application and operations, and includes the development of a clear structure of the environmental management system ensures that all employees are aware of their responsibilities, and how they affect the daily operations of the institution on the environment, including:

- A) The organization and responsibilities.
- B) Training and awareness and efficiency.
- C) Communications.
- D) Environmental management system documentation.
- E) Control of documents.

- F) Control operations.
- G) Preparedness and emergency response.

5- verification and corrective actions, and through the establishment of monitoring and follow-up to make sure compliance with environmental legislation and targets set by the company

6- Management Review of the performance of the system and periodically and make sure that the continuous development holds in relation to environmental performance of the company and between the survey conducted by a specialized international bodies in the field of environment for a group of companies that have implemented a system ISO 14000, that all these companies have benefited virtually from the application system quality management., the benefits that might be achieved from the application of a comprehensive environmental management system far outweigh the limited benefits reaped by the companies of the implementation of some isolated environmental applications.

As for their common management principles are:

- documented procedures.
- Audit systems.
- Corrective and preventive actions in the incidence of cases of non-conformity.
- Training and awareness.

Environmental systems and ISO 14001 series there are some companies that deal with environmental issues individually, for controlling emissions and noise pollution. However, the benefits that might be achieved from the application of a comprehensive environmental management system far outweigh the limited benefits reaped by the companies of the implementation of some isolated environmental applications.

Environmental regulations mechanism by which follow-up and development of environmental performance, the similarity of environmental quality management systems in terms of providing the means to adjust the companies. Reasons and causes creation of environmental management systems

Industrial Revolution that occurred led to environmental pollution brought to the attention of interested of all countries in the world, has called on the United Nations Conference in 1972 and the environmental problems resulting from the rapid development of the industry, creating interest in addressing the causes of this major pollution which would inevitably affect the quality of life in the world. Where he played the United Nations Environmental Programmed (UNEP) a clear role to build environmental awareness among people and among industrialists in particular

The concept of a management Environmental Quality 14001 Knows quality system administrative environment as "part of the administrative policy for the structure and planning activities, responsibilities, procedures and methods and resources to develop, implement and achieve conservation and auditing of environmental policies provides environmental management system mechanism by which follow-up and develop the environmental performance of institutions and companies. Where known environmental management system that framework systematic and aims to introduce environmental management within the activity of the entity and its products and services

Environmental management system is part of a comprehensive management system for an organization which includes organizational structure, planning activities, responsibilities, practices, procedures, processes and sources implementing and maintaining good environmental performance. And include aspects of the administration, which plans and develops and implements decline and maintain the environmental policy of the institution and its objectives and know EMS as part of the system overall administrative, which includes organizational structure, planning and operational practices, procedures, processes and capabilities development and environmental auditing and monitoring environmental policy is also implemented.

The international standard ISO 14001 is a set of standards developed by the International Organization ISO and other words that the series of ISO 14001 is a set of specifications optional environmentally friendly, and then it allows the organizations and bodies, in the world, follow the environmental management and one agreed, and therefore include ensures the protection of the environment from pollution, and in parallel with the requirements of economic and social development. A series specifications international standard Private EMS consists of a number of specifications focused on each one of them a set of terms and requirements of a technical nature and administrative purpose of encouraging and developing an environmental management more efficient and effective in various organizations towards the development of the environment and to provide the means of practical and useful features - effectively costs. - Reflect Forum organizers are to gather environmental information, interpretation and delivery specification ISO 14001 is standard provides a set of standard requirements for an environmental management system to enable the Organization to develop and implement policy and objectives taking into account the legal requirements governing the organization and information as well as information on the characteristics important environmental Encyclopedia quality Gulf. It is noted that both groups, considering that ISO series 14001 are only specifications measure the environmental management system, with series ISO not only individual environmental management system, there are other standard specifications related environmental management system

The quality system of the most important environmental mechanisms that enable enterprise to identify the environmental impacts resulting from the activities of the facility. Not only the application of the environmental management system to protect the environment, but also lead to improving the efficiency of the production process facility and compete in local and international markets. Therefore keen many industrial facilities to implement environmental management system and thereby applied to obtain a certificate of environmental quality 14001 and indicate a global studies that enterprises increase their shares by 5% if applied this system and improved its image and when less environmental risks increase shareholders desire to buy shares this facility, The study also found again that 52% of the survey sample are interested in buying products facilities that apply this system in addition to that, this system has other advantages. Therefore Kenana Sugar Company can acquire this certificate grace of God, with our support for researchers in this direction

## V. RECOMMENDATIONS

Based on the results of this research researcher recommends the following:

1 / Must measure the costs of environmental quality for the Kenana Sugar Company and downloaded in the financial statements are correct and clear and rational decisions related to improving and developing environmental performance.

2 / Should reduce the consumption of hazardous materials and chemicals and bring less dangerous materials in Kenana Sugar Company factory and production processes to another industry and also encourage complementary industries that depend on (waste) the sugar industry.

3 / Establishment and development of parks and landscaping in residential areas at Kenana Sugar Company.

4 / processing of agricultural waste to produce products with economic returns such as wood panels and paper

5 / Recycling of agricultural waste for energy sources and feed production from agricultural waste in the Kenana Sugar Company and use the remnants of the food industry and converted into animal feed. And processing of farm waste in the Kenana Sugar Company.

6 / Exert more efforts and spend money to protect the environment and also the cost of treating the environment from pollution and sanitation, and future costs of plans and programs for the future planning and training costs for workers in the field of environmental health and research and development costs in the field of environmental quality.

7 / This region-wide existing plant or industrial facility, but the scope of the state and the world must work on a good use of resources and also reduce the danger of flooding and reduce or wastewater treatment and re-treatment of industrial waste and others.

8 / Should be considered processes that return a benefit, such as recycling of waste and investments that reduce financial expenditures, also must spend on training workers in the sector of environmental rehabilitation and also exchange on research and development and future planning to reduce environmental damage and also insurance financially.

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# Design of Trust Aware Routing Framework

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**Abstract-** The multi-hop routing in wireless sensor networks (WSNs) offers little protection against identity deception through replaying routing information. An adversary can exploit this defect to launch various harmful or even devastating attacks against the routing protocols, including *sinkhole* attacks, wormhole attacks and *Sybil* attacks. Traditional cryptographic techniques or efforts at developing trust-aware routing protocols do not effectively address this severe problem. To secure the WSNs against adversaries misdirecting the multi-hop routing, we have design and implemented TARF, a robust trust-aware routing framework for dynamic WSNs. TARF provides trustworthy and energy-efficient route. Most importantly, TARF proves effective against those harmful attacks developed out of identity deception; the resilience of TARF is verified through extensive evaluation with both simulation and empirical experiments on large-scale WSNs under various scenarios including mobile and RF-shielding network conditions.

**Index Terms-** : CTP – Collection Tree Routing Protocol, EWMA-exponentially weighted moving average, RPGM-Reference Point Group Mobility TARF-Trust Aware Routing Framework, WSN – Wireless Sensor Network

## I. INTRODUCTION

Wireless sensor networks (WSNs) mainly supports military applications and forest fire monitoring. A WSN comprises battery-powered sensor nodes with extremely limited processing capabilities. With a narrow radio communication range, a sensor node wirelessly sends messages to a base station via a multi-hop path. However, the multi-hop routing of WSNs often becomes the target of malicious attacks. An attacker may tamper nodes physically, create traffic collision with seemingly valid transmission, drop or misdirect messages in routes, or jam the communication channel by creating radio interference. This paper focuses on the kind of attacks in which adversaries misdirect network traffic by identity deception through replaying routing information. Based on identity deception, the adversary is capable of launching harmful and hard-to-detect attacks against routing such as selective forwarding, wormhole attacks, sinkhole attacks and Sybil attacks.

## II. DESIGN CONSIDERATIONS

**Assumptions :** We target secure routing for data collection tasks, which are one of the most fundamental functions of WSNs. In a data collection task, a sensor node sends its sampled data to a remote base station with the aid of other intermediate nodes, as shown in Figure 1. Though there could be more than one base station, our routing approach is not affected by the number of base stations; to simplify our discussion, we assume that there is only one base station.

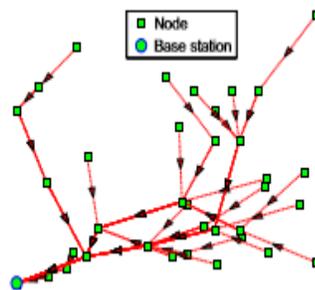


Fig.1.Multi-hop routing for data collection of a WSN

**Authentication Requirements:**TARF requires that the packets are properly authenticated, especially the broadcast packets from the base station. The broadcast from the base station is asymmetrically authenticated so as to guarantee that an adversary is not able to manipulate a broadcast message from the base station.TARF uses trustmanager.

**Goals :** TARF mainly guards a WSN against the attacks misdirecting the multi-hop routing, especially those based on identity theft through replaying the routing information. TARF aims to achieve the following desirable properties:

**High Throughput :** *Throughput* is defined as the ratio of the number of all data packets delivered to the base station to the number of all sampled data packets. Here, *throughput* at a moment is computed over the period from the beginning time (0) until that particular moment. Note that single-hop re-transmission may happen, and that duplicate packets are considered as one packet as far as *throughput* is concerned. *Through- put* reflects how efficiently the network is collecting and delivering data. *Throughput should be high.*

**Energy Efficiency:** We evaluate energy efficiency by the average energy cost to successfully deliver a unit-sized data packet from a source node to the base station. Note that link-level re-transmission should be given enough attention when considering energy cost since each re-transmission causes a noticeable increase in energy consumption. If every node in a WSN consumes approximately the same energy to transmit a unit-sized data packet, we can use another metric *hop-per-delivery* to evaluate energy efficiency. Here, the energy consumption depends on the number of hops, i.e. the number of one-hop transmissions occurring. It is abbreviated as *hop-per-delivery*.

**Scalability & Adaptability :** It should support large magnitude and high dynamic data. We will evaluate the scalability and adaptability of TARF through experiments with large-scale WSNs and under mobile and hash network conditions.

### III. DESIGN OF TARF

Before introducing the detailed design, we first introduce several necessary notion here.

**Neighbor :** For a node  $N$ , a neighbor (neighboring node) of  $N$  is a node that is reachable from  $N$  with one-hop wireless transmission.

**Trust level :** For a node  $N$ , the trust level of a neighbor is a decimal number in  $[0, 1]$ , representing  $N$ 's opinion of that neighbor's level of trustworthiness. Specifically, the trust level of the neighbor is  $N$ 's estimation of the probability that this neighbor correctly delivers data received to the base station. That trust level is denoted as  $T$  in this paper.

**Energy cost :** For a node  $N$ , the energy cost of a neighbor is the average energy cost to successfully deliver a unit- sized data packet with this neighbor as its next-hop node, from  $N$  to the base station. That energy cost is denoted as  $E$  in this paper.

**Overview :** For a TARF-enabled node  $N$  to route a data packet to the base station,  $N$  only needs to decide to which neighboring node it should forward the data packet considering both the trustworthiness and the energy efficiency. Once the data packet is forwarded to that next-hop node, the remaining task to deliver the data to the base station is fully delegated to it, and  $N$  is totally unaware of what routing decision its next-hop node makes.  $N$  maintains a neighborhood table with trust level values and energy cost values for certain known neighbors. It is sometimes necessary to delete some neighbors' entries to keep the table size acceptable. The technique of maintaining a neighborhood table of a moderate size is employed by TARF. A broadcast message from the base station is flooded to the whole network.

In TARF, in addition to data packet transmission, there are two types of routing information that need to be exchanged: broadcast messages from the base station about data delivery and energy cost report messages from each node. Neither message needs acknowledgement. A broadcast message from the base station is flooded. The freshness of a broadcast message is checked through its field of source sequence number. The other type of exchanged routing information is the energy cost report message from each node.

For each node  $N$  in a WSN, to maintain such a neighborhood table with trust level values and energy cost values for certain known neighbors, two components, *EnergyWatcher* and *TrustManager*, run on the node (Figure 2). *EnergyWatcher* is responsible for recording the energy cost for each known neighbor, based on  $N$ 's observation of one-hop transmission to reach its neighbors and the energy cost report from those neighbors. *TrustManager* is responsible for tracking trust level values of neighbors based on network loop discovery and broadcast messages from the base station about data delivery. Once  $N$  is able to decide its next-hop neighbor according to its neighborhood table, it sends out its energy report message: it broadcasts to all its neighbors its energy cost to deliver a packet from the node to the base station. The energy cost is computed as in Section 3.3 by *EnergyWatcher*.

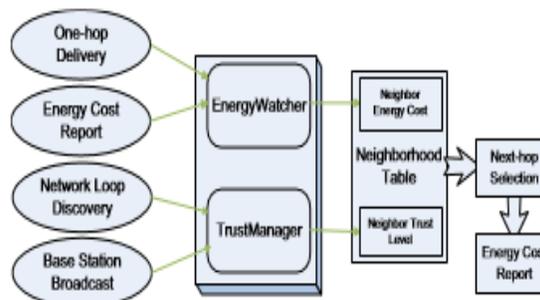


Fig. 2 : Design

of TARF

**Routing Procedure :** TARF, as with many other routing protocols, runs as a periodic service. The length of that period determines how frequently routing information is exchanged and updated. At the beginning of each period, the base station broadcasts a message about data delivery during last period to the whole network consisting of a few contiguous packets (one packet may not hold all the information). Each such packet has a field to indicate how many packets are remaining to complete the broadcast of the current message. The completion of the base station broadcast triggers the exchange of energy report in this new period. Whenever a node receives such a broadcast message from the base station, it knows that the most recent period has ended and a new period has just started. During each period, the *EnergyWatcher* on a node monitors en-

ergy consumption of one-hop transmission to its neighbors and processes energy cost reports from those neighbors to maintain energy cost entries in its neighborhood table; its *TrustManager* also keeps track of network loops and processes broadcast messages from the base station about data delivery to maintain trust level entries in its neighborhood table.

**Structure and Exchange of Routing Information :** A broadcast message from the base station fits into at most a fixed small number of packets. Such a message consists of some pairs of <node id of a source node, an undelivered sequence interval [a, b] with a significant length>, <node id of a source node, minimal sequence number received in last period, maximum sequence number received in last period>, as well as several node id intervals of those without any delivery record in last period. To reduce overhead to an acceptable amount, our implementation selects only a limited number of such pairs to broadcast (Section 5.1) and proved effective (Section 5.3, 5.4). Roughly, the effectiveness can be explained as follows: the fact that an attacker attracts a great deal of traffic from many nodes often gets revealed by at least several of those nodes being deceived with a high likelihood. The undelivered sequence interval [a, b] is explained as follows: the base station searches the source sequence numbers received in last period, identifies which source sequence numbers for the source node with this id are missing, and chooses certain significant interval [a, b] of missing source sequence numbers as an undelivered sequence interval. For example, the base station may have all the source sequence numbers for the source node 2 as {109, 110, 111, 150, 151} in last period. Then [112, 149] is an undelivered sequence interval; [109, 151] is also recorded as the sequence boundary of delivered packets. Since the base station is usually connected to a powerful platform such as a desktop, a program can be developed on that powerful platform to assist in recording all the source sequence numbers and finding undelivered sequence intervals.

