
**ST. MARYS UNIVERSITY**

**SCHOOL OF GRADUATE STUDIES**

# ASSESSEMENT OF LOGISTICS MANAGEMENT IN URBAN CONSTRUCTION PROJECT IN ADDIS ABABA

**BY TEWODROS TEKLAY**

**A THESIS SUBMITTED TO SCHOOL OF GRADUATE STUDIES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE MASTERS ARTS DEGREE IN PROJECT MANAGMENT**

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**ADDIS ABABA, ETHIOPIA**

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## ENDORSEMENT

This thesis has been submitted to St. Mary's University College, School of Graduate Studies for examination with my approval as a university advisor.

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# Abstract

This research assesses the perception of the construction industry stakeholders on the need and importance of logistics management on selected urban building construction projects, identify and analyze the current practices and challenges in the construction *logistics* management process.

The study used descriptive research designs based on data from primary and secondary sources. The study subjects are currently active urban projects in Addis Ababa which are being administered by the Addis Ababa Housing Development Agency. The main tools used for the collection of data included questionnaires and desk study as they are used to identify the various efforts that have been made in the past and to examine the challenges of logistics management. SPSS and relative importance index (RII) are used to examine the results from the questionnaire and findings are presented in charts and tables. The findings show that the construction industry stakeholders perceive that logistics management collaboration has helped in the construction industry as it improves delivery and reduction waste. The study also indicates the impacts of poor logistics management in building construction projects were delays, cost overruns and loss of project efficiency. On the other hand, late and incorrect payments and inaccurate data and engineering drawings not fitting the use are indicated as the major challenges for a successful *logistics* management. Furthermore, it was found that most of the stakeholders do not apply the integrated approach to logistics management. Therefore adding a construction *logistics* technology in construction project can reduce some unnecessary friction between construction stakeholders and third parties and also coordinate material flows that can lead to a reduction in the amount of material delivery vehicles that travels to site, thus alleviating some of the congestion in the urban transport system.



**Key words:** -*construction industry, construction logistic management, construction logistics technology, urban construction*

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# Acronyms

SCM- Supply Chain Management

CLM- Council of Logistics Management

CSCMP- Council of Supply Chain Management Professionals

TPL- Third Parity Logistics

CCC- Construction Consolidation Centre

CLC- Construction Logistics Centre

UCC- Urban Construction Centre

SPSS- Statistical Package for the Social Sciences

JIT-Just- In- Time

ICT- Information and Communication Technology

RFID- Radio Frequency Identification

RII- Relative Importance Index

# CHAPTER ONE: INTRODUCTION

## 1.1 Background of the study

Activities of the construction industry are vital to the achievement of national socio-economic development goals by providing shelter, infrastructure and employment. Activities by the construction industry affect nearly every aspect of the economy and the industry is one of the driving factors of the economic growth of developing countries (Betlejewska and Potkány, 2015).

The construction industry plays a vital part in economy of a nation since it provides demand for the production of goods and services from other related industries. Because of this it creates significant business through multiplier impacts. It includes a request for labor (incompetent, semi-skilled and talented), land and capital. It contributes to the national yield and reinforces the development of other divisions through a complex framework of linkages (EEA, 2008).The reason for concentrating on development in urban range is the on-going urbanization drift. In 2007 the worldwide urban population exceeded the rural population for the first time in history. (United Nations, 2015).In Africa, roughly 43 per cent of the population was living in urban regions in 2018, and Ethiopia is estimated to develop from 108 million inhabitants in 2018 to 191 million in 2050 whereas the extent urban is expected to extend from 21 per cent to 39 per cent (United Nations, 2018).Ethiopia will include the leading rural inhabitants between 2018 and 2050 around 31 million, expanding its rural population by 37 per cent taken after by Niger, which is anticipated to include 30 million country inhabitants, for an increment of 163 per cent (United Nations, 2018). This attraction to cities and urban areas means that new houses, apartment buildings, office complexes, hospitals, schools and infrastructure need to be constructed. Building new houses or renovating older housing stock is a natural way for a city to develop. However, construction projects are producing the end product (houses or infrastructure) at the place of consumption ( Ekeskär and Rudberg, 2016), meaning that a multitude of materials and resources need to be delivered to, and removed from, each site at the correct time (Lindén and Josephson,2013). This leads to additional transport flows being created, competing for the existing infrastructure with other traffic users.

Dubois and Gadde (2002) struggle that inside construction projects, the couplings between various stakeholders and activities on-site are characterized as tight, meaning that inside a project each stakeholder and activity is dependent on one another. At the same time, the construction projects are overseen from the temporary nature of construction projects also means those different temporary workers, sub-contractors, specialists and builders' need to be tendered and procured every time a new

construction project is launched. Dubois and Gadde (2000) emphasize that as much as 75 percent of the product value is added by sub-contractors and suppliers. With the short-term nature in mind, the industry has struggled to find good forms of long-term collaborative relationships.

