ST. MARY'S UNIVERSITY
SCHOOL OF GRADUATE STUDIES

PRACTICES OF MATERIALS MANAGEMENT AT CONSTRUCTION PROJECT SITES: IN THE CASE OF SMALL SIZED CONSTRUCTION ENTERPRISE IN KOLFE KERANIYO SUB CITY

DEPARTEMENT OF PROJECT MANAGEMENT

BY

MELAKU GIRMA IDNO: - SGS/0585/2011A

ADVISOR:

Dr. BUSHA TEMESGEN

ADDIS ABABA, ETHIOPIA

JUNE 2021

PRACTICES OF MATERIALS MANAGEMENT AT CONSTRUCTION PROJECT SITES:

IN THE CASE OF SMALL SIZED CONSTRUCTION ENTERPRISE IN KOLFE KERANIYO SUB CITY

BY

MELAKU GIRMA SGS/0585/2011A

THESIS SUBMITTED TO ST. MARY UNIVERSITY, SCHOOL OF GRADUATE STUDIES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PROJECT MANAGEMNT

ADDIS ABABA, ETHIOPIA

JUNE 2021

ST. MARY'S UNIVERSITY
SCHOOL OF GRADUATE STUDIES

THESIS TITLE

PRACTICES OF MATERIALS MANAGEMENT AT CONSTRUCTION PROJECT SITES:

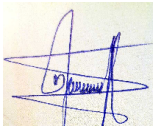
IN THE CASE OF SMALL SIZED CONSTRUCTION ENTERPRISE IN KOLFE KERANIYO SUB CITY

BY

MELAKU GIRMA

APPROVED BY BOARD OF EXAMINERS

----------	----------
Dean, Graduate Studies	Signature
----------	----------
Advisor	Signature
----------	----------
External Examiner	Signature



Muluadam Alemu (Ph.D)		July 13, 2021
Internal Examiner	Signature	Date

DECLARATION

I, the undersigned, declare that this thesis entitled **"practices of materials management at construction sites in the case of small sized construction enterprise in kolfe keraniyo sub city"** is my original work, and has not been presented by any other person for an award of a degree in this or any other University.

MELAKU GIRMA **----------**

Name **Signature**

ST. MARY'S UNIVERSITY

ADDIS ABABA, ETHIOPIA

JUNE 2021

ENDORSEMENT

This is to certify that this project work, "**practices of materials management at construction sites in the case of small sized construction enterprise in kolfe keraniyo sub city**" undertaken by MELAKU GIRMA for the partial fulfillment of Master of project management at St. Mary University, is an original work and not submitted earlier for any degree either at this University or any other University.

Research Advisor

---------- **----------**

Dr. BUSHA TEMESGEN **DATE**

ACKNOWLEDGMENT

First of all, I want to thank GOD for helping me for the successful completion of this research and bringing my desire to reality. Then I would like to express my gratitude and deep appreciation to my advisor, Dr. Busha Temesgen for his valuable comment, suggestions and advice during the period of preparing this thesis paper and also to saint marry University for giving me the chance to enroll the PM program.

TABLE OF CONTENTS

Contents **Page**

LIST OF TABLES

Table **Page**

ACRONYMS AND ABBREVIATIONS

A.A	Addis Ababa
A.A.H.P	Addis Ababa Housing Project
KKSC	Kolfe Keraniyo Sub City
SSCE	Small Size Construction Enterprise
HCB	Hollow Concrete Block
CICE	Construction Industry Cost Effectiveness
CII	Construction Industry Institute
IS	Indian Standard
Hr	Hour
ICT	Information Communication Technology
IS	Indian Standard
Kg	Kilo Gram
Lb	Pound
NO.	Number

ABSTRACT

This study assessed the current practices of managing materials in construction projects, the problems associated with materials management and measures for managing materials in construction project sites in kolfe keraniyo sub city. The study of this research analyzed using descriptive statics including mean index score method and frequency analysis and the principal tool used for collection of data was questionnaires for field survey, interview and site observation to make the study strong. Generally, the study conclude that Problems related with construction material management, Wastage in building construction project sites, measures taken for effective construction material management and usage of methodology were identified. Finally the study of this research recommend that Contractors, consultants, clients and other professionals working in the construction industry should increase their commitment to staff training and development in construction materials management so as to develop the necessary skills, update their knowledge, and encourage and support to develop new construction methodology for the reduction of wastages as well as to increase efficiency of materials management to address the problems.

Key words: - Construction Material Management; Current Practices; Construction Projects; Kolfe Keraniyo Sub City; Materials Wastage.

CHAPTER ONE

INTRODUCTION

1.1. Background of the study

Construction materials constitute a major cost component in any construction project. The total cost of materials may be 50-60% of the total project cost. (Dawood, 1996). Hence effective management of materials is highly important to the construction project. Poor planning and control of materials, lack of materials when needed, poor identification of materials, re handling and inadequate storage cause losses in labor productivity and over all delays that will can indirectly increase total project cost. Good project management in construction must therefore vigorously pursue the efficient utilization of materials (Haddad, 2006).

The material management is designed to improve the activities related to the flow of materials. They add that material management should coordinate purchasing, inventory control, receiving, warehousing, materials handling, planning and transportation (Dobler & Burt 1996).

It has also been estimated that in the American construction industry, the lack of effective materials management has resulted in work hour overruns of up to 18%, and a basic materials management system can be expected to provide up to 6% improvement in craft labor productivity (Thomas et al 1989).Though there are no documented figures for the work hour overruns for Ethiopian construction industry, but the figures are likely to be high for the Ethiopian situation.

The waste represents a relatively large percentage of production costs and this waste is due to the poor materials control on construction sites. (Navon & Berkovich 2005) identified the major problems of materials arriving to the site at the wrong time, or the wrong quantity, materials that do not match the purchase order (PO) and expenditing and reduction in waste caused by manual and in efficient materials management and control.

The ability to manage the flow of materials has also been found to have a great impact on the profitability of the firm. Losses of building materials occur on most construction sites in

Ethiopia, and wastage of materials is a major problem on construction sites in Ethiopia where the levels of wastage are considered to be fairly high.

The Construction industry is increasingly becoming competitive and good management practices are essential for those who want to remain competitive. However, the essential and desired site materials characteristics (materials attribute) of right quality, right quantity, right time and reasonable cost are evidently scarce on construction projects in Ethiopia (Asmara, 2015). Can the Ethiopian contractor/developer adequately manage materials for specified tasks on the site?

This study investigates the relationship between the extent practices of materials management (Planning, organizing and controlling) and materials attributes (availability, right quality, reasonable cost, minimal surplus and minimal wastage) for Hcb materials (gravel, Sand, Cement and water) on construction projects in Ethiopia, Addis Ababa, kolfe keraniyo sub city(KKSC).

Especially, management of construction materials is generally recognized to be the integrated coordination of materials takeoff, purchasing, expediting, receiving, warehousing, proper utilization and disposal. When these functions are not properly managed, materials shortages, surpluses, and cash flow problems are likely to occur. (Bell, 1987).

Materials management functions include planning and taking off materials, vendor Evaluation and selection, purchasing, expenditure, shipping, material receiving, warehousing and inventory, and material distribution (Narimah, 2011). Almost 60% of the total working capital of any industrial organization consists of materials costs. Materials management can only produce what it should with the right quantities of the right material at the right time.

Thus, any improper handling and managing of materials will cause a huge effect on the total project cost, time and quality. There is a need to explore on the area of materials Management, the issues relating to materials management problems. The aim of this study is Therefore to investigate deeply the material management practices on construction sites of Addis Ababa, KKSC.This study investigates the relationship between the extent of materials management (Planning, organizing and controlling) and materials attributes (availability, right quality, reasonable cost, minimal surplus and minimal wastage) for Hcb materials (gravel, Sand, Cement and water) on construction projects in Ethiopia, Addis Ababa, KKSC.

1.2. Problem statement

Construction projects in Ethiopia, Addis Ababa KKSC. Can be said to experience poor materials attributes in terms of availability, right quality, reasonable cost, minimal surplus and minimal wastage. Observed action of poor materials attributes on the construction site includes the following;

Materials arriving to the site at the wrong time, or in the wrong quantity; Forgetting to order materials; Lack of complete and up-to-date information regarding arrival of materials to the site and, or, regarding on site stocks, Surplus of, or missing, materials; Lack of storage space for materials on site; Waste of man-hours searching for materials and tracking them ;emergency purchases of materials; stoppage of work due to material shortages; inadequate storage space for materials; uncontrolled wastage of materials; damaged materials on site; wrongful purchase of materials; condemnation of materials and works by consultants; Disappearance of materials from site through theft.

The design and construction of buildings is a balance and compromise in the circumstances existing at the time, between quality, time and cost (Turner 1997). Costly 'labor delays experienced due to required quantity and quality of materials not being available could lead to increased cost overruns and overall delays in the construction project and could also affect the quality of the constructed facility (Enshassi et al., 2003, 2008).

The overall effect of poor materials attributes could therefore significantly lead to increased time and cost overruns, and poor quality for the project. At worst, for the contracted projects, it could also lead to protracted legal battles and arbitration due to cost and time overruns, and bad quality of the project (Josephine N. Sila, 2021).

The problem under study is the cause of poor materials attributes on construction sites in Ethiopia, Addis Ababa, KKSC for small scale construction enterprise.

Lack of effective material management is one of the major causes of this problem. Failure of the project manager to make available materials need could lead to delay. Non-compliance strictly with project bill of quantities, schedule of materials, specifications and construction program in material stock control practice is another contributing factor which tends gradually to decrease profitability of a project also often leads to extension of time respectively (FH Ahmed, 2017).

Besides that, the rate at which materials are being wasted due to improper management is becoming unbearable to small sized construction enterprise projects due to its effect on profit margin and proper usage of material to achieve quality job (Dey, 2001). Therefore, the overall intention of this study is to assess the material management practices on the construction projects site of small sized Construction Enterprise in KKSC.