Accordingly, each node in the network stores a table of <node id of a source node, a forwarded sequence interval [a, b] with a significant length> about last period. The data packets with the source node and the sequence numbers falling in this forwarded sequence interval [a, b] have already been forwarded by this node. When the node receives a broadcast message about data delivery, its *TrustManager* will be able to identify which data packets forwarded by this node are not delivered to the base station. Considering the overhead to store such a table, old entries will be deleted once the table is full. Once a fresh broadcast message from the base station is received, a node immediately invalidates all the existing energy cost entries: it is ready to receive a new energy report from its neighbors and choose its new next-hop node afterwards. Also, it is going to select a node either after a timeout is reached or after it has received an energy cost report from some highly trusted candidates with acceptable energy cost. A node immediately broadcasts its energy cost to its neighbors only after it has selected a new next-hop node. That energy cost is computed by its *EnergyWatcher* (see Section 3.3). A natural question is which node starts reporting its energy cost first. For that, note that when the base station is sending a broadcast message, a side effect is that its neighbors receiving that message will also regard this as an energy report: the base station needs 0

amount of energy to reach itself. As long as the original base station is faithful, it will be viewed as a trustworthy candidate by *TrustManager* on the neighbors of the base station. Therefore, those neighbors will be the first nodes to decide their next-hop node, which is the base station; they will start reporting their energy cost once that decision is made.

**Route Selection :** Now, we introduce how TARF decides routes in a WSN. Each node  $N$  relies on its neighborhood table to select an optimal route, considering both energy consumption and reliability. For a node  $N$  to select a route for delivering data to the base station,  $N$  will select an optimal next-hop node from its neighbors based on trust level and energy cost and forward the data to the chosen next-hop node immediately. The neighbors with trust levels below a certain threshold will be excluded from being considered as candidates. Among the remaining known neighbors,  $N$  will select its next-hop node through evaluating each neighbor  $b$  based on a trade-off between  $T_{Nb}$  and  $E_{Nb}$ , with  $E_{Nb}$  and  $T_{Nb}$  being  $b$ 's energy cost and trust level value in the neighborhood table respectively. Basically,  $E_{Nb}$  reflects the energy cost of delivering a packet to the base station from  $N$  assuming that all the nodes in the route are honest;  $1/T_{Nb}$  approximately reflects the number of the needed attempts to send a packet from  $N$  to the base station via multiple hops before such an attempt succeeds, considering the trust level of  $b$ .

Thus,  $E_{Nb} / T_{Nb}$  combines the trustworthiness and energy cost. However, the metric  $E_{Nb} / T_{Nb}$  suffers from the fact that an adversary may falsely reports extremely low energy cost to attract traffic and thus resulting in a low value of  $E_{Nb} / T_{Nb}$  even with a low  $T_{Nb}$ . Therefore, TARF prefers nodes with significantly higher trust values;. For deciding the next-hop node, a specific trade-off between  $T_{Nb}$  and  $E_{Nb} / T_{Nb}$  is demonstrated in Figure 5 (see Section 5.2).

**EnergyWatcher :** Here we describe how a node  $N$ 's *EnergyWatcher* computes the energy cost  $E_{Nb}$  for its neighbor  $b$  in  $N$ 's neighborhood table and how  $N$  decides its own energy cost  $E_N$ . Before going further, we will clarify some notations.  $E_{Nb}$  mentioned is the average energy cost of successfully delivering a unit-sized data packet from  $N$  to the base station, with  $b$  as  $N$ 's next-hop node being responsible for the remaining route. Here, one-hop re-transmission may occur until the acknowledgement is received or the number of re-transmissions reaches a certain threshold. The cost caused by one-hop retransmissions should be included when computing  $E_{Nb}$ . Suppose  $N$  decides that  $A$  should be its next-hop node after comparing energy cost and trust level.

Then  $N$ 's energy cost is  $E_N = E_{NA}$ . Denote  $E_{N \rightarrow b}$  as the average energy cost of successfully delivering a data packet from  $N$  to its neighbor  $b$  with one hop. Note that the re-transmission cost needs to be considered. With the above notations, it is straightforward to establish the following relation:  $E_{Nb} = E_{N \rightarrow b} + E_b$ . Since each known neighbor  $b$  of  $N$  is supposed to broadcast its own energy cost  $E_b$  to  $N$ , to compute  $E_{Nb}$ ,  $N$  still needs to know the value  $E_{N \rightarrow b}$ , i.e., the average energy cost of successfully delivering a data packet from  $N$  to its neighbor  $b$  with one hop. For that, assuming that the endings (being acknowledged or not) of one-hop transmissions from  $N$  to  $b$  are independent with the same probability  $P_{succ}$  of being acknowledged, we first compute

the average number of one-hop sendings needed before the acknowledgement is received as follows:

$$\sum_{i=1}^{\infty} X_i = \frac{1}{P_{succ}} \cdot (1 - P_{succ})^{i-1} = \frac{1}{P_{succ}}$$

Denote  $E_{unit}$  as the energy cost for node  $N$  to send a unit-sized data packet once regardless of whether it is received or not. Then we have  $E_{Nb} = E_{unit} / P_{succ} + E_b$

The remaining job for computing  $E_{Nb}$  is to get the probability  $P_{succ}$  that a one-hop transmission is acknowledged. Considering the variable wireless connection among wireless sensor nodes, we do not use the simplistic averaging method to compute  $P_{succ}$ . Instead, after each transmission from  $N$  to  $b$ ,  $N$ 's EnergyWatcher will update  $P_{succ}$  based on whether that transmission is acknowledged or not with a weighted averaging technique. We use a binary variable  $Ack$  to record the result of current transmission: 1 if an acknowledgement is received; otherwise, 0. Given  $Ack$  and the last probability value of an acknowledged transmission  $P_{old\ succ}$ , an intuitive way is to use a simply weighted average of  $Ack$  and  $P_{old\ succ}$  as the value of  $P_{new\ succ}$ . That is what is essentially adopted in the aging mechanism. However, that method used against sleeper attacks still suffers periodic attacks. To solve this problem, we update the  $P_{succ}$  value using two different weights as in our previous work, a relatively big  $W_{degrade} \in (0,1)$  and a relatively small  $W_{upgrade} \in (0,1)$  as follows:

$$P_{new\ succ} = (1 - W_{degrade}) \times P_{old\ succ} + W_{degrade} \times Ack, \text{ if } Ack = 0.$$

$$(1 - W_{upgrade}) \times P_{old\ succ} + W_{upgrade} \times Ack, \text{ if } Ack = 1.$$

The two parameters  $W_{degrade}$  and  $W_{upgrade}$  allow flexible application requirements.  $W_{degrade}$  and  $W_{upgrade}$  represent the extent to which upgraded and degraded performance are rewarded and penalized, respectively. If any fault and compromise is very likely to be associated with a high risk,  $W_{degrade}$  should be assigned a relatively high value to penalize fault and compromise relatively heavily; if a few positive transactions can't constitute evidence of good connectivity which requires many more positive transactions, then  $W_{upgrade}$  should be assigned a relatively low value.

**TrustManager**: A node  $N$ 's TrustManager decides the trust level of each neighbor based on the following events: discovery of network loops, and broadcast from the base station about data delivery. For each neighbor  $b$  of  $N$ ,  $T_{Nb}$  denotes the trust level of  $b$  in  $N$ 's neighborhood table. At the beginning, each neighbor is given a neutral trust level 0.5. After any of those events occurs, the relevant neighbors' trust levels are updated. Note that many existing routing protocols have their own mechanisms to detect routing loops and to react accordingly. In that case, when integrating TARF into those protocols with anti-loop mechanisms, TrustManager may solely depend on the broadcast from the base station to decide the trust level; we adopted such a policy when implementing TARF later (see Section 5). If anti-loop mechanisms are both enforced in the TARF component and the routing protocol that integrates TARF, then the resulting hybrid protocol may overly react towards the discovery of loops. Though sophisticated loop-discovery methods exist in the currently developed protocols, they often rely on the comparison of specific routing cost to reject routes likely leading to loops [32]. To minimize the effort to integrate TARF and the existing protocol and to reduce the overhead, when an existing routing protocol does not provide any anti-loop mechanism, we adopt the following mechanism to detect routing loops. To detect loops, the TrustManager on  $N$  reuses the

table of <node id of a source node, a forwarded sequence interval  $[a, b]$  with a significant length> (see Section 3.2) in last period. If  $N$  finds that a received data packet is already in that record table, not only will the packet be discarded, but the TrustManager on  $N$  also degrades its next-hop node's trust level. If that next-hop node is  $b$ , then  $T_{old\ Nb}$  is the latest trust level value of  $b$ . We use a binary variable  $Loop$  to record the result of loop discovery: 0 if a loop is received; 1 otherwise. As in the update of energy cost, the new trust level of  $b$  is

$$T_{new\ Nb} = (1 - W_{degrade}) \times T_{old\ Nb} + W_{degrade} \times Loop, \text{ if } Loop = 0. \\ = (1 - W_{upgrade}) \times T_{old\ Nb} + W_{upgrade} \times Loop, \text{ if } Loop = 1.$$

Once a loop has been detected by  $N$  for a few times so that the trust level of the next-hop node is too low,  $N$  will change its next-hop selection; thus, that loop is broken. Though  $N$  can not tell which node should be held responsible for the occurrence of a loop, degrading its next-hop node's trust level gradually leads to the breaking of the loop.

On the other hand, to detect the traffic misdirection by nodes exploiting the replay of routing information, TrustManager on  $N$  compares  $N$ 's stored table of <node id of a source node, forwarded sequence interval  $[a, b]$  with a significant length> recorded in last period with the broadcast messages from the base station about data delivery. It computes the ratio of the number of successfully delivered packets which are forwarded by this node to the number of those forwarded data packets, denoted as  $DeliveryRatio$ . Then  $N$ 's TrustManager updates its next-hop node  $b$ 's trust level as follows:

$$T_{new\ Nb} = (1 - W_{degrade}) \times T_{old\ Nb} + W_{degrade} \times DeliveryRatio, \text{ if } DeliveryRatio < T_{old\ Nb}. \\ (1 - W_{upgrade}) \times T_{old\ Nb} + W_{upgrade} \times DeliveryRatio, \text{ if } DeliveryRatio \geq T_{old\ Nb}.$$

**Analysis on EnergyWatcher and TrustManager**: Now that a node  $N$  relies on its EnergyWatcher and TrustManager to select an optimal neighbor as its next-hop node, we would like to clarify a few important points on the design of EnergyWatcher and TrustManager. First, as described in Section 3.1, the energy cost report is the only information that a node is to passively receive and take as "fact". It appears that such acceptance of energy cost report could be a pitfall when an attacker or a compromised node forges false report of its energy cost. Note that the main interest of an attacker is to prevent data delivery rather than to trick a data packet into a less efficient route, considering the effort it takes to launch an attack. As far as an attack aiming at preventing data delivery is concerned, TARF well mitigates the effect of this pitfall through the operation of TrustManager. Note that the TrustManager on one node does not take any recommendation from the TrustManager on another node. If an attacker forges false energy report to form a false route, such intention will be defeated by TrustManager: when the TrustManager on one node finds out the many delivery failures from the broadcast messages of the base station, it degrades the trust level of its current next-hop node; when that trust level goes below certain threshold, it causes the node to switch to a more promising next-hop node. First of all, it is often difficult to identify an attacker who participates in the network using an id "stolen" from another legal node. For example, it is extremely difficult to detect a few attackers colluding to launch a combined wormhole and sinkhole attack. Additionally,

despite the certain inevitable unfairness involved, TrustManager encourages a node to choose another route when its current route frequently fails to deliver data to the base station. Though only those legal neighboring nodes of an attacker might have correctly identified the adversary, our evaluation results indicate that the strategy of switching to a new route without identifying the attacker actually significantly improves the network performance, even with the existence of wormhole and sinkhole attacks. Fig 3 gives an example to illustrate this point. In this example, node A, B, C and D are all honest nodes and not compromised. Node A has node B as its current next-hop node while node B has an attacker node as its next-hop node. The attacker drops every packet received and thus any data packet passing node A will not arrive at the base station. After a while, node A discovers that the data packets it forwarded did not get delivered. The TrustManager on node A starts to degrade the trust level of its current next-hop node B although node B is absolutely honest. Once that trust level becomes too low, node A decides to select node C as its new next-hop node. In this way node A identifies a better and successful route (A - C - D - base). In spite of the sacrifice of node B's trust level, the network performs better.

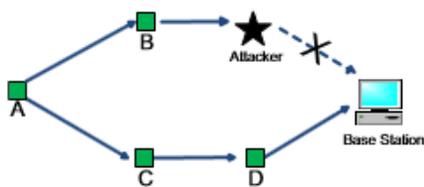


Fig. 3. An example to illustrate how TrustManager works.

Fig.3. An example to illustrate how TrustManager works.

Finally, we would like to stress that TARF is designed to guard a WSN against the attacks misdirecting the multi-hop routing, especially those based on identity theft through replaying the routing information.

#### IV. Simulation

In our experiments, initially, 35 nodes are randomly distributed within a 300\*300 rectangular area, with unreliable wireless transmission. All the nodes have the same power level and the same maximal transmission range of 100m. Each node samples 6 times in every period; the timing gap between every two consecutive samplings of the same node is equivalent. We simulate the sensor network in 1440 consecutive periods. Regarding the network topology, we set up three types of network topologies. The first type is the static-location case under which all nodes stand still. The second type is a customized group-motion-with-noise case based on Reference Point Group Mobility (RPGM) model that mimics the behavior of a set of nodes moving in one or more groups. The last type of dynamic network incorporated in the experiments is the addition of scattered RF-shielded areas to the afore mentioned group-motion-with-noise case.

The performance of TARF is compared to that of a link connectivity-based routing protocol. With the Link-connectivity proto-

col, each node selects its next-hop node among its neighborhood table according to an link estimator based on exponentially weighted moving average (EWMA). The simulation results show, in the presence of misbehaviors, the throughput in TARF is often much higher than that in Link-connectivity; the hop-per-delivery in the Link-connectivity protocol is generally at least comparable to that in TARF. Both protocols are evaluated under three common types of attacks: (1) a certain node forges the identity of the based station by replaying broadcast messages, also known as the sinkhole attack; (2) a set of nodes colludes to form a forwarding loop; and (3) a set of nodes drops received data packets. Generally, under these common attacks, TARF produces a substantial improvement over Link-connectivity in terms of data collection and energy efficiency. Further, we have evaluated TARF under more severe attacks: multiple moving fake bases and multiple Sybil attackers. TARF succeeds in achieving a steady improvement over the Link-connectivity protocol.