This of course also affects how logistics and material deliveries are managed. Different stakeholders can e.g. place different demands and considerations on how construction logistics is to be carried out. Managing projects under these complex conditions is difficult due to high levels of uncertainty, as well as a mixture of organizations (Locatelli, 2014). In essence, construction in urban areas faces two problems; the urban material delivery problem and the problem of coordinating multiple construction stakeholders.

This research assesses the perception of construction stakeholders in the importance and the impacts of the construction logistics management problems that affecting construction projects. And although develop alternative measures to improve construction logistics management.

## 1.2 Statement of the problem

Construction projects take place where sites are extremely crowded; this circumstance is repetitive for projects found in urban ranges. In huge cities where for virtually no storage space exists, a good management of logistics in order to get materials, people, information, machines, and equipment to the work force in a Lean manner (Just-in-Time) is vitally important to project success (Mossman, 2007).It has been reported that a 35% reduction in material wastage could be achieved by adopting more efficient logistics practices and the key to achieving it is the development and implementation of a vigorous construction logistics plan. These plans are an important tool to help the construction sector ensure that the right materials are in the right place at the right time in the right quantity and with the right cost (Material Logistics plan, 2007).

The construction sites are a very intense logistical spot, in which a lot of material that is being managed in a complicated way in order to construct and fulfill requirements. However, there is lack of integration of suppliers and producers as well as stocks and markets which are results of lack of harmonization of the client‘s requirements with materials and information flows.

Therefore, Construction in urban areas faces two problems; the material flow problem and the problem of coordinating multiple construction stakeholders.

## 1.3 Research Questions

The purpose of this thesis is to assess the perceptions of different construction stakeholders on the need and important of logistics management and the impacts of the construction logistics management problems that affecting construction projects.

To achieve this purpose, the following research questions have been addressed:

1. What are different stakeholder's perception in the construction industry on the need and importance of logistics management?
2. What are the impacts of poor logistics management on urban construction projects in Addis Ababa?
3. What are the challenges in the urban construction logistics management process?

## 1.4 Research objective

### 1.4.1General objective

The general objective this research is to assess the perception of stakeholders on the importance and impact of urban construction logistics management.

### 1.4.2 Specific objective

This study is undertaken with the following specific objectives. To achieve the above main objective, the following specific objectives are formulated:

1. To assess the perception of the construction industry stakeholders on the need and importance construction logistic management.
2. To identify and analyze the current practices and challenges in the urban construction logistics management process.
3. To identify the impacts of poor logistics management in urban building construction project.

## 1.5 Significance and Purpose of the study

In most construction projects in Addis Ababa, certain materials are procured and delivered to the project site for implementation by contractor or sub-contractor (such as cement and reinforcement bars, etc.). The construction sites are a very intense logistical spot, in which a lot of material that is being managed in a complicated way in order to construct and fulfill requirements. However, there's need of coordination of suppliers and makers as well as stocks and markets which are comes about of need of synchronization of the client's prerequisites with materials and information flows.

Most construction projects are not delivered within the planed schedule and expected construction costs due to inefficient logistics management. When the projects are delayed the construction costs are increasing as well. Because of this most of the constructions projects in Ethiopia incur extra costs that suffer client, government and community as whole.

Improving logistics management in urban construction projects enables good transport flows to city and reduced transportation cost. Further, knowing each impacts of poor logistics management and ensuring effective logistics management is a crucial factor to increase labor productivity and also assist the integration and coordination among contractors, sub-contractors and suppliers, which could increase construction workers productivity.

With having this perspective, the primary benefit of this research is to provide additional scientific knowledge that enables the stakeholders to know how construction logistics management solutions can help in coordinating different construction projects. Moreover, it promotes the construction sectors to develop alternative measures to improve their logistics management systems in order to increase productivity of urban construction projects.

## 1.6 Scope of the study

The scope of this study is focused on the respondent's perspective on the impacts of logistics management building construction projects. The context of the research is construction in the urban environment and to provide an understanding of how poor Construction logistics management affect building construction projects in urban areas, different stakeholder perspectives needs to be taken into account on material deliveries in urban construction. Specifically, the use of construction logistics management and the impacts of poor logistics management on urban construction projects are in focus. This focus has been investigates how poor construction logistics management mitigate and develop alternative measures to improve construction logistics management.

## 1.7 Limitations in Data Collection

The process of data collection did not go without a few downsides. They are described below:

- The study is based on one case study on Addis Ababa Condominium Housing Project.
- Low response rate of Suppliers
- The main respondents consist of project managers and contract managers. This is seen as a limitation since the research did not have a broader spectrum of participant to respond to the

questionnaire survey. In some cases, only one respondent from a specific role answered. This could also be a source of bias.