The problem under study is the cause of current materials management practices attributes on construction sites in Ethiopia, Addis Ababa, KKSC for small scale construction enterprise.

1.3. Research questions

The following are the research questions as related to this study.

1. What are the current practices of materials management for the production of hollow Block in small sized construction enterprise looks like?
2. What are the problems of materials management practices on the small sized Construction enterprise project sites?
3. What measures are put in place to ensure effective materials management on SSCE's projects construction sites?

1.4. Objective of the study

The primary objective of this study is to assess practices of materials management at construction sites in the case of small sized construction enterprise in kolfe keraniyo sub city with a view to giving solutions to the identified problems. .

The specific objectives of this research are;

1. To study the current practices of construction material management in small sized Construction Enterprise
2. To identify the problems of materials management on construction project sites in small sized Construction Enterprise
3. To assess the appropriate measures to be put in place to ensure effective Materials management in SSCE Construction Project sites.

To fulfill all these objectives, it is necessary to establish harmony and good co-ordination between all the employees of material management department and this department should have good co-ordination with the other departments of the organization to serve all production centers.

1.5. Significance of the study

It is widely recognized that construction industry plays a vital role in the process of economic growth and development, both through its products (infrastructure, buildings) and through the employment created in the process of construction itself (Gruenberg 1997). Construction Industry in Ethiopia is an important source of employment, income and capital formation. The industry creates investment opportunities for individuals, firms and government as well as providing basic infrastructure such as roads, housing, water and sewerage facilities required for development of other sectors. As mentioned earlier in this study, construction materials can constitute up to 60% of the cost of the project thus playing a very significant role in the success of the project and the industry as a whole.

The industry has been very competitive; Tendering procedures have also become very competitive. Many contractors are therefore forced to take contracts at very minimal profit margins. Occasionally some of the contractors have had to close down due to losses or have even been unable to complete some projects. If good materials management can be enhanced, project delivery and profit levels for the contractor or savings for the client will be greatly improved. This will also ensure that they remain competitive and sustainable. Effective materials management can provide better tools to the work force, improve cost effectiveness and have a significant impact on the ability of the construction industry to compete in both the domestic and international market place.

The informal construction sector within the construction industry has grown since the 1970's. With limited expertise and experience, this sector is likely to experience more negative material attributes and eventually less efficiency. The outcome of this study also assists the sector to be more efficient. Even for the established contractors, because of lack of regulated legal framework to regulate those who enter the industry as contractors, most of the construction firms lack qualified personnel to handle the management functions of the firms. This study would therefore be helpful to such firms in improving their management of materials.

1.6. Scope of the study

The study was conducted to assess the professionals' perception on material management Practices on the construction projects site of in SSCE. The study was conducted only in SSCE using self-administered semi structured questionnaire. Hence, it was limitations since the study is to be conduct in small sized construction enterprise, the results may not be used to generalize and apply to all construction contractors in the country as these contractors are different in organizational structure, type and scope of projects they undertake, technological capability etc. Furthermore, since the study had done by self-administered questionnaire, it was liable to social desirability bias.

For practical purposes, the study has been limited in scope to management of materials and does not include into other management aspects of the project that could also affect project performance. The materials under study have been limited to major materials that constitute hollow concrete block (HCB) (aggregate, Sand and Cement). Water which is also an ingredient of Hollow concrete block. Hollow concrete block were convenient to study, Hollow concrete block being an end product of several materials mixed together under defined standards/specifications. The simultaneous use of many materials to give this end product is likely to strongly expose aspects of inadequate management of materials.

Hollow concrete block in its varied forms is used on virtually all building projects mainly due to its unique properties and it being readily available. Consumption of cement, which is the main constituent material of HCB, is used to establish the growth of the building industry.
Timber, steel and stone are supposedly substitute materials to HCB. However due to various limitations of these substitutes mainly construction industry uses HCB. A study of HCB and its constituent materials is therefore likely to receive wider application. Although other factors could also be contributory to poor materials attributes, in depth analysis has only been carried out on the relationship between extent of materials management and materials attributes.

This scope covers sites where HCB is prepared and cast on site (in situ) are the most used on construction sites in Ethiopia. This scope is meant to narrow down the study to a manageable level and enable the researcher to carry out focused analysis.

1.7. Limitation of the study

- The major constraints of this study were the non-availability of adequately published and documented data about construction material management practice by the organizations which would have been useful if found.
- The main constraint was that even the data found it was not adequate.
- By geographical coverage, the study is limited to the sub city of Addis Ababa KKSC due to financial and time constraints.
- Time constraints, lack of adequate resources and denied access to sites, limited the actual number of sites studied

1.8. Study assumption

It is the basic assumption of this study that the sites studied follow conventional construction procedures where regardless of the construction procurement method used, designs are taken to some reasonable level of completion before construction work begins. It is assumed that the problems of poor materials attributes face both formal and informal construction projects. The size of the project, method of financing and size of the contractor could also have influence on materials management. However, the study did not consider on these influences in details. The study also assumed that the contractors or developers on sites studied are not scrupulous and that they are interested in good project delivery, particularly in terms of time, cost and quality.

HCB was selected to form the basis of this study because HCB works is done on virtually all major construction works and the process of HCB works encompasses most of the major issues about materials management and materials attributes. Thus HCB was assumed to be representative enough to study. However, it is assumed that the findings of this study are applicable to the rest of building materials.

Since Addis Ababa has the highest level of construction activities and all the projects studied are in Addis Ababa, it is assumed that it would be representative of other regions of the country. Addis Ababa is the capital city and the most active economic center of the country. Operations of economic activities in other parts of the country are mostly typical to similar activities in Addis Ababa.

1.9. Organization of the study

The Study has five chapters;

Chapter one gives a general introduction including background of the study, problem statement, research hypothesis, objectives of the study, significance of the study, scope and justification, limitations, assumptions, organization of the study and definition of terms. Chapter two covers literature related to management of materials and materials attributes. This forms the theoretical basis of the study and the basis for evaluation of primary data to make research conclusions. Chapter three covers research methodology. This includes research design, population and sample, data collection procedures, data analysis procedures and measurement of variables. Chapter four contains the actual data from the survey. It gives the findings and analysis related to the problem of the study. Chapter five contains conclusions and recommendations of the study.

CHAPTER TWO
RELATED LITERATURE REVIEW

2.1 Management of Construction Materials

This chapter is talking about scholarly paper that presents the current knowledge including substantive findings as well as theoretical and methodological contributions to a particular topic. Literature reviews are secondary sources and do not report new or original experimental work. Most often associated with academic oriented literature, such reviews are found in academic journals and are not to be confused with book reviews, which may also appear in the same publication.

Construction Materials management is an important function in order to improve productivity in construction projects. According to Bell and Stukhart (1986) materials management functions include "material requirement planning and material take off, vendor evaluation and selection, purchasing, expenditure, shipping, material receiving, warehousing and inventory, and material distribution"(Kasim, 2008).

According to (Kasim, 2008), an essential factor adversely affecting the performance of construction projects is the improper management of materials during site activities (Gulghane1, 2015). Material is the main component in any of the construction projects. Therefore, if the material management in construction projects is not managed properly it will create a major project cost variance. The total cost of the project can be well controlled by taking corrective actions towards the cost variance occur in the project (Madhavi et al. 2013; Veronika et.al. 2006). Studies by the Construction Industry Institute (CII) have shown that materials and installed equipment can make up 50–60% of the total project cost and impact 80% of its schedule (Caldas et al. 2014). During the last few years, enormous growth in infrastructure has been found, by wide range of diversity construction organization (Desale et.al. 2013). Fundamental principles of site material management enlighten the factors considered during site layout and planning for efficient material management. Ineffective material management practices are evident on many projects and cause considerable waste in time and money (Randolph et al. 2005; Keitany et al. 2014). For managing a productive and cost-efficient site efficient material management is very essential. The materials management system in any project insure that the

right quality of material and quantity of materials are appropriately selected, effectively purchased, properly delivered and safely handled on site in a timely manner and at a proper reasonable cost (Kanimozhi et.al, 2014; Donyavi et.al. 2009). Any organizations need to put their effects for proper materials management techniques for the effectiveness of project execution (Gulghane1, 2015).

Material management involves storage, identification and retrieval, transport, and construction methods. Each of above is indelibly linked to ensure safety, productivity, and schedule performance. According to Kini (1999), materials management is an indispensable part of the project management which can be integrated with engineering to provide an end product that meets the client's requirements and is cost effective. Over the years, materials management in any construction project has become a critical component of successful project execution (Caldas et.al, 2014; Georgekutty et.al, 2012). There should be a centralized material management team co-ordination between the site and the organization so that effective material management strategies can be applied and monitored.

Construction materials management may present similarities at the conceptual level but the implementation details vary. Material planning considers materials in the order of requirement at site (Desale et.al, 2013). Material procurement and storage on construction sites need to be properly planned and executed to avoid the negative impacts of material shortage or excessive material inventory on-site deficiencies in the supply and flow of construction material were often cited as major causes of productivity degradation and financial losses (Kanimozhi et.al, 2014). It is observed that construction materials are less homogeneous, less standardized, and more numerous than those of manufacturing, and that the characteristics of demand are different. There should be awareness about material planning & scheduling at every stage of material management (Patil et.al, 2013).

This is concerned with the planning and controlling process to ensure that the right quality and quantity of materials and installed equipment are appropriately specified in a timely manner, obtained at reasonable cost and are available when needed. Materials management involves the logistics of the materials components of a supply chain which involves the process of planning, implementing and controlling of the movement and storage of raw materials, work-in-process inventory, and finished goods from point-of-origin to point-of consumption. The management of

materials should be considered from the phases of the construction process and throughout the construction period. Generally, construction materials are bulky, expensive and are supplied in large amounts to construction sites. Therefore, there is a need for an excellent management system for handling materials.

Ballot (1971), defines material management as the process of planning, acquiring, storing, moving, and controlling materials to effectively use facilities, personnel, resources and capital (Haddad, 2006)

Tersine and Campbell (1977), define material management as the process to provide the right materials at the right place at the right time in order to maintain a desired level of production at minimum cost. The purpose of material management is to control the flow of materials effectively.

