ASSESSMENT OF PROFESSIONAL'S PERCEPTION ON MATERIALS MANAGEMENT PRACTICES ON CONSTRUCTION SITES IN SELECTED STATES IN NIGERIA.

BY

ALBERT IDOWU

DEPARTMENT OF BUILDING,

AHMADU BELLO UNIVERSITY, ZARIA NIGERIA

SEPTEMBER, 2O14

ASSESSMENT OF PROFESSIONAL'S PERCEPTION ON MATERIALS MANAGEMENT PRACTICES ON CONSTRUCTION SITES IN SELECTED STATES IN NIGERIA.

BY

ALBERT IDOWU B.Sc (BUILDING) ABU, 2008
M.Sc/ENV-DESIGN/4038/11-12

A THESIS SUBMITTED TO POST GRADUATE SCHOOL

AHMADU BELLO UNIVERSITY, ZARIA

NIGERIA

IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER OF SCIENCE IN CONSTRUCTION MANAGEMENT

DEPARTMENT OF BUILDING,

AHMADU BELLO UNIVERSITY, ZARIA NIGERIA

SEPTEMBER, 2O14

DECLARATION

I declare that the thesis entitled 'Assessment of Professional's Perception on Materials Management Practices on Construction Sites in Selected States in Nigeria' has been performed by me in the Department of Building under the Supervision of Dr. D. Dahiru and Dr. D. Kado.

The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another degree or diploma at any university.

Albert Idowu		
Name of Student	Signature	Date

CERTIFICATION

This thesis entitled 'ASSESSMENT OF PROFESSIONAL'S PERCEPTION ON MATERIALS MANAGEMENT PRACTICES ON CONSTRUCTION SITES IN SELECTED STATES INNIGERIA' by Albert Idowu meets the regulations governing the award of the degree of Master of Science in Construction Management of Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

_____ _____

Dr. D. Dahiru Date
Chairman, Supervisory Committee

_____ _____

Dr. D. Kado Date
Member, Supervisory Committee

_____ _____

Prof. K. Bala Date
Head of Department

_____ _____

Prof. A. A. Joshua Date
Dean of Postgraduate School

DEDICATION

This research work is dedicated to God Almighty Who guided and inspired me to write this thesis.

ACKNOWLEDGEMENT

I wish to thank the Almighty God for His infinite mercies, love and guidance throughout my studies.

My special gratitude goes to my supervisors Dr. D. Dahiru and Dr. D. Kado for critical reading of the research work in ensuring the successful completion of the thesis.

Special thanks goes to all academic staff and non-academic staff of Department of building, for their supports and encouragements, Prof. K. Bala (HOD), Prof. G.O. Okoli, Prof. M.M. Garba , Prof. I. Mbamali, Dr. I. Mshelgaru, Dr. Abdulazeez. I appreciate the contribution of every member of my family. I am very grateful to them. May God in all His goodness, bless them, Amen.

ABSTRACT

Construction materials usually constitute a major portion of the total cost in building construction project. An essential factor adversely affecting the performance of construction projects is the improper handling of materials during site activities. This research studied the Professional's Perception on Materials Management Practices on Construction Sites in selected states in Nigeria by the use of structured questionnaires administered to senior construction-professional personnel of construction firms. The data generated were analyzed using descriptive statistics. 62% response rate was achieved and used for analysis. The study showed that the factors militating against materials management contributes to delay in completion time of project such as storage of materials on site with mean value (4.9), incompetence of estimators (4.8), issuing of materials for use (4.7) and procurement for materials (4.6). Based on the findings, it was concluded that Materials management practices require a transformation to improve the overall in handling of materials for more efficiency and effectiveness on the construction site. It was also recommended that material management should be practiced on all sites and by all categories of building construction firms whether large, medium or small, adequate site security, also the provision for material storage in the preliminaries, competent and experienced personnel with basic managerial skills in material management should be engaged on site as store officer to enhance material management practice.

TABLE OF CONTENT

Title i

Declaration iii

Certification iv

Dedication v

Acknowledgement vi

Abstract vii

Table of contents viii

List of figures xiii

List of tables xiv

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study 1

1.2 Statement of Research Problem 6

1.3 Justification of the Study 6

1.3 Research Questions 8

1.4 Aim and Objectives 8

1.4.1 Aim 8

1.4.2 Objectives 8

1.5 Research Methodology 9

1.5.1 Literature review 9

1.5.2 Field survey 9

1.5.3 Analysis of Result 9

1.6 Scope and Limitation 10

CHAPTER TWO

LITERATURE REVIEW

2.1 Management Function 11

2.2 Material Management on Construction Project 12

2.2.1 Objectives of Materials Management 14

2.2.2 Components of Material Management 15

2.3 Materials Management Processes 15

2.3.1 Planning 15

2.3.1.1 Material Schedule 16

2.3.1.2 Ordering Planning 17

2.3.1.3 Storage Planning 18

2.3.1.4 Transportation Planning 18

2.3.2 Procurement 19

2.3.2.1 Material Purchase 19

2.3.2.2 Purchasing Departments 20

2.3.2.3 Purchasing Methods 22

2.3.2.4 Purchasing Procedures and Documentation 23

2.3.2.5 Ordering 23

2.3.2.6 Purchasing Records 24

2.3.3 Logistics 25

2.3.3.1 Material Logistics Planning (MLP) 26

2.3.3.2 Key Stages of a MLP within the Construction Process 27

2.3.3.3 Importance of Good Practice in Material Logistics Planning 29

2.3.3.4 Co-ordination of Material and Other Resources 30

2.3.4 Handling 31

2.3.5 Stock and Waste Control 32

2.3.5.1 Elements of a Waste Management Plan 33

2.3.5.2 Materials Wastage and Security Control on Site 34

2.3.5.3 Security Control of Materials 35

2.3.5.4 Material Control 36

2.3.5.5 Stock Control Technique 37

2.3.5.6 Reason for Holding Stock 37

2.3.5.7 Control 38

2.3.6 Storage of Materials 40

2.3.6.1 Popularity Storage 42

2.3.6.2 Physical Storage Facilities 43

2.3.6.3 Goods Receiving 43

2.4 Materials Management Problems 44

2.4.1 Factors Affecting Materials Management on Construction Sites 45

2.4.2 Approaches to Addressing Problems 46

2.5 Benefits Gained in Material Management 47

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Preamble 50

3.2 Research Design 50

3.3 Data Collection 50

3.4 Population of the Study 51

3.5Sampling Techniques 51

3.6 Sample Size 51

3.7 Method of Data Analysis 52

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCULSIONS

4.1 Analysis of the questionnaire 53

4.2. Respondents Profile 53

4.3 Materials Management Practices in Nigeria Construction firms 54

4.4 Factors Militating against Material Management 58

4.5 Measures for Effective Material Management 61

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusions 65

5.2 Recommendations 66

Reference 68

Appendix 73

LIST OF TABLES

Table4.1. Administered Questionnaires and Responses 53

Table 4.2 Educational Qualification 53

Table4.3 Profession of Respondents 54

Table 4.4 Years of Working Experience of Respondent 54

Table 4.5 person in charge of managing construction materials in construction projects 54

Table 4.6.person responsible for ordering materials 55

Table 4.7 method for apply in the purchase of material 55

Table 4.8 materials planner start planning for projects 55

Table 4.9 undertake market survey before ordering for materials 55

Table 4.10 frequency of market survey 56

Table 4.11 Assessment of materials 56

Table 4.12 Components of Materials Management 56

Table 4.13 Stages of materials logistics planning 57

Table 4.14 Factors Militating against Materials Management 58

Table 4.15 Materials Management Problems 59

Table 4.16 Causes of Materials Wastage on Sites 60

Table 4.17 Measures for Effective Materials Management. 61

Table 4.18 Benefits of Materials Management 62

LIST OF FIGURES

Figure1. Purchasing and materials management 21

Figure2. Organizational chart for store department in Construction Firm 42

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Material management can be defined as a process that coordinates planning, assessing the requirement, sourcing, purchasing, transporting, storing and controlling of materials, minimizing the wastage and optimizing the profitability by reducing cost of material. Baldva (1997) noted that Materials management is a process for planning, executing and controlling field and office activities in construction. While Eduardo (2002) viewed Materials management as the system for planning and controlling all of the efforts necessary to ensure that the correct quality and quantity of materials 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.

According to Khyomesh and Chetna, (2011) Building materials account for 60 to 70 percent of direct cost of a project or a facility, the remaining 30 to 40 percent being the labour cost. Therefore, efficient procurement and handling of material represent a key role in the successful completion of the work. It is important for the project manager to consider that there may be significant difference in the date that the material was requested or date when the purchase order was made, and the time at which the material will be delivered. These delays can occur if the contractor needs a large quantity of material that the supplier is not able to produce at that time or by any other factors beyond his control. Chan (2002) noted that the project manager should always consider that procurement of materials is a potential cause for delay. The management of Construction processes to reduce, reuse, recycle and effectively dispose of wastes has a serious

bearing on the final cost, quality, time and impact of the project on the environment. (Dania, 2007)

The goal of materials management is to ensure that construction materials are available at their point of use when needed. The materials management system attempts to ensure that the right quality and quantity of materials are appropriately selected, purchased, delivered and handled on site in a timely manner and at a reasonable cost, (khyomesh and chetna 2011). The scope of materials waste is vast, and this waste occurs in the industry irrespective of the size of the building firm, instructions about handling, storage and stacking are not provided with the goods or sent in advance to the site (Abdulazeez, 2000).

Materials management in construction is also regarded as the efficient use of goods and equipment before, during and upon completion of a building process. Petra (2013) observed that Successful materials management requires the participation of all persons involved in a construction process. For Materials may deteriorate during storage or get stolen unless special care is taken. Delays and extras expenses may be incurred if materials required for particular activities are unavailable. Ensuring a timely flow of materials is an important concern of material management (Shah, 1993).

Thus, Materials management is an important element in project management. Materials represent a major expense in construction, so minimizing procurement costs improves opportunities for reducing the overall project costs. Poor materials management can result in increased costs during construction. On the other hand, efficient management of materials can result in substantial savings in project costs. If materials are purchased too early, capital may be held up and interest charges incurred on the excess inventory of materials (Wendy, 2006).

Johnston (2001) opined that Material Management is divided between head office and site in major construction companies. The selection, pricing, ordering, preparation of schedules and payment accounts are dealt with at head office, learning the receipt storage, protection and use of materials to management on site. Due to the high cost of materials, if not properly managed during the period of execution of contract can lead to abandonment of project.

In his submission, lan (2008), opined that the rate at which materials are been squandered on site due to poor management is getting too rampant in our society and if not curbed, it can jeopardize the future of our construction industry. This is particularly true in view of the fact that mismanagement of construction resources (i.e materials, plants and labour) affects the continuity and profit margin of such project and if not checked can lead to technical insolvency or bankruptcy.

Therefore, attention must be paid to how materials are been procured, stored and managed in order to achieve perfect work, effective handling of materials, right usage of materials and control of construction resources.

This, explain the reason why Johnston (2001), noted that Materials management begins with planning and estimation, these can be achieved through proper site co-ordination measure of reducing wastes, the location and security of materials on sites, procurement of quality materials as being specified and effective administration of site together with quality control.

Lee and Donald (2001), observed that the problem associated with the absence of proper materials management on construction site could be wastage of resources making contract cost more than budget sum, reduction of profit margin of the contractor ineffectiveness of project

handlings reduction of output e.t.c. and if these are not properly taken care of it might be disastrous to the firm.

No construction project can commence and proved effective without an adequate supply of raw materials, apart from the careful planning of materials required by the builder, it is to his advantage to foster a good relationship with the suppliers, many of whom will have been selected due to their fulfillment of orders to the standard required and meeting of delivery times over a number of years (Pheng and Chuan, 2001).

Besides the builder's own suppliers, the architect may specify that a certain supplier must be used and these are termed "nominated supplier" whatever the type of suppliers to be used, the information passed to them and receive from them is the same and in all but in the smallest firms this information and document will pass through the buyer. (Yang, *et al*., 2003).The buyer must also ensure that the architect receives any samples from the suppliers in the very early stage of contract procedure to satisfy him of the relative merits of the material. It may, for example, not be possible to obtain the specified material in time in conjunction with the building programme, but by obtaining samples of similar products the architect may decide on a new form of construction or design to prevent hold ups.

In most cases, a buyer will send enquiries to two or three suppliers or in some cases, direct to manufacturers for such items as sand, gravel, brick, block, cement, e.t.c, regarding prices, delivery dates and such, for use at the estimating stage of the project. This will enable the estimator to use the figures obtained in the preparation of the tender figure.

To enable quick checks to be made on delivery or non-delivery of materials a card index system is generally adopted, this enables the purchasing or procurement department to keep a constant

eye on the supplies. These cards contain all necessary information and are best filed in date offer for case of reference. Even when bulk delivers have been placed according to programme, by taking the extra time and trouble to write out a card for each delivery the chance of losing sight of the delivery date is very much reduced, as regular checks will be on the file. As materials are received, the information will be recorded on the card.

Construction projects can be accomplished by utilizing management processes and these processes include planning, organizing, executing, monitoring, and controlling (Ahuja *et al* 1994 in Al Haddad 2006). During any construction project the three inter-related factors of time, cost, and quality need to be controlled and managed. Successful completion of projects requires all resources to be effectively managed. Prabu and Baker, (2006) regard Materials management as a means to achieve better productivity, which should be translated into cost reduction. For, according to Ademeso and Windapo (2008), 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 overall delays that can indirectly increase total project costs. Effective management of materials can reduce these costs and contribute significantly to the success of the project.