## 1.8. Organization of the Study

This thesis is divided into five chapters that organize, illustrate, and describe the steps taken to meet the defined research objectives. This thesis was organized as follows: The research paper encompasses five parts in which part one contains the introduction which tries to give information concerning the study area and some background information on it.

Chapter one; -Statement of the problem discussed specific details on the major problems of the study. The need for the study stating about the significance of the study, whereas objective of the study forwards the general and specific goals of the study. Research questions are made and scope of the study is stated on part one.

Chapter Two; - deal with literature review in which concepts on related topics is raised and discussed, in addition to this a detailed information concerning the research topic were given well in this section of the study.

Chapter three; - deals about research design and methodology

Chapter Four; - Which is all about presentation, analysis and interpretation of data that will be devoted on presenting the required sufficient amount of data and then analysis of this data has been made properly and finally based up on the presentation and analysis of those data interpretations were given at last.

Chapter five; - Which is the final part of the research report which emphasis on giving conclusions and finally pointing possible recommendations.

# CHAPTER TWO: LITERATURE REVIEW

## 2.1. Theoretical literature review

### 2.1.1 Project and Project Management: Definition

Numerous researchers define project in several ways, Abadir H. Yimam, (2011) defined project as a temporary endeavor that has definite beginning and end time undertaken next to specific cycle of initiation, definition, planning, and execution and which is a result of novel organization and coordination of human, material and financial resources. (Project Management Institute (PMI), 2004). Research by (Lester, 2006) defines a project as a unique set of coordinated activities, with definite starting and finishing points, undertaken by an individual or organization to meet specific objectives within defined schedule, cost and performance parameters.

Similarly a number of definitions are given for project management, The application and integration of modern management and project management knowledge, skills, tools and techniques to the overall planning, directing , coordinating ,monitoring and control of all dimensions of a project from its inception to completion ,and the motivation of all those involved to produce the product ,service or result of the project on time, within authorized cost, and to the required quality and requirement, and to the satisfaction of participants or stakeholders .(Chartered Institute of Building , 2002), (Fewings, 2005).

In general, in most of researches, management of a project is generally perceived to be concerned with the planning, organizing, and control of an ongoing process or activity such as the production of a product or delivery of a service. Project management is different in that it reflects a commitment of resources and people to a typically important activity for a relatively short time frame, after which the management effort is dissolved. Projects do not have the continuity of supervision that is typical in the management of a production process. As such, the features and characteristics of project management tend to be somewhat unique. Projects are subjected to a variety of laws and regulations that aim to ensure public safety and minimize environmental impacts. Compared to most other industries, construction projects involve relatively intensive labor use, and consume large amount of materials and physical tools

#### 2.1.2 What is a Construction Project? How is it managed?

Construction projects are managed indifferent ways from the management of other projects. (Abadir H. Yimam, 2011) research indicates that Construction projects are managed in different ways from the management of other projects and the difference mainly stems from the nature and characteristics of

construction projects. Some are usually capital intensive, complex; and require significant management skills, involvement and coordination of a wide range of experts in various fields. (Chartered Institute of Building, 2002). They also must address the geography and conditions of the project site and the relation of the project to the environment. (Project Management Institute (PMI), 2007). Projects are subjected to a variety of laws and regulations that aim to ensure public safety and minimize environmental impacts. And also compared to most other industries, construction projects involve relatively intensive labor use, and consume large amount of materials and physical tools. (Jekale, 2004).Construction, national or international, stands or falls by the quality of its project management. A project that is not properly managed can quickly head for disaster.

One of the main characteristics of the construction industry is that it first and foremost is built around temporary organizations and relationships. Different contractors, sub-contractors, consultants, builders' merchants and logistics operators need to be tendered and procured every time a new construction project is launched, making long-term relationships difficult to achieve. As discussed by Dubois and Gadde (2000), the construction industry is characterized with high levels of resource dependency and utilizes temporary network structures to ensure that this resource dependence can be met. Construction project organizations thus often become disconnected from the company level and hard to manage and integrate throughout the process, from drawings to finished building. (Dubois and Gadde, 2000).

Dubois and Gadde (2002) characterizes the network structure of the construction industry as two-fold; the industry has tight relationship networks within the projects, and a much looser network structure between the parent companies and projects and between different construction stakeholders. This means that within a project each stakeholder and activity is dependent on one another. Activities often have to be performed in sequence and if one activity is delayed, all the following activities will also be delayed (Dubois and Gadde, 2002). Similarly, workers and installers need to have materials in place and if deliveries are delayed the whole project can be delayed. Thus, there is a need within the project environment for tight couplings between stakeholders in order to move the project forward at the established pace. At the same time, they acknowledge that the couplings between the project and company levels are loose. The construction projects are managed from the project organization and the parent company has little control over the everyday operations of the project (Dubois and Gadde, 2002). Within these network structures, the bigger stakeholders have bargaining power due to their size and central position; whereas smaller, more specialized stakeholders have bargaining power through their asset specificity.