**Incorporation of TARF into Existing Protocols :** To demonstrate how this TARF implementation can be integrated into the existing protocols with the least effort, we incorporated TARF into a collection tree routing protocol (CTP). The CTP protocol is efficient, robust, and reliable in a network with highly dynamic link topology. It quantifies link quality estimation in order to choose a next-hop node. The software platform is TinyOS 2.x.

To perform the integration, after proper interface wiring, invoke the TrustControl.start command to enable the trust evaluation; call the Record.addForwarded command for a non-root node to add forwarded record once a data packet has been forwarded; call the Record.addDelivered command for a root to add delivered record once a data packet has been received by the root. Finally, inside the CTP's task to update the routing path, call the Record.getTrust command to retrieve the trust level of each next-hop candidate; an algorithm taking trust into routing consideration is executed to decide the new next-hop neighbor. (See Figure 5).

Similar to the original CTP's implementation, the implementation of this new protocol decides the next-hop neighbor for a node with two steps (see Figure 5): Step 1 traverses the neighborhood table for an optimal candidate for the next hop; Step 2 decides whether to switch from the current next-hop node to the optimal candidate found. For Step 1, as in the CTP implementation, a node would not consider those links congested, likely to cause a loop, or having a poor quality lower than a certain threshold. This new implementation prefers those candidates with higher trust levels; in certain circumstances, regardless of the link quality, the rules deems a neighbor with a much higher trust level to be a better candidate (see Figure 5). The preference of highly trustable candidates is based on the following consideration: on the one hand, it creates the least chance for an adversary to misguide other nodes into a wrong routing path by forging the identity of an attractive node such as a root; on the other hand, forwarding data packets to a candidate with a low trust level would result in many unsuccessful link-level transmission attempts, thus leading to much re-transmission and a potential waste of energy. When the network throughput becomes low and a node has a list of low-trust neighbors, the node will exclusively use the trust as the criterion to evaluate those neighbors for routing decisions. As show in Figure 5, it uses trust/cost as a criteria only when the candidate has a trust level above certain threshold. The reason is, the sole trust/cost criteria could be exploited by an adversary replaying the

routing information from a base station and thus pretending to be an extremely attractive node. As for Step 2, compared to the CTP implementation, we add two more circumstances when a node decides to switch to the optimal candidate found at Step 1: that candidate has a higher trust level, or the current next-hop neighbor has a too low trust level.

### V. Empirical Evaluation on Motelab

We evaluated the performance of TARF against a combined sinkhole and wormhole attack on Motelab at Harvard University. 184 TMote Sky sensor motes were deployed across many rooms at three floors in the department building (see Figure 6), with two to four motes in most rooms. Around 97 nodes functioned properly while the rest were either removed or disabled. Each mote has a 2.4GHz Chipcon CC2420 radio with an indoor range of approximately 100 meters. In Figure 6, the thin green lines indicate the direct (one-hop) wireless connection between motes. Certain wireless connection also exists between nodes from different floors. We developed a simple data collection application in TinyOS 2.x that sends a data packet every five seconds to a base station node (root) via multi-hop. This application was executed on 91 functioning non-root nodes on Motelab. For comparison, we used CTP and the TARF-enabled CTP implementation as the routing protocols for the data collection program separately. The TARF-enabled CTP has a TARF period of 30 seconds. We conducted an attack with five fake base stations that formed a wormhole. As in Figure 6, whenever the base station sent out any packet, three fake base stations which overheard that packet replayed the complete packet without changing any content including the node id. Other fake base stations overhearing that replayed packet would also replay the same packet. Each fake base station essentially launched a sinkhole attack. Note that there is a distinction between such malicious replay and the forwarding when a well-behaved node receives a broadcast from the base station. When a well-behaved node forwards a broadcast packet from the base station, it will include its own id in the packet so that its receivers will not recognize the forwarder as a base station. We conducted the first experiment by uploading the program with the CTP protocol onto 91 motes (not including those 5 selected motes as fake bases in later experiments), and no attack was involved here

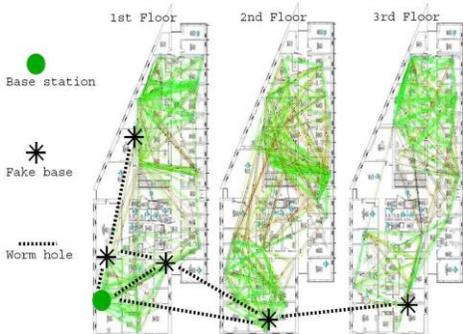


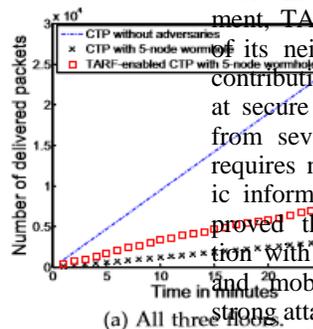
Fig. 6. Connectivity map of Motelab Fig.7 . Empirical comparison of CTP and TARF-enabled CTP on Motelab

Then, in another experiment, in addition to programming those 91 motes with CTP, we also programmed the five fake base stations so that they stole the id the base station through replaying. In the last experiment, we programmed those 91 motes with the TARF-enabled CTP, and programmed the five fake base stations as in the second experiment.

Each of our programs run for 30 minutes. As illustrated in Figure 7(a), the existence of the five wormhole attackers greatly degraded the performance of CTP: the number of the delivered data packets in the case of CTP with the five-node wormhole is no more than 14% that in the case of CTP without adversaries. The TARF-enabled CTP succeeded in bringing an immense improvement over CTP in the presence of the five-node wormhole, almost doubling the throughput. That improvement did not show any sign of slowing down as time elapsed. The number of nodes from each floor that delivered at least one data packet in each six-minute sub-period is plotted in Figure 7. On each floor, without any adversary, at least 24 CTP nodes were able to find a successful route in each six minute. However, with the five fake base stations in the wormhole, the number of CTP nodes that could find a successful route goes down to 9 for the first floor; it decreases to no more than 4 for the second floor; as the worst impact, none of the nodes on the third floor ever found a successful route. A further look at the data showed that all the nine nodes from the first floor with successful delivery record were all close to the real base station. The CTP nodes relatively far away from the base station, such as those on the second and the third floor, had little luck in making good routing decisions. When TARF was enabled on each node, most nodes made correct routing decisions circumventing the attackers. That improvement can be verified by the fact that the number of the TARF-enabled nodes with successful delivery record under the threat of the wormhole is close to that of CTP nodes with no attackers, as shown in Figure 7.

### VI. CONCLUSIONS

We have designed and implemented TARF, a robust trust-aware routing framework for WSNs, to secure multi-hop routing in dynamic WSNs against harmful attackers exploiting the replay of routing information. TARF focuses on trustworthiness and energy efficiency, which are vital to the survival of a WSN in a hostile environment. With the idea of trust management, TARF enables a node to keep track of the trustworthiness of its neighbors and thus to select a reliable route. Our main contributions are listed as follows. (1) Unlike previous efforts at secure routing for WSNs, TARF effectively protects WSNs from severe attacks through replaying routing information; it requires neither tight time synchronization nor known geographic information. (2) The resilience and scalability of TARF is proved through both extensive simulation and empirical evaluation with large-scale WSNs; the evaluation involves both static and mobile settings, hostile network conditions, as well as strong attacks such as wormhole attacks and Sybil attacks. (3) We have implemented a ready-to-use TinyOS module of TARF with low overhead; as demonstrated in the paper, this TARF module can be integrated into existing routing protocols



with the least effort, thus producing secure and efficient fully-functional protocols.

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# Mechanical Behavior Of Al 6063/ MoS<sub>2</sub>/ Al<sub>2</sub>O<sub>3</sub> Hybrid Metal Matrix Composites

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**Abstract:** In the present investigation research work is based on development of Al 6063 base hybrid metal matrix composite reinforced with 10 weight percentage of Aluminium Oxide (Al<sub>2</sub>O<sub>3</sub>), and varying weight percentage of Molybdenum disulphide (i.e. 3%, 5%, 7% & 9%). The composite was prepared by using stir casting technique. The density of Al 6063/ MoS<sub>2</sub>/ Al<sub>2</sub>O<sub>3</sub> were increasing when reinforcement of MoS<sub>2</sub> increases from 3% to 9%. The Ultimate Tensile Strength decreasing due to the additions of 3% to 9% of MoS<sub>2</sub> and also reinforced with alumina (Al<sub>2</sub>O<sub>3</sub>) into the base matrix. It was seen that while the Al 6063 alloys shows the pre- dominantly ductile fracture (base matrix). The composite specimens (with a MoS<sub>2</sub> addition) show an increase in the mixed mode (ductile and brittle regions). Investigation also predicts that hardness increases due to varying addition of MoS<sub>2</sub>. Micrographs of the composite specimen are taken for the study of particular or overall behaviour of the material.

## 1. INTRODUCTION

Aluminium silicon alloys and composites are being used in automotive applications like pistons, brake rotors and engine block cylinder liners. Tribological behaviour is an important aspect in the use of aluminium metal matrix composites in automotive applications. The wear behaviour of Al-Si alloys can be further enhanced by adding ceramic particles. Abrasive particles like silicon carbide, alumina, and diamond are added to improve the tribological behaviour by increasing the hardness of a composite. Nevertheless, lubricating particles like graphite and MoS<sub>2</sub> have also been added to improve the tribological behaviour of different materials by providing a solid lubricating layer. The additions of these particles considerably affect the mechanical behaviour of the composites.

There are various methods of producing composites like blending and consolidation, vapor deposition and consolidation, stir casting, infiltration process, spray deposition and consolidation, as well as in-situ reacting process. Of all these processes, stir casting is the simplest and the most economical method. Self-lubricating Al-MoS<sub>2</sub> composites have been prepared by using the powder-metallurgy route. In this investigation, four self-lubricating composites of molybdenum disulphide, namely, Al 6063 / 3% MoS<sub>2</sub> / 10% Al<sub>2</sub>O<sub>3</sub>, Al 6063 / 5% MoS<sub>2</sub> / 10% Al<sub>2</sub>O<sub>3</sub>, Al 6063 / 7% MoS<sub>2</sub> / 10% Al<sub>2</sub>O<sub>3</sub> and Al 6063 / 9% MoS<sub>2</sub> / 10% Al<sub>2</sub>O<sub>3</sub> have been produced with the stir-casting route. The changes in the mechanical and tribological properties caused by the addition of MoS<sub>2</sub> are studied.

## 2. DETAILS OF EXPERIMENT

### 2.1 Materials

Al 6063 was used as the matrix, alumina as hard reinforcement and molybdenum disulfide as soft reinforcement. This matrix alloy was used for intricate, thin-walled castings that demand high strength, such as castings for the automotive industry and general engineering.

**Table 1 Chemical Properties of Al 6063**

| Component | Mn    | Fe    | Mg     | Si     | Zn    | Ti    | Cr    | Cu    | Others |
|-----------|-------|-------|--------|--------|-------|-------|-------|-------|--------|
| Weight %  | 0.0 - | 0.0 - | 0.45 - | 0.20 - | 0.0 - | 0.0 - | 0.0 - | 0.0 - | 0.0 -  |
|           | 0.10  | 0.35  | 0.90   | 0.60   | 0.10  | 0.10  | 0.10  | 0.10  | 0.15   |

It has very good castability and is suitable for sand, gravity die-casting, and high-pressure die casting. To produce composites, the stir casting technique was used. Particle size of 400 micron alumina and 400 micron particle sizes of molybdenum disulfide reinforcements were used in this composite. Molybdenum disulfide in varying amounts ranging between 3%, 5%, 7%, and 9 wt. % was mixed with Al 6063 and 10 wt. % alumina composite. The densities of the composites were measured using Archimedes principle.

The weight of the composite samples was measured with the help of an electronic balance.

## 2.2 Preparation of the composite

First of all sand mould is prepared. The four main components for making a sand casting mold is base sand, a binder, additives, and a parting compound. In this casting process a pattern is made in the shape of the desired part i.e. cylinder. This pattern is made of metal. Stir- casting technique is used for the preparation of material. This approach involves mechanical mixing of the reinforcement particulate into a molten metal bath and transferred the mixture directly to a shaped mould prior to complete solidification. After the melting of material pouring is accomplished with gravity. Cast ingot surface is clean by machining process.

## 2.3 Testing of materials

The density of metal matrix composites was determined by Archimedes principle. The microstructure of the composite specimens was identified using an optical microscope. First of all rough grinding of specimen was done using emery papers of different grades. After the rough grinding fine polishing of the specimen was done. This polishing was done to remove fine scratches of specimen. For this purpose two different grades of polishing powder were used of size 0.017 $\mu$ m and 0.014  $\mu$ m. Etching of the specimen was done to remove any surface contamination and to reveal the grain boundaries. The tensile strength testing was carried out using universal testing machine. The ultimate tensile strength of the specimen was calculated from the load at which a fracture occurred. The hardness testing was carried out using vickers hardness machine. The hardness of the specimen is defined as the load divided by the surface area of the indentation.