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 (Dey, 2001). Materials management can only produce what it should with the right quantities of the right material at the right time (Arnold and Chapman 2004). 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

1.2 STATEMENT OF RESEARCH PROBLEM

The present state of the building construction industry in Nigeria reflects various problems ranging from delays in project execution/delivery, substandard work, disputes, to cost and time overrun as a result of material shortage and wastages on sites, theft and displacement of materials on sites, as well as poor accounting and security system of the concerned sites/firms (Adafin, 2011). According to Dahiru (2010), lack of materials not only causes delays, but a consequent decrease in productivity and resulting to cost overruns. This is no doubt lack of effective material management is one of the major cause 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 programme 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, and hence no proper material stock control practice (Inyang Udoh, 2002). Besides that, Dey (2001) noted that the rate at which materials are being wasted due to improper management is becoming unbearable to the contractors due to its effect on their profit margin and proper usage of material to achieve quality job been done through various techniques.

1.3 JUSTIFICATION OF THE STUDY

A major part of professional builder's responsibility in building production management entails the selection, purchase, testing, storing and use of construction materials. As noted earlier, materials are a major expense in construction, thus the ability of contractor to manage his team

and the flow of supplies are absolutely necessary for the successful project delivery and profit maximization. This requires the architects and engineers to specify exact supplies during pre-construction to avoid overstock. The construction management team is required to buy the correct amount of material at the right time to avoid cash flow, storage and deterioration problems. Subcontractors need to keep track of inventories, while suppliers are required to deliver as ordered and on time. The post-construction team has to evaluate remaining materials for reuse and recycling purposes.

However, this is not easy; First, if materials are purchased early, capital may be tied up and interest charges incurred on the excess *inventory o*f materials. Even worse, materials may deteriorate during storage or be stolen unless special care is taken. For example, electrical equipment often must be stored in waterproof locations. Second, delays and extra expenses may be incurred if materials required for particular activities are not available. Accordingly, ensuring a timely flow of material is an important concern of project managers. (Harris and MacCaffer, 2001)

Thus, to determine the misery behind proper materials management in construction sites in Nigeria, so as to guide against project delay and abandonment, also to create a standard method based on size of construction site to control cost of contract and materials wastage. It is not only desirable but necessary to undertake careful study of material management. Additionally, since Proper material management will benefit the firm in terms of increase profit margin, quick execution and reduce cost of the project. This brings the need for an evaluation of materials management in Nigeria construction industry.

1.4 RESEARCH QUESTIONS

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

1. What are the principle and procedures of good materials management?

2. What is the current practice of materials management?

3. What are the factors militating against materials management on construction sites?

4. What are the measures to be put in place to ensure effective materials management on construction sites?

1.5 AIM AND OBJECTIVES

1.5.1 Aim

The aim of the research is to assess professional's perception on material management practices on construction sites in selected states in Nigeria with a view to proffering solutions to the identified problems.

1.5.2 Objectives

The specific objectives of this research are;

1. To establish theoretical frame work on construction materials management.

2. To study the practices of construction material management by construction firms in Nigeria

3. To investigate the factors militating against effective materials management on construction site in Nigeria

4. To assess professionals perception on the measures to be put in place to ensure effective materials management in the construction industry in Nigeria.

1.6 RESEARCH METHODOLOGY

In order to achieve the objectives of this research, the work was pursued through the following;

1.6.1 Literature Review

Relevant literatures were reviewed from various textbooks, past projects, journal, government gazette, and internet materials etc. so as to articulate existing knowledge on how effective construction material management is carried out.

1.6.2 Field Survey

Primary data were collected using structured questionnaire as the instrument of the study to those that are responsible for materials management in construction firms. Besides that, Personal interview of professionals were used to generate data in relation to the stated objectives. This was carried out by visiting the building construction site under construction. The head offices of these construction firms across Lagos, Abuja and Kaduna were also visited.

1.6.3 **Analysis of Result**

Data analyses were undertaken using descriptive statistics. Frequency, means, percentages and standard deviation were used to express the statistical result. This was achieved using Microsoft excel and statistical package for the social science (SPSS) soft wares.

1.7 **SCOPE AND LIMITATION**

This work focused on materials management practices in Nigeria's construction sites. The study covered factors militating against materials management, measures for effective materials management on construction firms. The study was limited to only building construction sites in Lagos, Abuja and Kaduna, therefore not all the country was covered. Site waste management was not part of this research.

CHAPTER TWO

LITERATURE REVIEW

2.1 MANAGEMENT FUNCTION

For any kind of organization to run smoothly, it needs to implement core management concepts. This necessitates that the four management functions - planning, organizing, leading and controlling be precisely understood. According to (Kondalkar, 2007), the following are the four types of management function

1. Planning

Planning is the process used by managers to identify and select appropriate goals and courses of action for an organization. There are steps to good planning:

i. What goals should be pursued?

ii. How should the goals be attained?

iii. When resources should be allocated?

The planning function determines how effective and efficient the organization is and determines the strategy of the organization.

2. **Organizing**

In organizing, managers create the structure of working relationships between organizational members that best allows them to work together and achieve goals. Managers will group people into departments according to the tasks performed. Managers will also lay out lines of authority and responsibility for members. An organizational structure is the outcome of organizing. This structure coordinates and motivates employees so that they work together to achieve goals.

3. Leading

In leading, managers determine direction, state a clear vision for employees to follow, and help employees understand the role they play in attaining goals. Leadership involves a manager using power, influence, vision, persuasion, and communication skills. The outcome of the leading function is a high level of motivation and commitment from employees to the organization.

4. Controlling

In controlling, managers evaluate how well the organization is achieving its goals and takes corrective action to improve performance. Managers will monitor individuals, departments, and the organization to determine if desired performance has been reached. Managers will also take action to increase performance as required. The outcome of the controlling function is the accurate measurement of performance and regulation of efficiency and effectiveness.

2.2 MATERIAL MANAGEMENT ON CONSTRUCTION PROJECT

Construction industry is the most significant industry in the economy and the successful measure with completion within time, budget, accordance with specification and satisfaction of stakeholders (Nguyen *et al*, 2004). Construction is the process of physically erecting the project and using construction equipment, materials, supplies, supervision, and management necessary to accomplish the work (Clough *et al*, 2000). Construction projects are complex, with many organizations involved such as clients or owners, architects, engineers, contractors, suppliers and vendors. This includes the heterogeneous and often complex process of producing unique, large and immovable products with a supply of the resources (money, equipment, material, and labour).

The management of materials in construction projects is an important function that significantly contributes to the success of a project. As projects grow in scale and complexity, materials

management becomes more difficult, often requiring the use of appropriate tools and techniques to ensure, amongst other things, that materials are delivered on time, stock levels are well managed, the construction schedule is not compromised, and that wastage is minimized. Materials management is especially problematic for large and complex projects, where sophisticated tools and techniques are necessary. The management of materials in complex construction projects needs adequate consideration due to the various elements involved and the importance of the project. Furthermore, the implementation of appropriate Information and Communication Technologies (ICT) could facilitate new management processes for complex projects. For example, the potential of emerging technologies such as wireless technologies and tagging technologies could have a strong impact on materials management processes in the future.

The improper handling and management of materials on construction sites has the potential to severely hamper project performance (Ogunlana *et al,* 1996). The result of improper handling and managing materials on site during construction process will influence the total project cost, time and the quality (Che Wan Putra et al, 1999). The costs of materials management may range from 30-80% of the total Construction costs depending on the type of construction (Muehlhausen, 1991). However, Kini (1999), noted that 50-60% of the total cost of construction projects is for construction materials and equipment. According to Stukhart (1995), materials are a major component on any project with value 50-60%. Therefore, there is a need for efficient materials management in construction projects. This is because poor materials management will affect the overall construction time, quality and budget. Therefore, an effective materials management system is required in order to avoid problems, such as delays in a construction project.

Delays in materials supply have been found to be a major cause of time overrun (Dey, 2000). Many factors accelerate the delay of project duration, however poor materials management can have a major effect on site activities. Ogunlana et al (1996) suggested that the main reasons for project delays on housing projects in Thailand were incomplete drawings, material management problems, organization deficiencies, shortage of construction materials, and inefficiencies in site workers. Dey (2000) also observed that delays in materials supply was a major cause of time overrun. Thus, it would seem that materials delays are a major cause of delays in construction projects. There is also a need for an integrated material handling process from the design stage to the usage of materials-This could happen, with a good management system with the implementation of ICT in managing materials. Hence, a good materials management environment enables proper materials handling on construction sites.

2.2.1 Objectives of Materials Management

According to Khyomesh and Chetna (2011), the following are the objectives of materials management;

1. Efficient materials planning
2. Buying or Purchasing
3. Procuring and receiving
4. Storing and inventory control
5. Supply and distribution of materials
6. Quality assurance
7. Good supplier and customer relationship
8. Improved departmental efficiency

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

2.2.2 Components of Material Management are:

i. Material estimation, budgeting, planning and programming.
ii. Scheduling, purchasing and procurement
iii. Receiving and inspection.
iv. Inventory control, storage and warehousing
v. Material handling and transport
vi. Waste management

2.3 MATERIALS MANAGEMENT PROCESSES

Materials management processes involve the planning, procurement, handling, stock and waste control, and logistics surrounding materials on construction projects. A good materials management environment enables proper materials handling on construction sites. In order to better understand materials management the following processes are discussed: planning, procurement, logistics, handling, stock and waste control.

2.3.1 Planning

The process of planning construction methods has been defined as "understanding what has to be built, then establishing the right method, in the most economical way to meet the client's requirements" (Illingworth, 1993). This is a detailed scheme for achieving an objective for certain work tasks. In the case of materials, there is a need for an appropriate planning, which must be done concurrently with engineering, construction, and other project plans (Stukhart, 1995). Stukhart (1995) also mentioned, thus, material planning will provide guides for all the

subsequent activities and can have a great impact on the project plan. The materials planning process covers setting up and maintaining the records of each part used in each plant to determine target inventory levels, and delivery frequency (Payne *et al*, 1996). As a result, an excellent management of the materials record will help the flow of materials at the site in order to avoid several problems such as materials out of stock and materials that have not been delivered.

Stukhart (1995) mentioned that material planning would provide guides to all the Subsequent activities and that this could have a great impact on the project plan. The materials planning process covers the set up and maintenance of records and determines the target inventory levels, and delivery frequency (Payne *et a*l, 2006). Planning of access and routing of materials within a construction site has an important implication for the development of an effective materials management strategy (Faniran *et al*, 1998; Olusegun *et al* 1998) particularly in terms of increasing productivity and profit, and facilitating the timely completion of construction projects (Wong and Norman, 1997). The objective of efficient materials planning is, to increase productivity and profit of the company, and facilitate the completion of construction projects (Wong and Norman, 1997). Thus, better planning of raw materials on site can help to eliminate project delays and reduces activity times, resulting in better service

2.3.1.1 Material Schedule

Paul (2007) said while construction scheduling is concerned with the regulation of the flow of construction units through their preconceived plans of operations, material. Scheduling involve the establishment of time tables for the ordering of all materials requirement for maintaining the flow of materials must be schedule to coincide with the flow of all construction of activities involved in the actual construction of each project.

Chandler (2008) said schedule is a list in a diagrammatic presentation indicating requirement of resources. And aid used in the ordering of material is schedule. Materials gratuity will be required to be taken off from the drawing and must show:-

a. Quantity required to be fixed.
b. Waste allowed in the estimate.
c. The gratuity to be ordered.
d. Date of delivery.
e. Cost includes in the estimate.

The schedule is usually produced by Quantity surveyor or by a material schedule e.t.c. By systematic analysis to bills of quantity and contract drawing with specification, schedule is the pre-requisite for the programming of the materials delivery and material usage planning on the site. Material should never be ordered directly from the contract bills, which are only intended as a guide to the contractor pricing the contract. The estimate will produce schedule of material for the buyer. The estimator will produce figure for material to b delivered in bulk and those material that should be imported. The date of delivery guaranteed by the suppliers against each item can be compared with the builders plan requirements. In those circumstances changes in the specification with often enable the builder to order under material that will available within the required period for delivery and thereby avoid unnecessary delay in the future.

2.3.1.2 Ordering Planning

Materials may be ordered for by the architect or the contractor. The supplier dominated by the architect is called dominated supply. Whoever is making the order should give fullest information as regard delivery debt, the hour during which the material will be accepted on site

and other general terms and conditions such as liability for damage use, method of packing, size and weight of the load that can be handle on site. Materials that are on long term delivery should be placed on other as soon as the contract is sign so that material will arrive at the reward time. In the short form programmed the quantity of material required in the place and period of its use to be indicated.

2.3.1.3 Storage Planning

Before the material ordered arrives adequate preparation should be pounded for storage and its handing storage of nation and successful coordination are vital so as to prevent dissipation to site prevent dissipation to site procedures and wastage to material caused by disregard and disorganize operatives. Also good storage enhances proper management of materials aid it minimizes concerned. The rate at which materials are being used and the working order should provide a guide as to the quantity of materials to be ordered.

2.3.1.4 Transportation Planning

An efficient transportation of construction materials from storage to point of use reduces project cost. Therefore proper transportation planning system should be planned, the route and the best suited for the conveyance of each material should be used ford. And all fragile material must be tired to the transporting plan to prevent breakage. In the finer analysis, purchasing and trafficking have no logical alternative but walk together. Their interest are so interrelated that the performance of one department significantly influence use the degree of success attain by the order if purchasing ignore the principle of good traffic management in its daily work. It will in the long run inevitably pay excessive price for the transportation segment of the material it brings (Lamer, 2007).