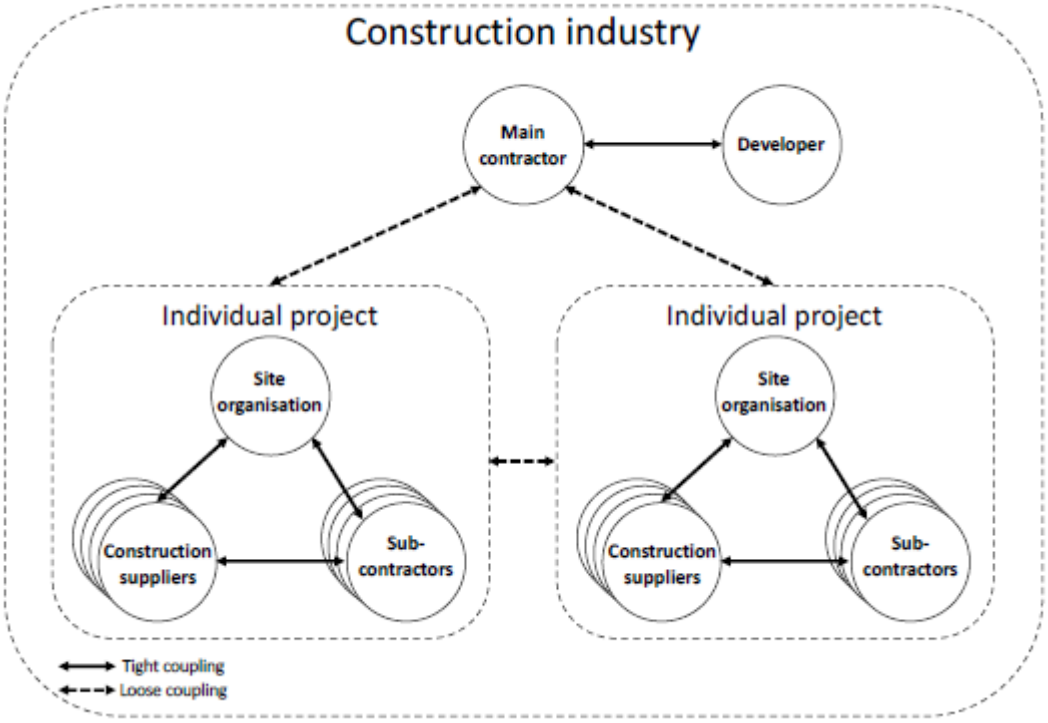


***Figure 2.1 - The construction industry structure of tight and loose couplings***

The fragmentation of the industry is however, not only disadvantageous. Several researchers highlight that the fragmented nature of the construction industry also allows for great flexibility at the project level, allowing for local adaptations and problem solving, but also as a means to handle the complexity of the industry (Dubois and Gadde, 2002). At the same time, there is a call for the industry to move away from adversarial relationships towards more collaborative working practices and long-term commitment (Josephson and Saukkoriipi, 2007).

### 2.1.3 Logistics in a Construction Project

The goal for any construction project is to deliver the project on time and on cost to the stipulated quality. The construction industry is producing its end products (the house or infrastructure) from vast amount of materials that have to be delivered to the place of consumption (Ekeskär and Rudberg, 2016; Thunberg, et al., 2017). Thus, the construction industry is greatly dependent on materials arriving to site when needed. The process of managing these material flows is called logistics.

Construction logistics as a discipline first came to prominence in the UK in 1980s with the start of construction management, procurement mechanism whereby the client directly contracts with

specialist trade contractors, project management contractor to coordinate and manage the construction process.

Logistics have several definitions but for the purpose of this research the most three definitions are described below:-

Logistics:

- The Council of Logistics Management (CLM) (1998), gives the most recent definition of logistics as "Logistics is the process of planning, implementing and controlling the efficient, effective flow and storage of goods, services, and related information from point of origin to point of consumption for the purpose of conforming to consumer requirements.
- "Logistics is the positioning of resource at the right time, in the right place, at the right cost, the right quantity and at the right quality" (Chartered Institute of Logistics and Transport, 2005).
- "Logistics is the time-related positioning of resource" (The Chartered Institute of Logistics and Transport, 2005).

