

Effects of Materials Management on Performance of Selected Construction Projects in Rwanda

A Case of Selected Sites of Baraka Properties Ltd.

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Abstract: This research project examined the contribution of material management practices on performance of construction of project. Specifically, the present research assessed the effects of material estimation costs on project performance, the effect of procurement on performance of construction project and examined the effect of inventory control on performance of construction projects. Both descriptive and correlational research designs were adopted where qualitative and quantitative approaches were applied. Data collection instruments that used were questionnaire, interview guide and documentary analysis. The target population was 200 contractors and 180 subcontractors. The sample size was 195 respondents. Furthermore, information was analysed using Statistical Package for Social Sciences version 21.0. Results evidenced a positive and significant correlation between material estimation cost and performance of construction project at Baraka Properties was 0.518. A positive and significant correlation of 0.884 was also obtained between procurement process and project performance. The results also indicated that the coefficient correlation between procurement process inventory control and project performance was 0.874. It was recommended that contractors should be careful with the problem areas that positively impact cost management, recruitment of qualified workers in managing and analysing costs. It was suggested the necessity to utilize inventory control systems, construction companies have to enhance their budget allocate to capacity building and career development in order to ameliorate required knowledge and skills for workers. It is pertinent to implement information technology that is helpful in disseminating information and quickening orders from supplies. Future studies are pertinent to assess the efficiency of these strategies to management project cost.

Key words: Material management, building material, material planning, material estimation cost, procurement, inventory control, Rwanda

1. INTRODUCTION

Globally, construction sector is one of the main element for investment. Previous evidence demonstrate that the construction outcome develop specifically rapidly, sometimes

beyond the proportion of economic development, entirely as countries positioned their fundamental infrastructure in place to stimulate development. Worldwide, the construction industry outputs was, by 2013, estimated to be 10% of the global GDP approximately US\$ 7.5 trillion (MINICOM, 2013). The global construction sector contributes about 6% percent of global GDP and these estimates would grow to 15 percent by 2025 (WEF, 2016). The countries with high growing rates will be China, India, Russia, Brazil, Poland and USA.

Construction industry is among the most intricate and difficult sectors in the world. Shehata & Gohary (2011) reiterates that construction performance impacts the production level of all sectors of economic activities. However, several problems which construction sector is encountering are many. The main construction sector concerns are raw material prices, skills of workforce, technology, resource scarcity, climatic change and urbanization and corruption.

Rwanda as a member of East African Community procures additional construction materials from the member states. There is high competition for construction materials within the region. For instance, cement from Uganda is a big competitor for Rwandese cement manufacture. According to Rwandan Ministry of Trade and Industry Report (MINICOM, 2013), among the contractors, the major competitors are local companies (57%), Chinese companies (29%) and the Indian granite industries (14%). Competition challenges are mainly due to lack of machines to improve quality and quantity of production (40%), limited access to markets (20%), and lower prices offered by competitors (20%) (Carver, & Nash, 2009).

The construction sector in Rwanda is growing faster and faster, while construction materials comprises a great cost element in construction project delivery, cost of materials may be 50 percent to 70 percent of total construction cost relying on the type of projects (Patil, 2013). This sector is an impeding one than other sector of economy owing to exclusive nature of any project and several antagonistic patties are tangled and project is inhibited by time, money quality and high risk.

Latha (2014) reiterates that material management is a step to plan, to implement and to control field and office actions and tasks related to the construction. Zeb (2014) describes managerial construction as a process for implementing, designing, planning and following up site tasks in any construction project. Flanagan (2009) separates material management into five integral classes like to measure, to specify, to procure and purchase goods where the order was transformed into supplier, provision to site and logistics of verifying orders, off-loading and stocking, managerial financial procedures of payment and usage of equipment in production at working place and removal of unused materials.

The growing problem around which this study turns consists on low performance of construction project. In fact, higher project cost (Ndegeya, 2015), inability to meet project time schedule (Patil & Pataskar, 2013), and poor quality assurance for construction projects (Jarkas & Bitar, 2011) were evidenced to be among indicators of poor performance of construction projects. Furthermore, construction projected failed due to failure ordering on time, over ordering, inadequate materials, bad measurements, stealing materials, cash flow issues to contractors owing to delay in payments. Previous studies conducted in Rwanda, problems of materials management caused the fall of four storey building in Nyagatare district and of a multi-storey block at the University of Rwanda, (MINALOC, 2013; Ezhilmathi, 2016; Ndegeya, 2015).

Scholars argued that in order to improve the performance of construction projects, several strategies must be adopted. These are: effective material estimation cost (Meng, 2012), adequate procurement (Nagapan, 2012), and appropriate inventory control (Mincks & Johnston, 2011). However, no studies in Rwanda have been conducted to investigate the adequacy, effectiveness and effects of those practices on the performance of construction projects. In search of ways to resolve this problem, the present study investigated the effect of material management practices on the performance of construction project in Rwanda.

The specific objectives that guided this research were

- i) To assess effects material estimation cost on performance of construction project in Rwanda
- ii) To determine effects of procurement on performance of construction project in Rwanda.
- iii) To examine effects of inventory control on the performance of construction project in Rwanda.

2. REVIEW OF RELATED LITERATURE

2.1.1. Material Management Practices in Construction Project

Material management is referred to as one of the greatest elements in the performance of construction projects. In this context, it's evident that material cost stands from 30% to 70% of the entire project expenditure (Flanagan, 2009). Construction material comprises of different raw materials acquired from several markets. However, their prices and presence are volatile due to certain circumstances of market conditions (Christopher, 2011).

Nowadays due to technological development, construction material necessitates to explore the international market

globally. Raw materials will be reversed in favour of engineer elements and mixed gatherings (Calkings, 2009). Then, after choice of materials till last product was produced it include a group of transformation which is defined as material management. This set comprises of storing, identifying, retrieving, transportation and construction techniques (Pellicer et al, 2013) The term material management refers to the process of designing, planning and controlling to be sure of the high degree of quality and quantity of materials determined in a given scheduled time (Donyayi & Flanagan, 2009) Furthermore, relying on evidences from different scholars, appropriate material management is one of the pertinent elements to the performance of construction project (Gulghane, 2015). Therefore, a great number of studies elucidate that appropriate material management could lead to a higher level of production of the project and stimulate its higher performance (Pande & Sabihuddin, 2015).