Beekman-Love (1978), states that a material management structure should be organized in such a way that it allows for integral planning and coordination of the flow of materials, in order to use the resources in an optimal way and to minimize costs (Haddad, 2006).

Materials management is a process for planning, executing and controlling field and office activities in construction. The goal of materials management is to insure that construction materials are available at their point of use when needed. The materials management system attempts to insure that the right quality and quantity of materials are appropriately selected, purchased, delivered, and handled onsite in a timely manner and at a reasonable cost. Materials management is the system for planning and controlling all of the efforts necessary to ensure that the correct quality and quantity of materials and equipment are properly specified in a timely manner, are obtained at a reasonable cost, and, most importantly, are available at the point of use when required (ASAD, 2005).

An extensive study of the literature survey revealed that projects are implementing without a specific method in construction material procurement and storage. It is usually done by approximation based on the project estimate. As a result, the procurement cost and storage cost are high, which leads to huge overheads in projects. The literature study leads to a conclusion that construction projects will suffer slippages at the beginning to every stages of its implementation and finally project loss is the net result. The major area of loss is identified in

procurement and carrying of construction materials. A new approach has suggested through this paper. This can be adopted as a general method to other projects (Georgekutty, (July-Aug 2012)).

2.2 Management of Construction Tools

Construction Materials and tool management are a large part of any construction project. In more recent years, construction firms have allocated more focus on retaining small tools, which in the past were perceived as "disposable". Numerous technological advances have been made that enable tool tracking to be more efficient. Barcodes and scanners are one of the most common techniques used to track tools today. The problem with implementing this system is the complexity of the process. In the past the tools were just replaced, one simple step. The barcode system requires labeling, tracking, cataloguing, filing, and coordinating a multitude of tools. The process is much more demanding (Kuykendall, 2007).

2.3 On site material management functions

Chandler (1987) stated that, the map of site control of materials is to command their conveyances to the site in order to command the waste and guarantee the materials available on site in the right clip. He besides added that, materials control duties can be separated into two countries of actions which is:

Action Prior to Locate Delivery

- This may include the under mentioned actions:
- Continuous cheque on order pending bringing or call for division day of the months
- Pull offing the alteration in the rate of work motion and measure its impact
- Deliveries schedule to set bringing day of the months consequently.
- Inform the provider about bringing accommodations
- Discuss and settle with the provider to accommodate to the agreed agenda.
- Follow up the measures and specification alterations of the stuffs
- Chasing a major undertaking in a sensible period of clip before supply confidence.

Action after Site Delivery

Concerned for materials having, look payment. These activities and actions provide an of import agencies for commanding the waste of materials, and do the right provider to extinguishing the add-on cost paid. However, whatever the actions of materials direction are running, they need a concerted engagement of both parties such as caput office and the site maps that are primary controlled under the action of site direction:

- Materials Planning and hastening
- Materials having and review.
- Materials managing and distribution.
- Inventory and stock list control
- Materials managing and distribution
- Quality Assurance and Quality control
- Material Surplus disposal

2.4 Factors Related with Construction Material Management

There are several factors within the scope of construction material management and each of these factors can give rise to potential problems. The more factors are divided, the more potential problems that exist. There are many factors which contribute to poor construction material management in construction projects. Zakeri et al (1996), suggested that factors such as waste, transport difficulties, improper handling on site, misuse of the specifications, and lack of proper work plan, inappropriate material delivery and excessive paperwork all adversely affect on construction material management (Phul, 2014). Factors related with construction material management can be mostly found in the following areas in the construction projects. K.A.Okorocha, (2013).

A. Planning and Scheduling
B. Monitoring and Controlling
C. Organization and Personnel
D. Procurement
E. Delivery
F. Storage and Storage facilities

G. Usage

H. Surplus and Waste cont

A. Planning and Scheduling

Planning is a fundamental, important process for every project. Construction Material planning, which is a key function of construction material management, is closely linked with project planning and control set-up. Scheduling the entire construction material program is essential to meeting the project timetable. Indeed, planning and scheduling are significant in terms of increasing productivity, profit and facilitating the timely completion of construction projects. The need for an effective construction material planning system becomes mandatory. Some companies have increased the efficiency of their activities in order to remain competitive and secure future work. Many other firms have reduced overheads and undertaken productivity improvement strategies. Considerable improvement and cost savings would seem possible through enhanced construction materials management. Timely availability of construction materials and systems are vital to successful construction. Construction materials management functions are often performed on a fragmented basis with minimal communication and no clearly established responsibilities assigned to the owner, engineer or contractor. K.A.Okorocha, (2013).

B. Monitoring and Controlling

Monitoring and Controlling of all construction activities in construction material management are conducted to ensure the right source of construction materials with the exact quality, at the right time and place suitable for minimum cost construction process. It is a process in which facilities, personnel, resources and capital are monitored and controlled to a significant impact on the operations of construction projects. K.A.Okorocha, (2013).

C. Organization and Personnel

Construction material management structure is organized in such a way that it allows for integral planning and coordination of the flow of construction materials, in order to use the resources in an optimal way and to minimize costs. The organization must be structured to provide for the timely performance of the work, with construction material personnel located at appropriate level of project management and influence the decision-making process. K.A.Okorocha, (2013).

D. Procurement

Preliminary investigations for developing sources for procurement of construction materials are made by floating enquiry indents. It is processed by the construction material procurement responsible personnel for inviting quotations with samples of construction materials where applicable. K.A.Okorocha, (2013).

E. Delivery

Delivery in terms of organizing the movement of vehicles, people and construction materials ensures the efficient use of workforce and production or process in construction projects. The routing of construction materials is one of the main causes which affect cost and time during construction. K.A.Okorocha, (2013).

F. Storage and Storage facilities

Construction material storage can be defined as the provision of adequate space, protection and control of building materials and components held on site during the construction process. A good and systematic storage of construction materials provides better management of construction materials in construction industry. K.A.Okorocha, (2013).

G. Usage

Usage of construction materials is the flow component that provides for their movement and placement. Construction Material usage can be Surplus and Waste Control. All projects can expect a certain amount of surplus and waste of construction materials after construction. Surplus and waste construction materials arise at any stage of construction process from inception, right through design, construction and operation of the building facility. Hence, control of surplus and waste construction materials is important to successful construction material management.

Stock control is classified as a technique devised to cover and ensure all items are available when required. Stock control can include raw construction materials, processed construction materials, components for assembly, consumable stores, general stores, maintenance construction materials and spares, work in progress and finished products. It is of great importance that the bulk of construction materials delivery requires proper management of stock control. Meanwhile,

construction activities can generate an enormous amount of waste and construction materials waste has been recognized as a major problem in the construction industry. However, tighter construction materials planning can reduce waste and can directly contribute to profit-improvement and productivity. Each process stated above plays an important role for an effective construction materials management. However, there are construction materials management issues that have not yet been tackled effectively. Section 2.6 will highlight on the current construction materials management problem faced in the construction industry (Maniammai, 2014).

H. Stock and Waste Control

Stock control can categories as a technique planned to be the screen and to guarantee all stuffs or equipment are available when needed. Stock control include natural stuffs, processed stuffs, assembly constituents, consumable shops, general shops, care stuffs and spares, work in advancement and finished merchandises. It is really of import as the building stuffs were bringing as requested and with the patterned advance by the proper direction of stock control. At the same clip, building activities will bring forth large sum of the waste and it will do trouble to the building industry. However, with the planning of the stuff direction which is effectual will assist to cut down the waste of stuff and increase the net income of the companies. K.A.Okorocha, (2013).

2.5 Control of construction Materials

According to (Cheng Hu), Construction Materials (including raw materials, finished products, semi-finished products, components and parts) are construction material conditions of construction, and construction material quality is one of necessary conditions to ensure construction quality (Ying, 2010). Main contents of quality control of construction materials:

(1) Construction Material procurement

The contractor should purchase construction materials based on the integrated consideration of engineering characteristics, construction contracts, and the scope of application, construction requirements, the performance and price of construction materials. The procurement should be arranged in advance according to the construction schedule. Project manager department or enterprises should establish common information of construction material suppliers and track the

market timely. If necessary, construction material sample or field trip is required, and the strict instruction of quality items in construction material procurement contracts should be paid attention. (Ying, 2010).

(2) Construction Material testing

Through a series of detection methods, the construction material data obtained is compared with quality standards, to judge the reliability of quality construction materials, and whether they can be used for engineering. Sampling inspection is commonly used method. (Ying, 2010).

2.6 Challenge of practices materials management on site

There are many issues which contribute to poor materials management in construction Projects. Zakeri et al (1996) suggested that waste, transport difficulties, improper handling onsite, misuse of the specification, lack of a proper work plan, inappropriate materials delivery and excessive paperwork all adversely affect materials management. Shortage of materials contributes to the cause of delay in managing materials in the construction site Ogunlana, Promkuntong, Jeark-jirm (19960; Abdul-Rahman, and Alidrisyi, (1994); Aibinu and Odeyinka, 2006). Late delivery of ordered materials is also problematic in materials management. Furthermore, Dey (2001) noted that the common issues relating to materials management are as follows:

Procedure of buying and supply of materials, the challenges frequently occurs when the materials is non tantamount as the telling purchase, the skipped list out telling materials, timing of materials getting, measures of materials, deficiency of preparation and equal direction, deficiency of Just In Time scheme, deficiency of communicating and relation between contractor and supply concatenation companies are the chief hindrances. Dey, (2001)

In building site, the challenging is obvious which are specifically as:

- Miscarriage to order stock on clip which postponements the undertakings;
- Misguided clip presenting which interrupts the work agenda;
- The sum telling more than the demands;
- Incorrect materials or mistake in path of materials leads dual work;
- Scamp on materials from bringing into production;
- Double handling of stuffs because of unequal stuff.

The key to success of a building direction procedure is to be effectual in building. The chief jobs lead to un effective are fault timing of materials received by the site or unequal quality, improper information for materials arrival to the site stock, losing materials, inaccessibility of storage infinite, and waste of labor for materials seeking on site.