The term logistics in a construction industry can be defined as getting construction materials; equipment's and labor to site before they are required. Logistics functions in a construction firm can be divided into supply logistics and site logistics. **Supply logistics** are related to activities that are cyclic in the production process. These activities are basically: supply resources (materials, equipment and manpower) specification, supply planning, acquisition of resources, transport to site and delivery, and storage control. **Site logistics** are related to physical flow planning, organizing, directing and controlling on-site. This means, management of handling systems, safety equipment, site layout, definition of activity sequence and resolution of interference among production teams activities on-site (Silva and Cardoso, 1999).

Construction project site logistics is an important part of logistics. Logistics management requires accurate delivery date material plans to suit the actual site plan and storage arrangements. Otherwise, it will lead to the construction schedule delays and interruptions, or resulted in the storage, handling and transportation process waste of resources (Duiyong, Shidong and Mingshan, 2014). The multidisciplinary processes that comprise construction logistics include material supply, storage, processing and handling, manpower supply; schedule Control, Site infrastructure and equipment location, site material flow management on a construction site and management of information related to all physical and services flows. Good construction logistics is all about optimizing those processes

to enhance efficient delivery, movement and installation of materials and components on the construction site.

**Logistics management** can be defined as part of supply chain management that plans, implements, and controls the efficient, effective forward and reverses flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customers' " requirements (CSCMP, 2013). According this definition, logistics management is an integrating function, which coordinates and optimizes all logistics activities for proper utilization of resources and satisfying the end user.

Logistics is often defined as managing the supply chains, the latter being a network of organizations linked by material and information flows bounded with a product (project) life cycle (from the procurement of raw materials through processing and handling the products and the final product, distribution and sales to the end-user and finally, to waste utilization). All the processes and relations concerning the above flows form a logistic system. A company, being a member of a larger supply chain of suppliers and customers, has its own system of internal logistics also in the form of supply chains (Anna Sobotka, 2005).

(AbdulmohsenAlmohsen and JanakaRuwanpura, 2011) shows that construction logistics can be defined as "the management of the flow of materials, tools, and equipment (and any related object) from the point of discharge to the point of use or installation (The European Construction 1994). Bringing together and coordinating the management of these three vital components between the project's principal parties would increase productivity substantially. On a construction site, these components must be properly managed in order to ensure a project's success.

Ineffective management, on the other hand, will result in conflicts between these aspects. These conflicts will ultimately cause project delays, and cost overruns. Because the cost of materials and equipment represents a large proportion of the total project budget, it is vital to manage these costs effectively. Several studies show that these two components consume between 60 and 70% of a project's total budget. Managing the flow of materials, assuring its quality, checking the quantity, allocating the storage areas, coordinating the overall process, triggering the orders, and updating the participants are major obstacles in construction logistics management (Agapiou et al. 1998).

Construction project logistics is a multidisciplinary process which includes physical distribution of materials and equipment's, purchase, transportations, warehousing, loading and unloading and stockpiling or storage, allocating information processing etc.(Kagioglou et al., 1999). And also

According to Christopher(1999) construction logistics activities start with proper planning, organizing, commanding or controlling materials at right time, right place, low cost and high quality guaranteed and then the purchased material should appropriately transported, stored and distributed for site construction work.

### 2.1.4 Basics of logistics management within Construction projects

Organizing and administering a construction site so that the right resources get to the right place in a timely fashion demands strong leadership and a rigorous process. Good construction logistics on construction sites saves time and construction costs. To plan construction logistics, numerous interferences between configuration of construction site and construction work have to be considered. In particular in outfitting processes, their countless possible work sequences and many involved companies govern production logistics. (Voigtmann and Bargstädt, 2010).

Reports and reviews on the UK construction industry have highlighted the inefficiencies and waste of the industry due to poor logistical performance. The "Improving Construction Logistics" report published by the Strategic Forum for Construction Logistics Group (2005) recognizes the following factors preventing the industry from properly addressing logistics

- ✓ The lack of incentive to change, as there is no real "problem owner"
- ✓ Construction projects seen as one-off and as a result difficult to optimize logistics for long term benefit
- ✓ The fragmented nature of construction industry and the lack of direct employment
- ✓ Inadequate advanced planning of projects and short lead times
- ✓ The lack of cost transparency in the construction process that hinders the identification of potential savings from improved logistics
- ✓ Inadequate information flow
- ✓ Lack of trust, confidence and understanding of the constraints of the supply chain
- ✓ Clients believe that project costs already include for appropriate logistics resources to be committed to projects.

The improper consideration of logistics in a construction project may result to a high proportion of trucks moving around the road network either empty or with part-loads of materials, traffic congestion due to trucks that arrive on site and have to wait to gain access or be unloaded and skilled craftsmen

that often use their skills for less than 50% of their time on site due to their involvement with non-skilled tasks such as unloading a truck or moving products around site.(Dimitris Papaprokopiou, 2010)

### 2.1.5. Characteristics that distinguish Construction logistics from other types of logistics

Logistics in the construction industry has some notable characteristics that distinguish it from the general logistics and these are

- Disposable, just exist for a construction project;
- Uncertainty;
- Supply chain end when the project completion,
- High risk, the occurrence of risk always leads to serious financial loss;
- System reliability is complex, and controllability is weak.