2.3.2 Procurement

The term procurement encompasses a wide range of activities that includes purchasing of equipment, materials, labour and services required for construction and implementation of a project (Barrie and Paulson, 2002). The objective of procurement in materials management is to provide quality materials at the right time and place, and at an agreed budget. Payne et al. (2006) stated that procurement is about organizing the purchasing of materials and issuing delivery schedules to suppliers and following-up, to make sure that suppliers deliver on time. A failure in the purchasing process or in overseeing and organizing the buying functions as listed by Canter (2003) could result in:

i. Over-ordering of materials (wastage problems);
ii. Over-payments for materials (inadequate administration procedures);
iii. Loss of benefits (lack of skilled negotiating procedures)
iv. Lack of knowledge (when and where the best service/source might be available at any particular time).

2.3.2.1 Material Purchase

Purchasing has a direct impact on profitability and individual job profits. Purchasing needed raw material, supplies and equipment is a vital area for cost reduction. Since it involve the spending of large sums. Frank (1980) explained circumstances of misuse and water of resources in the form of material can be extensive and include:

a. buying the wrong article
b. Buying too much
c. Buying too little
d. Buying uneconomically

e. Losing material in transit, in storage in use

f. Materials stolen or proffered

g. Spoilage and damage to material before use

h. Scrap and spoiling during use

i. Buying or making out of balance

According to Lamer (2007), purchasing is one of the basics functions common to all type of business enterprise. These functions are basic because no business can operate without them all business are administered or managed by coordinating and integrating those six functions:-

i. Creation, the idea of design function

ii. Finance, the capital acquisition records function

iii. Personnel, the human resources and labour relation function

iv. Purchasing, the buying of required equipment, material, and services

v. Conversion, the changing of material to economic goods

vi. Distribution, the selling or marketing of goods produced

The good of the purchasing department then should be to avoid cheap purchase but to look for optimum purchases. Sometime good material can be purchased at lower unit cost through large – order size purchases.

2.3.2.2 Purchasing Departments

In large organization the purchasing group may include purchasing analyst, traffic expert expedite as well as management. In some cases purchasing is expanded to include all logistics involve in the moving handling storing of material.

Lamer (2007), the purchasing department on the order hand has the responsibility and authority to schedule outside production the purchasing department is an organization unit of firm whose duties include some part or all of the purchasing function.

PURCHASING DEPARTMENTS FOR TYPICAL CONSTRUCTION FIRM

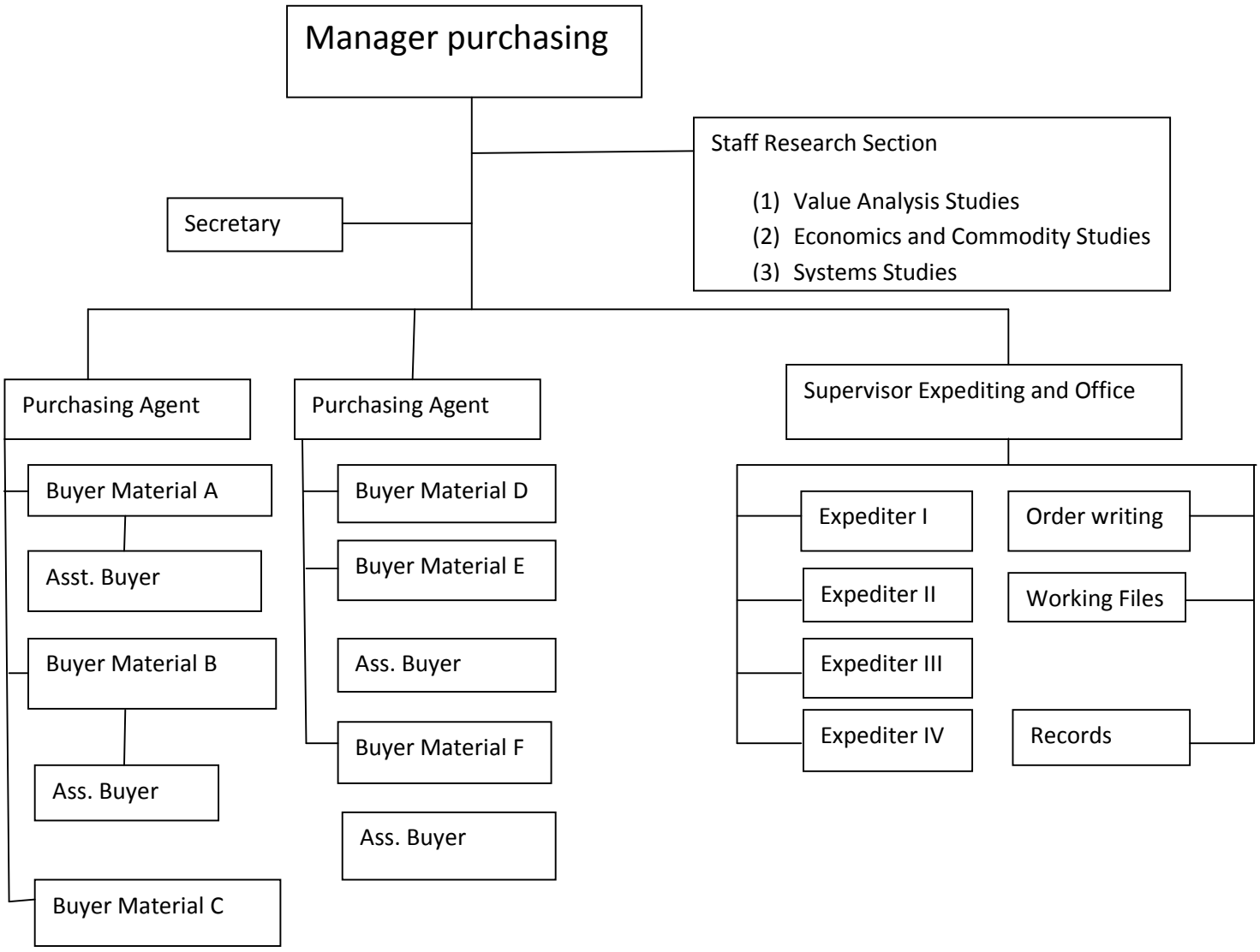


Figure 1: Purchasing and Material Management

Source: Lee and Debtor (1985)

2.3.2.3 Purchasing Methods

1. Purchase Accounting. Purchase accounting is a method used to make sure that

(a) Only goods authorized are purchase

(b) Only goods and material purchased and received are paid for

(c) Payment made in accordance with agreed and or on contractual terms.

Forms: - Forms used in purchase accounting include purchase orders, receipts of material form invoices and statements.

Entry is by the supplying firm and includes terms of purchase, such as cash discounts for preempt payment of statements.

2. Purchasing research

Purchasing research is a technique that systematical searches for the analytics and quantity of need material at the best price as well as analyzing eventually uses of such material and expensive method of use. Study of the following may be included purchase research.

(1) Material used in construction:- new material, alternative materials, high quality materials

(2) Price: - including satisfactory supply at best price, Market and economic trends.

(3) Capital equipment decisions:- whether to buyer hire

(4) Work study

(5) Assessment of material cost in relation to use purchasing employees who have studied these areas can provide the following cost reduction purchase service.

i. Recommend an economic intercompany system of supply

ii. Set up a purchasing system for efficient supply of material

iii. Be able to fare cast supply price changes

iv. Be able to forecast market changes

v. Be aware of new materials and work-study.

TYPE OF PURCHASE

According to (Bajeh, 2010), the following are the types of purchase;

1. Batch purchase

2. Schedule purchase

3. Sale supplier agreement

2.3.2.4 Purchasing Procedures and Documentation

The process is started with purchase requisition, the authorization of the firm through an approved official to buy the needed materials. Quality, quantity, and date needed are specified on a requisition form, which must be signed by an authorized person. The requisition form should also be numbered for accounting control in the case of materials that are needed periodically, a repeating requisition form may be established, where goods are ordered regularly according to a predetermined schedule. A section to include purchase order number, address should be included in the form's design for best control.

2.3.2.5 Ordering

Selecting of suppliers in purchasing depends on several factors.

(a) Quality of materials

(b) Price goods and materials

(c) Availability of materials in bulk and small quantities

(d) Service offered by supplier

(e) Payments terms offered by supplier

(f) Reliability of supplier

Supplier offering case discounts for prompt payment may be cheaper overall than companies without discounts, even if the basic goods costs more.

Quotation request from:- are often used determined supplier's prices for goods. Quotation are compared and the supplier offering the best advantages to the buyer chose.

The next step is preparation of purchase order. Careful from design is needed. Since the purchase order serves as a legal contract, therefore, the Factor to be included are:

Name and number of farm, name address of supplier, name and address of buyer, date of order, description of goods, quantity of materials, production, delivery destination, delivery date, terms of payment, cost of transportation, discount and signature of purchasing officer. Form design and flow should be planned for simplicity for handling, avoiding unnecessary and costly duplication. Purchase orders or contracts often list conditions and terms to protect buyer

2.3.2.6 Purchasing Records

One key area in reducing purchasing cost is that of record keeping. The following trade lists should be maintained for rapid construction.

(i) Supplier's name and address, including what goods are supplied by each

(ii) Prices of goods last purchased in each area

(iii) Purchase made, listing items, prices and suppliers

(iv) Date of purchase

The following records give status purchase to process ensuring time and cost control.

(i) File of contracts outstanding by deadline date

(ii) Receiving book, detailing deliveries

(iii) Invoice book, detailing invoices proceed

(iv) Codes for use on requisition, quotation requests and purchase order to indicate department and material for accounting use.

(v) Order register for purchase to progress but not yet received.

(vi) Department breakdown of purchasing costs.

2.3.3 Logistics

Logistics is a concept that emphasizes movement and it encompasses planning, implementing, and controlling the flow and storage of all goods from raw materials to the finished product to meet customer requirements (Stukhart, 1995). Raw materials for construction are usually varied, bulky and heavy and required proper handling in the supplying process. Consequently, the construction industry requires active movement of materials from the suppliers to the production area in both the factory and the worksite (Pheng and Chuan, 2001).

The primary focus of the logistics concept in construction projects is to improve coordination and communication between project participations during the design and construction phases, particularly in the materials flow control process (Agapiou *et al*, 1998). They also mentioned that

problems arise in the materials flow control process which includes delays of materials supply, due to some materials purchased just before they are required and waste of materials during storage, handling and transporting when procured in large quantities without complying with the production needs on site. The previous research suggested that, the routing of materials is one of the main causes which affect cost and time during construction projects (Varghese and O'Connor, 1995).

Hence, the factors that should be taken into consideration during the logistics process for effective materials management include:

a. optimum forecasting of materials movement
b. Planning of access and routing of material within a construction site.

2.3.3.1 Material Logistics Planning (MLP)

Material logistics planning is a practice designed to assist construction projects in proceeding smoothly whilst achieving programme certainty and cost predictability on complex building projects. Material logistics planning relates to the proactive management of the types and quantities of materials to be used, including supply routes, handling, storage, security, use and reuse, recycling and disposal of excess materials. As projects get larger, supply chains increase in complexity and planning controls get tougher so that logistics becomes progressively more important.

The use of logistics as a complementary approach to construction management is becoming more popular and logistics is now a key feature of pre-construction planning; not just on large complex schemes, but also in the planning and delivery of mainstream housing and fit-out contracts. MLPs are tools to formalize and implement the logistic planning process.

MLPs are tools to manage all materials from project conception through to demobilization and completion. The MLP covers key aspects such as:

1. The setting of objectives and key performance indicators for efficient material use;
2. Training;
3. Minimization of materials through attention to:
    i. material specifications;
    ii. delivery of materials;
    iii. storage of materials;
    iv. handling of materials;
    v. use of materials;
    vi. disposal of materials; and
4. Identifying lessons to be learned and best practice.

Poor material management is commonly linked to the inaccurate or surplus ordering of materials, damage to materials, inadequate storage, rework due to errors, poor workmanship, defective site processes, and inefficient use of materials. Ordering materials that are not used on the project due to loss, wastage or being surplus to requirements has a cost which is often overlooked as it is built into the total project price and paid for by the client. This includes the cost of purchase and delivery, storage and handling, disposal, treatment or return to supplier, and labour to manage the unused materials. Implementation of a comprehensive MLP will lead to economic, efficiency and sustainability benefits. A template

2.3.3.2 Key Stages of a MLP within the Construction Process

The key stages of material logistics planning are shown in relation to the construction process

1. Identified responsible persons and their roles

2. Implement a training and communication plan

3. Determine material types and quantities from the detailed design

4. Plan for material receipt and storage

5. Implement procedures to manage sub-contractors

6. Site mobilization and construction

7. Project completion and demobilization

Logistic planning should be initiated at the project outset to achieve the greatest material savings. Ideally the client should develop and maintain a clear strategy for best practice logistics planning based on their corporate goals and policies. The logistics strategy will define the approach to formulation of the MLP. However the development of a project specific MLP is often a designated, or implied, responsibility of the main contractor, whereas it should be used during the design stage to minimize material wastage through eliminating bespoke designs; for example, reducing the proportion of unique window sizes.

Once the design of the project has been agreed, the material types and quantities should be built into the MLP together with a programme specifying the project phase for which they are required. It is important to identify and understand how materials will be procured, delivered, stored and handled onsite and incorporate these procedures into the MLP so that they can be communicated to all relevant parties. The MLP will be implemented during site mobilization and is a live document that changes as the project develops.

Site practices should be monitored for their conformance to the MLP. The plan should also be reviewed on a regular basis and updated as improvements or design changes are identified. The main causes of material wastage during the construction phase are:

a. off cuts of materials such as tiles and plasterboard;

b. inaccurate or surplus ordering of materials;

c. damage to materials e.g. through inappropriate handling, inadequate storage;

d. rework due to errors, poor workmanship or defective site processes; and

e. inefficient use of materials e.g. use of temporary materials such as hoardings.

2.3.3.3 Importance of Good Practice in Material Logistics Planning

Logistics principles are not difficult in themselves, but putting them into practice takes commitment, effort and attention to detail, with an emphasis on manageability. There is a strong business case for implementing MLPs in construction projects using the good practice guidance laid out in this document. The MLP may assist in delivering financial, efficiency and sustainability benefits.