2.6.1 Approaches Addressing when there is Problems on materials management practices on site.

The lack of a proven or standardized supply chain management (SCM) model for the construction industry makes it challenging to be implemented effectively. One of the most common challenges for SCM in construction is the lack of integration and collaboration between all the parties involved.

Design changes, inaccurate calculations, and lack of trust among the stakeholders can be a hurdle in the effective implementation of SCM. Poor quality of materials and equipment, inadequate training of subcontractors and workers are some of the other challenges. Further, there are no tools to efficiently measure the performance of all the parties involved in the project.

Firstly, if there are any problems with the materials delivery (relating to late delivery, materials damages or shortages) the suppliers were advised immediately. There was a second strategy, which involved referral of any problems to the Project's Quality Officer, who solves problems relating to the quality of materials. Lastly, in order to deal with the logistics within the work place', all work by labour is carefully controlled and monitored. In order to avoid double handling and committing the same mistake by to labour force, the site manager gives clear instructions and delegates certain work processes to the construction workers.

According (Narimah ,2008), the measures for effective materials management practices on construction project are:- timely placing of orders for materials; ensure quality assurance/control processes are in place; logistics for tracking & transportation of materials to site; receiving and inspecting materials on site; storage & issuing of materials to construction location; complete quality records of materials; established material management system to be used; documentation; record receipt of goods upon delivery; monitoring of materials distributed; assigning of material codes; construction activities and schedule of materials; proper materials handling; make the store safe from theft and vandalism; materials return to be submitted weekly; determine the daily

allocation of materials on site; education/training/enlightenment of staff in charge of materials management; special security agents; and usage of qualified construction professionals

2.7 Benefits Gained in Good Materials Management practices on site

According to Bernold and Treseler (1991), the following are the benefits of materials management.

- Time is widely recognized as a primary criterion for performance measurement. Poor material management can have a negative effect on project time, like the insufficient stock of materials, lead to idling time as workers try not to exhaust the stockpile or it is worsened by the work stoppage. Due to this shortage, materials need to be reordered and causes longer idling time. Consequently, the work progress will be delayed. Therefore, the availability of sufficient quantity of materials affects the projects time. A proper material management system ensures that there is enough buffer stock so as to prevent any stoppage in production.

- Cost is one of the major considerations in the entire cycle of projects. Effective material management is able to reduce the overall cost of material. For example, in the purchasing process, discounts and bulk order may be economical as it reduced the transportation and ordering cost, thus, by minimizing the procurement cost of materials, the higher chances for reducing the overall project cost and concurrently increasing company profit. However, the reasonable time needs to be considered so that the materials are not ordered too early or it may affect the company capital, interest charges, and storage charges. Wrong calculations can lead to over or under stocking which will be bad for the industry. A proper MM system helps in determining the number of materials to be ordered to reduce cost without any obstructions in production

- The term quality has sometimes become a problem as it is a subjective matter and understood differently by different people and organizations. Therefore, it is important to be able to identify client's requirements and specify clearly in the contract document. Availability of resources such as materials and equipment as planned during project duration is one of the factors contributing to quality performance. The available

equipment also needs to be in good condition and in sufficient quantity. Without the proper and sufficient equipment, quality of the project can be jeopardized. Similarly, the materials itself also needs to be inappropriate quality according to the specification. In sum, the available resources must be in accordance with the specification, sufficient quantity and functional. The material management system can be used to ensure all this hence getting a satisfactory quality in production.

- The productivity is measured in terms of unit completely accomplished during given period and the related costs in terms of man-hours or money. After analysis in different industries, a research organization reported that the lack of materials is a primary factor that had a moderate to strong effect on productivity. More importantly, it has been accumulated that disruptions in material management resulted in a loss of labor productivity as well. Material storage also had a significant impact on labor productivity. For example, inappropriate storage location increases unproductive inputs. This occurs as the workers need longer time and effort to retrieve materials. Due to this, wasting of workers' energy occurs and they may end up physically fatigued. With appropriate site storage, workers energy can be productively used to perform the task in progress. This situation is also similar to the efficient site layout for material movement. Efficient movement of materials increases productivity whilst reduces material travel time. Besides, the availability of material and equipment motivates workers to improve work productivity.

- Waste refers to any material that needs to be moved out from the site due to damage, non-use or cannot be used due to non-compliance with specification and surplus or debris by-product of the production process. In simple words, waste is a product or material that is unwanted and required to transport out. Inappropriate material storage contributes to waste generation. Strategies for waste minimization are the stock control for minimization of over or duplicate ordering, good practices of material handling, systematic inventory process and proper material storage. Hence, the efficient material management practice throughout entire process will minimize the waste generation.

2.8 Use of Information Communication Technology (ICT) in the construction projects

2.8.1 General

There are many millions of documents (such as drawings, specifications, bills of quantities, correspondence, schedules, programs) currently exchanged on paper between practitioners in the construction industry. It is common place that each of these documents are subsequently re-keyed, photocopied and filed, as they pass between different locations and computer applications (Hore1, 2006).

At present the extent of use of Information Communication Technology (ICT) in the construction industry is relatively unsophisticated, mainly dependent on telephone, facsimile machines and networked personal computers. At the simplest level, the electronic transmission of business documents offers savings in paper and postage. By going a step further, businesses can make strides in communicating with their partners, at relatively low cost, through direct links between their computers.

2.8.2 Opportunities for Electronic Support in Construction Projects.

Construction sectors in many countries around the world are increasingly recognizing the importance of ICT. ICT is improving the capability and efficiency of specific aspects within the construction process. ICT should support the entire construction process from inception through to the operational maintenance of the building asset. The idea of a project model that supports improved co-ordination and management of information throughout the project life cycle is gained increased recognition (Hosseini, 2012).

2.8.3 Information and communication requirements in construction Projects

According to (Murray et al., 2001), the construction sector is considered one of the most information-dependent industries. For instance, a construction project chain may involve large numbers of skilled professionals and companies with, quite often, much repetition of activities and accumulation of paperwork. Majority of these participants require access to the regular project information at one time or another (Sekou, 2012).

This means that, timely and accurate access to information is therefore important for all project participants as it forms the basis on which decisions are made and physical progress is achieved. Currently, several construction documents such as drawings, specifications, bills of quantities, correspondence, schedules, and programs produced on construction projects are currently exchanged on paper bases and face to face communication between practitioners in industry (West, 2008).

Admittedly, effective collaboration between all the role players during construction is not only important but also necessary for the successful completion of a construction project. With so many interested parties, effective communication and information sharing among them is vital. Not only must the formal structures and networks be examined to understand the level of information sharing that is happening on a formal basis, but the informal relationships among parties will depend on how and when information is shared and how and when information is flowing

2.8.4 Need for ICT in the construction Projects

According to, Hassanain et al, 2000, the implementation of these ICT technologies in construction are aimed at supporting information sharing among individuals and groups since the construction industry of today and of the future demand the use of sustainable systems enabled by information and communication technologies. Currently, Information and Communication Technologies (ICT) are said to be providing construction firms with new opportunities for enhancing information management processes, communication and collaboration.

According to Songer (2000), owner organizations are requiring the engineering/construction industry to perform at extraordinary levels of project delivery, hence, advances in project delivery systems and use of information technologies provide tremendous potential for enhancing the construction industry's overall performance

2.8.5 Role of ICT in the construction process

According to (Peansupap, 2004), the benefits offered by ICT on construction project are well documented in literature. This include among others improved access to richer information to

aid decision making, quicker information, improved information flow, greater management control and getting geographically dispersed group to work together

The roles of implementing ICT are highlighted in the following stages of the construction process.

1. Tender stage

According to (COBRA, 2009; Çaglar, 2005; Björk, 2002), the main functions of ICT usage at this stage are to advertise and distribute tender documents, select successful Tenders and award contracts. Software used in the stage can:

- Speed up the distribution of documentation and Tenders‟ communications;
- Register Tenders online and download tenders/work packages electronically;
- Provide a simple environment to evaluate the Tenders‟ responses through standard templates;
- Prevent unauthorized access through built in security mechanisms;
- Communicate changes in the tender documents, during the tender process, quickly and easily

2. Design and construction stage

According to (cowel, 2005), both design and production of construction projects share a need for rapid access to information and communication in real time. Improving information and communication support for the core activities at the design and construction stage has become a strategic challenge for the construction industry to increase efficiency and productivity in the construction process (Samuelson, 2003).

Project managers and contractors' control and manage the exchange of documents between members of the project team so that the overall deadlines of the project are met (Business Market Watch, 2005).

It is essential that each team member receives the right documents at the right time such as the latest version of drawings, specifications requirements among others. ICT software's are used at this stage to:

- Improve efficiency of work
- Reduce the risk of errors and rework by ensuring that everyone in the project team is working with the most current drawings and other documents;
- Save time in the query (request for information, RFI) and approval process, by allowing the design team to mark up and comment on drawings online;
- Eliminate the risk of losing important files, by maintaining all current and past versions in one central location;
- Improve team communication by enabling team members to raise and respond to queries in a structured way;
- Maintain a complete log of all communications for tracking purposes (audit trail facility);
- Provide clients and other participants with a view of the project as it is built; as some software have incorporated virtual reality models to denote the status of a project at any point in time (a snap shot view of a project);
- Provide a collaborative environment whereby the diverse participants can perform online collaboration via the web.
- The real exchange of information takes place via other, informal channels, where other forms of information and communication technology such as e-mail, SMS messaging and mobile telephones, which enable direct contacts between project members in network-like cooperation.