In construction terms logistics is all about ensuring that design, procurement and construction practices are optimized to enhance efficient delivery, movement and installation of materials and components on the construction site. This requires multidisciplinary processes that seek right cost, right time and right quality.

Organizing and administering a construction site so that the right resources get to the right place in a timely fashion demands strong leadership and a rigorous process. Good construction logistics on construction sites saves time and construction costs. To plan construction logistics, numerous interferences between configuration of construction site and construction work have to be In particular in outfitting processes, their countless possible work sequences and many involved companies govern production logistics.

### 2.1.6. Construction Materials Management on Construction Projects

Materials management in construction projects is a key function that significantly contributes to the success of a project. The management of materials in construction projects is made challenging by materials shortages, delays in supply, price fluctuations, damage and wastage, and lack of storage space. Materials management is a vital function for improving productivity in construction projects. The management of materials should consider at all the phases of the construction process and throughout the construction and production periods. This is because poor materials management can often affect the overall construction time, quality and budget. The importance for planning and

controlling of materials to ensure that the right quality and quantity of materials and installed equipment are appropriately specified in a timely manner, obtained at a reasonable cost, and are available when needed. Many construction projects apply manual methods, not only for the tracking of materials, but also for materials management as a whole and this involves paper-based techniques and is problematic with many human errors (NarimahKasim, 2013).

***Table 2.1 Sources and causes of construction site material management problems***

| | **Factor** |
|---|---|
| Design | Changes made to the design while construction is in progress |
| | Lack of attention paid to standard sizes available on the market |
| | Designer‘s unfamiliarity with alternative products |
| | Complexity of detailing in the drawings |
| | Incomplete contract documents at commencement of project |
| | Selection of low quality products |
| Operational | Errors by tradespersons or laborers |
| | Damage to work done caused by subsequent trades |
| | Use of incorrect material, thus requiring replacements |
| | Required quantity unclear due to improper planning |
| | Delays in passing of information to the contractor on types and sizes of products to be used |
| Material Handling | Errors by tradespersons or laborers |
| | Damage to work done caused by subsequent trades |
| | Use of incorrect material, thus requiring replacements |
| | Required quantity unclear due to improper planning |
| | Delays in passing of information to the contractor on types and sizes of products to be used |
| Procurement | Ordering errors |
| | Lack of possibilities to order small quantities |
| | Purchase products that do not comply with specification |

Managing and Minimizing Wastage of materials on construction projects Construction Material wastage has been recognized as a major problem in the construction industry that has important implications both for the efficiency industry and for the environmental impact of construction projects. Moreover, waste measurement plays an important role in the management of production systems since it is an effective way to assess their performance, allowing areas of potential improvement to be pointed out (Carlos Torres Formoso, 2002).

| No. | Methods of material management |
|---|---|
| **1.** | Purchasing raw materials that are just sufficient |
| **2.** | Good coordination between store and construction personnel to avoid over ordering |
| **3.** | Adoption of proper site management techniques |
| **4.** | Training of construction personnel |
| **5.** | Accurate and good specifications of materials to avoid wrong ordering |
| **6.** | Checking materials supplied or right quantities and volumes |
| **7.** | Employment of skilled laborers |
| **8.** | Minimizing design changes |
| **9.** | Change of attitude of workers towards the handling of materials |
| **10.** | Accurate measurements of materials during batching |
| **11.** | Access to latest information about types of materials on the market |
| **12.** | Vigilance of supervisors |
| **13.** | Careful handling of tools and equipment on site |
| **14.** | Good construction management practice |
| **15.** | Adherence to standardization |

***Table 2.2 Methods for Materials managing and Minimization***

### 2.1.7. Challenges of the Construction Logistics

There are substantial difficulties in applying logistics management in the construction industry (Saad, et al., 2002). Factors such as short-termism, lack of trust and adversarial relationships, the transient nature of construction projects and the considerable number of infrequent clients were highlighted as the main problems associated with the implementation of logistics management in construction. This section will address the main challenges associated with adopting logistics management in the construction industry. Customer focus, logistics management may well help improve the construction industry with its poor relationships, fragmented processes and lack of internal and external customer focus. However, there remain a number of critical issues within the construction industry that need to be considered and rectified. A long list of problems could be itemized, including lack of trust and commitment, co-ordination problems and training problems, all of which are already well documented by reports (Latham, 1994; Egan, 1998). Consequently, scope for implementing logistics management within construction could be limited (Saad, et al., 2003).