However, the following are among the greatest impediment in construction project in Rwanda: Lack of skilled personnel; dependence of external professionals; absence of domestic construction materials and lack of suppliers in the marketplace; lack of developed and advanced infrastructure and scarcity of spaces and storage in the country (Doloi et al., (2012). Finally, the aforementioned elements affect negatively the degree of awareness of the necessity of material management practices in Rwandan construction sector (Abdul et al, 2013).

2.1.2. Material management processes and techniques

Scientific evidences show that material management comprises of a group of procedures that need to be integrated, administered, managed and assembled (Patil, 2013). The stating point of all phases in material management is planning. This must be assessed for the purpose to afford guidance to all components of activities. In a study of Gulghane (2015), material planning involves the quantification, ordering and scheduling of materials and activities to be carried out. In this regards, the usage of appropriate material management stimulate higher production and profitability to any construction companies and this can render them to high level of performance (Kasim et al, 2005).

On the pursuit of adequate material management, quality of service is a pertinent measurement of project. Respecting standard of construction materials is very pertinent to the establishment of a rigour sustainable and cost effective structure where every construction project had various setting of specific obligation to fulfil (Patil, 2013). Contractors must choose and undertake procurement adequately taking into consideration construction materials. It is recommended to carry out a research and assessment of various material properties to see whether they are compatible with various sites of buildings. Procurement of construction materials must be delivered after approval (Low, 2014). Procurement refers to appointment of contractors and preparation of a contract but it is very important as the first step of delivering procedure (Mead & Gruneberg, 2013). All tasks procedures start from purchase of materials, services and other necessities pertinent to the construction project and their execution (El-Gohary, et al, 2014).

Several companies, vindicate that construction materials and components obtained from external supplier have a paramount percentage of the cost of the end product and adequate procurement is positively improving the competitiveness of any construction project (Rivas, Borcherdimg, Gonz´alez and Alrcn, 2010). Various researchers proposed that the selection of a suitable strategy of procurement is helpful to the reduction of effects occurring from circumstances like delay in delivering, low standard of raw materials, low quality, few resource and many others.

Logistic refers to the movement and comprises of planning, execution and follow up and storage of all materials from raw to the finished ones to attain the expectation of clients (Safa et al, 2014). Planning all the aforementioned activities is helpful to the formulation of an effective construction site layout that may afford easy accessibility and transmitting materials in the site. Therefore, for controlling the accessibility and to augment security of the site, setting up wall or fence is taken into consideration as a prerequisite (Caldas et al, 2014) and planning of access and transmission of material on the construction site (Kasim & Ern, 2014) are elements that necessitate to be the focus during logistics for adequate material management.

Different materials had not the same characteristics and properties that render handling of materials to be problematic. Suitable material handling includes handling, storing and control of construction material (Karim & Ern, 2014). Adequate guarantee during storage is sometimes not considered and this lead to low quality of materials or its decline and worsening. It was proposed that the storage are necessitates for enclosing, cleaning and drying adequate air condition and for some material had to be stacked on pallets and without humidity (Low,2014). Further, the control of material wastage is very important in controlling the construction cost. Calkins (2009) specifies that material waste is estimated to nine percent by weight in Dutch construction sector and between 20 and 30 percent of purchased materials in Brazil. Material waste emanates from planning, procurement, material handling and operation procedures. Benton & McHenry (2010) specified that construction materials wastage is not the same with the value of material provided and approved on the construction site. Material waste was seen as a main and growing issue in construction project and it may lead to ineffectiveness of construction project delivery. Appropriate control will be helpful to the enhancement of production and can ameliorate waste control in the construction (Kasim, 2011).

Through the minimization of procurement cost for construction materials, a reduction of general cost of project occurred and improving the profitability of a company, suitable time to take into considerations as whether material ordered too early, it can influence financial capital, interest rate and storage costs (Del Pico, 2013), lack of standard or low quality in material management lead to the enhancement of construction cost. This was due to opportunity to loose material during handling and execution steps are more than other and it needs material replacements (Othman & Potty, 2014).

Planning and procurement are deemed to be pertinent procedures that follow up and monitor the overall cost of construction project. Material control and expedition is one of the paramount step and is preventing shortage and surplus of material appeared on the construction site. Time is described as the level that overall working environment enhanced the achievement of a construction project on time (Said &El-Rayes, 2012). It is the beginning of signing contract where most of them had the same content regarding the time schedule for achieving and executing the work where it is very necessary to realize the work on time. Time can be acknowledge as the ultimate measurement of project success and sustainability (Melton, & Iles-Smith, 2009), the lack of respect of time scheduled necessitate to reorder materials and lead to the prolonged time of consuming materials. Lack of respect in time assigned to a project lead to the enhancement of working expenses and the procurement decreases idling time and suitable materials adjustment decreases extra time for modification of resources (Nwachukwu, 2010).

Lacking a suitable and enough material can put a risk at the appropriate quality of duties assumed by employees. (Hughes, 2014). Same as the materials necessitates being adequate quality based on their main characteristics (Nagapan, 2012). The adoption of adequate quality of construction materials stimulate the satisfaction of the quality of construction activities and will be approved by engineers (Mincks & Johnston, 2011). All in all, available resources could be related to specifications, satisfactory quantity and function

2.1.3. Causes of ineffective material management

Jarkas and Bitar (2011) proposed that transport complexities, waste, inadequate handling on site, misuse, improper working design, waste inadequate material delivery and excessive working paper all lead to the ineffective material management. In a research undertaken by Wanjari and Dobariya (2016) agrees the general pertaining issues in material management is inability for ordering on time which lead to the delay in project implementation, wrong direction of delivering , over ordering, inadequate materials or stealing materials and double handling of material due to inadequate .

Moreover, a research carried out by Patil and Pataskar (2013) pinpointed that the problems could emerge owing to error, particularly due to some construction firm still focus on manual methods for management that comprise paper based methods. A research carried out by Potty and Ramanathan (2011) on the challenges in material management used six case studies. Findings under this research revealed the greatest impediment to the material management are associated with challenges site and site logistics concerning the material handling and allocation and order and provision of construction materials on the site.

Another evidence from Patel and Vyas (2011) shows that the planning, procurement, vender choice and execution steps if not done in appropriate ways, they can bring huge problems to the material management. In light with the above information, the correlation between those problems and ineffective material management has been revealed (Durdyev & Mbachu, 2011). Furthermore, to ameliorate the construction project delivery in Rwanda, future studies must assess important of ineffective material management at each step.