3. Trading (e-commerce)

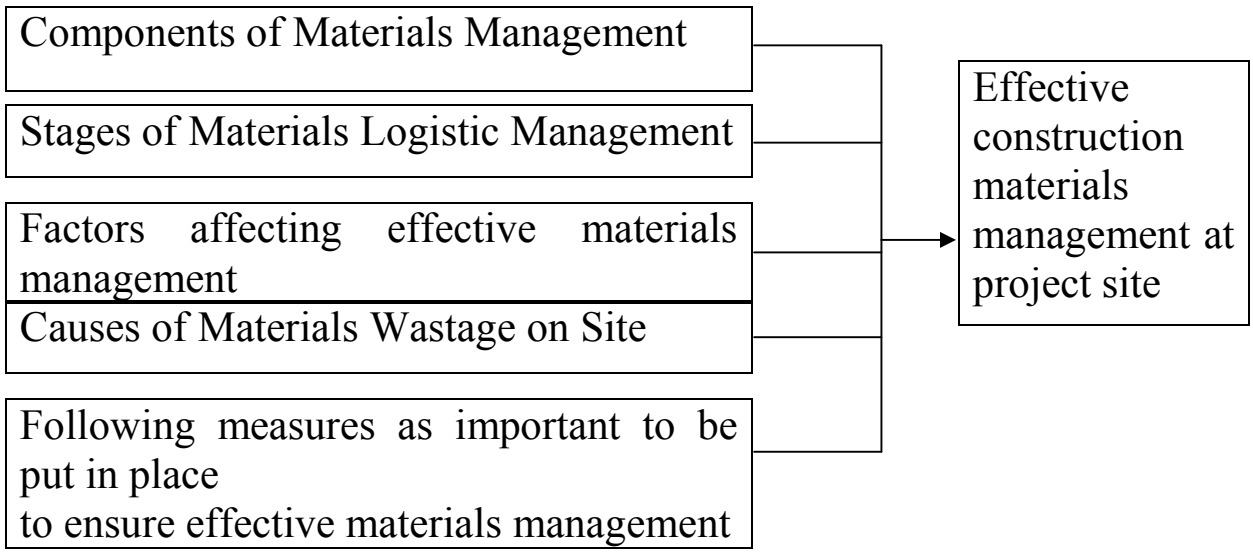
According to (Woksepp and Olofsson, 2007; e-Business Market Watch, 2005), purchasing of construction materials is a lengthy and complex process, which requires the identification of considerable resources and potential suppliers as well as the evaluation of quotes, which are normally received in different formats. Web-enabled Software used in this stage can:

- Save time in the procurement of construction materials by automating document distribution and communications (E-procurement);
- Reduce the administrative costs of document handling and distribution to multiple parties;

- Reduce errors due to effective communication;
- Ensure ease of comparison and evaluation of bids.
- Despite these significant roles, studies indicate that the ICT utilization ratio is still relatively low in the construction industry.

2.9 Conceptual frame work of the research

Fig 2.1: - diagrammatical presentation of conceptual framework of the research



CHAPTER THREE

RESEARCH METHODOLOGY

This chapter includes the methodology used in this thesis work and provides information about the research strategy, site of the study, sources of information, sampling techniques, sampling size, method of data processing, method of data analysis and interpretation.

3.1 Research Approach

Research approach is the general principle which will guide a research. As to Dowson (2007) research approach is the overall approach to studying your topic and includes issues you need to think about such as the constraints, dilemmas and ethical choices within your research. In this study, the quantitative research approach was used by supplementing with qualitative data to better answer the basic research questions. Scholars in the field suggest that the choice of the approaches should base on the purpose that the approach provides for the research than only saying this approach is better than the other. Dowson (2007:25) says "Neither qualitative nor quantitative research is better – they are just different. Both have their strengths and weaknesses." Thus, data was gathered from project managers and construction engineers, office engineers, follow up engineers, site engineers and quantity surveyors, general forman, purchasers, store keepers those who are working in building projects which are located in different part of the sub cities, via self-administered closed ended questionnaire.

3.2 Research Design

A research design is an important part of the methodology that provides a framework for data collection and analysis. Accordingly, in this study to find out the material management practice on construction projects sites descriptive survey research design was employed due to the nature of the study. "Survey research uses instruments like questionnaires and interviews to gather information from groups of subjects" (Ary, Jacobs, Razavieh, & Sorensen, 2006, p. 31). In survey study, researchers ask questions about people's beliefs, opinions, characteristics, and behavior (Creswell, 2003).

There are different types of survey designs like longitudinal and cross-sectional, in this study however the use of cross-sectional survey design was employed. The design is considered appropriate for this study since it involves collecting data at shorter time regarding people opinions and beliefs (Babbie, 2005; Creswell, 2003). It also enables the researcher to obtain current information about the practices encountered in the project site and the actual practices they perform and their commitment regarding efficient utilization construction materials management.

3.3 Sources of Data

The aim of this study was to assess the practices of material management in construction project site around kolfe keranyo sub city of Addis Ababa. The main sources of this study were project managers and construction engineers, office engineers, follow up engineers, site engineers and quantity surveyors, general forman, purchasers, store keepers, those who are working in building projects. These primary sources are selected, because of their responsibility.

3.4 Sample and Sampling Techniques

The study area was in Addis Ababa KKSC. This sub city is selected because other researchers did not give attention both in terms of the area and the practices of materials management. In this sub city, there are so many small scaled construction enterprises. Some of these construction enterprises are taken as both a population and samples. Then, from the population those construction enterprises‟ populations are taken. These will project managers and construction engineers, office engineers, follow up engineers, site engineers and quantity surveyors, general forman, purchasers, store keepers. After deciding on the construction enterprises, researcher has identified the samples from the population in the selected enterprises. The following table shows the population, sample size and sampling techniques used.

Table 3.1. Summary of the Population, Sample Size and Sampling techniques

No	Participants	Total population	Sample size	%	Sampling techniques	Remarks
1	Project manager	10	10	100	Purposive Sampling	Selects to interview
2	Construction engineer	10	10	100		
	Sub total	**20**	**20**	**100**		
3	Office engineers	10	8	80	Purposive Sampling	Selects to interview
4	Follow up engineers	10	9	90		
5	Site engineers	20	18	90		
	Sub total	**40**	**35**	**87.5**		
6	Quantity surveyor	20	20	100	Purposive Sampling	Selects to questioners
7	General forman	20	20	100		
8	Purchasers	10	8	80		
9	Store keepers	10	7	70		
	Sub total	**60**	**55**	**92**		
	Total	**120**	**110**			

Source: own filed survey

3.5 Data Collection Instruments

Data collection instruments also called research methods. With this regard, Dowson (2007:15) says "Research methods are the tools you use to gather your data." In this study three instruments were used. These are: questionnaire, semi-structured interview and direct observation. These instruments are considered important to triangulate the data and/or to combine the strengths of each instrument by minimizing their weaknesses.

3.5.1 Questionnaire

The researcher preferred questionnaire as the main data gathering instrument because it is easier to handle and simpler for respondents to answer within short period of time (Koul, 2008). Also, the questionnaire is the most widely used type of instrument in research. Thus, the questionnaires were prepared in English language containing both open-ended and closed-ended items. Regarding the parts, there were general background and the main questions of the items. On the main part, questions were presented by classifying in to important theme and identify the respondents view through the use of Likert Scales. The questionnaires were developed from literature focusing on the basic research questions of the study. The questionnaires were used to collect data from their view on the five basic research questions of the study.

3.5.2 Semi-structured Interview

This interview was conducted in order to get in depth information and to cross check and supplement the information collected through the questionnaire about construction material management practices in this sub city. This instrument was particularly used to get data from project managers and construction engineers since these bodies have better understand the management and utilization of construction materials at project site. In doing this, interview guide questions were prepared with the main focus to get detail information focusing on the basic research questions.

3.5.3 Observation

Observation was conducted to get adequate data on basic research questions that focus on the actual practices of construction materials management as well as utilization. The observation had its own check lists to better facilitate the observation process. The observation of project site was including: observing the production site, buildings under construction and stores.

3.5.4 Reliability and Validity Test

Before the actual data collection, pilot test was conducted to see the quality of the instruments. Accordingly, a pilot test distributing 20 questionnaires to the respondents who were not participate in the study. The main purposes of the pilot test were to see the readability of the

items, the time given, the consistency and content of the items. Accordingly, the format and order of the question were improved. A thorough editing was done by the researcher. The reliability of the questionnaires was measured by using crobanch‟s alpha method by the help of SPSS version 21. Consequently, the Alpha results 0.852, which indicate the questions constructed were measuring a similar concept highly. As suggested by Cohen, Manion and Morrison (2007) the reliability coefficient above 0.7 are generally found to be internally consistent. Then, the questionnaires were administered to the research respondents for actual data collection of the study.

3.5.5 Methods of Data Analysis

Based on the nature of the basic question developed and the data collected from the respondents both descriptive and inferential statistics were employed by using SPSS version 21.0. To analyze the respondents‟ characteristics descriptive statistics like frequency and percentage were used while frequency, percentage, mean and the Std carry out to determine the significance level of differences in the responses of respondents. Likewise, Rank correlation was used to analyzing the major factors that were practices of construction materials management and utilization.
Moreover, information and/or opinion reported by respondents through the open-ended questions, structured interview and observation were considered in data interpretation and analyzing by supplementing those data gained through closed ended questionnaires.

3.5.6 Ethics of the study

In conducting this study, emphasis was given to every important ethical issue. People were participated with their full permission. Every effort was made to keep participants anonymous and confidentiality. Moreover, every source that is using in this study was acknowledged.

3.5.7 Pilot Test

The reliability of an instrument is the degree of consistency (Polit & Hunger 1985) as cited on (Hammad 2013). In order to have accurate finding Creswell (2003) recommends using different data sources. The methods used in this study were from different sources and one data supports the other data. For questionnaire it is essential to check internal reliability of data (Creswell

2003). The less variation an instrument produces in repeated measurements of an attribute, the higher its reliability (Hammad 2013). Cronbach's Coefficient Alpha can be used to check reliability of questionnaire. The normal range of Cronbach's coefficient alpha value between 0.0 and + 1.0, and the higher values reflects a higher degree of internal consistency (Hammad 2013). The equation used to analyze Cronbach's Coefficient Alpha is

$$\alpha = \frac{Kr}{1+(K-1)\bar{r}}$$

Where K is items (variables) in the scale and r is the average of the inter-item correlations for major activities on construction materials managements, the value of Cronbach's Coefficient Alpha analyzed using SPSS21 shows the questionnaire is reliable and most are highly reliable.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRITATION

4.1. Result/Findings of the study

This Chapter deals with the presentation and analysis of the data collected from different groups of respondents through questionnaires, interviews and observation. The purpose of this study was to assess the practice of materials management in small scaled enterprise around kolfe keraniyo sub city. In order to achieve this purpose, A total of 120 questionnaires which dealt with survey to assess the material management practices in the construction projects site of SSCE. However, 110 questionnaires were collected and usable responses (91.67% response rate), relevant documents have been also reviewed.