1. Financial Benefit

Ordering materials that are not used on the project due to loss, wastage or being surplus to requirements has a cost which is often overlooked as it is built into the project price and paid for by the client. The total cost of poor material logistics includes the cost of:

a. purchase and delivery;

b. storage and handling;

c. disposal, treatment or return to supplier; and

d. labour to manage the materials.

2. Labour Efficiency

The efficiency of the labour force on-site contributes to the project costs, duration and quality, as well as the client's perception of the construction organization. Implementing efficient material logistic practices will reduce the number of times materials are handled and prevent skilled craftsmen being taken away from the core tasks to handle materials. Onsite personnel

performance will increase by having the materials required for a task on hand, at the right time and in the right quantities.

3. Legislative and Policy Drivers

There is an increasing thrust of public policy (including waste strategy reviews, planning requirements, and industry targets) to achieve greater material resource efficiency. While there is currently no regulatory obligation to implement a formalized plan to minimize the purchase and use of materials that will result in waste, the following initiatives provide a clear indication of the direction in which policy is moving.

4. Environmental Benefits

Improving project environmental performance helps clients and contractors demonstrate their commitment to reducing their impact on the environment.

2.3.3.4 Co-ordination of Material and Other Resources

The money proposed for any activity in the bill of quantity should be spent judiciously otherwise the cost of replacement of stolen or damage material might above normal. The people responsible for doing any task must be seen to do it otherwise responsibility will invaded by the people concern. Control is also necessary to ensure that performance cost and time target are achieved. Problems of inadequate material management, if an organization lack efficient material management for the Following problem may be occurred:

i. Increase in material wastage men and machine may be idle waiting for materials.

ii. Men and machine may be idle waiting for materials

iii. Delay in completion of the project.

iv. Possibility of fraud, theft or loss

v. Extensive claims may arrive from shortage material

vi. Contract sun may be increase.

2.3.4 Handling

Effective material handling can be define as using the right method in providing the right amount of the right material, at the right place, time, sequence, position, condition, and cost. This involves handling, storing, and controlling of the construction materials. Therefore, materials handling provides movement to ensure that materials are located and that a systematic approach is required in designing the system. Handling of materials is the flow component that provides for their movement and placement. The importance of appropriate handling of materials is highlighted by the fact that they are expensive and engage critical decisions. Due to the frequency of handling materials there are quality considerations when designing a materials handling system. The selection of the material handling equipment is an important function as it can enhance the production process, provide effective utilization of manpower, increase production and improve system flexibility (Chan, 2002).

The importance of appropriate handling of materials is highlighted by the fact that there are expensive and engages critical decisions. The materials handling equipment selection is an important function in the design of a material handling system in order to enhance the production process, provide effective utilization of manpower, increase production, and improve system flexibility (Chan, 2002). In addition, materials scheduling is also an essential part of handling material on site, which has several benefits (Che Wan Putra *et al.,* 1999) such as:

i. showing the quantities involved in each particular operation;
ii. providing a key to the distribution of materials on site; and
iii. Demonstrating useful way of checking quantities required by sub-contractor, etc.

Materials must be delivered to site undamaged and without any wastage. Most common problems associated with materials supply is inadequate unloading and handling facilities, which attribute a high proportion of wastage (Canter, 1993). Therefore, handling with safety during movement of materials at site, which reduce the percentage of materials wastage and finally foster significant improvement can often the total system productivity.

2.3.5 Stock and Waste Control

The European Construction Institute's Total Productivity Management report (ECI,1994) states that "materials delivery to site is a critical, productivity-related aspect which demands the introduction of a carefully developed system of monitoring and control as early as possible". Delivery of the bulk of the construction materials requires proper management of the stock control. Stock control is a technique to ensure all items such as raw materials, processed materials, components for assembly, consumables stores, general stores, maintenance materials and spares work in progress and finished products are available when required. (Prabu and Baker, 2006).

According to Teo and Loosemore, (2001), Construction activity can generate an enormous amount of waste and materials waste has been recopied as a major problem in the construction industry (Formoso *et al,* 2002). There are also mentioned that construction materials waste, in the USA contributes approximately 29%. In the UK it contributes more than 50% and in Australia it contributes 20-30%. This is evidence to control constructions materials in a good way during the construction process. The cause of waste in construction projects indicates that waste can arise at any stage of the construction process from inception, right through the design, construction and operation of the built facility (Faniran and Caban, 1998). Therefore, waste can

be reduced through the careful consideration of the need for minimization and better reuse of materials in both the design and construction phases.

Material storage on site requires close attention in order to avoid waste, loss and any damage of materials which would affect the operations on the construction project.

Problems often arise during materials supply because of improper storage and protection facilities (Canter, 1993). Previous studies have identified that building materials often require a large storage capacity which is rarely available on site (Agapiou *et al*, 1998). However, Stukhart (1995) suggested that there are a few considerations to be taken into account in the planning of the storage space such as timing of the initial buy, and historical information and experience. Materials management on site should seek to reduce loss of profit due to theft, damage and wastage, as well as running out of stock. Therefore, the requirements of storing space should be taken into consideration from the initial stage of the construction process.

2.3.5.1 Elements of a Waste Management Plan

Project planning is very important because it allows the opportunity to define a problem, assess possible solutions, proceed to implement the final option and make provision for evaluation at the end. It is unthinkable to commence a construction project without going through this process. For the same reason, waste management on construction sites should be planned before construction activities begin (in order to avoid dealing with waste as a problem).

A waste management plan does not have to be complicated; in fact it need not even be a long document. It simply needs to be concise, comprehensive and practical for easy interpretation and implementation on site. A good waste management plan will contain the following components:

a. Goals;
b. Waste audit;
c. Waste disposal options;

d. Waste handling requirements;
e. Transportation requirements;
f. Economic assessment.

2.3.5.2 Materials Wastage and Security Control on Site

Materials waste control methods reduce firm and industry wastages from practice already operation thus reducing project costs. Control is applied to the following areas.

1. Materials quality:- Inspection of materials prior to construction can eliminate faculty materials that would waste processing labour and other materials if unchecked.

2. Materials standard should be specified to aid to the inspection process.

3. Materials handling efficiency including equipment and methods that will not charge materials in storage or interplant practices

4. Employee training to maximize efficient construction.

5. Study packing to protect incoming materials and outgoing materials.

When determining the amount of waste and methods to control it the following statistics should be established.

(1) Weight and / or volume of wastes.
(2) Sources of wastes
(3) Value of waste.
(4) Later use of waste, if any.

Therefore, with the trend of materials cost using at a faster than other resources the control of waste is vitally important, both on and off site.

Buttler (1983) in the Element of Administration for building student's stressed that waste can reduce by the following:-

(1) Ensure that materials are delivered as required so that site storage time is cut a minimum this requires careful phasing of deliveries between site and supplier.
(2) Ensure that materials delivered are those specified for that particular job.
(3) Ensure that workman are not only producing excessive amount of "off event"
(4) Make sure that the storage is located near the site.
(5) Make sure that stored materials are not deteriorated.
(6) Collect waste and use to prevent more cutting.

2.3.5.3 Security Control of Materials

Security is the protection of business property including information, both in the plant or site and intra-sit. Costs are reduced through the use of security by a reduction of materials, suppliers that are proffered or stolen. Additionally insurance costs may be reducing when adequate security pensions are made. One study made by professor leons redzinoicy, well-known criminology at Cambridge University, indicates that as many as of preterm of women and 29 percent of men carry out one or more indictable crimes during their lifetimes, and percentages are rising. Cost of security system it is much lower when the system is designed and built on site. Theft resistance doors and windows fencing, compounds, store shed, day guard and night, dogs on the site. Alarm e.t.c are all much cheaper to install.

2.3.5.4 Material Control

Chandler (2008) explained that the degree of control on the inflow of materials and accompanying paper work will depend upon the size of the contract and the staff assigns to over see this work. After all the planning ordering and buying process have been working to effect a tight control over the materials situations, the site can negate the whole system if it does not carry out its functions (to supervise the utilization of materials on the site). He stressed further that control on site must be exercised respect of waste deterioration, misuse e.t.c. careful check should be made to ensure correction of orders and that materials delivery can be properly stretch and unnecessarily handling avoided.

Control measures on site should include:

1. Delivery: schedule of timing and contractual responsibility in delivery orders should be agreed with supplier. Order should be checked on arrive on site by competent storekeeper.
2. Security and storage: practical site security with fencing where necessary and a watched gateman, site store with lock. In addition, site manager's office should be situated in such a position that he could have an overview of the entire site where practicable.
3. Internal Transportation: This should be done in a way to avoid double handling.
4. Adequate supervision: should ensure that materials are not dropped, spoiled or discarded unnecessarily during operation.
5. Accounting: Records should be kept of all transactions – receipts, suppliers, waste, and transfers to other sites and so on.

2.3.5.5 Stock Control Technique

Compton(2009) states that "stock control" is the means by which materials of the correct quality and quantity is made available as and when required with due regard to economy in storage and ordering cost, purchase prices and provision of in terms of money. Higgins (2006) explained that careful stock control assures the user that materials and supplies are not being wasted or stolen and can reduce costs of such goods and their storage. He said further that another fact of the technique controls purchase goods inventories from the times they are supplied until incorporated by the contractors. Both areas of stock control include the following basic steps.

a. Goods receiving and receiving the receipt.

b. Storage of goods in goods conductor.

c. Control recording incoming and outgoing construction materials as well as the supply on hand. Also control of incoming and issuing of construction materials as well as inventories of stock on hand and reserve stock records of issuing materials and the of inventory turnover.

2.3.5.6 Reason for Holding Stock

The cost goods for inventory burden cost is high usually 25-35 percent of the values of goods – (Higgins, 2006). This figure includes the cost of the physical storage facilities.

Handling, distribution taxes insurance and deterioration. Deterioration account for well over half of the cost, and therefore they are especially suitable targets for cost reduction procedures.

Storage should be kept to the minimum required, and reasons for holding stock include the following reasons.

a. Delivery cannot be exactly matched with day by day usage.

b. Quantity discounts or projected inflation caused price increase on materials purchased large enough to offset storage costs.

c. Fear of widely fluctuating market for goods.

d. Fear of short run inflation on some materials constantly used.

f. Some items appreciate in value during the time of storage e.g block.

2.3.5.7 Control

Stock control requires the following steps.

1. Establishing a base inventory of goods now held, as well as a method for adding to or subtracting from the inventory, will eliminate costly annual stock taking.
2. Decisions must be made as to the amount of supplier's goods to be held, taking business conditions and quantity needed into account along storage cost factors.
3. Co-ordination of purchase and delivery schedules by departmental head and the purchasing department.

The following are the stock control;

a. ABC Analysis: this is a useful technique for stock control materials. Here, goods are broken down into one of three classifications of value of goods consumed. A small percentage of items stocked will account for a large percentage of total value, and storage cost control can be more precisely applied to these items with the saving of large areas of cost with little effort.

b. Material Utilization Control**:** the efficient use of construction materials to reduce waste thus lowering costs. According to Higgins (2006), primary methods of materials utilization include efficient materials selection, efficient handling and use, standardized materials practices, and administrative controls.

c. Efficient Material Selection: includes choosing the lowest cost material of an adequate quality for construction purpose after considering the availability of needed grades, sizes, quality, e.t.c.

d. Efficient Handling and Use: can be facilitated through proper management of computers firm with correctly designed and maintained fools and equipment. Oil leaks rusty e.t.c. and also ruin raw materials. If the equipment is not adequately taken case of it can increase the cost of raw materials. Materials handling could be manual or mechanical, materials are handled manually when human labour/power is employee to carry/move or handled manually to and in site. Examples of such materials that could be handled manually to and on site are bagged some package and loose materials. Materials are handled mechanically when mechanic, equipment or plants are the device used to move the materials are dumper, forklift, trucks, Carnes, host power shovel city.

As a matter of fact, the following objectives were enjoyed in an organization employing plant to handling materials for construction operation on site,

To achieve the object of material management without hampering other objectives.

a. To improve the quantity and standard of work carried out and to offer better services to the client where possible.

b. To strive continually period of the project. And selection of particular equipment for handling materials both to and of site depends on the following factors.

c. Cost of plant hire or own

d. Management of plant

e. Type of construction site

f. The operation to be performed.

g. Degrees of standardization of flexibility desire in machine.

2.3.6 Storage of Materials

According to Mezue (1992) material storage can be defined as merely keeping material(s) in sage place until it is required or requested for use in a manufacturing process. Manufacturing process also includes construction process. To obtain good material storage, a system whereby material are systematically organized by administratively keeping them safely and providing for the best means of flowing in and out of them is adopted. Storage of materials is the direct responsibility of site management and has a strong influence of material.

Chandler (1978) advanced that attitude taken to newly delivered materials and components will be carried through their subsequent handling and usage. A careless regard for the value and utility of the materials on part of the management could lead to a progressive deterioration in the operatives' regard for the materials. The system adopted for the storage of materials will therefore depends wholly on the co-operation of the site team. He stressed further that areas on site allocated for the storage of materials should be determined after considering the under listed questions:-

1. Will construction take place in that area?

2. Is the storage for a long or short term relatives to the contract time?

3. Can delivery transit vehicles safely and easily reach the areas?

4. Can on site movement storage area to point of use be safely and economically carried out?

5. Are the materials as near t their point of use as practically possible?

6. Is the materials have considered value are they in a security areas?

7. Will the storage area create problems in routine site transport and personnel?

The answers to each of these questions will vary from materials to materials.

Good storage facilities must be maintained by construction industries for effective construction work cost and cost control.

Materials must be stocked in places where they can be easily obtained for use.

Below is a typical organization chart for store department.