2.1.4. Project performance

Meng (2012) explains that project performance is assessed through its product and project usage quality, timeliness, budget compliance and degree of customer satisfaction. Low and Ong (2014) evidenced that managerial limitations, managerial time and management related costs, performance of managerial skills, risk management, management of human resources and incorporation in relation to the project success where he gives strong correlation. In evaluation of the performance of project, the time schedule contributes more to the assessment and relying on (Punch, 2014) the maturity in time management routines lead to the durability in project performance where time frame is not routinized.

The timeframe is very important to achieve the project target. The phenomenon of not delaying in executing project is linked with the time schedule. Cheng (2014) and Del Pico (2013) evidenced that project in construction section is attained due to a set of various factors like procurement process, adequate working conditions, financial resources and effective plan and effective monitoring and evaluation.

The quality of projects information had positive effects on project success (Rashfa, 2014). Therefore, associated with the quality and technical obligation is limitation. The achievement of project in interior of the time scheduled is seen as a motivating factor of project durability and performance. The plan of time is very pertinent to realize project goal and outcomes in a specified period by taking into consideration the project fixed objectives (Walker, 2015). Performance refers to the determining and promotion of success and assessment output relying on the fixed objectives assigned to any project (Othman & Napiyah, 2014). In this context, performance refers to the individual or group fetching taking into consideration the cooperation toward positive outcome. Performance achievement is the process of the long journey and the level of explanation of the method in which the degree of attainment take into accounts six integral elements like nature of skills, knowledge, identification, features and constant components (Gunduz, Nielsen & Ozdemir, 2013).

Another crucial dimension in project performance involves the level of customer satisfaction (Keith & Kling, 2016). A project that in the final analysis stimulate customer satisfaction would be evidenced to perform well. In monitoring the success of any project is profitable to the stakeholders and shareholders by facilitating them to approve the service obtained to safeguard managers by ameliorating service they provide to customer (Said & El-Rayes, (2012). Project performance is related to the end product objective in terms of success and realization the prerequisites as well as satisfaction of clients. Therefore, project success lead to its sustainability and durability in terms of obtaining a competitive advantage, improvement of reputation for a firm, enhancing market share and attaining certain level of profitability (Kirkpatrick & Feeney, 2015). Project manager whose individual profile was to the ideal project manager for a specific project type was performance in effect on customer (Cooke & Williams, 2009).

2.2. Empirical literature

A study carried out by Khandve (2015) in India to assess the effects of material estimation cost using a qualitative

approach. It had a sample size of 200 construction companies. The study explored the effects of estimating costs on the performance of service delivery. The author specified that material estimation lead to the adequacy and effectiveness of services provision. It also show a strongly correlation between material plan and high level of production and profitability of the company.

Another study undertaken by Moldavian scholars (Mincks & Johnston, 2011) reiterates that cost estimation lead to the effective forecasting relying on the availability of information. In USA, an association of engineers published a report on the effects of budgeting and its preparation to the success of construction companies. In this regards, there is a need to formulate the ultimate goals for budget preparation in order to meet what companies have in the inventory storage (Jarkas & Bitar, 2011). However, budgeting for materials is achieved relying on annual, trimestral or semestrial information and expenses and this can stimulate construction project to be sustainable and successful.

A study carried out in South Africa by Walliman (2011) assessed the influence of procurement on performance of construction project. A sample size of 72 companies participated in the study. The study assessed whether appropriate procurement procedures between contracting parties is very adequate to stimulate organizational success (IMF, 2018). Khandve (2015) with the sample of 218 respondents from 30 consecutive companies observed that procurement consist of the identification and analysis of obligation and purchasing categories, selection criteria, choice of suppliers, negation of contracts and actions as mediator between two parties and follow up and providing association with suppliers. A survey carried out on handling material is the deliverance of those equipment that gives an adjustment and geographical position (Towey, 2013). Meanwhile, the choice of material handling equipment is crucial to improve the productivity procedures, give the adequate operation of workers, enhancement of production and advancement of the flexibility of the system (Madhavi, 2013). In this regards, effective material handling includes handling, storing and following up construction materials.

Therefore, it was very crucial to adopt adequate way of transporting, loads and unloads of material cannot be carried out in the rain (Latha, 2014). The researcher recommended that storage necessitates to be surrounded, bounded and unpolluted and dry with adequate air circulation with some materials necessitated for loaded on pallets not more than some safety height to avoid humidity (Low, 2014).

In fact stock control involves raw materials, transformed materials, assembly components, usable stores, general repairs and spares materials and finished materials (Donyavi & Flanagan, 2009). Therefore, is necessary for construction materials to be provided as required and with the advancement by appropriate management of stock control. The construction project is producing huge amount of waste and it will stimulate complexity to the construction sector (Cheng, 2014). In conclusion of this points, with plan and design of the material management practices which is very

suitable can be helpful to the reduction of waste of material and improvement of the firm’s return.

2.3. Theoretical framework

The theories discussed in this research are application theory, system theory and theory of lean construction.

2.3.1. Application Theory

Donyavi and Flanagan (2009) analysed the role of this model for customers, planning firms in construction sector. The real effects of the model for construction sector customers and contractors. Using this theory, a construction firm can attain the highest level of expected outcomes and other theories must be seen as crucial phase to the attainment of higher effectiveness given by the entire construction sector.

Nevertheless, several elements were advanced, one is the theory of construction management which establishes a way that can be evaluated and they confirm information necessary to assess key term in the model (Donyavi & Flanagan, 2009). Another elements argued that construction sector may be advanced within studies and surveys in the adequate, organizing teamwork, cooperation and dissemination of information were sufficient. According to scholars, the theory established a situation where CM studies may be adopted and give higher clarification and application than obtainable and stimulate future studies (Bank, 2018).

2.3.2. System theory

This model reiterates that a response is attained through the cooperation of various elements in the working conditions. The claim of the system model is the focus on interdependence of the element of conflicting and cooperating parts. However, material management is an organization model that has been developed through the adoption of system model to management (Bank, 2018).

In this regards, a system refers to a set or association of interdependent components that operate conjointly to realize a

shared objectives (Calkins, 2009). In an attempt to apply the system as a term for material management, the researcher wants to express anything outside to the system itself by interacting with its elements. Therefore, material management become an important and coherent element of system which focuses on particular tasks and which its correlation with other are expressed. The study used system theory because, it increases organisation's adaptability to environmental changes. The organisation is studied as a whole and not through its parts. This enables it to adapt to the needs of the environment. Decisions are made keeping in mind the macro as well as micro environment.