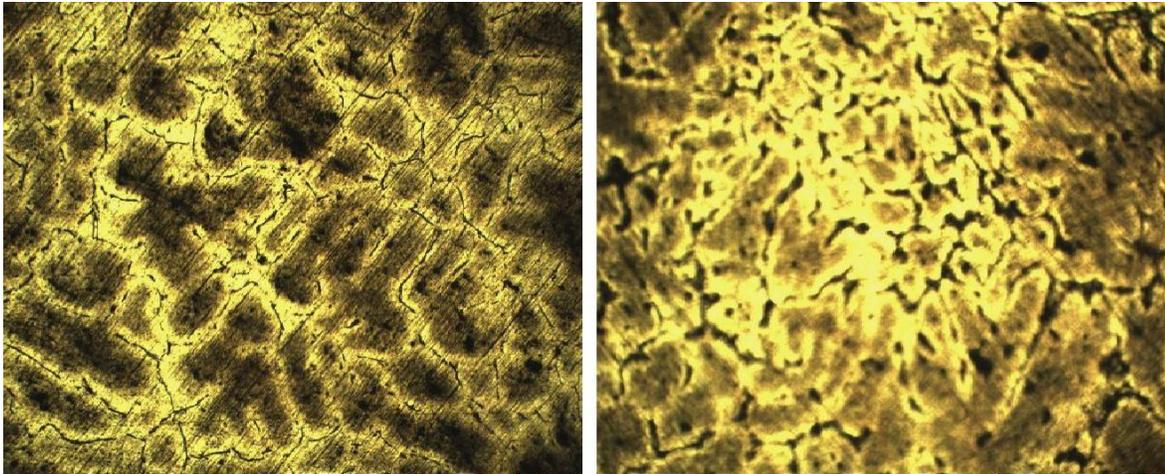
**Table 2** Mechanical property of Metal Matrix Composites

| Metal Matrix Composites  | UTS (N/mm <sup>2</sup> ) | Density (kg/mm <sup>3</sup> ) | Hardness (HB) | Decrease in UTS, % | Increase in Density, % | Increase in Hardness, % |
|--|--------------------------|-------------------------------|---------------|--------------------|------------------------|-------------------------|
| Al 6063 / 3% MoS <sub>2</sub> / 10% Al <sub>2</sub> O <sub>3</sub> | 72.41                    | 2860                          | 36.2          | -                  | -                      | -                       |
| Al 6063 / 5% MoS <sub>2</sub> / 10% Al <sub>2</sub> O <sub>3</sub> | 67.45                    | 2890                          | 36.3          | 6.85               | 1.05                   | 0.27                    |
| Al 6063 / 7% MoS <sub>2</sub> / 10% Al <sub>2</sub> O <sub>3</sub> | 56.48                    | 2930                          | 36.6          | 16.26              | 1.38                   | 0.83                    |
| Al 6063 / 9% MoS <sub>2</sub> / 10% Al <sub>2</sub> O <sub>3</sub> | 25.60                    | 2970                          | 37.1          | 56.64              | 1.36                   | 1.37                    |

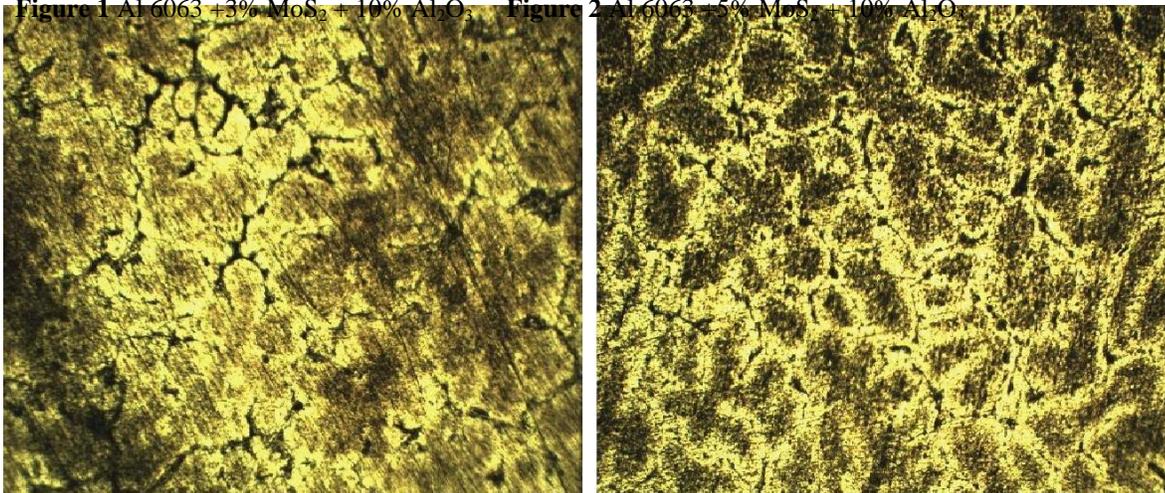
## 3. RESULTS AND DISCUSSIONS

### 3.1 Microstructures

Optical microstructure of the composite material is shown in the figure. Figure 1 explains that microstructures are not fully refined due to the lack of poor mixing. But the same part also shows that composites of Molybdenum disulphide (MoS<sub>2</sub>) are good. Figure 2 explain that grain size is crystal clear and refine the microstructure from previous one. It also shows some voids or pores in the Metal Matrix Composite (MMCs). Figure 3 & 4 gives the clear information regarding the voids or holes in the Metal Matrix Composite due to increase in reinforcement upto 7 & 9 weight percentage Molybdenum disulphide (MoS<sub>2</sub>).



**Figure 1** Al 6063 +3% MoS<sub>2</sub> + 10% Al<sub>2</sub>O<sub>3</sub>    **Figure 2** Al 6063 +5% MoS<sub>2</sub> + 10% Al<sub>2</sub>O<sub>3</sub>



**Figure 3** Al 6063 +7% MoS<sub>2</sub> + 10% Al<sub>2</sub>O<sub>3</sub>    **Figure 4** Al 6063 +9% MoS<sub>2</sub> + 10% Al<sub>2</sub>O<sub>3</sub>

### 3.2 Mechanical Properties

The mechanical properties of the composites (density, hardness and tensile strength), given in Table 2. Shows the average properties of various test specimens at different composition.

The density of Molybdenum disulfide (MoS<sub>2</sub>) is higher than that of the aluminium alloy and hence an increase in the Molybdenum disulfide (MoS<sub>2</sub>) content will raise the density of the composite. The densities of increase in Molybdenum disulfide from 3% to 9% were marginally higher than the density of the aluminium alloy by 1 % and 2 % respectively.

The tensile strength decreases considerably due to the additions Molybdenum disulfide (MoS<sub>2</sub>) from 3% to 9% by mass. The observed decrease in UTS may be due to various mechanisms like the particle pull-out and crack propagation, which are initiated by the presence of MoS<sub>2</sub>.

The hardness increases considerably due to the additions Molybdenum disulfide (MoS<sub>2</sub>) from 3% to 9% by mass. This is due to an increase in the proportion of the hard particulates in the composites, which increases the composites resistance to indentation in comparison to the monolithic alloy.

## 4. CONCLUSIONS

In this research work, Al 6063/ MoS<sub>2</sub>/ Al<sub>2</sub>O<sub>3</sub> composites are fabricated using the stir-casting technique and the mechanical behaviour of the metal matrix composites were studied. The following important observations can be noted:

4.3 Vickers hardness of Al 6063 with molybdenum disulphide (MoS<sub>2</sub>), Alumina (Al<sub>2</sub>O<sub>3</sub>) and Magnesium Metal Matrix Composites (MMCs) are increases when increasing the weight percentage of Molybdenum disulphide.

- f. Density of Al 6063 with molybdenum disulphide ( $\text{MoS}_2$ ), Alumina ( $\text{Al}_2\text{O}_3$ ) and Magnesium Metal Matrix Composites (MMCs) are increases when increasing the weight percentage of Molybdenum disulphide.
- g. Ultimate tensile strength of Al 6063 with molybdenum disulphide ( $\text{MoS}_2$ ), Alumina ( $\text{Al}_2\text{O}_3$ ) and Magnesium Metal Matrix Composites (MMCs) are decreases when increasing the weight percentage of Molybdenum disulphide.

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# The Effect of Resistance Training Program on the selected Physical Fitness Variables of female Basketball players

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**Abstract-** The purpose of the present study was to find out the effect of nine weeks resistance training program on selected physical fitness variables of Basketball players. For this purpose twenty female basketball players from Delhi University were selected to act as subjects for the study, the age of the subjects ranged from 17 to 21 years. The minimum level of participation was Inter-University. The subjects were further divided into two groups i.e. Control and Experimental group, group-I underwent resistance training and group-II acted as control and continued with their regular physical activity. The training period for the study was three days in a week for nine weeks. Pre data of both the groups were taken prior to the training period; the subjects were tested for speed, back strength and abdominal strength. The dependent's test and analysis of covariance was applied as statistical tool. In all cases 0.05 level was fixed as significance. It was concluded from the results of the study that training groups had improved on back strength, and had no significant improvement on the speed and abdominal strength.

**Index Terms-** Resistance Training, Physical Fitness

## I. INTRODUCTION

Training is not recent discovery in ancient times, people systematically trained for military and Olympic endeavours. Today athletes prepare themselves for a goal through training physical training endeavours. The objectives of physical training are to increase the athlete's physiological potential and to develop bio-motor abilities to the highest standards. A program of resistance training develops strength. The basis of all gains in any type of fitness endeavour is the over load principle, which means providing a greater stress or load on the body. For the greatest gain muscular strength and power, the level of resistance should be at or near maximal as the competitive season nears. Prior to this, training should approach maximal resistance in a gradual progressive, organized manner. Resistance, strength and weight training all have become popular form of recreation as well as method of condition athletes. The term strength, which requires the body's musculatures to move against some type of opposing force presented by various types of equipment. We use the term resistance training in order to encompass a wide range of training modalities rather than weight training, which really refers to a performance characteristic mesal function and will be defined as the maximal force a muscle or muscle group can generate at a specified velocity. Resistance training is fast becoming in most popular exercise in the world today. Moderate intensity resistance training has been shown in order to confer health bene-

fits such as favourite changes in body composition and blood lipids related to heart disease. Moderate such resistance training may also help to prevent and treat some type of lower back pain and other conditions such as arthritis and osteoporosis.

A more accurate definition of speed is this: speed is the ability to as fast as possible, through the optimal range of motion, in a deliberate and intentional manner, in particular deflection. Speed is not just measured on how act a person is either; there are several components of measurement that give a complete picture of a player's speed. The benefits of abdominal strength and endurance are similar to strength and endurance in other skeletal muscles. Greater abdominal strength increases the amount of force that your abdominal contraction can generate against resistance. Flexing your abs repetitively or sustaining abdominal contractions for longer periods of time required greater abdominal endurance. The unique benefits of abdominal strength and endurance derive from the function of this muscle group. Leg strength is possibly the most neglected and undervalued component of physical fitness. Lack of leg strength can be a cause of poor performance and inefficient technique can be a possible underlying cause for many of the strain and tear type muscle injuries found in sports.

## II. OBJECTIVES OF THE STUDY

- To find out the effect of Resistance training on the back strength of University level female basketball players.
- To find out the effect of Resistance training on the abdominal strength of University level female basketball players.
- To find out the effect of Resistance training on the speed of University level female basketball players.

## III. HYPOTHESIS OF THE STUDY

- There would be a significant of the effect of Resistance training on the back strength of University level female basketball players.
- There would be a significant of the effect of Resistance training on the abdominal strength of University level female basketball players.
- There would be a significant of the effect of Resistance training on the speed of University level female basketball players.

IV. PROCEDURE AND METHODOLOGY

By applying random sampling 20 female basketball players, with minimum Inter-University level participation were selected from Delhi University to act as subjects for the study. The groups were divided into two groups i.e. control and experimental, the experimental group underwent nine weeks physical fitness training program and the control group continued with their regular physical activity. The physical fitness variables selected for the study were speed, back strength and abdominal strength. The data was collected for both the groups before the nine week training program and then after the training program. The collected data was analyzed by computing Descriptive analysis followed by Paired 't' test

|                | Experimental Group | Control Group |
|----------------|--------------------|---------------|
| Pre Test Mean  | 23.10              | 21.30         |
| Post Test Mean | 27.10              | 22.45         |
| 't'            | <b>3.30*</b>       | 0.47          |

\*Significant at 0.05 level

Table No.1 depicts the values for Paired Sample 't' test for the pre and post test values of Back Strength for Experimental and Control group, which shows that the pre test mean for experimental and control group is found to be 23.10 and 21.30, whereas the post test mean of the experimental and the control group is found to be 27.10 and 22.45 respectively. Further the table shows that a significant difference is found in the pre and post values of the experimental group as the value is found to be 3.30, which is significant at 0.05 level and no significant difference is found in the values of the control group. The graphical representation has been shown in fig no. 1

V. RESULTS AND DISCUSSION

The appropriate statistical techniques were employed; the results have been presented in the following tables:

Table No. 1: Paired Sample 't' test for the pre and post test values of Back Strength for Experimental and Control group

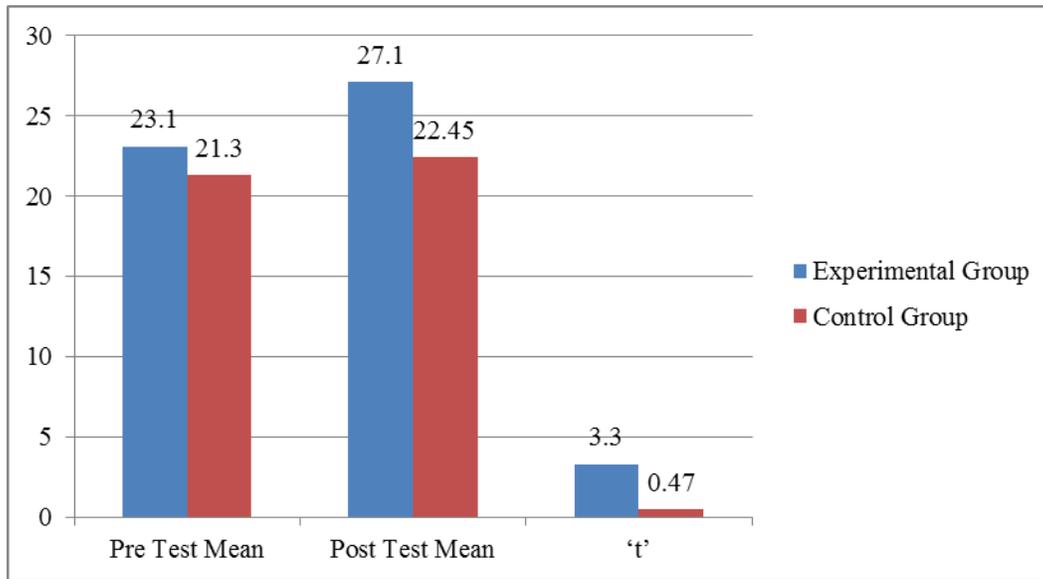


Fig No.1: Graphical representation of Paired Sample 't' test for the pre and post test values of Back Strength for Experimental and Control group

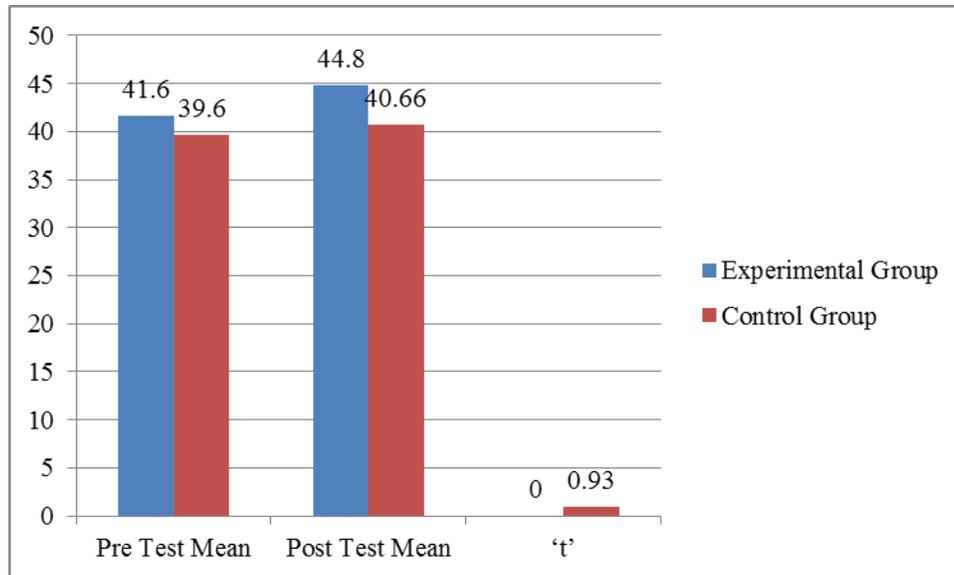
Table No.2: Paired Sample 't' test for the pre and post test values of Abdominal Strength for Experimental and Control group

|                | Experimental Group | Control Group |
|----------------|--------------------|---------------|
| Pre Test Mean  | 41.60              | 39.60         |
| Post Test Mean | 44.80              | 40.66         |
| 't'            | <b>4.02*</b>       | 0.93          |