ORGANIZATIONAL CHART FOR STORE DEPARTMENT IN CONSTRUCTION FIRM

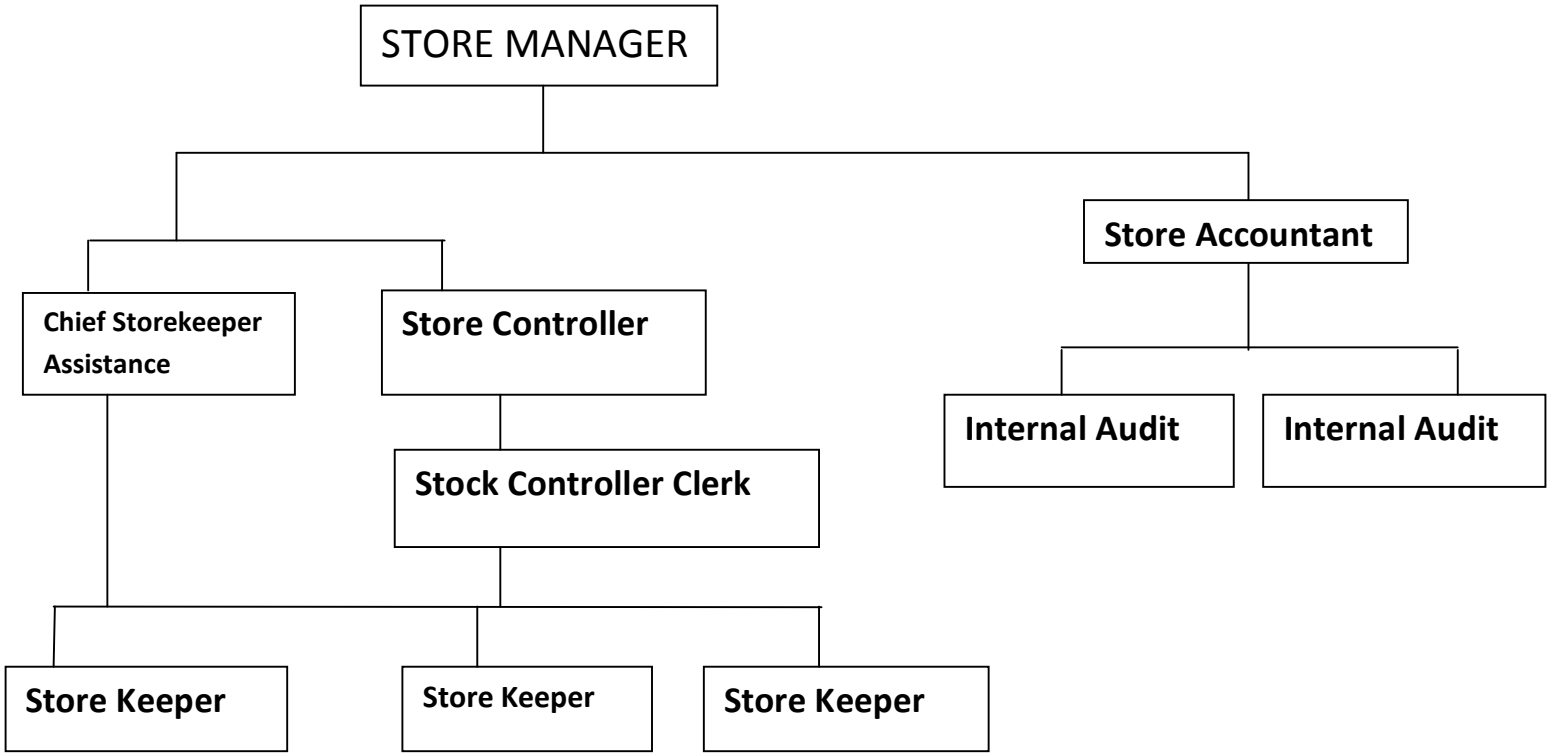


Figure 2: Organizational Chart for Store Department in Construction Firm

Source: Peter and David (1992)

2.3.6.1 Popularity Storage

Popularity storage is a stock controls technique that places the most frequently used and or the most easily moved materials, suppliers or goods nearest the point issue.

Priorities and storage positions are assigned to good to the following order.

(i) Most often issued most easily moved items.

(ii) Out of date items.

(iii) Excess stock items.

(iv) Out of reason items.

2.3.6.2 Physical Storage Facilities

1. In arranging storage areas, the following factors should be considered.

Central versus networks system: choice of one large storage place or a network of smaller storage areas is the first consideration. If only one operation is served or if multiple operations are located near one another, a central storage place is the most economical. If branch operations are located near one another, a central storage place is the most economical. If branch operations are spreads over a wide geographical area, however branch areas may be proffered to allow storage near the point of use.

2. Transportation loading and unloading materials should design to most efficiently handle the type of transportation used, as should access facilities such as roads or rail access features.

3. Safety areas should be designed for storage of fragile or dangerous materials.

4. Open areas such as outdoor yards may be used for low cost storage for durable materials or goods not harmed by weather.

2.3.6.3 Goods Receiving

In goods receiving, incoming materials and suppliers are checked against purchase order for quantity and conditions and shipment is recorded, purchasing departments and inspection division are notified. A multiple copy form called a good received register may be used for this purpose.

The forms are numbered and show the date received, suppliers name and address e.t.c. this form, combined with the suppliers invoice and an inspection form, are used by the accounting department to make it payment.

2.4 Materials Management Problems

There are many issues which contribute to poor materials management in construction projects. Zakeri *et al* (1996) suggested that waste, transport difficulties, improper handling on site, 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 *et al*, 1996; Abdul Rahman *et al;* 2006; 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:

a. Receiving materials before they are required, causing more inventory cost and chances of deterioration in quality;
b. Not receiving materials at the time. of requirement, causing loss of productivity;
c. Incorrect materials take-off from drawings and design documents;
d. Subsequent design changes;
e. Damage/loss of items;
f. Selection of type of contract for specific materials procurement;
g. Vendor evaluation criteria;
h. Piling up of inventory and controlling of the same; and
i. Management of surplus materials.

The traditional construction method supply paper-based work during the construction process. This can produce excessive paperwork and contributes poor materials management in construction projects (Zakeri *et al*, 1996). There is also give problematic, effort - prone and inefficient in the recording and exchanging information of materials component within a supply

chain. The implementation of information and communications technology (ICT) can help the management of construction activities to become more effective and faster. The emergence of ICT systems could transform conventional methods and improve materials management. The use of ICT has also increased with new software related to the construction industry and can support the effective management of materials practices. Therefore, the ICT-enabled solution could help in order to overcome the problems. For example, improving materials supply management through an intelligent system to facilitate bidding, requisition and ordering of materials.

2.4.1 Factors Affecting Materials Management on Construction Sites

According (Narimah, 2011), the following are the factors affecting materials management;

1. Sourcing of materials and requisition
2. Demand estimation
3. Transportation
4. Receiving and verification of materials on site
5. Storage of materials on site
6. Issuing of materials for use
7. Procurement or indent for materials
8. Quality inspection and control
9. Maintenance
10. Time
11. Materials handling
12. Stock and waste control
13. Financial ability
14. Possession of qualified staff

15. Possession of qualified subcontractors

16. Possession of qualified of required equipment

17. Competence of estimators

18. Availability of equipment

19. Duration of the project

20. Type of project

21. Type of materials

22. Level of awareness

2.4.2 Approaches to Addressing Problems

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.

Measures for Effective Materials Management Practices on Construction Sites

According Narimah B. K. 2008, the following are the measures for effective materials management practices on construction project;

1. Timely placing of orders for materials

2. Ensure quality assurance/control processes are in place

3. Logistics for tracking & transportation of materials to site

4. Receiving and inspecting materials on site

5. Storage & issuing of materials to construction location

6. Complete quality records of materials

7. Established material management system to be used

8. Documentation

9. Record receipt of goods upon delivery

10. Monitoring of materials distributed

11. Assigning of material codes

12. Construction activities and schedule of materials

13. Proper materials handling

14. Make the store safe from theft and vandalism

15. Materials return to be submitted weekly

16. Determine the daily allocation of materials on site

17. Education/training/enlightenment of staff in charge of materials management

18. Special security agents

19. Usage of qualified construction professionals

2.5 BENEFITS GAINED IN MATERIAL MANAGEMENT

1. Elimination of bulk passing: by defining centrality the authority and responsibility for all the materials function under are key individual, a central part of control for the total flow system is provides. When using departments have problems regarding their materials requirements, they can look at are central part within the organization for answers and action.

2. Better inter-department/section co-operation: this is accomplished both between the materials management function and manager departments within the total organization, and also with the various sub functions that make up the materials department. Using departments find that they

relieve better, more efficient service from the materials section. This creates an atmosphere conducive to solving materials user supplier problems with a sense of mutual trust and cooperation. In addition to cooperation between user section and the materials department, cooperation will be festered between the various functions making up the material, under a central responsible manager, these departments will develop a sense of mutual support and confidence in accomplishing the total material jobs.

3. Lower prices for materials and equipment used. Wise buying requires accurate information, promptly supplied, regarding materials used. Wise buying requires accurate information, promptly supplied, regarding materials needs. This enable purchasing to take advantage of things such as quality buying, use of various types of blanket orders and other type if contract buying arrangement and buying in anticipation of market changes when all materials functions including materials planning control and inventory control are joined together organizationally, communication regarding materials requirements are generally expedite.

4. Faster inventory turnover: Dug to great speed, accuracy and completeness of communication regarding materials requirement and usage rates, it is often possible to reduce the total investment inventory, with resultant savings in inventory cases. Indeed some firms famed that centralization of materials function resulted in a 20-40% reduction in site of materials stock.

5. Continuity of supply of materials during construction: descriptions in operations are extremely costly to a construction firm and the client. Yet descriptions do occur, often because of breakdown in communications between various materials function and lack of cooperation between functioning. Material management factors the used for co-operation communication, coordination which help to prevent such disruptions.

6. Reduce material lead time: with long communicates a substantial amount of time may elapse between the date potential material user recognize his need and the time that material of relieved by the construction firm. If this information must be transmitted to materials planning and control, then to inventing control and finally to purchasing and if these three functions are vet in close organizational proximity, several days male elapse before the purchase order even goes to vendor. Additionally, there is a chance that because of the organizational distance between functions, urgency in materials needs may be misunderstood.

Benefits of Effective Materials Management; According to Bernold and Treseler (1991), the following are the benefits of materials management.

i. Reduce cost of materials
ii. Improvements in labor productivity
iii. Project will be constructed on time or early than expected
iv. Purchase saving
v. Providing adequate storage of materials on site
vi. Reduction in duplicated orders
vii. Improvements in project schedule
Viii. The effective design site layout so as to aid in the management of materials on site
Ix. The installation of materials hoists on site to aid in the movement of materials
x. Better relations with suppliers
xi. Better handling of materials
xii. Better field material control
Xiii. Quality control
xiv. Reduce of materials surplus
xv. Better cash flow management

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 **PREAMBLE**

This chapter highlights the data collection procedures in the study. It also explains the parameter in the methodology such as the research design, data collection, population of the study, sampling techniques, sample size, and method of data analysis. In addition, several discussions with professionals were conducted with a view to extent valuable information that helped in constructing a frame work for this research

3.2 **RESEARCH DESIGN**

The research was designed in such away to assess the problem of effective materials management practices in Nigeria construction sites and also to investigate professionals' perception on the measures to be put in place to ensure effective materials management in the construction industry in Nigeria.

3.3 **DATA COLLECTION**

The primary data was obtained through field survey. In order to collect data and to meet the set objectives of the research, a structured questionnaire based on the aim of this study was designed. The questionnaire consisted of section A and B. Section A was used to generate data on the respondent's profile which includes: profession, years of working experience and educational qualification.

Section B of the questionnaire was used to gather information on the Materials Management Practices in Nigeria Construction Sites which includes: factors militating against materials management, components of materials management, problems of materials management, causes of materials wastage on site, ways and means of improving materials management in Nigeria

construction sites and among others. Respondents were asked to rate them on a 5-point likert scale with '5' indicating strongly agree and '1' indicating strongly disagree

3.4 **POPULATION OF THE STUDY**

The population was all professionals in the construction industry, i.e. Architects, Builders, Engineers and Quantity Surveyors who were managing construction projects at a senior cadre level in all categories of construction firms duly registered with the corporate affairs commission in Nigeria.

3.5 **SAMPLING TECHNIQUES**

The main study for this research is interview which is both written (questionnaire) and oral. Oral interview were conducted at the head offices and sites of construction firms in Lagos, Abuja and Kaduna due to the fact that a lot of construction activities and companies are concentrated there.

Questionnaire was chosen for this research work to ensure simplicity and accuracy. Random sampling techniques were adopted to select the sample frame. Ninety (90) questionnaires were distributed to construction firms (Lagos, Abuja and Kaduna).

3.6 **SAMPLE SIZE**

From the central limit theorem which states that, " with very few exceptions, no matter what form the underlying populations distribution takes, as 'n' increases, the sampling distribution of averages approaches a normal distribution, thus the normal distribution can be used to approximate probabilities incase of reasonably large sample ($n \geq 30$) from non normal distributions," (Dawdy and Wearden, 1985), a sample size of 90 was chosen for this research from which 30 questionnaires were administered to each of the three states. After preliminary analysis of the data the number of usable questionnaires for analysis amounted to: 19 from Lagos; 21 from Abuja; and 16 from Kaduna. On the whole, a total of 56 questionnaires returned

completed in a usable format. A return rate 62% was achieved which is considered sufficient for the study based on the assertion of Moser and Kalton (1971), that the result of a survey could be considered significant if the response rate is not lower than 30-40%. Therefore, the percentage of the returned questionnaires is adequate for analysis.