2.3.3. Theory of Lean Construction

Using a CM model among stakeholders stimulate the adoption of new model of lean construction due to its central role in producing material in construction sector. This theory was advanced by Lauri Koskela (2008). Among construction companies, the issues and techniques of lean theory provide solutions to the above approaches. Moreover, the theory affords a look at procedures that are included, relied on model, that encourage assumptions that might be assessed by adoption to construction sector. Most of research were conducted using lean theory meeting several years ago. These studies used it to attempt how to attain the adequacy and success of construction project. The present study used lean construction extends from the objectives of a lean production system, maximize value and minimize waste to specific techniques, and applies them in a new project delivery process. Therefore, lean theory, principles and techniques, taken together, provide the foundation for a new form of project implementation.

2.5. Conceptual Framework

A conceptual framework for this research project emanates from the existing literature review that revealed elements of material management practices. The conceptual framework establishes the link between material management practices and performance of construction project.

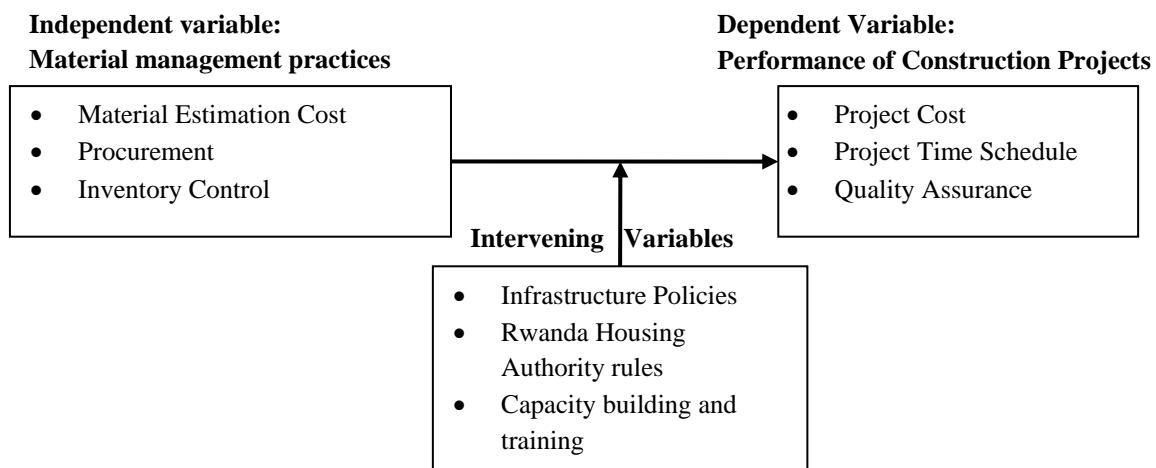


Figure 1: Conceptual Framework
 Source: Researcher (2020)

3. RESEARCH METHODOLOGY

3.1. Research Design

Babbie (2009) refers to research design as a methodical strategy respected during the course of carrying out a study in order to find solution to the growing issue or phenomenon under study. This study used both descriptive and correlational research design. The research adopted qualitative and quantitative approaches. In this regards, a descriptive research was adopted to explain effects of material management practices on performance of construction project Rwanda (Calkins, 2009).

3.2. Target Population and Sampling

It is defined as a group of objects, events, issues, individuals or other elements concerned by the research phenomenon (Blaxter *et al*, 2010). In this regards, the present research is concerned with 243 registered engineers and 35 architects in Rwanda. Population that were included in are people working in Construction industry. These are 75 workers (Director Managers, project managers, Technical manager, Supervisors, Procurement managers, Helpers, and Security staff) carrying out their activities in one organisation located in the aforementioned district (Creswell, 2013) The aforementioned respondents came from five construction sites of Baraka Properties. These are Baraka Villas project located at Kagugu, partitioning Prime Minister Office, University teaching hospital-Masoro, Geneco-Remera and Intech Solutions-Masoro.

Sample size is precise number of respondents considered as representatives of the entire population (Pickard, 2009). A purposive sampling technique has been adopted to permit the architect or of this study to obtain relevant evidences from the entire population (Creswell, 2013). In order to determining a sample size, the author used Yamane (1967) formula. In this case,

$$n = \frac{N}{1 + Ne^2} = \frac{380}{1 + 380 * 0.05^2} \approx 195$$

Where N represents the population size, n=sample size, e=degree of procession (0.05).

Table 1: Calculation of sample size

Categories	Population	Sample Size
Contractors	150	77
Subcontracts	170	87
Engineers	50	26
Regulators	10	5
TOTAL	380	195

Source: Rwanda Housing Authority (2018)

3.3. Data collection instruments

A structured questionnaire was used to gather primary data. It was made of four sections; one section was concerned with sociodemographic characteristics of respondents. Other one gives information concerning specific objectives. The third one is related to the second objectives and fourth with the third specific objectives.

The measurement took into consideration Likert scale where 1=Strongly Agree, 2=Agree, 3=Not Sure, 4=Disagree, 5=Strongly Disagree.

3.4.2 Administration of research instruments

Literature review was given what other have written related to material management (Pickard, 2009). Relevant evidences were gathered from seminar and workshop, journals and internet sources. A questionnaire was both online and hand delivered. Furthermore, structure interviews selected customers and regulators were carried out to obtain evidences in the topic. Therefore, a questionnaire were given physically and via email in order to obtain required information.

4. FINDINGS AND DISCUSSIONS

4.1. Demographic Characteristics of Respondents

Section on sociodemographic characteristics of respondents depicts on general information concerning participants. These include gender, age group, working experience, educational profile and responsivities assumed by respondent.

Table 2: Gender Profile of Respondents

Gender profile	Frequency	Percentage
Male	145	74.5
Female	50	25.5
Total	195	100.0

Source: Primary data (2020)

From Table 2 evidenced that majority of respondents are men. It means that 74.5% were men. Furthermore, only 25.5% are women. This indicated the existence of gender balance in the distribution of respondents henceforth the likelihood of obtaining balanced answers.

Table 3: Age Distribution of Respondents

Age Group	Frequencies	Percentage
26-30 years	73	37.5
31-35 years	73	37.5
36-40 years	24	12.0
41-50 years	25	13.0
Total	195	100.0

Source: Primary Data (2020)

Findings presented in Table 3 indicated 75% of respondents are aged between 26 and 35 years old. In this regards, workers of the company case are youth compared to the age group of others. This implied that workers in the company are in the productive age and energetic to attain planned objectives. This indicates that most of respondents are in their middle age and thus in a right position to attain high level of performance for construction project in Rwanda. Therefore, the age of respondents could not affect the study findings.