\*Significant at 0.05 level

Table No.2 depicts the values for Paired Sample 't' test for the pre and post test values of Abdominal Strength for Experimental and Control group, which shows that the pre test mean for experimental and control group is found to be 41.60 and 39.60, whereas the post test mean of the experimental and the control

group is found to be 44.80 and 40.66 respectively. Further the table shows that a significant difference is found in the pre and post values of the experimental group as the value is found to be 4.02, which is significant at 0.05 level and no significant difference is found in the values of the control group. The graphical representation has been shown in fig no. 2



**Fig No.2: Graphical representation of Paired Sample 't' test for the pre and post test values of Abdominal Strength for Experimental and Control group**

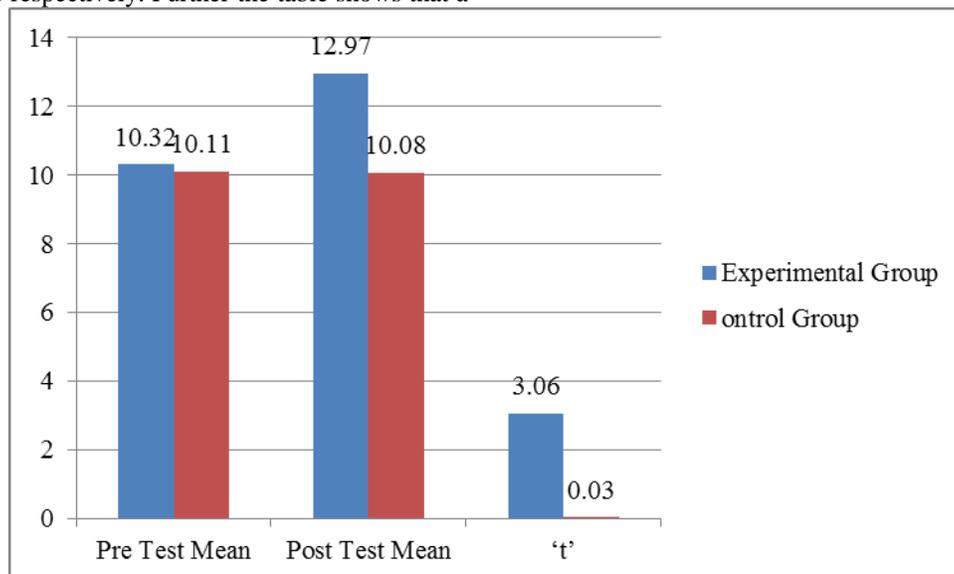
**Table No. 3: Paired Sample 't' test for the pre and post test values of Speed for Experimental and Control group**

|                | Experimental Group | Control Group |
|----------------|--------------------|---------------|
| Pre Test Mean  | 10.32              | 10.11         |
| Post Test Mean | 12.97              | 10.08         |
| 't'            | <b>3.06*</b>       | 0.03          |

**\*Significant at 0.05 level**

Table No. 3 depicts the values for Paired Sample 't' test for the pre and post test values of Speed for Experimental and Control group, which shows that the pre test mean for experimental and control group is found to be 10.32 and 10.11, whereas the post test mean of the experimental and the control group is found to be 12.97 and 10.08 respectively. Further the table shows that a

significant difference is found in the pre and post values of the experimental group as the value is found to be 3.06, which is significant at 0.05 level and no significant difference is found in the values of the control group. The graphical representation has been shown in fig no. 3



**Fig No.3: Graphical representation of Paired Sample‘t’ test for the pre and post test values of Speed for Experimental and Control group**

VI. CONCLUSIONS

- It may be concluded that resistance training has a significant effect on the abdominal Strength of the female basketball players.
- Resistance training has a significant effect on the Back Strength of the female basketball players.
- It was found that speed of a female basketball player is improved by resistance training program.
- Resistance training is an effective method for improvement in the physical fitness of female Basketball players

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# Polymer producing bacteria showing siderophore activity with chrome azurol S (CAS) agar plate assay

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**Abstract-** Biological waste water are characterized by the exposure of microorganism to transient conditions, where biomass is submitted to alternating periods of high and low substrate concentration and aerobic and anaerobic environments which make some microorganisms respond the production of polymers and various biochemical agents. Bacteria utilize siderophores to help the process of ferric iron uptake in environment. This process can be found across three domains and is necessary for microorganisms to obtain iron needed for essential process. The present investigations were undertaken to check the siderophore producing activity of bacteria which produces polymer. A total of 640 bacteria were isolated from waste water pond. Among them 198 bacterial strains showing polymer production were isolated. Out of which 12 potential strains were selected and investigated for siderophore activity. The result showed that out of 12 bacteria some of them showed siderophore activity.

**Index Terms-** Bacteria; polymer; Siderophore

## I. INTRODUCTION

Iron is most essential microelements for virtually all living cells and is usually abundant in the environment, particularly in soils and natural aquifers. However, its bioavailability is relatively low and with a dramatically decreased solubility of ferric species under physiological pH values owing to their complete hydrolysis. This results in the development of special biological regulated mechanism of Fe (III) solubilization e.g., involving specific natural low-molecular weight chelating agents such as siderophore, which transport Fe (III) to the cell surface in the form of a complex with further Fe (III) release from the latter in the course of its reductive assimilation (Kamnev et al., 2000). Many microorganisms possess high affinity iron uptake system mediated by the action of low molecular weight iron chelators termed as siderophores (Lankford, 1973; Neilands 1981). Bacteria utilize siderophores to help the process of ferric iron uptake present in environment. This process is found in all three domains and is necessary for many microorganisms to obtain the environmental iron needed for various processes.

Dissolution of Fe minerals liberate two soluble forms of iron these are Fe<sup>2+</sup> and Fe<sup>3+</sup>, which can be used by microorganism and plants. Dissolution occurs depending upon water redox potential and pH. Under aerobic conditions at a neutral to alkaline pH, iron is present in the form of Fe(III) mineral, Fe(OH)<sub>3</sub>, which is essentially insoluble. (Lindsay and Schwab 1982). Under these

conditions, organisms that depend on the soil and water as their sole source of mineral nutrients are susceptible to Fe deficiency. Siderophores are classified by ligands used to chelate ferric iron. These include catecholates, hydroxamates, and carboxylates (6). Various assays have been developed to detect different phenotypes of siderophores (2–4). These assays are useful for the identification of various siderophores, numerous assays would have to be performed to detect all possible forms of siderophores. Schwyn and Neiland (8) developed a universal siderophore assay using chrome azurol S (CAS) and hexadecyltrimethylammonium bromide (HDTMA) as indicators. Chrome azurol S (CAS) agar effectively differentiated bacteria that are capable of excreting large amounts of siderophore. In the current investigation, we focused on performing siderophore activity for the all 12 isolates which were isolated based on polymer character.

## II. MATERIALS AND METHODS

### Sampling

The present investigation was undertaken with an objective to select a promising native polymer producing strains. The samples were collected at four different sites of polluted pond and screened for potential PHA accumulators. The collection of samples and survey for PHA accumulating bacteria was done for two consecutive years. The screening was done regularly on monthly intervals to determine the variation in bacterial flora and the PHA accumulators simultaneously.

### Isolation, screening and maintenance of bacteria

The water samples 1 ml, were measured and mixed vigorously for 10 min. Samples were serially diluted ten folds before plating. A 0.1 ml sample of each dilution was surface spread on sterile Luria Bertani agar medium. After incubation of 48 h at room temperature, the colony forming units (CFU) were counted to check the total viable count. After the initial sampling, the incubated plates were used to estimate CFU/ml sample. The colonies formed on these plates were also checked for pigment production. These pigments have much value due to their natural origin and industrial use.

All isolates accumulating PHA were maintained on Luria Bertani agar slopes as working cultures. Culture stocks were also maintained on Luria Bertani agar slopes, by sealing the tubes with paraffin wax. Preservation of cultures at 4°C was achieved by growing the isolates in 0.5 ml half strength Luria Bertani broth in sterile capped vials. Glycerol was sterilized and 0.5 ml

was added to the grown culture as a cryoprotectant and the vials were preserved at 4°C.

### Morphological characterization and microscopic observation

The selected bacterial isolates were examined for their morphological features. The morphological characteristics were examined on their respective agar plates. The pure cultures from the slants were placed on the agar plates. After the growth of colonies morphological characters of the colonies like the colour, shape, size, surface, pigment production and gram staining etc. were recorded. All the 196 bacterial isolates were screened for their biochemical and enzymatic activities. Out of which 12 prominent PHA producers are accumulated.

### Preparation of glassware

All the glassware used was cleaned with 3mol/L HCl to remove iron and rinsed in deionized water without exception (Cabaj and Kosakowska, 2007).

### Preparation of chrome (CAS)

The procedure given for making CAS agar by Schwyn and Neiland's original paper was followed:

CAS agar plates were prepared by mixing a dye made of CAS, Fe, and hexadecyl-trimethyl-ammonium bromide (HDTMA) with M9-based growth media. For 1 L of CAS-agar, 100 mL of CAS-Fe-HDTMA dye was mixed with 900 mL of freshly prepared growth media. The CAS-Fe-HDTMA dye was prepared in advance as follows, for 1L: 10 mL of a 10 mM ferric chloride (FeCl<sub>3</sub>) in 100 mM hydrochloric acid (HCl) solution was mixed with 590 mL of a 1-mM aqueous solution of CAS. The Fe-CAS solution was then added to 400 mL of a 2-mM aqueous solution of HDTMA. The resulting CAS-Fe-HDTMA solution was autoclaved for 25 min in a polycarbonate bottle that had previously been soaked overnight in 10% (vol/vol) HCl then rinsed five times with MilliQ water. The CAS-Fe-HDTMA dye was stored at room temperature covered from light until use.

**The growth media was prepared as follows, for 1L of CAS-agar:** 30.24 g of 1,4-piperazine-diethanesulfonic acid (Pipes), together with 1 g of ammonium chloride (NH<sub>4</sub>Cl), 3 g potassium phosphate (KH<sub>2</sub>PO<sub>4</sub>), and 20 g sodium chloride (NaCl) was dissolved into MilliQ water by adjusting the pH with 10 M NaOH to 6.8. As a solidifying agent, 9 g of agar noble (Difco) were added to the solution. We found that the more commonly used solidifying agents, agarose, and agar also led to a discoloration of the CAS dye, likely owing to higher phosphate content. The volume was adjusted to 860 mL, and the solution was autoclaved. After cooling, 30 mL of a sterile 10% (wt/vol) Casamino acids (Difco) aqueous solution and 10 mL of a sterile 20% (wt/vol) glucose aqueous solutions were added. Finally, the 100 mL of CAS-Fe- HDTMA were added to the growth media. The final concentrations of the CAS-agar components are as follows: 100 mM pipes, 18mm NH<sub>4</sub>Cl, 22mm KH<sub>2</sub>PO<sub>4</sub>, 2% (wt/vol) glucose, 10mm FeCl<sub>3</sub>, 58mm CAS, 80mm HDTMA.

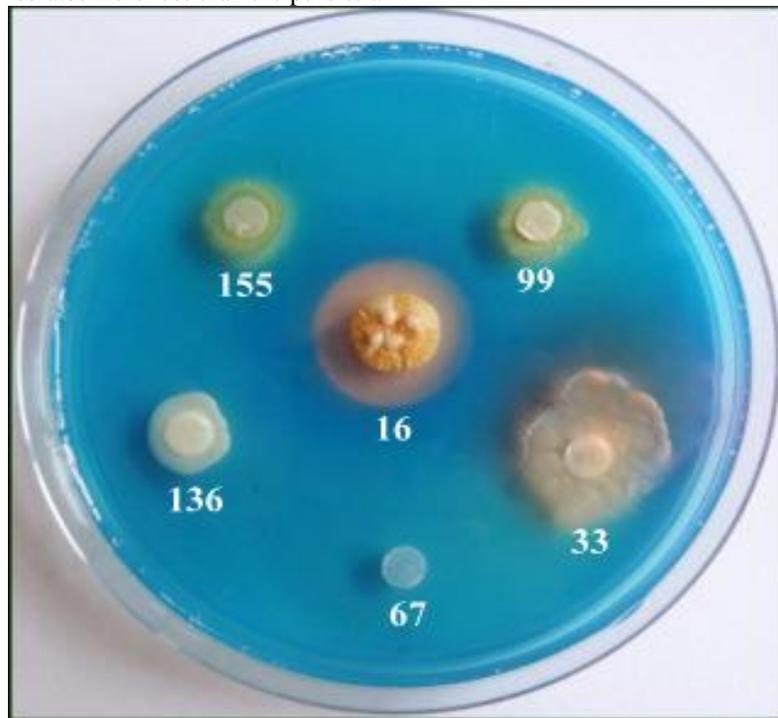
Conventional paper-disc agar diffusion assays were used for investigating. Sterilized filter paper discs, 10 mm in diameter, were placed on overnight agar plate in sterile conditions. A 10 µL supernatant achieved by centrifuging of fermentation broth of

strain QM3 at 11,000 g for 15 min was diffused onto a paper disc. The uninoculated plates of CAS-agar as control were incubated under the same conditions as described previously. All these experiments were made at least three times with three replicates for each one. The CAS reaction was determined by measuring the position or distance of the advancing color-change front (in centimeter) in the CAS-blue agar, starting from the center of the paper-disc after incubation times. The clone diameter (CD) of strain QM3 (growth reaction) and orange halo diameter (HD) (CAS reaction) .

### III. RESULTS AND DISCUSSION

Twelve isolates were selected to check the siderophore activity, the strains were grown in LB media. These isolates were then sub-cultured for isolation in pure culture form and CAS assay was performed using these different strains.

When the strains were incubated on CAS agar plates the following three responses were observed: no growth, growth but no halos surrounding colonies, and growth and small to large orange halos surrounding the colonies illustrated in figure-1. Results were visually distinct in terms of halo formation, because there was a contrast of orange halos against the blue medium. Very few polymer bacteria showed siderophore activity, consequently in the presence of HDTMA, CAS is competitive in chelating the metal below neutral pH, while ferric hydroxide seems to have a higher stability at pH values above 7. When orange halos from isolates were compared with pure strain of *Rhizobium meliloti* it was found that the diameter of orange halos from all isolates were less than the pure strain.



**Figure 1: Isolates showing siderophore activity by producing orange colour.**

Since the assay is based on the competitive exchange of iron (III), potential chelators are detectable corresponding to their affinity for the metal i.e., strong chelators like siderophores react in a 1: 1 ratio, while weaker ones need to be present in an excess. Hence, it is conceivable that, at least at higher concentrations, transition metal binding metabolites, especially antitumor antibiotics such as bleomycin, Adriamycin, and streptonigrin could also be detected.