3.7 **METHOD OF DATA ANALYSIS**

In the analysis of data obtained on the research, descriptive statistics were adopted. Tables, means, standard deviation and percentages were used to describe the results. These were carried out using Microsoft Excel and statistical package for the social science (SPSS) Packages.

Mean score involves assigning numerical values to respondents ratings of factors e.g strongly agrees 5, agree 4, partially agree 3 etc. the mean score for each criterion is determined as follows

$$\text{Mean score} = \frac{5n_5+4n_4+3n_3+2n_2+1n_1}{n_5+n_4+n_3+n_2+n_1} \quad \text{----------3.1}$$

Where n_1= number of respondents who answered strongly disagree

n_2=number of respondents who answered disagree

n_3= number of respondent who answered partially agree

n_4=number of respondents who answered agree

n_5=number of respondents who answered strongly agree

This provided the basis of calculating the standard deviation, which gives the average of all deviation from the mean and is computed as follows

$$\text{Standard deviation (SD)} = \sqrt{\sum \frac{F(X-\bar{X})2}{n}} \quad \text{----------3.2}$$

Where $\sqrt{}$ = square root sign

$\sum$= sum,

F= frequency

X= score,

$\bar{X}$ = means of score

n= total number of scores,

CHAPTER FOUR

4.0 DATA PRESENTATION, ANALYSIS AND DISCULSIONS

4.1 ANALYSIS OF THE QUESTIONNAIRE

As stated previously, questionnaires were used to obtain primary data for this research work. The result of the returned questionnaire is presented in the table 4.1. From the table, it gives the breakdown of the administered questionnaires based on the number of responses obtained

Table4.1. Administered Questionnaires and Responses

Questionnaire	*Frequency*	*Percentage %*
No. distributed	90	100
Accepted responses	56	62
Total	90	100

Source: Field Survey, (2013)

Based on the level of homogeneity of the returned questionnaires, 62% response rate is considered adequate for analysis and conclusions of this type of research (Akintoye, 2000)

4.2. RESPONDENTS PROFILE

Some part of Section 'A' of the administered questionnaire was based on respondents' profile. Questions were asked about the profession, years of experience and respondents educational qualification.

Table 4.2 Educational Qualification

Education	*Frequency*	*Percentage %*
ND	0	0
HND	15	26.8
BSC	24	42.9
MSC	13	23.2
PHD	4	7.1
Total	56	100

Source: field Survey, (2013)

Table 4.2 shows that 42.9% of the respondents are first Degree holders, 26.8% are HND holders and 23.2% are Master Degree holders. In summary, about 73.2% of the respondents have first degree and above.

Table 4.3 Profession of Respondents

Profession	*Frequency*	*Percentage %*
Architect	5	8.9
Builder	21	37.5
Quantity surveyor	19	33.9
Civil engineer	7	12.5
Others	4	7.1
Total	56	100

Source: Field Survey,(2013)

The distribution of respondent's profession is shown in table 4.3. The highest concentration of the respondents are Builders (37.5%), next are Quantity Surveyors (33.9%), then Engineers (12.5%), Architect (8.9%) while 7.1% are for remaining professions.

Table4.4. Years of Working Experience of Respondent

Year of Experience	*Frequency*	*Percentage %*
1-5	7	12.5
6-10	26	46.4
11-15	19	33.9
16-20	4	7.1
Total	56	100

Source: Field Survey, (2013)

Table 4.4 shows that 87.4% of the respondents have been working with construction firms for more than five years while about 12.5% have experience less than six years

4.3 MATERIAL MANAGEMENT PRACTICES IN NIGERIA CONSTRUCTION FIRMS

Table 4.5 Person in Charge of managing Construction Materials in Construction Projects

Responses	*Frequency*	*Percentage %*
General Manager	9	16.1
Project Manager	13	23.2
Site Manager	8	14.3
Store Manager	23	41.1
Others	3	5.4
Total	56	100.0

Source: Field Survey, (2013)

Table 4.5 Shows that the person in-charge-of managing construction material is the store manager (41.1%), follow by project manager (23.2%), then General Manager (16.1%) while site engineer (14.1%) and others (5.4%).

Table 4.6.Person Responsible for Ordering Materials

Responses	*Frequency*	*Percentage %*
General manager	4	7.1
Site engineer	6	10.7
Procurement dept.	36	64.3
project manager	9	16.1
Others	1	1.8
Total	56	100.0

Source: Field Survey, (2013)

Table 4.6 shows that (64.3%) of the respondents for procurement department responsible for ordering materials, (16.1%) of the project manager responsible for this duty, (10.7%) for site engineer while (7.1%) of the General Manager for ordering of materials and (1.8%) for others.

Table 4.7 method for purchasing of material

Responses	*Frequency*	*Percentage %*
Bulk purchase	43	76.8
in pieces	13	23.2
Total	56	100.0

Source: Field Survey, 2013

It shows that 76.8% of the respondents for bulk purchase while 23.2% for in pieces.

Table 4.8 Planning for Project

Responses	*Frequency*	*Percentage %*
Before tender	12	21.4
After award of contract	36	64.3
during construction process	8	14.3
Total	56	100.0

Source: Field Survey, 2013

Table 4.8 shows how materials planner starts planning for project. From the table, 64.3% of the respondents agree for after award of contract, 21.4% for before tender while 14.3% observed during construction process.

Table 4.9 undertake market survey before ordering for materials

Responses	*Frequency*	*Percentage %*
Yes	46	82.1
No	10	17.9
Total	56	100.0

Source: *Field Survey, 2o13*

From above table 4.9, it shows that 82.1% agree for undertaken market survey before ordering for materials while 17.9% of the respondents disagree.

Table 4.10 Frequency of Market survey

Responses	*Frequency*	*Percentage %*
Weekly	4	8.7
Monthly	12	26.1
after every 3 months	15	32.6
after every 6 month	9	19.6
over 6 months	6	13.0
Total	46	100.0

Source: Field Survey, 2013

Table 4.10 shows that 32.6% for after 3 months, 26.1% for monthly, and 8.7% for weekly while 32.6% for after every 6 months and above.

Table 4.11 Assessment of Materials

Responses	*Frequency*	*Percentage %*
Testing	9	16.1
Selection	31	55.4
Measurement	16	28.6
Total	56	100.0

Source: Field Survey, 2013

From Table 4.11 above, 55.4% of the respondents for selection of materials, and then 28.6% observed measurement for materials while 16.1% agree for testing for materials.

Table 4.12 Components of Materials Management

S/n Components of material management	*N*	*Min.*	*Max.*	*Mean*	*Std. Dev.*
1. Material estimation, budgeting, planning & Programming	56	4.00	5.00	4.910	.287
2. Scheduling, purchasing and procurement	56	3.00	5.00	4.696	.569
3. Receiving and inspection	56	3.00	5.00	4.214	.755
4. Inventory control, storage and warehousing	56	4.00	5.00	4.678	.471
5. material handling and transport	56	3.00	5.00	4.482	.660
6. Waste management	56	4.00	5.00	4.875	.333

Source: Field Survey, 2013

Table 4.12 shows components of materials management, material estimation, budgeting, planning & Programming has mean value (4.9) follow by Waste management (4.8), then

Scheduling, purchasing and procurement and Inventory control, storage and warehousing (4.6), material handling and transport (4.4) while Receiving and inspection(4.2).

Table 4.13 Stages of Materials Logistics Planning

S/n Stages	*N*	*Min.*	*Max.*	*Mean*	*Std. Dev.*
1. Identified responsible persons and their roles	56	3.00	5.00	4.392	.705
2. Implement a training and communication plan	56	3.00	5.00	4.750	.513
3. Determine material types and quantities from the detailed design	56	3.00	5.00	4.500	.738
4. plan for material receipt and storage	56	3.00	5.00	4.803	.483
5. implement procedures to manage sub-contractors	56	3.00	5.00	4.660	.611
6. Site mobilization and construction	56	3.00	5.00	4.571	.683
7. project completion and demobilization	56	2.00	5.00	4.017	.962

Source: Field Source, 2013

Table 4.13 shows the stages of materials logistic planning, the respondents strongly agree for the stages of materials logistics planning. Since all have the mean value above 4.00.

4.4 **FACTORS MILITATING AGAINST MATERIALS MANAGEMENT**

Table 4.14 Factors Militating against Materials Management

S/n Factors	*N*	*Min.*	*Max.*	*Mean*	*Std. Dev.*
1. Sourcing of materials and requisition	56	3.00	5.00	4.428	.759
2. Demand estimation	56	3.00	5.00	4.785	.494
3. Transportation	56	3.00	5.00	4.625	.648
4. Receiving and verification of materials on site	56	3.00	5.00	4.625	.589
5. Storage of materials on site	56	3.00	5.00	4.875	.384
6. Issuing of materials for use	56	3.00	5.00	4.714	.562
7. Procurement for materials	55	3.00	5.00	4.618	.680
8. Quality inspection and control	55	3.00	5.00	4.563	.631
9. Maintenance	56	3.00	5.00	4.339	.769
10. Time	56	3.00	5.00	4.321	.716
11. Materials handling	56	4.00	5.00	4.910	.287
12. Stock and waste control	56	3.00	5.00	4.267	.797
13. Financial ability	56	3.00	5.00	4.142	.818
14. Possession of qualified staff	56	3.00	5.00	4.607	.651
15. Possession of qualified subcontractor	56	3.00	5.00	4.428	.709
16. Possession of qualified of required equipment	56	3.00	5.00	4.553	.600
17. Competence of estimators	56	3.00	5.00	4.857	.401
18. Availability of equipment	56	1.00	5.00	3.964	1.072
19. Duration of the project	56	3.00	5.00	4.660	.611
20. Type of Project	56	1.00	5.00	4.000	1.026
21. Types of materials	56	3.00	5.00	4.589	.626
22. Level of awareness	56	3.00	5.00	4.428	.683

Source: Field Survey, 2013

Table 4.14 represents the factors related to materials management on construction site. The results show that majority of the construction professionals believes that the factors which have bigger effect on material in construction site are "materials handle with mean value (4.9), storage of materials and competence of estimators (4.8), and issuing of materials for use (4.7). On the other hand, the factors, which have lower effect on materials in construction site, are availability of equipment (3.9), type of project (4.0) and financial ability (4.1). From the above it can be deduce that, mishandling of materials, storage of materials and competence of estimators are the major factors that affecting effective materials management in Nigeria construction sites.

Table 4.15 Materials Management Problems

S/n Materials management problems	*N*	*Min.*	*Max.*	*Mean*	*Std. Dev.*
1. Lack of storage space	56	3.00	5.00	4.553	.630
2. Problems of logistic of material	56	3.00	5.00	4.250	.792
3. Materials damage	56	3.00	5.00	4.678	.575
4. Site access point	56	2.00	5.00	4.535	.808
5. Operation limitation due to security considerations	56	2.00	5.00	4.357	.818
6. Inadequate loading area at consolidation center	56	3.00	5.00	4.357	.698
7. Problem with congestion at loading area	56	2.00	5.00	4.142	.903
8. Weather	56	2.00	5.00	4.250	.768
9. Management of surplus materials	56	4.00	5.00	4.892	.312
10. Dust	56	2.00	5.00	4.000	.953
11. Project delay	56	3.00	5.00	4.339	.720
12. Site erosion	56	3.00	5.00	4.464	.659
13. Difficulty in delivery of materials	56	3.00	5.00	4.428	.656

Source: Field Survey, 2013

From the table 4.15 above shows the materials management problem on construction, the respondents ranked management of surplus materials high with the mean value of 4.8, follow by materials damage with mean value of 4.6 while lack of storage space and site access point have the means value of 4.5. It can be inferred that the hope of solving the materials management problem lies on the hands of the construction professionals.

Table 4.16 Causes of Materials Wastage on Sites

S/n Causes of materials wastage on site	*N*	*Min.*	*Max.*	*Mean*	*Std. Dev.*
1. Weather condition	56	3.00	5.00	4.642	.644
2. Batching of materials	56	3.00	5.00	4.107	.755
3. Placing of materials	56	3.00	5.00	4.464	.761
4. Stocking and pilfering	56	3.00	5.00	4.375	.675
5. Distance	56	3.00	5.00	4.196	.672
6. Handling of materials	56	3.00	5.00	4.803	.443
7. Labour force	56	2.00	5.00	4.464	.873
8. Inexperience personnel	56	3.00	5.00	4.285	.731
9. Equipment malfunctioning	56	2.00	5.00	4.035	.852
10. Lack of information about type and size of materials on design document	56	3.00	5.00	4.339	.815
11. Error in information about type and size of materials on design documents	56	2.00	5.00	4.196	.882
12. Design changes and revisions	56	3.00	5.00	4.714	.562
13. Ordering of materials that do not fulfill project requirements defined on design document	56	3.00	5.00	4.678	.542
14. Over- ordering or under-ordering due to mistakes in quantity surveys	56	3.00	5.00	4.607	.651
15. Damage of materials due to deficient stockpiling and handling of materials	56	3.00	5.00	4.553	.630
16. Imperfect planning of construction	56	3.00	5.00	4.392	.730
17. Workers mistakes	56	3.00	5.00	4.732	.485
18. Conversion waste from cutting uneconomical Shape	56	2.00	5.00	4.160	.757
19. Lack of site materials control	56	3.00	5.00	4.750	.513
20. Lack of waste management plan	56	3.00	5.00	4.678	.575
21. Lack of adequate storage space	56	3.00	5.00	4.589	.626
22. Lack of adequate room for account for Materials and materials becoming buried on Site	56	2.00	5.00	4.232	.808
23. Difficult to transport materials around site	56	2.00	5.00	3.964	.952
24. Workplace becoming overcrowded	56	3.00	5.00	4.214	.779
25. Increase security risks due to lack of adequate space to safety facilitate the storage of materials	56	3.00	5.00	4.357	.672

Source: Field Survey, 2013

Table 4.16 represents the causes wastage related to material in construction site.(4.8) respondents strongly agree that handling of materials is the major cause of materials wastage, follow by lack of site materials control, workers mistakes, and design changes and revisions causes waste increase (4.7) while (4.6) of the means value believes that Lack of waste

management plan, Over- ordering or under-ordering due to mistakes in quantity surveys and Ordering of materials that do not fulfill project requirements defined on design document causes waste increase on construction site.