Table 4: Respondents' experience in Baraka Properties Ltd

Experience	Frequency	Percent
1-5 years	60	30.8
5-10 years	100	51.3
Above 10 years	35	17.9
Total	195	100.0

Source: Primary Data (2020)

Findings in Table 4 reflect that 51.3% of respondents had a working experience ranging from five to ten years. This was followed by 30.8% of respondents experienced from one to five years working at Baraka Properties Ltd. Furthermore 17.9% of workers from Baraka Properties Ltd had experience of more than ten years.

Table 5: Education of Respondents

Education of respondents	Frequency	Percentage
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In Table 5, it was reflected that most of respondents, 70 (36.9%) attained the high level of secondary schools in construction, 21 (10.8%) respondents hold a diploma while 101 (51.8%) respondents have bachelor's degree. Finally, 3 (1.5%) respondents have master's degree. The researcher contended that employees and employers at Baraka Properties are skilled enough to execute adopted material management practices and achieve effective performance of construction project.

4.2. Presentation of findings

This section presents responses obtained from a questionnaire survey and interview guide. The analysis was performed according to three specific objectives. These are to assess the effects of material estimation cost on performance of construction project in Rwanda; to determine effects of inventory control on the performance of construction project in Rwanda; and to examine the effects of procurement on project performance in Rwanda.

Table 6: Material Estimation Cost on Performance of Construction Project in Rwanda

Level of Agreement	Disagree		Not Sure		Agree		Total		
	N	%	N	%	N	%	N	Mean	Stadev
Feasibility Estimates	39	20.1	37	19.2	118	60.7	195	3.8	1.5
Approximate or conceptual estimates	61	31.3	10	5.1	124	63.6	195	3.4	1.5
Contractors' detailed estimates	25	12.7	20	10.2	150	77.1	195	4.1	1.2
Progress Estimates	59	30.2	13	6.6	123	63.2	195	2.8	1.7
Final Estimates for final payment to contractor	24	12.2	15	7.8	156	80.0	195	3.8	1.6

Source: Primary data (2020)

The project manager or stakeholders begin with the provision of initial material cost estimation known as feasibility study. Results evidenced that 118 (60.7%), a mean of 3.8, standard deviation equal to 1.5 agreed that they used to approximate or conceptual estimates for material estimation costs. In this regards, then the project was felt to be feasible and funds are acquired. After initial estimation, project design must be done with the intention to denote necessities and kind or nature and quality of construction materials. In fact, cost approximation is performed at this level and this is known as conceptual cost estimation. Its intention is to change cost according to the target and size of a construction project need and (Akeel 1989; Barrie and Paulson 1992).

Moreover, 150 (77.1%) respondents, with a mean of 4.1, standard deviation of 1.2 evidenced that at Baraka properties Ltd, they used to detail estimates for contractors' detailed

Secondary schools	70	36.9
Diploma' degree	21	10.8
Bachelor	101	51.8
Master	3	1.5
Total	195	100.0

Source: Primary (2020)

4.2.1. Effects of Material Estimation Cost on Performance of Construction Project in Rwanda

This section presents and analyse information on the effects of material estimation on performance of construction project in Rwanda. In this regards, material cost estimation refers to the examination of the predictable cost of any construction project. The adequacy of this estimation had a clear impact on desired gain of the construction contractor. Therefore, some unforeseen event may be more to the basic estimation to enhance the degree of confidence, this premium is influenced by different factors.

The cost is seen as the pertinent element of project management and may be seen as one of the crucial aspects of any project and the motivating factor of attaining expected outcomes of any project (Azhar et al, 2008). Besides that, Gido and Clements (2003) argued that there are four cost interconnected indicators in material estimation cost analysis that were adopted to analyse material estimation cost of project. These indicators are TBC (Total Budgeted Cost), CBC (Cumulative Budgeted Cost), CAC (Cumulative Actual Cost), and CEV (Cumulative Earned Value). The Table 4.5 presents various material estimation cost that are used at Baraka Properties.

estimates and subcontractors. In this regards the company must plan contract documents as the foundation of cost estimation by contractors with the intention to give a bid. These documents concerned with drawings, specifying, general and specific conditions, agreements, consent and promise (Barrie and Paulson 1992). The aim of this estimation was to assess the actual cost of project (Akeel 1989).Meanwhile, project managers must know, create and implement estimation duties (Samphaongoen 2010).

In addition results show that 123 (63.2%) fo respondents with a mean of 2.8 and standard deviation of 1.7 evidenced that Baraka Properties Ltd estimates the progress cost. Observation from the present study did not contradict evidences from past studies where it has been revealed that constrictor's bid estimation is not the ultimate cost estimation for any construction project. Furthermore, other cost estimation were

done during the construction stage. These include progress estimation which is concerned with contract change order cost estimation to ascertain completion rate and its corresponding payments (Akeel, 1989).

Findings show that 156 (80.0%) with the mean of 3.8, std equal to 1.6 indicated that the Baraka Properties Ltd used to provide the final Estimates for final payment to contractor. In this context it was seen that on project realization, it is pertinent to create the ultimate cost estimation for the entire project implemented. It is adopted to prove amount that are usually realized. It determined the last payment for a contractor at Baraka Properties.

Qualitative data was collected from key informants to deepen the analysis. In This regards, the researcher perform interview with the managing director of Baraka properties. The managing director focused on actual possible strategies used

in construction industry, with client expecting a better service and project that meet their requirements more. The director says “in *estimating cost for our construction projects, we have adopted adequate strategies including the feasibility estimates, approximate or conceptual estimates, contractors’ detailed estimates, the progress estimates and final estimates for final payment to contractor*”. This information did not contradict the findings from ordinal respondents in quantitative data.

Finally, expect conceptual and detailed cost estimation, other were done when project is described and more evidences and facts were available. Moreover, preconstruction cost estimation, other were done when or after construction phase is executed to establish the final project cost. These cost estimations must bring up to date all detailed cost estimations with the focus on real in spite of expected cost (Bley, 1990).