However, it is difficult to grow fastidious microorganisms on the CAS agar plate and some ingredients of the CAS agar have innate antibacterial activity. The detergent HDTMA used in the preparation of CAS medium proved to be toxic to some bacteria as indicated by small halo formation in case of mixed rhizobial culture.

#### IV. CONCLUSION

In conclusion, the CAS assay on solid medium can be a useful tool for screening siderophore producer microorganisms. Although very little polymer bacteria showed siderophore production. It is simpler and cheaper but can offset the effect of inoculation on siderophore by using paper-disc diffusion. We have shown that the choice of substrate is crucial for the evaluation of siderophore production of microorganisms. Particularly, strain QM3, a potential use in biocontrol, is evaluated to improve of siderophore production.

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# Detection of Water-logging Areas Based on Passive Remote Sensing Data in Jessore District of Khulna Division, Bangladesh

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**Abstract-** Water-logging is one of the major environmental problems and challenges of socio-economic development in the south-western part of Bangladesh. In this research paper, Jessore district of Khulna division was selected as the study area to detect water-logging and damaged agriculture lands. To carry out this detection, Landsat imageries from 1972, 1989 and 2014 were used. A post classification comparison of change detection was followed to calculate transformation of water and agriculture in the study area. About 32830 hectare lands were extracted as waterlogged areas, which is 13% of the total land. Moreover, agriculture has been decreased while water bodies have upward trend. In this analysis, a multi-regression analysis was performed using *Upazila* wise waterlogged as independent variable and *Upazila* wise damaged agriculture lands as dependent variable. This result shows a strong correlation between waterlogged and damaged areas, which was 93% at 95% confidence level with *P* value < 0.5. The overall accuracy assessment for water and agriculture were 92%, 91% and 95% in 1972, 1989 and 2014 respectively

**Index Terms-** Agriculture, Bangladesh, Change Detection, Jessore, Landsat, Water-logging.

## I. INTRODUCTION

The south-western coastal zone area of Bangladesh has been facing drastic water-logging problems. The part of the district Jessore is located in this zone and has been affected as well. Some *upazilas* of this district are directly affected with regular water-logging and drainage congestion problems due to vulnerable climate, over silted up riverbed and low capacity of drainage systems.<sup>[1]</sup> The entire district sways badly water-logging during all seasons. Around 2% to 20% people of Jessore district were found affected water-logging problem.<sup>[1]</sup> People of that region suffer a lot and get affected by various water borne diseases. The healthy sanitary systems totally collapse during water-logging period. Social environment, local economy, and ecology has been hampered and degraded due to prolonged water-logging. In addition to these problems, damages of agriculture crops has been shown to be a major disaster due to water logging. In the study paper, temporal remote sensing of Landsat imageries of 1972, 1989 and 2014 were used to detect water-logged areas in order to calculate damaged agricultural crops in the study area.

According to WARPO (2005), the nearby river bed and sediment system was interrupted which causes intensifying the Water-logging situation.<sup>[2]</sup> Climate change vulnerabilities also effects directly or indirectly to drainage congestion by storm surge.<sup>[3]</sup> A research work using satellite image analysis reveals that the water-logging problem is increasing gradually in this region.<sup>[4]</sup>

Paul et al., (2000) used Landsat 5 TM imageries to detect open water bodies and floodplain of the Murrumbidgee River near the city of Wagga Wagga, Australia<sup>[5]</sup>. They found that optical Landsat is very useful for detecting water bodies and floodplain in their study. NDVI and NDWI have important application to identify water-logged areas. Sahu (2014) used integrated GIS and remote sensing in order to detect water-logging areas in the part of Purba Medinipur district of Keleghai river basin, India. Finally, he used a statistical analysis that shown a strong correlation of water-logged areas and canal density.<sup>[6]</sup>

## II. OBJECTIVE OF THE STUDY AND STUDY AREA

The main objective of this study is to detect water-logged areas in Jessore district using temporal Landsat imageries. The specific objectives are as follows:

- 1) To assess water bodies and agriculture using multi-temporal data sets.
- 2) To assess agriculture damaged areas.

The study area is located in the south-western part of Bangladesh. The entire Jessore district lies between latitude N 22° 50' to N 23° 20' and longitude E 88° 50' to E 89° 30' (Figure 1). The whole area covers about 2606.94 square km with total population approximately 2764547.<sup>[7]</sup> The study area consists of 4 municipalities and 8 *upazilas*; Jessore Sadar, Abhaynagar, Bagherpara, Chaugachha,

Keshabpur, Jhikargachha, Manirampur and Sharsha. The major rivers are Chitra, Bhairab, Kobadak, Betna and Mukteshwari. The whole region's land surface is characterized by Ganges-tidal floodplain. Most of the areas are nearly flat and poorly drained. The average maximum temperature is 34°C which sometimes crosses over 40°C during summer. The average minimum temperature is 15°C. April is the hottest while January is the coldest month. The average rainfall is about 198 mm. June to October month covers about 80% of total precipitation.<sup>[8]</sup>

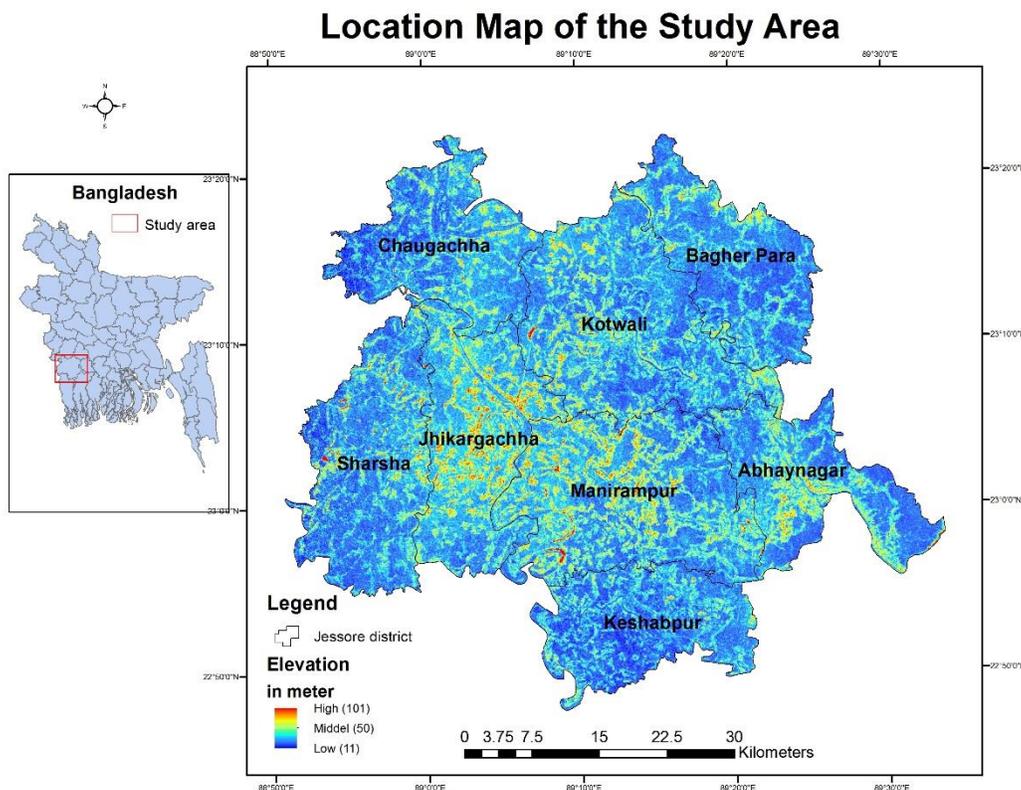


Figure 1 Location map of the study area on elevation data.

### III. DATA MATERIALS AND METHODOLOGY

In this study, temporal Landsat imageries from 1972, 1989 and 2014 were used. Mainly four channels e.g. NIR, Red, Blue, and Green were opted for extracting spectral information for water-logged and agriculture from the study area. The main characteristics of the remotely sensed imageries are given in Table 1.

These passive Landsat data were collected and downloaded from the GLCF's (Global Land Cover Facility) as free of cost. An *Upazila* vector polygon map of the study area was collected from Bangladesh Local Government and Engineering Department (LGED) to mask out the study area from the whole scene of Landsat imageries. Finally, the vector shape file was used in zonal tool to extract *Upazila* wise water-logged and damaged agricultural areas.

Table 3 Metadata of remote sensing

| Landsat  | Row/Path | Date of accusation | Resolution (Meter) | Projection |
|----------|----------|--------------------|--------------------|------------|
| MSS      | 044/148  | 1972-12-11         | 60                 | UTM/WGS 84 |
| TM       | 044/138  | 1989-11-11         | 30                 | UTM/WGS 84 |
| OLI_TIRS | 044/138  | 2014-02-05         | 30                 | UTM/WGS 84 |

The overall methodological framework for the study is presented in Figure 2. These three sets of passive Landsat imageries from 1972, 1989 and 2014 were used for detecting water-logged and agriculture areas using Normalized Difference Vegetation Index (NDVI) and Normalized Difference Water Index (NDWI) respectively.

**A. NDVI for Vegetation**

NDVI is a widely used vegetation index for delineating vigor vegetation using near infrared (NIR) and RED band. NDVI is a non-linear function which ranges between -1 to +1 where water, rocks, and bare soils are indicated by values in -1 range and the vigor of vegetation is indicated by values near to +1.<sup>[9]</sup> The following equation (i) is used to calculate vegetation in the study:

$$[NDVI = (NIR - RED) / (NIR + RED)] \dots \dots \dots (i)$$

To identify agricultural lands, values between +0.6 to +0.8, +0.6 to +0.7, and +0.5 to +0.8 were extracted from the resultant NDVI images of 1972, 1989 and 2014 respectively.

**B. NDWI for Surface Water**

The NDWI can be identified water logged areas using green and NIR channel. The NDWI has been developed to achieve the goal.<sup>[10]</sup> Similar to NDVI, it produces -1 to +1 values. However, most of the water bodies are found in near to +1 value. The main equation (ii) of this index is below:

$$[NDWI = (GREEN - NIR) / (GREEN + NIR)] \dots \dots \dots (ii)$$

In this study, NDWI values between +0.5 to +0.9, +0.6 to +0.8, and +0.4 to +0.9 were classified as water logged areas from 1972, 1989 and 2014 imageries.

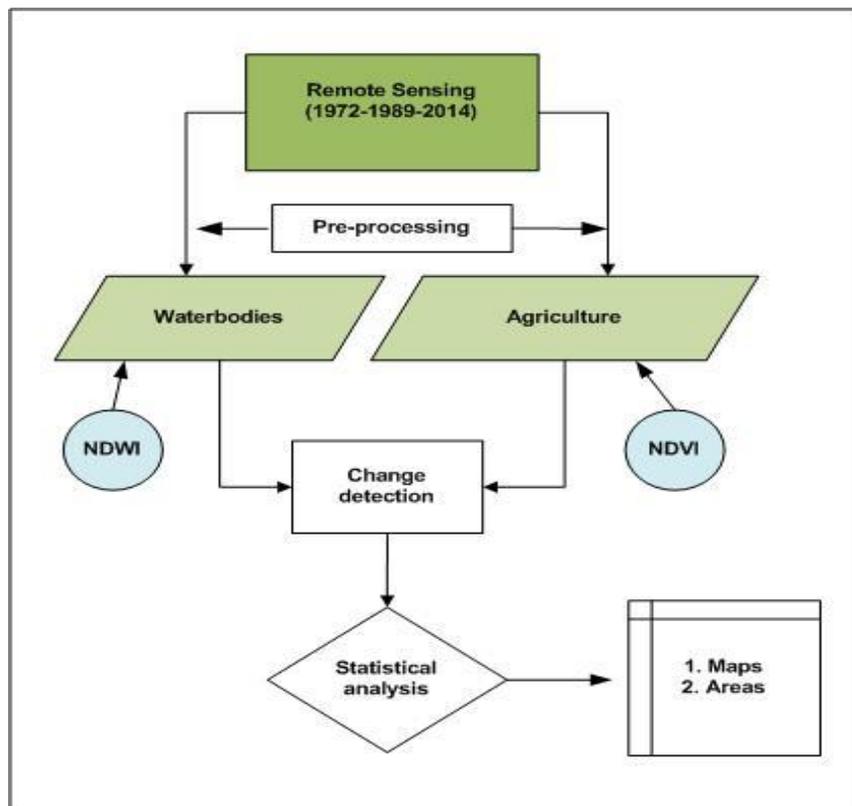


Figure 2 The main methodology followed to carry out this study

**C. Accuracy Assessment**

Accuracy assessment is an important part for classifying remote sensing data. In this study paper, an accuracy assessment/error matrix was used to compare reference data and classified images. The error matrix compares the relationship between known reference data (ground truth) and the corresponding results of an automated classification.<sup>[11][12]</sup>

**D. Change Detection Analysis**

Change detection is the process of identifying differences in the state of an object or phenomenon by observing it at different times.<sup>[9][13]</sup> In this paper, post-classification comparison method of change detection was used to find out conversion of water and agriculture areas. Post classification comparison change detection is widely used and easy to understand.<sup>[9][14]</sup>

IV. RESULTS AND DISCUSSION

From this analysis, it is found that there is an apparent declined tendency of agricultural lands from 1972 to 2014. Agriculture lands have decreased by 50% and 25% in 1989 and 2014 respectively from the 1972 in the study (Figure 3). The main reasons for this downward percentage are mainly development and anthropogenic interventions. Moreover, population pressure, natural disaster, salinity, urbanization are exposed as the key driving forces in order to lead this situation. On the other hand, water bodies have gradually increased from 1972 to 1989 and 2014 (Figure 3).

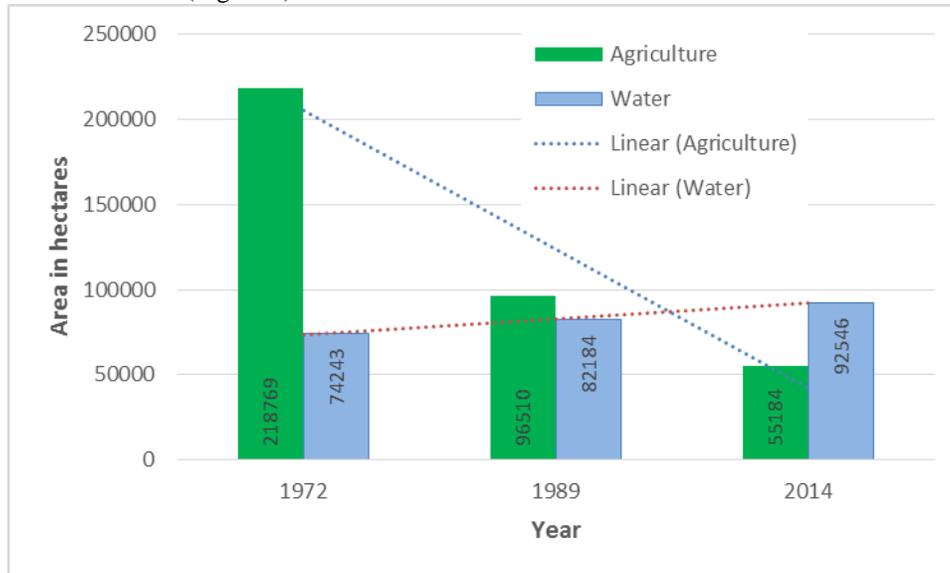


Figure 3 Decrease and increase tendency of agriculture and water areas in 1972, 1989 and 2014.