The questionnaire contains variables which include issues such as component of materials management, stage of material logistic planning, factors which affect effective material management, problems of material management, and causes of material wastage. All items in the questionnaire are arranged in a form of Likert items to capture the feelings of respondents in scale ranging from 1 to 5. All the data has been analyzed in SPSS 2021 so that the accuracy of the information is maintained. In addition to this a self-administered close ended questionnaire is included to support the researcher to discuss the results more clearly.

4.1.1 General Information about Respondents

In this part the personal characteristics of the respondents is presented, analyzed and interpreted as follows.

Table 4.1 Administered Questionnaires and Responses

Questionnaire	**Frequency**	**Percentage (%)**
No. of distributed	120	100
Accepted responses	110	91.67

Source: Computed from own survey data (2021)

Table 4.2 Respondent's Sex

Sex		Frequency	Percent
Valid	Female	45	40.9
	Male	65	59.1
	Total	110	100.0

Source: Computed from own survey data (2021)

Table 4.2 shows that most (59.1%) of respondents are male and (40.9%) of the respondents are female.

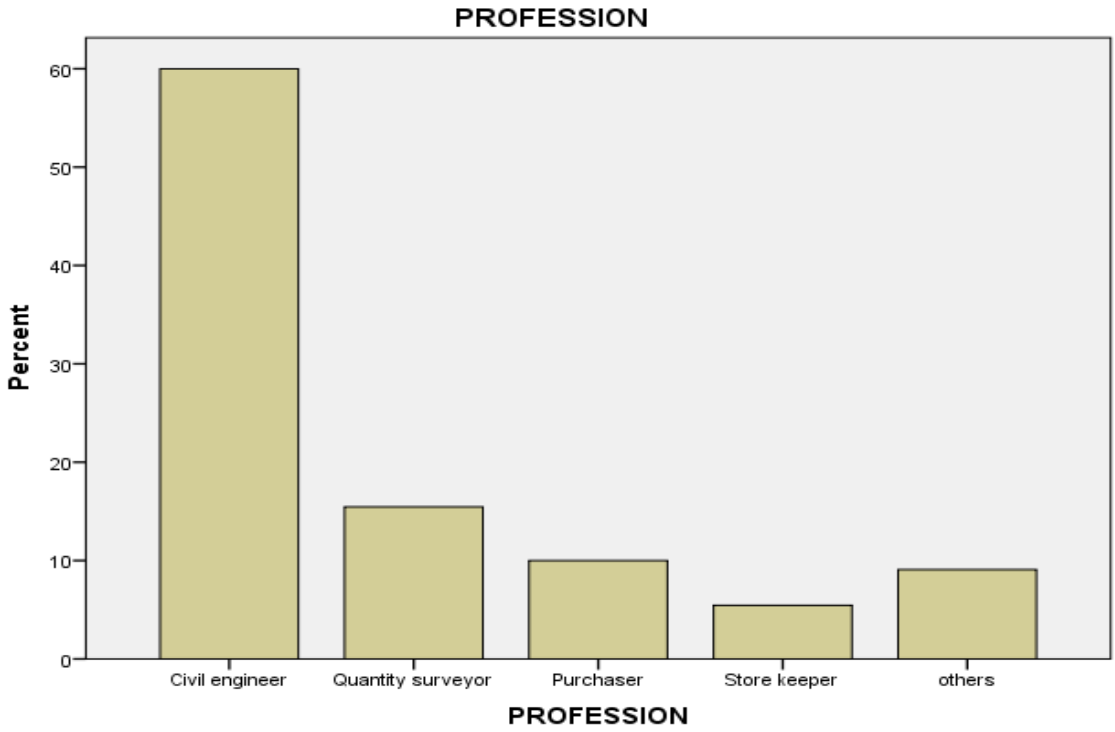
Table 4.3: Respondent's Educational Qualification

Educational Level		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Diploma	33	30.0	30.0	30.0
	Advanced Diploma	1	.9	.9	30.9
	BSC	71	64.5	64.5	95.5
	MSC	5	4.5	4.5	100.0
	Total	110	100.0	100.0	

Source: Computed from own survey data (2021)

Table 4.3 shows that 64.5% of the respondents are first Degree holders30% are Diploma holders 4.5% are Master Degree holders and 0.9% advanced diploma. There were no qualifications below advance diploma and above master's degree.

Figure 4.1 Profession of Respondent's



Source: Computed from own survey data (2021)

Figure 4.1 The distribution of respondent's profession were shown, the highest concentration of the respondents are civil engineers (60%), quantity surveyor (each 15.5%), purchaser (10%), store keepers (5.5%) then finally others (9.1%).The high representation of civil engineers was inevitable as these are the very key professionals usually engaged in the construction industry in KKSC.

Table 4.4 Year of Working Experience of Respondent's

Work Experience		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-5	39	35.5	35.5	35.5
	6-10	34	30.9	30.9	66.4
	11-15	36	32.7	32.7	99.1
	16-20	1	.9	.9	100.0
	Total	110	100.0	100.0	

Source: Computed from own survey data (2021)

Table 4.4 shows that 70 of them or 64.5% of the respondents have been working with construction firms for more than five years while about 35.5% have experience less than six years.

4.1.2 Material Management Practices in Small Scaled Enterprise

Table 4.5 Person in charge of managing construction materials in Construction Project

Managing Person		Frequency	Percent	Valid Percent
Valid	Project Manager	26	23.6	23.6
	Construction Engineer	35	31.8	31.8
	Office engineer	27	24.5	24.5
	Site Engineer	5	4.5	4.5
	Store manager	17	15.5	15.5
	Total	110	100.0	100.0

Source: Computed from own survey data (2021)

Table 4.5 Shows that the person in-charge-of managing construction material is the Construction engineer (31.8%), follow by project manager (23.6%) and also office engineer (24.5%), then store manager (15.5%) and site engineer (4.5%). This result was shown that key professionals are participated on materials managing at construction site.

Table 4.6 Person Responsible for Ordering Material

Ordering Person		Frequency	Percent	Valid Percent
Valid	Project Manager	36	32.7	32.7
	Construction engineer	24	21.8	21.8
	Office engineer	50	45.5	45.5
	Total	110	100.0	100.0

Source: Computed from own survey data (2021)

Table 4.6 shows that (45.5%) of the respondent's office engineer is responsible for ordering materials, (32.7%) of the respondent's project manager is responsible for this duty, (21.8%) for

construction engineer are responsible for ordering of materials. This result was shown that key professionals are participated on materials ordering at construction site.

Table 4.7 Method for Purchasing of Material

Purchasing Method		Frequency	Percent	Valid Percent
Valid	In Bulk	87	79.1	79.1
	In pieces	23	20.9	20.9
	Total	110	100.0	100.0

Source: Computed from own survey data (2021)

Table 4.7 shows that 79.1% of the respondents for bulk purchase while 20.9% for in pieces.

Table 4.8 Materials planning for project. The result was shown that purchasing was done in a bulk.

Planning Time		Frequency	Percent	Valid Percent
Valid	Before construction	46	41.8	41.8
	During construction	64	58.2	58.2
	Total	110	100.0	100.0

Source: Computed from own survey data (2021)

Table 4.8 shows how materials planner starts planning for project. From the table, (41.8%) of the respondents agree for before construction begin, (while (58.2%) observed during construction process.

Table 4.9 Undertake market survey before ordering for materials

Market Survey		Frequency	Percent	Valid Percent
Valid	Yes	39	35.5	35.5
	NO	71	64.5	64.5
	Total	110	100.0	100.0

Source: Computed from own survey data (2021)

From above Table 4.9 it shows that 35.5% agree for undertaken market survey before ordering for materials while 64.5% of the respondents disagree. Those enterprises had a little practice on market survey before ordering.

Table 4.10 Assessment of Material

Quality checking		Frequency	Percent	Valid Percent
Valid	Testing	57	51.8	51.8
	Selection	42	38.2	38.2
	Measurement	11	10.0	10.0
	Total	110	100.0	100.0

Source: Computed from own survey data (2021)

From Table 4.10 above, 51.8% of the respondents for testing of material, 38.2% for selection of materials, and then 10% agree for observed measurement for materials.

Table 4.11 Components of Materials Management

SN	Components	Mean	Std. Deviation
1	The enterprise has effective and proper Material budget planning	3.0818	.87924
2	The enterprise has effective material scheduling process	3.7091	.75838
3	The enterprise has effective material handling	3.4818	.90596
4	The enterprise has effective inspection mechanism	3.6364	.99289
5	The enterprise has proper Waste management system	3.2000	1.00275
6	The enterprise has good inventory control	3.1091	1.11162
Combined mean and standard deviation		**3.3695**	**0.9418**

Source: Computed from own survey data (2021)

Table 4.11 shows components of the enterprise's materials management , materials scheduling has mean value(3.7),material inspection has mean value (3.635) follow by materials handling has mean value(3.48),Waste management (3.2), then material inventory (3.109), while good budget planning has a mean value(3.0818). Finally combined mean score value 3.3695 combined Std Deviation score value 0.9418. Table 4.11 shows the components of materials management, the respondents strongly agree for the enterprise were applied material scheduling, handling and inspections but they had weak practice on budget planning, waste management and inventory control. This result also supported by the interview discussion made with project managers and construction engineers.