Table 7: Effects of Material Estimation Cost on performance of construction projects

Level of Agreement	Disagree		Not Sure		Agree		Total		
	N	%	N	%	N	%	N	Mean	Stdev
Reduces delays	60	30.6	5	2.8	130	66.6	195	3.6	1.4
Improves quality of services	37	19.2	20.4	10.5	137	70.3	195	2.2	1.4
Ensures steady supply to users/customers	71	36.2	23	11.9	101	51.9	195	3.4	1.5
Ensures price control for users materials	24	12.3	4	2.3	167	85.4	195	3.4	1.5
Helps in controlling stocks	72	36.7	3	1.9	120	61.4	195	3.3	1.7
It helps in controlling prices of the products	24	12.4	7	3.4	168	86.2	195	3.2	1.5

Source: Primary Data (2020)

From Table 7, it was reflected that the mean evidences with highest effects were that: reduces delays 130 (66.6%) with a mean of 3.6 and Standard deviation of 1.4. Therefore, improves quality of services and ensures steady supply to the users/customers was strongly agreed by 137 (70.3%) with a mean of 2.2 and standard deviation of 1.4, ensures steady supply to the users/customers (3.4) and ensures price control for users materials (3.4). The material estimation cost with mean higher than 3.3 meaning the agreement with the statement that material estimation cost can stimulate higher level of success for construction project at Baraka Properties. This tendency has been in accepting with the above statement discovered in the existing literature. Most of people who

participated in the research process reiterated that material estimation cost have a positive significance role in encouraging the success of construction properties at Baraka Properties Ltd, Kigali.

Qualitative results indicated that adequate material estimation has led to high performance for Baraka construction projects. In this regards, chief engineer of the company under this research argues “*owing to effective material estimation costs, we were able to improves quality of services, we have ensured steady supply to the users/customers, price control for users materials and it has helps us in controlling stocks but also to follow up prices of the products*”. This information did not contradict the findings from respondents.

Table 8: Correlation Analysis of the Study variables

		Material E stimation Cost	Performance of construction project
Material Estimation Cost	Pearson Correlation	1	.518**
	Sig.(2-tailed)		.000
	N	195	195
Performance of Construction Project	Pearson Correlation	.518**	1
	Sig.(2-tailed)	.000	
	N	195	195

**Correlation is significant at the 0.05 level (2-tailed).

Source: Primary Data (2020)

Further, information indicated that the coefficient relationship between material estimation cost and performance of construction project at Baraka Properties is 0.518. It implied the significant relationship between material estimation cost

and the success of construction project of Baraka Properties Ltd, Kigali, Rwanda whereby had contributed to the development of aforementioned company.

4.2.2. Effects of inventory control of materials on Performance of Construction Project in Rwanda.

The second research objective determined effects of inventory control on performance of construction project in Rwanda. Inventory control practice is the pertinent occupation of material management and it procedures the central element in an institution (Ramakrishna, 2005). A record system involves all elements of handling a firm’s inventories, buying, and provision, obtaining, controlling, warehousing, storing, transacting and rearranging. Utilizing this meaning,

respondents have been asked to provide responses to reports as it is inferred to Baraka Properties Ltd.

Respondents assessed the degree of participations, apathetic, low participation and very low participation. Relying on interviews with Baraka properties, it was seen that the company uses just in time, lot for lot, butter stock, material requirement planning, and electronic data interchange (EDI), enterprises resource planning (ERP), ABC analysis and intelligence resource planning in Table 9.

Table 9: Inventory Control System –Degree of Involvement at Baraka Properties

Level of Agreement	Disagree		Not Sure		Agree		Total	Mean	Stdev
	N	%	N	%	N	%	N		
Just-In-Time	40	20.6	10	5.1	145	74.3	195	1.65	.87
Lot for Lot	78	40.2	14	7.4	102	52.4	195	2.39	1.11
Buffer Stock	89	45.6	8	4.0	98	50.4	195	2.50	1.29
Material Requirement Planning (MRP)	77	39.4	11	5.8	107	54.8	195	2.16	1.15
Electronic Data Interchange (EDI)	83	42.7	11	5.4	101	51.9	195	2.30	1.21
Enterprise Resource Planning (ERP)	43	22.2	20	10.2	128	65.6	195	1.91	1.09
ABC Analysis	80	41.2	18	9.2	97	49.6	195	2.63	1.38
Intelligence Resource Planning	64	32.6	20	10.2	110	56.2	195	2.06	1.07

Source: Primary (2020)

Information demonstrated a higher involvement of JIT in materials management (1.65) and ERP (1.91). The mean for information provided indicated the existence of higher level of involving MRP (2.26), IRP (2.06). EDI (2.30) and lot for lot (2.39). A level of involving inventory control system on the success of construction project with the mean low than 2.5 meaning that participants highly use inventory control system within the company. The tendency was in favor with the existing literature. In addition, findings indicated that inventory control system scores have been a pertinent technique to help the success of construction projects at Baraka Properties Ltd.

With the intention to enhance the success of construction project, it is very important to endorse inventory control systems. This with high standard deviation have been ABC analysis (1.38), buffer (1.29) and electronic data interchange (1.21). All the above evidences vindicated the far from the average therefore suggesting the existence of low level of participation in these systems at Baraka Properties Ltd.

Furthermore, information with low standard deviation comprises of JIT (0.87), intelligence resource planning (1.09). These responses have been near by the mean, meaning that responses have been not changed, therefore, inventory control are highly involved at Baraka Product Properties.

The ABC analysis refers to comprehensive model of grouping customer or products to be above to obtain most out of time and resources when form is delivering them and this is divided into three components. The first is representing the pertinent products or services that a client has. The second stand for middle of way for clients or services or products and this is at low level of services. The last is relied to many transactions that are important to the firm.

This interview indicates that most inventory control of materials practices used are many. The director of Baraka advances “Just-In-Time, Lot for Lot, Buffer Stock, and Material Requirement Planning (MRP), Electronic Data Interchange (EDI) and the Enterprise Resource Planning (ERP)”. This information did not contradict the findings from ordinal respondents in quantitative data.