Post classification comparison of change detection method was used to produce a detailed changes information of water and agriculture from 1972, 1989 and 2014 classified images (Table 2 and Figure 4). In this stage, the 1972 classified image was overlaid with the classified images of 1989 and 2014 in order to get the changes of water and agriculture. Likewise, resultant map of 1989 was overlaid with the 2014 image. Table 2 reveals that water and agriculture have decreased by -35% and -30% from 1989 to 2014. On the other hand, water and agriculture have increased tendency from 1972 to 2014.

Table 4 Change detection tabulation of water and agriculture

| Feature     | Temporal Data ( hectares) |            |           |            |           |            |
|-------------|---------------------------|------------|-----------|------------|-----------|------------|
|             | 1972-1989                 |            | 1989-2014 |            | 1972-2014 |            |
|             |                           | Change (%) |           | Change (%) |           | Change (%) |
| Water       | 47700                     | 122%       | 30800     | -35%       | 16800     | 43%        |
| Agriculture | 46000                     | 62%        | 36100     | -30%       | 9900      | 13%        |

For detecting water-logged areas using these three classified images, a union operation was used in raster calculator in ArcGIS platform. It means all common and seasonal water bodies in these three classified images were leveled as permanent water-logged areas (Figure 5). Due to this reason, all Landsat imageries were collected from the winter season of Bangladesh. In this study, about 32830 hectare lands were extracted as water-logged areas, which is 13% of the total land.

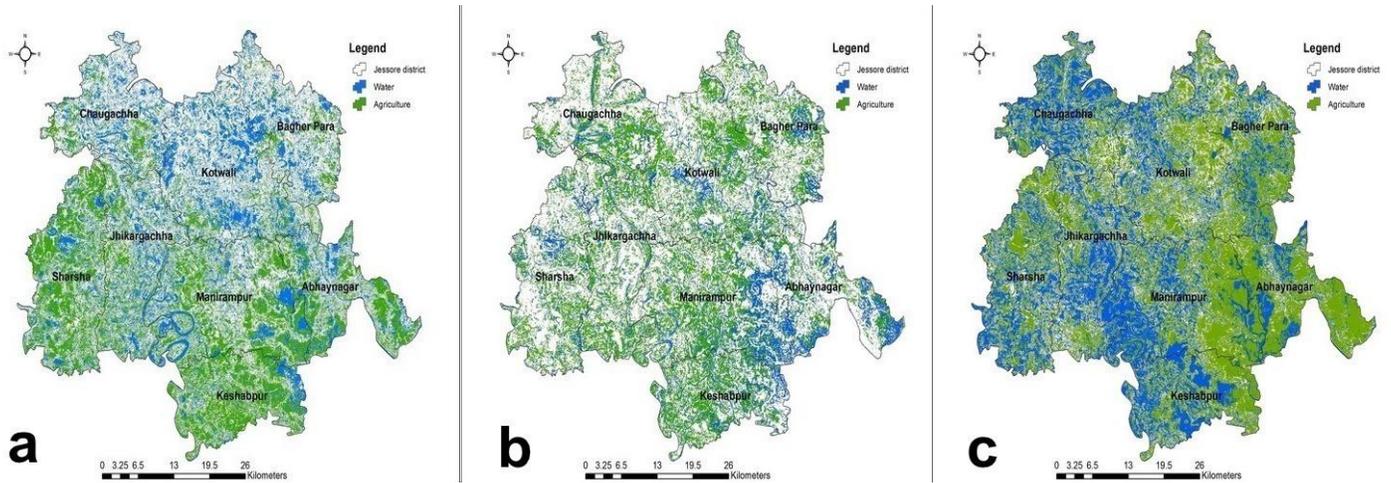


Figure 4: Spatial distribution of water and agriculture in 1972 (a), 1989 (b) and 2014 (c)

In order to delve how many areas were damaged, identified water-logged areas were multiplied with the classified agriculture maps of 1972, 1989 and 2014. Finally, the *Upazila* vector map used for deriving spatial distribution of agriculture damaged areas using zonal statistics. Figure 3 indicates that, a clear increased tendency of agriculture damage due to water-logging from 1972 to 2014. Most of the vulnerable *Upazilas* are in terms of damage; Monirampur, Jessor sadar, Keshabpur and Jhikargachha (Figure 6).

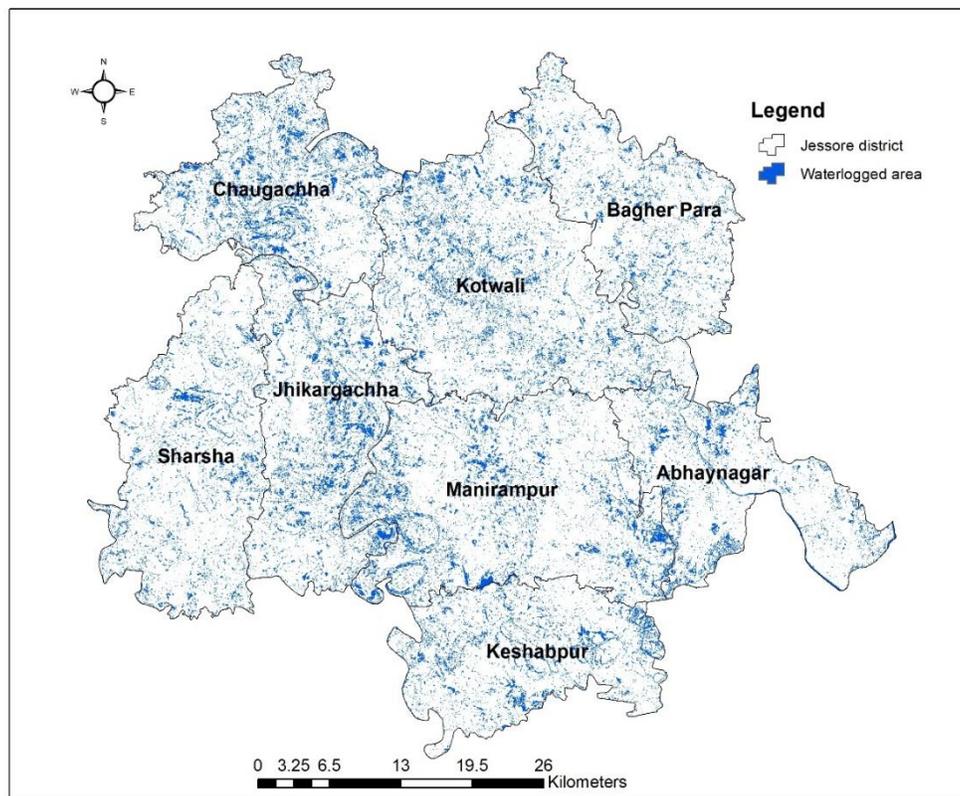


Figure 5 Identified water logged areas using multi-temporal Landsat imageries in Jessore district

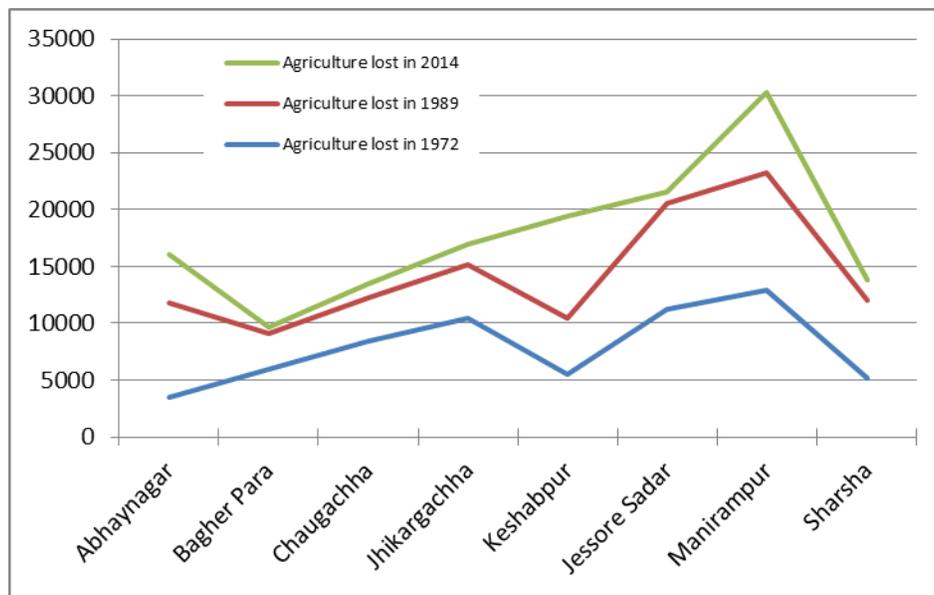


Figure 6 Agriculture damaged areas based on the analysis of 1972, 1989 and 2014 imageries

To identify relationship between water-logged and agriculture damaged areas, a multi-regression analysis was performed. In this analysis, water-logged areas of the eight *upazilas* added as independent variable while agriculture damaged areas of the same *upazilas* were used as dependent variable. Finally, this result (Table 3) shows a significant positive correlation (93%) at 95% confidence level with *P* value < 0.5. It indicates that, if there are more water-logging phenomena then agriculture damage will be higher. Water-logged areas have robust influence for leading damage of agriculture lands and crops which can be affected to local ecology, biodiversity and livelihoods.

Table 5 Regression of water logged areas and agriculture damaged areas in the study area.

| Regression Statistics |             |
|-----------------------|-------------|
| Multiple R            | 0.96562124  |
| R Square              | 0.932424379 |
| Adjusted R Square     | 0.881742664 |
| Standard Error        | 412.7821285 |
| Observation           | 8           |

About more than 1500 pixels were selected as reference data for both classified water and agriculture images. The overall accuracy assessment for water and agriculture were 92%, 91% and 95% in 1972, 1989 and 2014 respectively.

## V. CONCLUSION

Landsat imageries are shown to be a useful material to detect water-logged areas in this study. Using medium resolution (30 meter) passive data for extracting water and agriculture in rural and semi-rural area can be viable. Normalized difference vegetation index (NDVI) and normalized difference water index (NDWI) were also appropriate for generating lucid information for water and agriculture respectively. In this research, some other important environmental and socio-economic data have not used. Therefore, such kinds of data are recommended for further research on the field in the study area. In terms of environmental degradation and damage of agriculture crops, the government and development agencies should take into account as serious issue in the entire south-western part of Bangladesh.

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# Adsorptive Removal of Copper from Aqueous Solution by Using *Syzygium Cumini L*

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**Abstract-** Excess of copper in drinking water is significantly toxic to human being and ecological environments. Various treatment technologies for copper removal from industrial and municipal waste water effluents has been investigated in past. In the present study batch adsorption studies were carried out for adsorption of Cu by using natural cheap agro waste such as *Syzygium Cumini L* for removal of copper from aqueous solution. The effects of initial metal concentration, Dose, pH, contact time on the removal on Cu have been studied. Results indicate that contact time of 360 min is sufficient to achieve equilibrium at different concentrations. Determination of Cu was done using Atomic absorption spectrophotometer. The peak percentage adsorption of Cu was attained at pH 7.0. Adsorption parameters were determined using both Langmuir, Freundlich and Temkin isotherms, but the experimental data were better fitted to Langmuir equation than to Freundlich and Temkin equation.

**Index Terms-** — Adsorption, Adsorption Isotherms, AAS Batch study, Copper removal, *Syzygium Cumini L*.

## I. INTRODUCTION

Water supports all forms of life on earth. The availability of clean water to the human population is of paramount importance. As the world population increases, water consumption also increases. Water pollution is a major problem in the global context and has even been suggested to be the leading cause of death and disease worldwide. The major contributor for this rise in the concentration level is in the extensive development of heavy & manufacturing industries that use metals & related compounds. Therefore there is an urgent need that all possible sources of agro-based inexpensive adsorbents should be explored and their feasibility for the removal of heavy metals should be studied. Copper is a toxic metal. It causes a disease named Wilson's disease. It causes harmful biochemical effects, toxicity and hazards in flora, fauna and human beings. Intake of copper through air, water, and food beyond its permissible limits causes disease. Copper toxicity leads to serve mucosal irritation, corrosion, widespread capillary damage hepatic and renal damage, central nervous system irritation followed by depression. Over the last few decades, several methods have been devised for the treatment and removal of heavy metals. The commonly used procedures for removing metal ions from aqueous streams include chemical precipitation, Chemical reduction, Xanthate process, Cementation, Solvent Extraction, Electro deposition, Reverse osmosis, Electro dialysis, Ion exchange, Donna dialysis may require working with corrosive chemicals, increase the volume of waste sludge, used a trial and error approach, high cost of electrodes has inspired researchers to investigate effective treatment

process called Adsorption and to find suitable low cost adsorbents.. The objective of this study to evaluate the feasibility of using the *Syzygium Cumini L* seed powder for the removal of copper, optimize of the different operating parameters such as pH, adsorbent dose, contact time and initial copper concentration were studied, to find the equilibrium values, in order to get maximum efficiency study the comparison of Adsorption capacity of locally available adsorbent. Validate the results obtained, in terms of copper removal efficiency (percentage), using adsorption isotherms, viz. Langmuir, Freundlich, Temkin isotherm models.

## II. MATERIALS AND METHODOLOGY

### A. Preparation of adsorbent

*Syzygium Cumini L* is an evergreen tropical tree in the flowering plant family Myrtaceae, native to India and Indonesia. Seeds were locally collected from *Syzygium Cumini L* tree located in Nasik. Flesh of the fruit was removed. The seeds were separated from the *Syzygium Cumini L* fruits by eating and seed was washed with the distilled water. The seeds were dried in shade and stored at 25°C. The dried seed was ground and screened to uniform powder by using 150 microns sieve. Thus *Syzygium Cumini L* seed powder is stored in an air tight container for further usage.

### B. Reagents and equipment's

Prepare a series of standard metal solutions in the optimum concentration range by appropriate dilution of the following stock metal solutions with water containing 1.5ml conc. (HNO<sub>3</sub>)/l. Thoroughly, dry reagents before use. In general use reagents of the highest purity.

### Copper

Dissolve 1.00g copper metal in 15ml of 1+1 HNO<sub>3</sub> and dilute to 1000ml with water;

$$1.00\text{ml} = 1.000\text{mg Cu}$$

Air, cleaned and dried through a suitable filter to remove oil, water and other foreign substances, use metal free water for preparing all reagents and calibration standards and as dilution water. Acetylene standard commercial grade acetone.