4.5 **MEASURES FOR EFFECTIVE MATERIALS MANAGEMENT**

Table 4.17 Measures for Effective Materials Management.

S/n Measures for effective material management	*N*	*Min.*	*Max.*	*Mean*	*Std. Dev.*
1. Timely Placing of orders for materials	56	3.00	5.00	4.214	.706
2. Ensure quality assurance/control processes are in place	56	3.00	5.00	4.357	.818
3. Logistics for tracking & transportation of materials to site	56	3.00	5.00	4.303	.784
4. Receiving and inspecting materials on site	56	3.00	5.00	4.553	.630
5. Storage and issuing of materials to construction location	56	3.00	5.00	4.660	.548
6. Complete quality records of materials	56	4.00	5.00	4.714	.455
7. Established material management system to be used	56	3.00	5.00	4.160	.707
8. Documentation	56	4.00	5.00	4.821	.386
9. Record receipt of goods upon delivery	56	4.00	5.00	4.767	.426
10. Monitoring of materials distributed	56	3.00	5.00	4.678	.508
11. Assigning of material codes	56	3.00	5.00	4.571	.598
12. Construction activities and schedule of Materials	56	3.00	5.00	4.321	.663
13. Proper materials handling	56	4.00	5.00	4.750	.436
14. Make the store safe from theft and Vandalism	56	4.00	5.00	4.839	.370
15. Materials return to be submitted weekly	56	3.00	5.00	4.410	.707
16. Determine the daily allocation of materials on site	56	4.00	5.00	4.875	.333
17. Education/training/enlightenment of staff in charge of materials management	56	4.00	5.00	4.517	.504
18. Special security agents	56	4.00	5.00	4.553	.501
19. Usage of qualified construction professionals	56	3.00	5.00	4.517	.632

Source: Field Survey, 2013.

Table 4.17 shows the measures for effective materials management. The respondents strongly agree that should be measures for effective materials management practices in Nigerian construction sites, since all have the mean value above 4.00.

Table 4.18 Benefits of Materials Management

S/n Benefits	*N*	*Min.*	*Max.*	*Mean*	*Std. Dev.*
1. Reduce cost of materials	56	4.00	5.00	4.785	.414
2. Improvements in labour productivity	56	3.00	5.00	4.517	.632
3. Project will be constructed on time or early than expected	56	3.00	5.00	4.303	.658
4. purchase saving	56	4.00	5.00	4.553	.501
5. Providing adequate storage of material on site	56	4.00	5.00	4.482	.504
6. Reduction in duplicated orders	56	3.00	5.00	4.392	.528
7. improvements in project schedule	56	3.00	5.00	4.535	.601
8. The effective design site layout so as to aid in the management of materials on site	56	3.00	5.00	4.607	.651
9. The installation of materials hoists on site to aid in the movement of materials	56	3.00	5.00	4.553	.630
10. better relations with suppliers	56	3.00	5.00	4.500	.572
11. better handling of materials	56	4.00	5.00	4.714	.455
12. better field material control	56	4.00	5.00	4.678	.471
13. Quality control	56	4.00	5.00	4.571	.499
14. Reduce materials surplus	56	4.00	5.00	4.821	.386
15. better cash flow management	56	3.00	5.00	4.446	.600

Source: Field Survey, 2013

From the above Table 4.18, it can observed that the respondents strongly agree for benefits of materials management with mean value 4.0 and above.

DISCUSSION OF FINDINGS

The data collected for the purpose of this study were evenly supplied by all various types of construction firms where materials managements are being administered. However, the analysis reveals most common ways through which improper management of materials contributes to delay in completion time of project nowadays such as weather effect on materials, site vandalism, theft (pilfering), loss of materials within personnel's, shortage supply of materials

needed, lack of goods transportation from source of purchase, non-availability of experience operatives or project manager, poor storage facilities, lack of proper supervision and inadequate security. 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 what will be required to achieve a proper management of materials. Table 4.13 shows the stages of materials logistic planning, the respondents strongly agree for the stages of materials logistics planning.

Table 4.14 represents the factors related to materials management on construction site. The results show that the majority of the construction professional believes that the factors which have bigger effect on material in construction site are "materials handle with mean value (4.9), storage of materials and competence of estimators (4.8), and issuing of materials for use (4.7). On the other hand, the factors, which have lower effect on materials in construction site, are availability of equipment (3.9), type of project (4.0) and financial ability (4.1). From the above it can be deduce that, mishandling of materials, storage of materials and competence of estimators are the major factors that affecting effective materials management in Nigeria construction sites. Therefore, construction firms should create awareness on effective materials management by education and training. Table 4.17 indicates the measures for effective materials management. The respondents strongly agree that should be measures for effective materials management practices in Nigeria construction sites. 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. It can be deduced therefore that, proper materials handling in Nigeria construction sites can be a help for effective materials management and also education and training of staff in charge of materials management.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 CONCLUSIONS

The following conclusion could be drawn from the research work;

1. Materials management processes require a transformation to improve the overall in handling of materials for more efficiency and effectiveness on the construction site. This is because poor handling 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.

2. Only by proper management of materials in construction sites can aids materials management in Nigeria construction sites, as it aids the speedy completion period, it saves time of execution, it gives high quality works and reduces the materials wastage.

3. Materials management process improves the success rate of project planning and execution thus lowering the project cost.

4. From the projects surveyed, it had been found out that improper material management on site needs be discovered and prevented in order to achieve the desired output, such as; poor site planning, lack of competent operations, inadequate security, wrong ordering of materials, incompetence of the site manager/resident engineer, corrosion and decay of materials when not properly protected from weather, availability of space on site for storing fragile and valuable materials, inexperience personnel, difficulty to transport materials around sites e.t.c. if all these could be put into consideration before resuming any site and all necessary or adequate provisions

are been made to prevent the occurrence of these; proper materials management will benefit the firm in terms of increase profit margin, quick execution and reduce cost of the project.

5.2 RECOMMENDATIONS

Based on the results of this study, the following recommendations are made to foster effective materials management practice of construction projects in Nigeria:

1. The contractors should ensure effective control of materials from design to construction stage so as to adequately reduce processes that can lead to wastages in construction.

2. Construction firms need to evolve better means and facilities in which building materials could be well-stored with pallets at the base or as may be applicable to prevent undue damage which may lead to wastages.

3. The designer should co-ordinate dimensions between materials specified during design and those procured for use at sites so as to guide site personnel on how to prevent avoidable waste in the use of various types of materials during execution of construction projects.

4. The construction firms should create a functioning section that would see to the appraisal of the plan and compliance with its provisions through capacity building and manpower development.

5. Material management should be practiced on all sites and by all categories of building construction firms, whether large, medium or small.

6. There should be a proper planning of material management right from the inception of project execution and strict compliance with the project bill of quantities, schedule of materials, construction programme, specification, proper stock accounting and security systems is essential so as to ensure timely project execution and standard work delivery within reasonable cost, time and quality.

7. The use of incompetent hands (e.g. skilled and unskilled labour) as store officer or stock controller on construction sites should be discouraged. Competent and experienced personnel with basic managerial skill in material stock control or material management should be engaged in order to enhance material stock control practice.

8. The provision for materials storage in the preliminaries

9. The extent of work, nature of work to be done, and materials to be used should be defined in order to prepare a work study.

With these steps afore listed, successful materials management can be achieved in our various construction sites and without much effect of the size of the project affecting the management.

Contribution to Knowledge

1. The study was able to discovered that, the major factors why there was an ineffective materials management was due to lack of good storage facility for materials, mishandling of materials, incompetence of estimators and issuing of materials for use.

2. The study as however identified very good step which the construction firms observed that the procurement department are responsible for ordering construction materials.

3. The study also found out that some of the vital measures that will ensure effective materials management were not observed such as monitoring of materials distributed, quality assurance are in place, documentation and make the store safe from theft and vandalism.

REFERENCES

Abdul-Rahman, H., Berawi, M. A., Mohamed, O., Othman, M. and Yahya, I. A. (2006): Delay Mitigation in the Malaysian Construction Industry. *Journal of Construction Engineering and Managemen*t, Vol. 132, No. 2, pp. 125-133

Abdul-RahmanH, and Alidrisyi M.N, (1994): "A Perspective of Material Management Practices in a Fast Developing Economy: the case of Malaysia", Construction Management and Economics, vol. 12, pp. 412-422,

Abubakar A.D. (2000): Evaluating Material Application Waste on Building Construction Sites, A case study of Kaduna state, department of Building, Ahmadu Bello University, Zaria.

Adafin, Johnson Kayode et al. (2011): *an assessment of factors affecting material stock control practice on selected construction sites in Nigeria'*, Continental J. Environmental Design and Management 1 (1): 22 - 31, Wilolud Journals, 2011

Ademeso O.S. and Windapo, A.O (2008): "Relationship between Material Management Approach and Scheduled Project Completion Time", Construction and Building Research of the Royal Institution of Chartered Surveyors Conference, COBRA, Dublin Institute of Technology,

Agapiou, A., Clausen, L. E., Flanagan, R., Norman, G. and Notman, D. (1998): The Role of Logistics in the Materials Flow Control. Construction Management and Economics, Vol. 16, No. 2, pp. 131-137.

Agarwal A. (2001): "Benchmarking wastage control of construction materials", NICMAR *Journal of Construction Management*, Vol 16, No.1, January 2001

Aibinu, A. A. and Odeyinka, H. A. (2006): Construction Delays and Their Causative Factors in Nigeria. *Journal of Construction Engineering and Management*, Vol. 132, No. 7, pp. 667-677.

Al haddadEyad Abed El-Qader (2006): A Construction Materials Management System for Gaza Strip Building Contractors; The Islamic University of Gaza Deanery of Graduate Studies Faculty of Engineering Construction Management Program.

Arnold J.R. and Chapman S.N, (2004): "Introduction to Materials Management 5th Ed.", New Jersey: Prentice-Hall,

Bajeh Johnson. (2010): Materials Management in Construction Site, dept. of quantity surveyor, FUTA,Akure.

BaldvaSurbhi. (1997): Thesis, Material management in construction industry, CEPT

Barrie, D. S. and Paulson, B. C. (2002): Professional construction management: including C.M., design-construct, and general contracting. Mc Graw Hill, London.

Bernold, L. E. and Treseler, J. F. (1991): Vendor Analysis for Best Buy in Construction, *Journal of Construction Engineering and Management*, Vol.117, No. 4, December 1991, pp. 645-658.

Canter, M. R. (2003): Resource Management for Construction an Integrated Approach. Macmillan, London.

ChandaniKansara. (2007): "Identification of material wastage in residential buildings", NICMAR journal of Construction Management, Vol 13, No.1, January 2007

Chandler E.T. (2008): The Planning of Storage and Management on Site, Special Correspondence, London.

Che Wan Putra, C. W. F., Ahmad, A., Abd Majid, M. Z. and Kasim, N. ' (1999): Improving material scheduling for construction industry in Malaysia. In Malaysian Science & Technology Congress 99, 6 8 December 1999, Johor Bahru, Malaysia

CIB/CSIR (2001): "Construction site waste management and minimization"

Clough, R. H., Sears, G. A. and Sears, S. K. (2000): Construction Project Management, John Wiley & Sons, USA

Compton T.M. (2009): Materials Control in Constructiobn Sites, Journal of Construction Management and Economics, pp32

Dahiru D.D. (2010): 'Problem of Ready-mix Concrete Production in the Construction Industry in Nigeria and its Cost Implication' West Africa Built Environment Research (WEBER) Conference, July 27-28, 2010, Accra, Ghana, pp. 445-57.

Dania A. A. (2007**):** A Study of Construction material waste Management Practices by Construction Firms in Nigeria, department of building, Ahmadu Bello University, Zaria, Kaduna state, Nigeria

Dawdy, H. Wearden P. (1985): Statistical Methods for Research, Appollo Press, London.

Dey P.K, (2001): "Re-engineering materials management: A case study on an Indian refinery, *Business Process management Journal*, vol.7 (5), pp. 394-408

Dey, P. K. (2000): Managing Projects in Fast Track -A Case of Public Sector Organization in India. *International Journal of Public Sector Management*, Vol. 13, No. 7, pp. 588-609.

Donyavi, S. and Flanagan, R. (2009): The impact of effective material management on construction site performance for small and medium sized construction enterprises. *In:* Dainty, A.R.J. (Ed) *Procs 25th Annual ARCOM Conference,* 7-9 September 2009, Nottingham, UK, Association of Researchers in Construction Management, 11-20

ECI (1994): Total Productivity Management: Guideline for the Construction Phase. European Construction Institute, Loughborough, Leicestershire

Eduardo L (2002): "Material waste in building industry: Main causes and prevention", *Journal of Construction Engineering and management*, Vol 12, No.4, July 2002

Faniran O.O. and Caban, G. (1998): Minimizing Waste on Construction Project Sites. Engineering, Construction and Architectural Management, Vol. 5, No. 2, pp. 182-188.

Frank T (1980): A Model of Supply Chain Management for Construction using Information Technology, Krakow, Poland.

Formoso, C. T., LS. M, De Cesare, C. and Isatto, E. L. (2002): Materials waste in building industry: Main causes and prevention. *Journal of Construction Engineering and Management*, Vol. 128, No. 4, pp. 316-325

Higgins, (2006): Modern Construction Management, Granada, MC Caffer Publisher, U.S.A.