Table 10: Effects of Inventory Control on Performance of Construction Projects

Level of Agreement	Disagree		Not Sure		Agree		Total	Mean	Stdev
	N	%	N	%	N	%	N		
Reduction in wastes	59	30.3	8	4.1	128	65.6	195	3.31	1.23
Reduction in production costs	57	29.0	15	7.6	124	63.4	195	3.48	1.48
Increased product quality	43	21.8	20	10.0	133	68.2	195	3.74	1.26
Time deliveries	78	40.2	13	6.7	104	53.1	195	3.69	1.09
Increased profitability	67	34.2	3	1.5	125	64.3	195	3.63	1.22

Reduced stock levels	82	42.1	7	3.4	106	54.5	195	3.35	1.31
Decreased production cycle time	86	44.2	8	4.2	101	51.6	195	3.74	1.12
System flexibility	89	45.4	4	1.8	103	52.8	195	3.74	1.03

Source: Primary Data (2020)

From Table 10, the average of information given with the highest impacts comprises: improved product quality, reduced production cycles times and system flexibility (3.74), timely provision and enhanced the profit and income (3.63). Inventory effects control system with mean higher than 3.5 meaning that participants accept that inventory control systems would stimulate the success of construction project at Baraka Properties. The tendency was concurred with the existing studies. Many respondents accepted that inventory control given that inventory control systems were high significant factor to the success of construction properties at Baraka Properties Ltd, Kigali.

Findings on the mean of adequately three meaning that they were apathetic of saying the influences. The above information include: reducing wastes (3.31), decreased the level of stock, reducing the production costs (3.48). Therefore, it may be indorsed to obstacles encountering material management and to the absence of adequate inventory control systems at Baraka Properties. The highest standard deviation is related to the decrease in production costs (1.48), reduction in stock level (1.31), enhanced production quality

Table 11: Correlation Analysis of the Study Variables

		Inventory System	ControlPerformance of construction project
Inventory Control System	Pearson Correlation	1	.884**
	Sig.(2-tailed)		.000
	N	195	195
Performance of Construction Project	Pearson Correlation	.884**	1
	Sig.(2-tailed)	.000	
	N	195	195

**Correlation is significant at the 0.05 level (2-tailed).

Source: Primary Data (2020)

Therefore, information indicated that coefficient relation between inventory control and performance of construction project at Baraka Properties was 0.884. The evidences implied a positive correlation between inventory control and performance of construction project of Baraka Properties Ltd, Kigali, Rwanda whereby had contributed significantly to the development of construction firms.

4.2.3. Effects of Procurement on Performance of Construction Project in Rwanda

This section provides information related to the effects of procurement on performance of construction project in Rwanda. Procurement consists of appointing contractors and

Table 12: Effects of procurement on performance of construction project at Baraka Properties

Level of Agreement	Disagree		Not Sure		Agree		Total	Mean	Stdev
	N	%	N	%	N	%	N		
Floating of tender as per App	53	27.1	55	28.1	87	44.8	195	2.0	1.2

(1.26) and the decrease of wastes (1.23) meaning that those answers have been far away from meaning while was insignificant. The lowest standard was from system flexibility (1.3) and timely provisions (1.09) meaning that answers have been near to the average of significance due to participants have been in concur with impacts. The analysis indicated that most of participants accepted that inventory control systems would stimulate the decrease of waste (65.6&), timely provision (53.1), reduction of cycles times (51.6), that in turn impacts the success of construction project.

Qualitative results indicated that inventory control has led to high performance for Baraka construction projects. In this regards, chief procurement of Baraka Properties asserts “due to the adoption of inventory control, Baraka was able to reduce wastes, production costs, but also to ameliorate the product quality, delivering materials on due time and date, the productivity was also optimized profitability. Baraka properties Ltd was able to decrease the stock levels and the production cycle time with the system flexibility “.This information did not contradict the findings from respondents.

prepare a contract, but a beginning point in the process of provision (Mead & Gruneberg, 2013). These actions involved in the procurement process are purchasing of equipment, materials, labour and services necessary for construction and execution of a project (Kasim, et al., 2005). The researcher established ideas and point of views on if procurement influences performance of construction project in Rwanda. This section includes identifying, the growing problem in procurement process through various steps and the contribution their can afford to performance of construction project at Baraka Properties Ltd.

Procurement method are selected as indicated in the procurement plan (PP)	6	3.1	55	28.1	134	68.8	195	3.8	1.6
Timely approval of PP and Insurance of GPN	71	36.5	39	19.8	85	43.8	195	4.1	1.2
Timely and appropriate submission of PR	41	20.8	81	41.7	73	37.5	195	3.6	1.3
Adequacy of binding documents	130	66.7	37	18.8	28	14.6	195	3.4	1.5
Advertisement of tender opportunities	91	46.9	63	32.3	41	20.8	195	4.1	1.2
Verification of Successful Bidder's price to the Market	142	72.9	14	7.3	37	19.8	195	2.0	1.2
Procurement record keeping	79	40.6	77	39.6	37	19.8	195	3.8	1.6

Source: Primary data (2020)

People were irritable that most of tenders looking in procurement plan through procurement organs were indicated in sheet and that are actually not executed. People possesses perceptions that the preparation of procurement plan was pertinent in executed tenders. Information in Table 12, demonstrated that 45% of responses accepted that tenders were executed as per year procurement plan. Meanwhile, 27% and 28% of responses did not accept and were neutral on detached as per procurement plan. The disappointment to the procedure of tenders emanate from inadequate procurement system as imaged objectives were not realized.

A survey on the devotion in using procurement approaches demonstrated in yearly procurement plan that 68.8% of responses accept that the approaches were executed per plan. Information agrees that an amelioration of the procurement process as given that per had a suitable considerate on using procurement approaches this, evading pointless adjusted during the execution.

The purpose of general procurement notice was to change people on different procurement change that exist for each on financial year. It stimulate organizations to predict and make themselves. However, the announcement of GPN to the people stimulate competitiveness as many suppliers, contractors or service deliverers have awareness of change while increasing the success of construction project. This research demonstrated that 43.8% of participants from Baraka properties accepted that general procurement notice was accepted timely and issued to the community. However, 56.2% which contains 36.5% that disagree and 19.7% that are not sure on whether the general procurement notices were accepted on time and delivered to the people on due time.

This research evidenced that 37.5% accepted that procurement requirements from incumbent directorates or units were yielded at the right time and well denoted. In addition, 20.8% did not accept and 41.7% were not sure. This great number of

uncertainty and disagreement forth estate on fear on the study question. This evidences that to some extent there is an issue on delivering user requirements to the public procurement units for designing and beginning to tender.