Table 4.12 Stages of Materials Logistic Management

SN	Stages	Mean	Std. Deviation
1	The enterprise implements procedures to manage suppliers	3.9182	.87924
2	The enterprise plans logistic of material at site mobilization and Construction time	3.3000	.89391
3	The enterprise identifies responsible persons for their job roles	3.9909	.53322
4	The enterprise plans for material storage	3.7455	.90297
5	The enterprise determines material types and quantities from the detailed design	3.8909	.73379
6	The enterprise plans logistic of material at project completion and demobilization time	3.2273	.80889
Combined mean and standard deviation		3.6788	0.792

Source: Computed from own survey data (2021)

Table 4.12 shows the stages of materials logistic planning, the respondents most of them agree for the stages of materials logistics planning because the combined mean value above 3.5. However, the two Stages of Materials Logistic Management such as the enterprise plans logistic of material at site mobilization and Construction time; and at project completion and demobilization time were observed to be the most problematic stages. According to the interview made with project managers and construction engineers, the enterprise plans logistic of material at site mobilization and Construction time was the most serious problem in material logistic management.

Table 4.13 factors affecting effective materials management

SN	Factors	Mean	Std. Deviation
1	There is Improper issuing of materials on the enterprise's construction projects site	3.5909	1.06051
2	The enterprise procurement process of materials is good	3.3182	.84519
3	The enterprise quality inspection is good	3.1818	.80345
4	Assigning of qualified staff on the enterprise is good	3.0182	1.01350
5	The enterprise materials handling mechanism is proper	3.1091	.89181
6	The enterprise material transportation system is well managed	3.9091	.61399
7	The enterprise stock and waste control system is good	2.9909	.99074
Combined mean and standard deviation		**3.3454**	**0.8884**

Source: Computed from own survey data (2021)

Table 4.13 represents the factors related to materials management. The results show that majority of the construction professionals believe that the factors which have big effect on material management were the enterprise material transportation system (3.909), Improper issuing of materials with mean value (3.5909), and procurement process with mean value (3.3182), whereas quality inspection with mean value (3.1818), materials handling (3.1091), qualified staff (3.0182), stock and waste control (2.9909) were believed to have less effect on material management. During the qualitative discussion made with the professionals, they explained that though there was enough construction material, there were poor control of stock and waste.

Table 4.14 Causes of Materials Wastage on Site

SN	Components	Mean	Std. Deviation
1	The enterprise has ordering problems due to mistakes in quantity surveyor.	4.0636	.63934
2	The enterprise has wastage due to handling problems.	4.0455	.36814
3	The enterprise has wastage due to lack of inspection.	3.0818	.96861
4	The enterprise has wastage due to problems of stocking.	3.7182	.62269
5	The enterprise has wastage due to poor material quality.	3.8273	.50428
6	The enterprise has wastage due to problems of workmanship.	3.9636	.84514
7	The enterprise has wastage due to wrong construction methodology.	3.9727	.90320
8	The enterprise has wastage due to communication between three parties(consultant, contractor and client)	4.2182	.59635
Combined mean and standard deviation		**3.8613**	**0.6809**

Source: Computed from own survey data (2021)

Table 4.14 represents the causes of wastage related to material at enterprise construction project site.(4.2182) respondents strongly agree that poor communication between parties cause of materials wastage, followed by ordering problems(4.0635), due to handling problems. (4.0455), wastage due to wrong construction methodology (3.9727) due to problems of workmanship (3.9635), wastage due to rework (3.8545), wastage due to poor material quality (3.8273), wastage due to problems of stocking (3.7182), wastage due to lack of inspection (3.0818). Thus, the result showed that except wastage due to lack of inspection (3.0818), all the aforementioned issues were explained to be serious cases of material wastage on site. The same result was found during a discussion made with professionals.

Table 4.15 following measures as important to be put in place to ensure effective materials management

SN	Components	Mean	Std. Deviation
1	The enterprise makes monitoring of materials distribution	3.0455	.78268
2	The enterprise implements proper materials handling system.	3.2455	.81484
3	The enterprise makes the site store safe from theft.	4.0273	.69677
4	The enterprise implements proper assigning of material codes.	2.4636	.58541
5	The enterprise organizes proper documentation.	2.3545	.56805
6	The enterprise implements Education/training/enlightenment of staff in charge of materials management.	2.6364	.64577
7	The enterprise Assigns qualified construction professionals.	3.2000	.98428
8	The enterprise applies quality assurance/control processes.	2.7909	.74311
9	The enterprise exercises inspecting materials on site.	3.5091	.78688
10	The enterprise Follow up the daily allocation of materials.	3.6455	.64376
11	The enterprise implements Ordering of materials on time.	2.5909	.85986
Combined mean and standard deviation		**2.7925**	**0.73744**

Source: Computed from own survey data (2021);

Table 4.15 shows the measures for effective materials management. The first three most following measures as important to be put in place to ensure effective materials management were Makes the site store safe from theft (4.0273), Exercises inspecting materials on site (3.6455), and follow up the daily allocation of materials (3.509). These following measures could assume to be the area where big emphasis to be given to overcome problems related to material management in construction site.

4.2. Discussion of Findings

The data collected for the purpose of this study were evenly distributed to all types of construction project sites where materials managements are being administered. However, improper management of materials contributes to delay in completion time increases total cost of project.

Findings shows that method of purchasing of materials in bulk, with a little market survey before ordering is more common on the enterprise's construction project sites and. The study has also shows the following: there is poor waste materials management systems in the enterprises, poor inventory control, mobilization and demobilization of materials on project site also not good, also there are factors that affect effective materials management on those enterprises like poor procurement process, lack of materials inspection, assignment of improper qualified person and poor stock and waste control management. The main causes of materials wastage in project site is lack of inspection. Good site management will make a serious attempt to overcome these problems by providing better control of the site and more protection to work during the early stages of the contract.

From the data gathered so far, materials management on the site plays a very important role on construction firm and if not seriously planned and properly controlled, it might cost the firm more than the budgeted cost of the project. To achieve a proper management of materials. Table 4.12 shows the stages of materials logistic planning, the respondents strongly agree for all stages of materials logistics planning.

Table 4.13 represents the factors related to materials management on those enterprises construction project site. The results show that majority of the construction professionals believe that the factors which have bigger effect on material in the enterprise's construction site are materials handle with mean value (3.9091), " Improper issuing of materials with mean value (3.5909), procurement process with mean value (3.3182), material inspection with mean value (3.1818) and assignment of qualified person with mean value (3.0182). On the other hand, the factors, which have lower effect to materials management on enterprise's construction project sites, are material stock and waste control system with mean value (2.9909). Wrong stock and

waste control system and assignments of proper qualified person are the major factors that affecting effective materials management on those enterprises construction project sites.

Therefore, those enterprises should get awareness on effective materials management by education and training from government body. Firstly, if there are any problems with the materials delivery (relating to late delivery, public procurement procedure, materials damages or shortages) proper documentation the suppliers should be organized to control their duty, timely placing of order should be introduced, monitoring of materials distribution, related properly construction activities and schedule of materials.

There was which referral of any problems relating to quality of material, receiving and inspecting of materials on site has to exercise, ensure quality assurance/control processes are in place, complete quality records of materials should be available.

There was other methods to deal the problems, which referral of any problems relating to surplus of material, congestion on loading area and security on site, relate properly construction activities and schedule of materials, have to record receipt of goods upon receiving and issuing, implement proper assigning of material codes, make the site store safe from theft and vandalism Lastly, in order to deal with the logistics within the work place, all work by labour is carefully controlled and monitored. In order to avoid double handling and committing the same mistake by to labour force, the site manager gives clear instructions and delegates certain work processes to the construction workers.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATION

5.1 Summary of Findings

The study of this research was analyzed using descriptive statics including mean index score method and frequency analysis and the principal tool used for collection of data is questionnaires for field survey, interview and site observation to make the study strong. The identified major problems such as design change, lack of proper work planning and scheduling, in adequate supervision in usage of materials, poor practices of market survey before ordering of materials , improper planning of materials during mobilization and demobilization when at the time of project starting and finishing, inadequate inventory control of materials, inadequate stock and waste control system, improper issuing of materials, improper assigning of qualified staff on the enterprise and poor quality inspection mechanisms. Generally, the study conclude that Problems related with construction material management, Wastage in building construction project sites, measures taken for effective construction material management and usage of methodology were identified.

5.2 Conclusions

The following conclusion could be drawn from the research work;

Materials management processes should apply improves the overall in handling of materials and waste management system for more effectiveness on those enterprises construction project sites. This is because poor handling and stock and waste management of construction materials affects the overall performance of construction projects in terms of cost, time, quality and productivity. The minimization of materials wastage during the construction phases is important in order to avoid loss of profits.

Materials management process improves the success rate of project execution and timely availability of material, thus minimizing the project cost.

Proper management of materials in construction sites, can benefits enterprises construction project sites, as it reduces completion period, it saves time of execution, it gives high quality works and reduces the materials wastage, and also it will improve the cash flow.

From the projects site surveyed, it was found out that improper material management on site needs to be discovered and prevented in order to achieve the desired output. if all the identified problems put into consideration before starting any site and all necessary or proper provisions are been made to prevent the occurrence of the identified problems, proper materials management will benefit the enterprise in terms of increase net income, fast execution and reduce project cost.

As material management includes material estimation, purchasing, expediting, receiving, were housing, proper utilization & disposal, if this function are not properly managed material shortage, surplus and cash problems are likely to occur on those enterprises construction project sites.

5.3 Recommendations

Based on the results of this study, the following recommendations are made to boost effective materials management practice of construction projects in Small sized construction enterprises around kolfe keraniyo sub city:

- ✓ The enterprise needs to develop better means and facilities in which building materials could be well-stored with shades, bedding materials applicable to prevent damage which may lead to wastages.
- ✓ Material management should be practiced on all sites o f the enterprises.
- ✓ The project manager should guide site personnel on how to prevent avoidable waste in the use of various types of materials during execution of construction projects.
- ✓ In order to be effective and efficient on construction works, the amount of work, type of work to be done, and materials to be used should be listed in details.
- ✓ The enterprise/government should facilitate training of management for site personnel in order to improve their effective material management capability and must use of skilled

manpower for their works and provide sufficient supervision with professionals to ensure effective material management on building construction sites

Based on the above recommendations successful materials management can be achieved in those enterprises' construction project sites.