HMSO (1995): Construct LT. Bridging the Gap: An Information Technology Strategy for the United Kingdom Construction Industry. HMSO, London, U. K.

Illingworth J. andThain K, (2008): "Material Management is it worthit?" Technical Information Service, the Chartered Institute of Building ASCOT,

Illingworth, J. R. (1993): Construction Methods and Planning. E& FN Spon, London.

Inyang-Udoh, U.I. (2002): "Appraisal of Stock Control System on Building Sites"; the Quantity Surveyor; 38(1), 17 – 21.

Johnston, J. E. (2001): Site Control and Material Handling Storage and Protection, First Edition, Butter Worth Limited, London.

Kent, T., (1991): In Guidelines for the Management of Major Construction Projects, NEDC. HMSO, London

Khyomesh V. Patel and Chetna M. Vyas. (2011): 'Construction Materials Management on Project Sites' National Conference on Recent Trends in Engineering & Technology, B.V.M. Engineering College, V.V. Nagar, Gujarat, India. 13-14, may 2011.

Kini, D. U. (1999): Materials Management: The Key to Successful Project Management. *Journal of Management in Engineering*, ASCE, Vol. 15, No. 1, pp. 30-34.

Kondalkar V.G. (2007): Organizational Behaviour, New Age International Publishers, New Delhi, pp22-23.

Kong, S. C. W. and Li H. (2001): An E-commerce System for Construction Material Procurement. Construction Innovation, Vol. 1, No. 1, pp. 43-54.

Lambert, D.M, Stock J.R, and Ellram L.M, (2008): "Fundamentals of Logistics Mangagement" United States: McGraw Hill,

Lamer M. (2007): Improving Construction Site Management Practices Through Knowledge, Ph.d Thesis, Loughborough University.

Lan C. (2008): Materials Management on Building site, 1st Edition, London, The construction Press Lancaster.

Lee T. and Debtor M. (1985); Purchasing and Supply Management on Construction Project, McGrw Hill Company, UK, pp 442

Lee L. and Donald W.D. (2001): Purchasing and Material Management, New York, MC Craw Hill Publisher

Mezue A.Y. (1992); Improving of Storage Facility for Construction Project: Strategy for more Sustainale Construction, DETR, London.

Moser, C.A. and Kalton, G. (1971): Survey Methods in Social Investment, Heinemann Education, London.

Muehlhausen, F. B. (1991): Construction Sites Utilization: Impact of Material Movement and Storage on Productivity and Cost. Logistics Information Management, Vol. 14, No. 5/6, pp. 337-343.

Narimah Binti Kasim, (2008): Improving Materials Management on Construction Projects, Loughborough University.

NarimahKasim (2011): ICT Implementation for materials management in construction projects: case studies; KICM *Journal of construction engineering and project management*, Faculty of Technology Management, Business & Entrepreneurship, UniversitiTun Hussein Onn Malaysia, online ISSN 2233-9582

Nguyen, L. D., Ogunlana, S. O. and Un, D. T. X. (2004): A Study on Project Success Factors in Large Construction Projects in Vietnam. Engineering Construction and Architectural AlanaScinent, Vol. 11, No. 6, pp. 404-413.

Ogunlana, S. 0, Promkuntong, K., Jeark-jirm, V. (1996): Construction Delays in a Fast-growing Economy: Comparing Thailand with Other Economies. *International Journal of Project Management*, Vol. 14, No. 1, pp. 37-45

Olatunji Joseph Oladiran (2010): implementation of waste management plan, importance, contents, procedures, problems and solutions, Department of Building, Faculty of Environmental Sciences, University of Lagos, Akoka Yaba, Lagos, Nigeria

Petra Tumbull (2013): Materials Management in Construction Projects, eHowcontribute, Jan 14, 2013.

Paul N. (2007): More than Materials; Managing What's need to create value in Construction 2nd European Conference on Construction Logistics ECCI, Dortmound, Germany.

Payne, A. C., Cliclsoin, J. V. and Rcavill, LR. P. (2006): Management for Engineers. John Wiley & Sons, England.

Peter R. and David C. (1992): Materials Control and Waste on Building Sites, Building Research and Information. Vol.24 pp55

Pheng L.S. and Chuan,C.J. (2001): "Just-in-time management in precast concrete construction: a survey of the readiness of main contractors in Singapore", Integrated Manufacturing Systems. vol.12, pp.416-429,

Prabu, V. and Baker, M. (2006): "Materials Management" UK: McGraw-Hill,

Shah, K.C. (1993): "Material Management", All India Council of Technical education

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

Teo, M. M. M. and Loosemore, M. (2001): A Theory of Waste Behavior in the Construction Industry. Construction Management and Economics, Vol. 19, No. 7, pp. 741-751.

Varghese, K. and O'Connor, J. T. (1995): Routing Large Vehicles on Industrial Construction Sites. *Journal of Construction Engineering and Management*, Vol. 12 1, No. 1, pp. 1-12.

Ward Wendy. (2006):" Resource management", Concrete construction, Jan 2006

Wong, E. T. T and Norman, G. (1997): Economic Evaluation of Materials Planning Systems for Construction. Construction Management and Economics, Vol. 15, No. 1, pp. 39-47.

Wrap (2007): Material Logistics Plan Good Practice Guidance

Yang P.S. Chen Y.Y. Li GH, Zhong S.X. (2003): 'Mapping Approach for Examining Waste Management on Construction Sites', *Journal of Construction Engineering and Management*, Vol. 130, No. 4, July/August 2004, pp. 472-481

Zakeri, M., Olomolaiye, P., Holt, G. D. and Harris, F. C. (1996): A Survey of Constraints on Iranian Construction Operatives' Productivity. Construction Management and Economics, Vol. 14, No. 5, pp. 417-426.

Appendix

Department of Building,

Faculty of Environmental Design,

Ahmadu Bello University, Zaria.

Dear Respondent,

The main purpose of this questionnaire is to assess materials management practices in Nigeria construction sites with a view to proffering solutions to the problems of excessive waste leading to cost overrun.

This is a part of partial fulfillment of the requirements for degree master of science in construction management from Ahmadu Bello University, Zaria. Hoping that the result of this questionnaire will improves the overall handling of materials and reduces the overall costs of materials in Nigeria construction sites.

The information in the question will be used for academic research with complete commitment and absolute confidence to your information. Kindly, therefore supply accurate answers to the questions and any information provided would be used strictly for academic purposes and respondents are guaranteed maximum confidentiality.

Thank you for your expected contributions.

Researcher

Albert Idowu

Tel: 08064961023

SECTION A: Respondents general information

1. Name of the organization (optional) _____

2. Number of Employees

0 – 9 employees [ ] 10 – 99 employees [ ] 100 – 299 employees [ ]

3. Respondents profession

Architect [ ] Builder [ ] Quantity surveyor [ ] Civil engineer [ ] others _____

4. Respondents' years of experience

0 – 5 years [ ] 6 – 10 years [ ] 11 – 15 years [ ] 16 – 20 years [ ]

5. Respondents highest educational qualification

ND [ ] HND [ ] BSC [ ] MSC [ ] PHD [ ]

SECTION B: MATERIALS MANAGEMENT PRACTICES IN CONSTRUCTION SITES

1. Who is the person in charge of managing construction materials in construction projects?
General Manager [ ] Project Manager [ ] Site Engineer [ ] Store manager [ ] others _____

2. Who is the person responsible for ordering materials?
[ ] General Manager [ ] site engineer [ ] procurement department [ ] project manager [ ] others ____

3. Which method do you apply in the purchase of material?
Bulk purchase [ ] in pieces [ ] others _____

4. In making bulk purchases do you take into consideration the nature/type of material?
Yes [ ] No [ ]

5. When does your materials planner start planning for projects?
Before tender [ ] after award of contract [ ] during construction process [ ]

6. Does your firm undertake market survey before ordering for materials?
Yes [ ] No [ ]

7. If Yes, how often?
Weekly [ ] monthly [ ] after every 3 months [ ] after every 6 months [ ] over 6 months [ ]

8. How do you assess materials?
Testing [ ] Selection [ ] Measurement [ ] others _____
9. Who is responsible for monitoring handling of materials on sites?
Site engineer [ ] project manager [ ] store manager [ ] others _____

10. Do you consider stock and waste control for effective material management on sites?
Yes [ ] No [ ]

11. Rank the following components of materials management where 5- strongly Agree, 4- Agree, 3- partially Agree, 2-Disagree, 1- strongly disagree

S/N	Components of Materials Management	Responses				
		5	4	3	2	1
1	Material estimation, budgeting, planning and programming.					
2	Scheduling, purchasing and procurement					
3	Receiving and inspection					
4	Inventory control, storage and warehousing					
5	Material handling and transport					
6	Waste management					
7	Others					

12. Rank the following stages of materials logistic planning, where 5- Strongly Agree, 4-Agree, 3- Partially Agree, 2-Disagree, 1-Strongly Disagree.

S /N	Stages	Responses				
		5	4	3	2	1
1	Identified responsible persons and their roles					
2	Implement a training and communication plan					
3	Determine material types and quantities from the detailed design					
4	Plan for material receipt and storage					
5	Implement procedures to manage sub-contractors					
6	Site mobilization and construction					
7	Project completion and demobilization					

13. Please rank the following factors in order of their relevance as factors affecting materials management. Where 5-Strongly Agree, 4-Agree, 3- partially Agree, 2-Disagree and 1-Strongly Disagree

S/N	Factors	Responses				
		5	4	3	2	1
1	Sourcing of materials and requisition					
2	Demand estimation					
3	Transportation					
4	Receiving and verification of materials on site					
5	Storage of materials on site					
6	Issuing of materials for use					

7	Procurement or indent for materials					
8	Quality inspection and control					
9	Maintenance					
10	Time					
11	Materials handling					
12	Stock and waste control					
13	Financial ability					
14	Possession of qualified staff					
15	Possession of qualified subcontractors					
16	Possession of qualified of required equipment					
17	Competence of estimators					
18	Availability of equipment					
19	Duration of the project					
20	Type of project					
21	Types of materials					
22	Level of awareness					
23	Others					

14. The following have been identified as problems associated with materials management.
Where 5- Strongly Agree, 4-Agree, 3-Partially Agree, 2-Disagree, 1-Strongly disagree.

S/N	Materials management problems	Responses				
		5	4	3	2	1
1	Lack of storage space					
2	Problems on logistic of material					
3	Materials damage					
4	Site access point					
5	Operation limitation due to security considerations					
6	Inadequate loading area at consolidation centre					
7	Problem with congestion at loading area					
8	Weather					
9	Management of surplus materials					
10	Dust					
11	Project delay					
12	Site erosion					
13	Difficulty in delivery of materials					
14	Others					

15. Please rank the following factors in order of their relevance as causes of materials wastage on site.
5- Strongly Agree, 4-Agree, 3-Partially Agree, 2-Disagree, 1-Strongly disagree.

S/N	Causes of material wastage on site	Responses				
		5	4	3	2	1
1	Weather condition					
2	Batching of materials					
3	Placing of materials					
4	Stocking and pilfering					

5	Distance					
6	Handling of materials					
7	Labour force					
8	Inexperience personnel					
9	Equipment malfunctioning					
10	Lack of information about type and size of materials on design documents					
11	Error in information about type and size of materials on design documents					
12	Design changes and revisions					
13	Ordering of materials that do not fulfill project requirements defined on design documents					
14	Over – ordering or under – ordering due to mistakes in quantity surveys					
15	Damage of materials due to deficient stockpiling and handling of materials					
16	Imperfect planning of construction					
17	Workers mistakes					
18	Conversion waste from cutting uneconomical shape					
19	Lack of site materials control					
20	Lack of waste management plan					
21	Lack of adequate storage space					
22	Lack of adequate room for account for materials and materials becoming 'buried' on site					
23	Difficult to transport materials around site					
24	Workplace becoming overcrowded					
25	Increased security risks due to the lack of adequate space to safely facilitate the storage of materials					
26	Others					

16. Rank the following factors as important measures to be put in place to ensure effective materials management in construction sites

5- Strongly Agree, 4-Agree, 3-Partially Agree, 2-Disagree, 1-Strongly disagree.

S/N	Measures for effective Materials management	Responses				
		5	4	3	2	1
1	Timely placing of orders for materials					
2	Ensure quality assurance/control processes are in place					
3	Logistics for tracking & transportation of materials to site					
4	Receiving and inspecting materials on site					
5	Storage & issuing of materials to construction location					
6	Complete quality records of materials					
7	Established material management system to be used					
8	Documentation					
9	Record receipt of goods upon delivery					
10	Monitoring of materials distributed					
11	Assigning of material codes					
12	Construction activities and schedule of materials					
13	Proper materials handling					
14	Make the store safe from theft and vandalism					
15	Materials return to be submitted weekly					
16	Determine the daily allocation of materials on site					

17	Education/training/enlightenment of staff in charge of materials management					
18	Special security agents					
19	Usage of qualified construction professionals					
20	Others					

17. Rank the following factors in order of their relevance as importance and benefits of material management planning.
5- Strongly Agree, 4-Agree, 3-Partially Agree, 2-Disagree, 1-Strongly disagree.

S/N	Importance and Benefit of material management planning	Responses				
		5	4	3	2	1
1	Reduce cost of materials					
2	Improvements in labor productivity					
3	Project will be constructed on time or early than expected					
4	Purchase saving					
5	Providing adequate storage of materials on site					
6	Reduction in duplicated orders					
7	Improvements in project schedule					
8	The effective design site layout so as to aid in the management of materials on site					
9	The installation of materials hoists on site to aid in the movement of materials					
10	Better relations with suppliers					
11	Better handling of materials					
12	Better field material control					
13	Quality control					
14	Reduce of materials surplus					
15	Better cash flow management					
16	Others					