Results show that 20.8% from Baraka Properties Ltd accept that procurement change were suitably adverse in accepted media. Moreover, 79.2 comprises of 46.9% did not accept and 32.3% were uncertain. The origin of a suitable publication was to afford equal chance by qualified suppliers or contractors and fascinate as many figures of economic actors as possible to confirm competition, while achieving value of money. A research conducted to assess the prices of bids for the accepted bidders evidenced that 72.9% of responses did not accept that bid process were verified prior to award to the approved bidders while the remaining 7.3% accepts with the statement.

The role of record keeping was very pertinent in improving clearness, audit and accountable with procurement system. Results shows that only 19.8% of responses from per accepted on system for upholding procurement records and 40.6% and 39.6% of responses have not been accepted and were neutral.

In order to strengthen data analysis, the researcher held interview with the chief in charge of inventory in order to see what and to what extent procurements practices had affects the success of Baraka construction projects. This this context, she confirms "what I can tell you is that adequate inventory control practices we have adopted are for instance floating of tender as per App, adequate procurement methods selected as indicated in the procurement plan (PP), timely approval of PP and Insurance of GPN, timely and appropriate submission of PR, adequate binding of documents, advertisement of tender opportunities, verification of successful bidder's price to the market and procurement record keeping. This information did not contradict the findings from ordinal respondents in quantitative data

Table 13: Effects of procurement on performance of construction projects

Level of Agreement	Disagree		Not Sure		Agree		Total	Mean	Stdev
	N	%	N	%	N	%			
Improves quality of materials procured	78	40.2	15	7.9	101	51.9	195	2.9	1.4
Acquiring of right materials at the reasonable prices	60	30.6	14	7.1	121	62.3	195	3.2	1.5

Ensure sufficient and availability of materials	34	17.3	20	10.2	141	72.5	195	3.6	1.4
Recognition of a need for materials.	58	29.9	6	2.9	131	67.2	195	2.2	1.4
Selection of possible source of supplies	69	35.6	20	10.1	106	54.3	195	3.4	1.5
Clear invoice and payments	63	32.3	18	9.1	114	58.6	195	3.3	1.7
Settling favourable tendering prices	56	28.6	15	7.9	124	63.5	195	2.9	1.4

Source: Primary Data (2020)

From Table 13, the average of information given with the highest impact comprised of: Improves quality of materials procured, acquiring of right materials at the reasonable prices (2.9), ensure sufficient and availability of materials (3.2) and recognition of a need for materials (3.6). The effects of procurement with mean higher than 3.3 meaning the participants accept that impacts of procurement would achieve the highest level of success of construction project at Baraka Properties. The tendency was in accepting with the existing and previous studies. Most of responses accepted that procurement systems were a positive element to the success of construction properties at Baraka Properties Ltd, Kigali.

Findings with the mean of about three inevitable have been apathetic of the aforementioned impacts. Those include: selection of possible source of supplies (2.2), clear invoice

and payments (3.4), and settling favourable tendering prices (3.3). It is able to qualify the constraints encountering procurement at Baraka Properties.

Qualitative information on procurement indicated that this material management practice used by Baraka Properties stimulates the success of construction projects undertaken by the company. Furthermore, interview held with the director of procurement unit indicates that he says “*this practice improves quality of materials procured, right materials at the reasonable prices, to be sure with sufficient and availability of materials, recognition of a need for materials, selection of possible source of supplies, clear invoice and payments and leads to settle of favourable tendering prices*”. This information did not contradict the findings from respondents.

Table 14: Correlation Analysis of the Study variables

		Procurement Process	Performance of construction project
Procurement process	Pearson Correlation	1	.874**
	Sig.(2-tailed)		.000
	N	195	195
Performance of Construction Project	Pearson Correlation	.874**	1
	Sig.(2-tailed)	.000	
	N	195	195

**Correlation is significant at the 0.05 level (2-tailed).

Source: Primary Data (2020)

Findings indicated that coefficient correlation between procurement process and performance of construction project at Baraka Properties is 0.874. It means that there is a significant correlation between procurement process and success of construction project of Baraka Properties Ltd, Kigali, Rwanda hence has contributed to the development of company.

5. CONCLUSION AND RECOMMENDATIONS

The first research objective assessed effects of material estimation cost on performance of construction project at Baraka Properties Ltd. The researcher argued that in most of cases, contractors efforts used in managing costs were relied on managing resources. A quantitative analysis was done using coefficient correlation test at 95% indicates that cost reports, cost estimation and budget, and resource management were pertinent elements utilized by contractors to copy with cost on construction projects.

The second research objective determined effects of inventory control system on the success construction project at Baraka Properties Ltd. Findings discovered the existence of a positive relationship between inventory control and performance of construction project. This meant that through inventory control in material management, a company can attain the profit of adequate utilization of employees, affording system flexibility, enhancing production, reducing lead time, reducing wastes, reducing production expense, enhancing product quality were attained.

Scores from the study indicated that inventory control system contribute more to the success of construction project, and like companies should know that inventory control will be strongly accepted in material management actions related to the attaining of higher level of success for construction project. Findings indicated that coefficient correlation between inventory control and performance of construction project was

0.884. It implied the significance link between inventory system and success of construction projects of Baraka PropertiesLtd.

The third objective examined the effects of procurement on performance of construction projects of Baraka Properties Ltd. Procurement in the company did not succeed to preservice the reliability and integrity as the government according wrong contract management, and analysis ca stimulate the postponements or retardation in distributing due financial means provisions to suppliers, cost increase owing to unnecessary change orders. In addition, most of efforts are concerted to people who have tender that are approved rather than considering it in a holistic way of procuring.

Following the findings from this research, the researcher recommended the management of Baraka Properties Ltd, and other construction firms to embrace construction material management in Rwandan construction companies to improve project performance. There is a need of adopting the best management plans. Giving enough and professional figures of labour and adequate materials using detailed cost estimation and using adequate bidding documents.

This study proposes that contractors focus on issues that remarkably impact cost management, involvement of expert in cost estimation renewing staff members through in-service training, refresher course and involvement in workshops of cost management system. Construction sector may consider effects of developing ICT to systematize their cost information management systems. The research proposes the necessity to use inventory control system and information communication technology particularly MRP for attaining higher level of success and ameliorating the ultimate outcomes of site construction. There is a need to afford stuffiest in service training and capacity building for construction management of material in the country in order to have adequate site in construction.

Further studies are needed to establish the efficiency of these mechanism for managing construction projects.

Furthermore, the study had only focused on cost in term of material management. In this regards, a study is needed to see the contribution of material management on project provision in term of quality. Furthermore, a wide sector wit sample may be adequate to generalize information discussed in the research.

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