REFERENCES

Abdul-Rahman,. H. and Alidrisyi, M. N. (1994*) "A Perspective of Material Management Practices in a Fast Developing Economy; the case of Malaysia". Construction Management and Economics, 12, 412-422.*

Aibinu, A. A., & Odeyinka, H. A. (2006*). Construction delays and their causative factors in Nigeria. Journal of construction engineering and management, 132(7), 667-677.*

Bell, L.C. and Stukhart, G. (1987) Costs and *benefits* of materials

Management systems. *Journal of Construction Engineering and Management,* Vol.l 13 No. 2,

June 1987, 222-235.

Chandler, A.K. (1978) *Material management on building sites.* Lancaster, Construction Press.

Creswell, J. W. (2003). *Research design: Qualitative, quantitative and mixed methods*

approaches. London: Sage Publications.

Cryl, E.D. (2001) *a materials management course for a graduate level*

Construction management curriculum: ASC proceedings of the 37lh annual Conference

University of Denver- Colorado, April 4-7, 2001. Denver, University of Denver. p. 101 -108.

[Online]. Available from: http:// www.acseditor.unl.edu [Accessed 5lh January 2005].

Cohen, L., Manion, L., & Morrison, K. (2007). *Research methods in education* (6th ed.). Routledge/Taylor & Francis Group.

Datta, A.K. (2003) *Materials management.* New Delhi, Prentice Hall.

Dawood, N.N. (1996) A strategy for a computer- based materials management system for the building Industry. *Journal of financial management in property and construction.* [Online]. Available from: http// www.rdg.ac.uk [Accessed 23rd November 2004],

Dobler and burt 1996 *purchasing and supply management*

F. Ahmed (2017). Improving construction materials management practices in construction sites. https://www.semanticscholar.org/paper/Improving-construction-materials-management-in-Ahmed/08fea695f8e0ddbeba7d48cc47eebcadad9c7bb5#citing-papers. Accessed on June 13, 2021.

Gruneberg L. S. (1997) *Construction economics: an introduction.* London, Macmillan Press.

Handrickson, C. (1998) *Project management for construction.* Pittsburg, Prentice Hall.

Johnston, J. E. (1981) *Site control of materials.* London, Butterworth's.

K.A.Okorocha (2013) *International Journal of Management Sciences and Business Research, Volume 2, Issue 4, 2013*

Kithinji, B.N. (1988) *Systems approach to building project management: experience from Kenya.* Unpublished M.A. thesis, University of Nairobi.

Magad, E.L. and Amos, J.M. (1995) *Total materials management.* New York, Chapman and Hall.

Mbatha, M. (1993) *Management of building projects*; Published PhD thesis, Bcrgischcn University.

Narimah 2011 *ICT implementation for materials management in construction projects; case study*

Journal of construction engineering and project management 1(1), 31-36 2011

Navon and berkovich *development and on site evaluation of an automated materials management and control model* journal of construction engineering …2005 ascelibrary.org

Stukhart, G., (1995) Construction Materials Management, Marcel Dekker Inc. New York.

Tavakoli, A. and Kakalai, A. (1993) A materials management system. *Construction Management Economics Journal* [online]. Available from: http// www.extra.rdg.cc.uk [Accessed on 23rd November 2004],

Thomas, H. R. et al (1989) Impact of material management on productivity: a case study. *Journal of Construction, Engineering and Management,* Vol. 115 No.3, September 1989, 370-375.

Turner E. A. (1997) *Building procurement.* London, Macmillan Press.

Waimvright, W.N. (1970) *Practical builders estimating.* London. Hutchinson Educational Ltd.

Wihnnch, H. and Koonz, H. (1993) *Management: a global perspective.* Singapore, Me Graw-Hill Inc.

APPENDICES

Questionnaire

Questionnaire
St. Mary's University
School of Graduate Studies
MA in Project Management (PM)

Questionnaire to be filled by project manager, construction engineer, office engineer, site engineer, quantity surveyor, general foreman, store keepers and purchasers.

Dear respondents
I am undertaking a research survey to assess the material management practices in the construction projects site of Small Scale Construction Enterprise.
The research is an individual research project as part of my study for MA Degree in project management at St. Mary's University.
The main purpose of this research questionnaire is to assess materials management practices in Small scale construction enterprise in construction project sites with a view to put forward solutions to the problems of excessive waste leading to cost overrun.
As a key staff you are invited to participate in this survey. The information you provide in response to the items in the questionnaire will be used as part of the data needed for the study. All the information you provide will kept in strict confidentiality and it will be used only for academic research please answers each question carefully. If you are unsure of an answer; please respond with your best estimate. I value your participation and thank you for the commitment of time, energy and effort. If you have any further question, I can be reached at the address below.

Sincerely
Melaku Girma
tsedu2010@gmail.com
Cell phone No.0911 382697

General Instructions

- There is no need of writing your name
- In all cases where answers options are available please tick (√) in the appropriate box.
- In this questioner only consider materials which are aggregates, sand, cement and water used for HCB production.

Part I: General information about the respondents

1. Gender ☐ Female ☐ Male
2. What is the number of employees in your team/site? _____
3. What is your Profession? ☐Civil engineer ☐Quantity surveyor ☐general foreman ☐ Purchaser ☐ Store keeper ☐ others
4. Your work Experience in year _____
5. What is your highest educational Level? ☐Diploma ☐ Adv Diploma ☐ BSC ☐ MSC ☐ PhD

Part II: Practices of Materials Management in Construction Sites

1. Who is the responsible person in managing construction materials in construction projects site?
   ☐Project Manager ☐Construction Engineer ☐ Office engineer ☐ Site Engineer ☐Store manager ☐ others
2. Who is the person responsible for ordering materials? ☐ Project Manager ☐ Construction engineer ☐Office engineer ☐ others
3. Which method is applied on your project in the purchase of material☐In Bulk ☐ In pieces ☐ Others
4. If the purchase is in bulk, does it take into consideration the type and quality of material? ☐ Yes ☐ No
5. When does the materials planner start planning for projects? ☐Before construction process ☐ During construction process
6. Does your Project undertake market survey before ordering for materials? ☐ Yes ☐No
7. How do you assess the quality/standard of materials? ☐ Testing ☐ Selection ☐ Measurement ☐ Others
8. Who is responsible for monitoring & handling of materials on sites? ☐Construction engineer ☐Site engineer ☐ Store manager ☐ others
9. Do you consider stock and waste control for effective material management on sites? ☐ Yes☐ No

10. In what level you assess the value of the following components of materials management?

- SD(Strongly Disagree), D(Disagree), PA(Partially Agree), A(Agree), SA(Strongly Agree)

SN	Components	Response				
		SD	D	PA	A	SA
1	The enterprise has effective and proper Material budget planning					
2	The enterprise has effective material scheduling process					
3	The enterprise has effective material handling					
4	The enterprise has effective inspection mechanism					
5	The enterprise has proper Waste management system					
6	The enterprise has good inventory control					

11. In what level you evaluate the following stages of materials logistic planning?

- SD(Strongly Disagree), D(Disagree), PA(Partially Agree), A(Agree), SA(Strongly Agree)

SN	Stages	Response				
		SD	D	PA	A	SA
1	The enterprise implements procedures to manage suppliers					
2	The enterprise plans logistic of material at site mobilization and Construction time					
3	The enterprise identifies responsible persons for their job roles					
4	The enterprise plans for material storage					
5	The enterprise determines material types and quantities from the detailed design					
6	The enterprise plans logistic of material at project completion and demobilization time					

12. In what level you evaluate the following factors affecting effective materials management?

- SD(Strongly Disagree), D(Disagree), PA(Partially Agree), A(Agree), SA(Strongly Agree)

SN	Factors	Response				
		SD	D	PA	A	SA
1	There is Improper issuing of materials on the enterprise's construction projects site					
2	The enterprise procurement process of materials is good					
3	The enterprise quality inspection is good					
4	Assigning of qualified staff on the enterprise is good					
5	The enterprise materials handling mechanism is proper					
6	The enterprise material transportation system is well managed					
7	The enterprise stock and waste control system is good					

13. In what level you evaluate the following factors in order of their relevance as causes of materials wastage in your site?

- SD(Strongly Disagree), D(Disagree), PA(Partially Agree), A(Agree), SA(Strongly Agree)

SN	Components	Response				
		SD	D	PA	A	SA
1	The enterprise has ordering problems due to mistakes in quantity surveyor.					
2	The enterprise has wastage due to handling problems.					
3	The enterprise has wastage due to lack of inspection.					
4	The enterprise has wastage due to problems of stocking.					
5	The enterprise has wastage due to poor material quality.					

6	The enterprise has wastage due to problems of workmanship.					
7	The enterprise has wastage due to wrong construction methodology.					
8	The enterprise has wastage due to communication between three parties(consultant, contractor and client)					
9	The enterprise has wastage due to rework.					

14. In what level you evaluate the following measures as important to be put in place to ensure effective materials management in construction sites?

- SD(Strongly Disagree), D(Disagree), PA(Partially Agree), A(Agree), SA(Strongly Agree)

SN	Components	Response				
		SD	D	PA	A	SA
1	The enterprise makes monitoring of materials distribution					
2	The enterprise implements proper materials handling system.					
3	The enterprise makes the site store safe from theft.					
4	The enterprise implements proper assigning of material codes.					
5	The enterprise organizes proper documentation.					
6	The enterprise implements Education/training/enlightenment of staff in charge of materials management.					
7	The enterprise Assigns qualified construction professionals.					
8	The enterprise applies quality assurance/control processes.					
9	The enterprise exercises inspecting materials on site.					
10	The enterprise Follow up the daily allocation of materials.					
11	The enterprise implements Ordering of materials on time.					