### C. Batch Adsorption study

Batch experiments were carried out in 250mL glass jar with 250 mL test solution at room temperature (29±2°C). The jar, along with known volume of test solution of fixed concentration at neutral pH, was shaken in Jar test apparatus at 100 rpm to study the equilibration time for maximum adsorption of copper. The effect of pH on copper was studied by adjusting the pH of test

solution using 1N HCl or 1N NaOH on fixed quantity of adsorbent. At the end of the desired contact time, the samples were filtered using Whatman no. 42 filter paper and the filtrate was analyzed for residual copper concentration by Atomic Absorption spectrophotometer: Model No. AA-200, PERKIN described in the standard methods of examination of water and wastewater. The batch study was performed to determine the optimum condition and to study the effect of pH, adsorbent dose, contact time and initial copper concentration on the test solution.

**D. Data modeling**

The efficiency and copper adsorption capacity from the residual copper concentration was calculated by the following equations.

The percent removal efficiency of the copper was calculated as follow,

$$\% \text{ Removal} = \frac{C_i - C_e}{C_i} \times 100 \quad (1)$$

Where,  $C_i$  is the initial copper concentration (mg.L-1),  $C_e$  is the equilibrium concentration of copper solution (mg.L-1).

$$\text{Adsorption capacity (qe)} = \frac{(C_i - C_e) \cdot V}{m} \quad (2)$$

Where,  $C_i$  is the initial copper concentration (mg.L-1),  $C_e$  is the equilibrium concentration of copper solution (mg.L-1),  $V$  is the volume of solution used in the batch (lit.),  $m$  is mass of adsorbent (g),  $q_e$  is adsorption capacity (mg of copper removed/g of adsorbent).

**III. RESULTS AND FINDINGS**

**A. Effect of Adsorbent dose on percentage copper removal**

One of the parameters that strongly affect the adsorption process in an aqueous solution is the adsorbent dose. This is an important parameter, because it determines the capacity of an adsorbent for a given initial concentration of the adsorbate. More specifically, the increase rate of this parameter was high for higher adsorbent doses, due to the greater availability of active sites on the surface of the materials, and low for lower adsorbent doses, due to the progressive saturation of these active sites. However, the amount of Cu (II) adsorbed per adsorbent mass unit decreased considerably as the adsorbent dose increased. This can be attributed to adsorption sites remaining unsaturated during the adsorption reaction. In addition, it could also be noticed that the majority of the tested materials, steady state was reached for an adsorbent dose value 0.1g/l. Therefore, the optimum adsorbent dose of 0.1 g/L was selected in all the subsequent experiment.

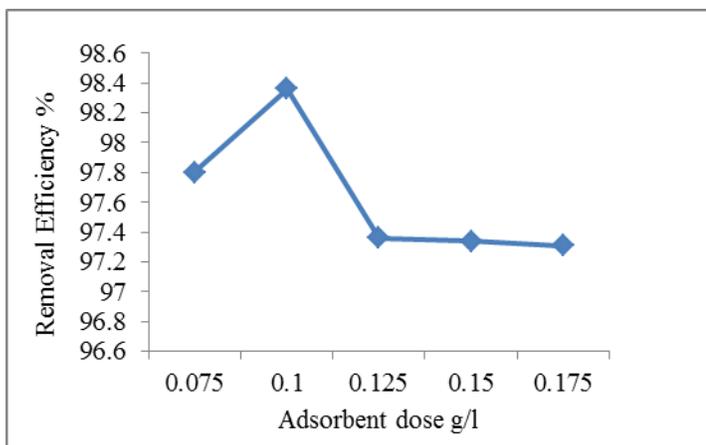


Figure 1: Graph for effect of Adsorbent dose on copper removal

**B. Effect of Initial metal concentration on percentage copper removal**

The mechanism of metal adsorption from an aqueous solution is particularly dependent on the initial metal concentration in the solution. According to the results increasing the initial Cu(II) concentration caused an increase in the amount of Cu(II) adsorbed per adsorbent mass unit. This was due to the increase in the driving force for mass transfer, which is the concentration gradient. In addition, a decrease in the Cu (II) removal could be noticed as the initial Cu(II) concentration in the solution increased, due to the saturation of the active sites in the solution (El-Ashtoukhy et al., 2008). These findings agree with previous studies (Aydin et al., 2008; El-Ashtoukhy et al., 2008; Zheng et al., 2008).

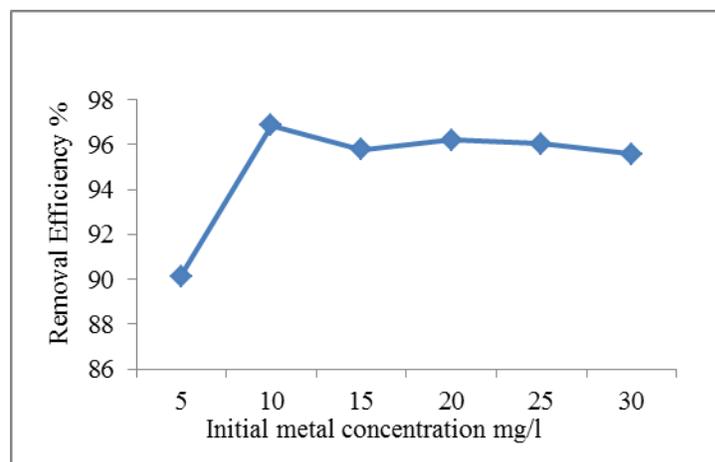


Figure 2: Graph for effect of Initial metal Concentration on copper removal

**C. Effect of pH on percentage copper removal**

The pH of an aqueous solution is one of the most important controlling parameters in the heavy metal adsorption process. It affects the surface charge of the adsorbent and the degree of ionization and speciation of the heavy metal in the solution. This study was carried out in a pH range 2-11 since copper starts to precipitate above pH 7. The optimum Cu (II) uptake of 97.16%, by Syzygium Cumini L respectively, was observed at pH 7.

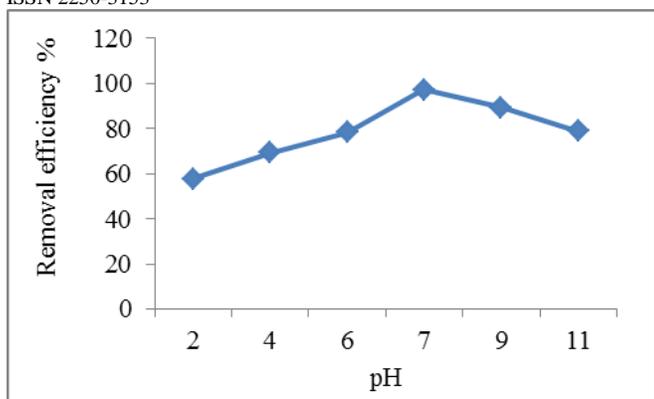


Figure 3: Graph for effect of pH on copper removal

**D. Effect of Contact Time on percentage copper removal**

By increasing contact time, an increase in both the amount of Cu(II) adsorbed per adsorbent mass unit and the Cu(II) removal was obtained. In most cases, the quick initial rate of adsorption during the first few minutes of contact was followed by a slower one, until equilibrium state was reached. This was due to the existence of abundant vacant active *Syzygium Cumini L* sites, whereas as adsorption continued a progressive saturation of these active sites with time occurred. In addition, the required time to reach equilibrium was about 6 h, since an increase of contact time to 24h did not have any significant effects.

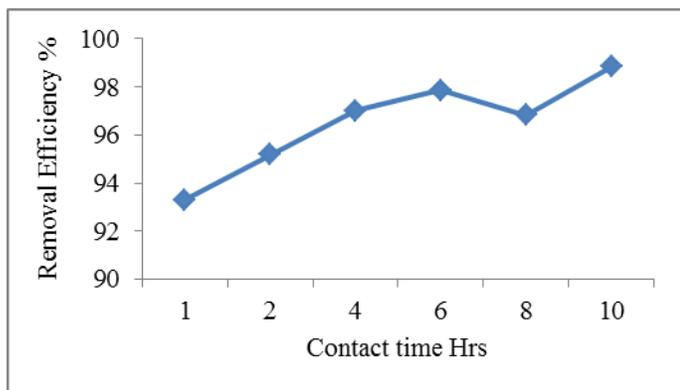


Figure 4: Graph for effect of Contact time on copper removal

**E. Validation of results using adsorption isotherms**

**1) Freundlich model**

Freundlich equation is derived to model, the multilayer adsorption for the sorption on heterogeneous surfaces.

The Freundlich model is formulated as :

$$q_e = K_f (C_e)^{1/n} \quad (3)$$

Where,  $q_e$  is the amount of ion adsorbed (mg/g),  $C_e$  is the equilibrium concentration (mg/L),  $K_f$  and  $1/n$  are empirical constants, indicating the adsorption capacity and adsorption intensity, respectively. The above may be converted to a linear form by taking logarithms:

$$\log q_e = \log K_f + 1/n \log C_e \quad (4)$$

The values of Freundlich constants (slope) and adsorption capacity (intercept) were obtained from the linear correlation plots between  $\log q_e$  with  $\log C_e$

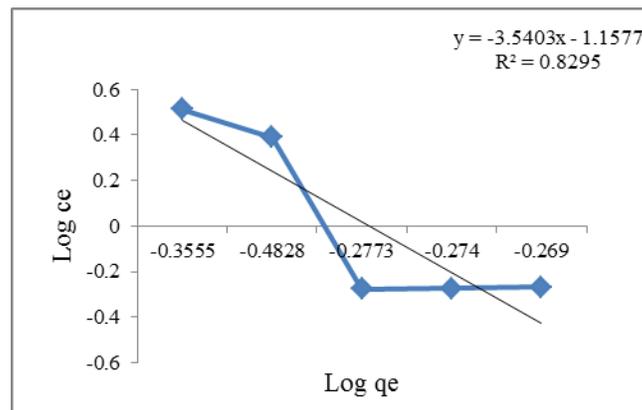


Figure 5: Freundlich model for removal of copper using *S.Cumini L*

**2) Langmuir model**

The Langmuir isotherm is valid for monolayer adsorption onto a surface containing a finite number of identical sites. Based upon these assumptions, Langmuir represented the following equation:

$$q_e = Q_{ob}C_e / (1 + bC_e) \quad (5)$$

The linear form of the Langmuir isotherm is expressed as follows.

$$1/q_e = (1/Q_o) + (1/Q_{ob}C_e) \quad (6)$$

Where,  $q_e$  is the amount of copper adsorbed per gram of the adsorbent at equilibrium (mg/g),  $C_e$  is the equilibrium concentration of adsorbate (mg/L),  $Q_o$  is the adsorption capacity of adsorbent and  $b$  is a constant related to the energy adsorption.

The values of Langmuir constants (slope) and adsorption capacity (intercept) were obtained from the linear correlation plots between  $1/q_e$  and  $1/C_e$ .

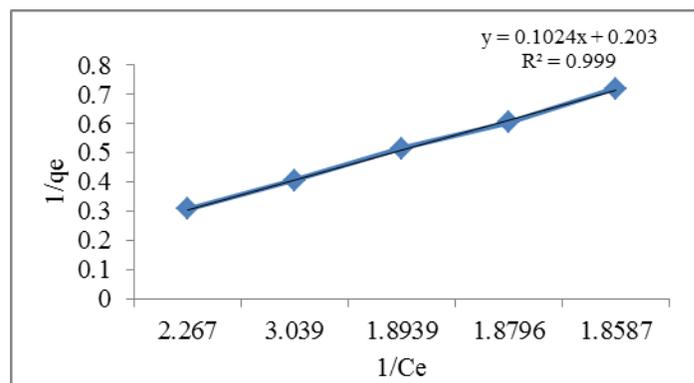


Figure 6: Langmuir model for removal of copper using *S.Cumini L*

## 3) Temkin model

The Temkin isotherm is represented by the following equation:

$$q_e = RT/b \ln(KTCe) \quad (7)$$

The linear form of the Temkin isotherm is expressed as follows.

$$q_e = B1 \ln KT + B1 \ln Ce \quad (8)$$

Where,  $B1 = RT/b$

Where,  $q_e$  and  $C_e$  have the same meaning as noted previously and the other parameters are called the Temkin constants,  $R$  universal gas constant ( $8.314 \text{ J mol}^{-1} \text{ K}^{-1}$ ),  $T$  is temperature in (K). The plot of  $q_e$  versus  $\log C_e$  will generate a straight line. The Temkin constants  $B1$  and  $KT$  can be calculated from the slope and intercept of the linear plot.

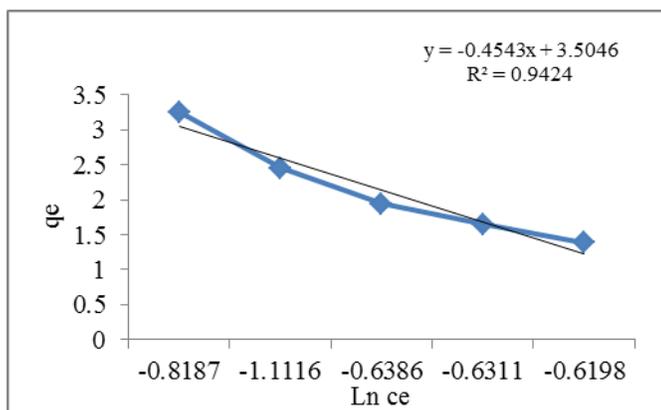


Figure 7: Temkin model for removal of copper using S.Cumini L

#### IV. CONCLUSION

The operational parameters such as pH, adsorbent dose, contact time and initial copper concentration were found to have predominant effect on the adsorption efficiency of Syzygium Cumini L seed powder.

The uptake of copper ions is possible between pH of 2.0 and 10; however pH of 7.0 gives maximum copper removal for Syzygium Cumini L seed powder.

The removal efficiency at pH=7 is about 97.16% whereas at pH=6 it is 78.36%. Which are also encouraging and might be improved by optimizing the operating parameters at the pH=7.

The percentage of copper removal was found to be a function of adsorbent dose and contact time at a given initial solute concentration. In case of effect of adsorbent dose, equilibrium dosage of 0.1g was found for Syzygium Cumini L seed powder after that there is no any significant change on copper removal efficiency with increase in dose. While the maximum efficiency was found to be 99.84%.

The increase in copper concentration from 5 to 30mg/L the percentage of copper removal was decreased from 99.54-90.14% and curve gradually attains equilibrium after 720 min for Syzygium Cumini L seed powder. As there was no significant increase in percentage of copper removal after 360 min so equilibrium time of 360 min was chosen for Syzygium Cumini L seed powder.

The isotherm study for Syzygium Cumini L seed powder represent that the equilibrium data fits better to Langmuir

model (i.e.  $R^2$  value = 0.999 for S.Cumini L respectively) than Freundlich, Temkin model. According to Langmuir model the maximum adsorption capacity was found in case of Syzygium Cumini L seed powder were 49.9 mg/g respectively.

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