Much research work and real test cases analyses have assessed that construction is ineffective and many problems can be observed. Analysis of these problems has shown that a major part of them are

supply chain problems, originating at the interfaces of different parties or functions, among which the following are few of them (Vrijhoef R., et al., 2001):

- Client/design interface: difficulties in finding out client‘s wishes, changes of client‘s wishes, long procedures to discuss changes,
- Design/engineering interface: incorrect documents, design changes, extended wait for architect‘s approval or design changes,
- Engineering/purchasing & preparation interface: inaccurate data, engineering drawings not fitting the use,
- Purchasing & preparation/suppliers interface and purchase & preparation/subcontractors interface: inaccurate data, information needs not met, adversarial bargaining and other changes,
- Suppliers/subcontractors interface and suppliers/site interface: deliveries not in conformance with planning, wrong and defective deliveries, long storage period, awkward packing, large shipments,
- Subcontractors/site interface: subcontracted work not delivered according to main design, contract and planning,
- Site/completion of building interface: problematic completion due to quality problems,
- Completion of building/occupation interface: unresolved quality problems, delayed occupation due to late completion,

It can be noticed from this list that communication problems (either described in terms of data, or more generally in terms of information handled during the exchanges) form an important part of the problems faced in construction supply chains.

### 2.1.8. Impacts of poor construction logistics managements

The study made by Fadiya, (2012), Usman and Muhammad (2015) showed that the consequences of current inefficient logistics practice in the construction industry results the following impacts.

- **Materials Loss**: improper management of logistics in construction projects leads large amount of material to be lost or damaged. On site storage system and mechanism, wrong choice of

selecting transporting mechanisms, having excess amount of material and etc. has been considered as the result of poor logistics management.

- **Delay in construction project delivery**: the delay of construction material delivery and material availability on construction site makes construction process to be interrupted. This interruption of construction makes the whole construction project delivery time to delay.
- **Operatives/plant collision**: poor logistics systems make the construction site disorganize and leads to onsite accidents such construction equipment/plant/ collision. This makes the construction process to be disrupted and behind the schedule.
- **Inaccurate data**: manual documentation system and mechanism makes the difficulty of accurate data filling and convey when needed. Inaccuracy of information regarding inventory, storage location and inaccurate reports makes construction process too difficult.
- **Excessive cost of construction**: Inefficient logistics makes the cost of construction to be excessively high because excess supply of materials, theft and materials damage are non-value-added costs.
- **Poor image of the construction industry**: if logistics management not good the image of construction sectors are not good. Because poor logistics results in large quantity of onsite wastage, construction vehicles are not properly managed it increase urban traffic congestion truck accident and environmental pollution. This all contributes bad impression about the construction industry in society.
- **Poor quality construction**: if the logistics management is not good in construction sites maintaining quality is difficult. Allocating less skilled laborers‟, not properly handling material, less coordination and communication are the factors that contribute to poor quality construction in construction projects. If the quality of materials is not properly maintained and trained workers are not assigned appropriately it will inevitably make the production of quality construction more difficult and leads the project for poor quality outcome.
- **Promotes of corruption & robbery**: luck of non appropriate storage place, hiring of not well skilled laborers, onsite material production, using less quality materials and unavailability of material trucking systems are considered as main factors of inefficient logistics management that contributes to corruption and robbery in construction projects.

- **Fragmentation** of activities within the construction process: There are several construction teams who are involved in one construction projects. Such as design team and construction team and suppliers‟ teams. Absence of good communication and coordination systems because of poor logistics management in between those parties leads the construction process to be fragmented and untidy.

- **Traffic congestion due to trucks**: now days because of expansion of construction projects in urban areas (developing country) there are large number of construction trucks moves on urban road networks. Those trucks are moving around the city for delivering to construction or moving from site. The movement the number traffic volumes will be increased and traffic congestion could be created. Even on some large construction project sites; trucks makes queue for loading or unloading of materials when arrived on the site because of poor logistics management.

- **Added risks to health and safety:** improper material storing, handling on site inevitably bring additional potential hazards. Manual material handling loading or unloading (either because product is in the wrong part of the site or because the right equipment is not available) adds to the health risks to those on site.

### 2.1.10 Methods and techniques to Improving poor construction logistics managements

To manage the material deliveries to these urban construction sites, there is a need to improve how construction logistics is controlled, coordinated and executed. Agapiou, et al. (1998) highlight that the focus of any construction logistics setup must be to improve coordination and communication between project stakeholders, and that the solution must be designed from a holistic view to create the best possible material flows to and from site. A construction logistics technology can range from just a small change in working practices (Gajendran, 2013; Tanskanen, et al., 2015), implementing planning systems and ICT tools, to large-scale terminal networks structures or just in-time solutions (Transport for London, 2013). Lately, the construction industry has started to look at how urban goods transport in general is managed. One popular suggestion for reducing the impact of urban goods transports has been to employ urban consolidation centers (UCC's) (Allen, et al., 2014; Björklund, et al., 2017). By consolidating goods from multiple suppliers into one shipment, the amount of goods movements within cities can be reduced. The idea of consolidating goods to reduce the number of goods movements has now received attention in the construction industry as well, paving the way for construction logistics center's (CLC's) ( Transport for London, 2013).

There are various logistics technologies used by various construction projects in the different part of the world. These logistics techniques are used to simplify the logistics process and managements. According to Anthony et al. (2007) and Matouzko (2015) those logistics technologies are:

I. Just-In-Time delivery (JIT)

The JIT logistics were developed by the Japanese automobile manufacturer system Toyota as an essential part of The Toyota Production System. The basis of this system is the absolute elimination of waste (Bertelsen and Nielsen, 1997). Moreover, authors stated that; JIT delivery is a service of regular delivery or supply of materials to the construction site without any delays. It is the mechanism of continuous supply of right quantity of material at right quality, in right time and at right place. In this case there is no as such onsite storage is needed. Therefore risk of material damage and loss, site congestion and safety issue will be minimized.

II. Construction Consolidation Centre (CCC)

A Construction Consolidation Centre, also called Building Logistics Centre, is a distribution facility through which material deliveries are channeled to construction sites. It is the way of storing material from suppliers at some strategic places that will be at appropriate distance from all construction projects sites. Then from these centers materials are transported to each construction projects sites JIT deliveries systems.

According to Lundesjo (2011) consolidation centers has much advantage for construction sites. Such as: reduces freight traffic to site by up to 70%, increases productivity of site labor by 30 minutes per day leading to a 6% productivity gain and reduces onsite waste by 7-15% through less material damage and shrinkage. As it was stated here; efficient logistics management in construction projects can be achieved by applying construction consolidation center and through this, site congestion reduction, increase of productivity and reducing of material wastage; will be achieved.

III. Demand Smoothing

Demand smoothing is a way of looking on the project activities in the entire chain and identifying whether the performance can be “smoothed” to decrease transport resourced, materials and labor needed to carry out the activity. It helps to identify peaks and gaps in the materials‟ needs over a time period (Lundesjo, 2011). This indicates that, balancing of material, work force availability and work at hand allows to know for how long material will be enough who will be assigned on which activity and

help know when another order should be made. According demand smoothing concept any resources should be allocated when needed at appropriate time and place. Resources are not to be excess or shortage.

IV. On-site Marketplaces

This method is the way allowing the trade worker to bring their products on construction site and stored daily used materials (such as screw, bolts, drill bits, nuts, saw blades and etc. in a temporary ware house. Then the materials distributed to appropriate place when it is required.

The major advantage with onsite market place is the guarantee of available supplies and material in the right and safe place. And also help the contractors/subcontractors not to have their own material storages on-site. Therefore; this enhance performance increase and construction cost reduction (decrease transportation cost, decrease chance of material loss etc.). (Lundesjo, 2011).

V. Pre-assembled and offsite fabrication

Prefabrication is a good method for smoothing construction logistics. Because of all the components used for building construction is produced in factory and transported to the construction site for assembly. It ensures better quality, less material wastage, minimizes labor force cost, reduces onsite congestion and reduces construction time, lower amount of errors and decreases transport cost (Lundesjo, 2011).

VI. Information and Communication Technology (ICT) Systems

ICT Systems are used to keep track and monitor materials through entire supply chain process (starting from production place until it is used or installed onsite). Tag systems was used to manage material deliveries with the help of different sort of information technology (bar code).Then Radio frequency identification (RFID) is used for reading of tags or barcode of that material on site for checking the material. The tag system, having relatively low cost, allows the monitoring of material to the point of final use and can offer detail information about how is it going on site. It helps to know easily how much material was used and how much material is left in the store (Lundesjo, 2011.)

VII. Third Party Logistics

It is way of involving the third person, rather than supplier and consumer in the logistics system for making better logistics system. The main purpose of such companies is to create safe, clean and work-

efficient working place by efficient and better planed logistics. Therefore; contractors and subcontractors do not need to spend more time on rework and moving material within the site. The most of the material transportation is done by this third party during evening when the workers are away and cranes are available (to reduce work interruption for loading and unloading materials, to reduce onsite and urban congestion etc.). Every next working day workers have ready material in right quantity and on the right place. It makes safer and clean construction environment (Matouzko, 2015).

Third-party logistics (TPL) can essentially be said to be the outsourcing of a company's logistics function to an external logistics service provider, a "third party", that acts as an intermediary between two supply chain companies (Marasco, 2008), at least managing and executing transportation and warehousing.

## VIII. Applying Integrated/Systematic Construction Logistics

A systematic approach to construction logistics has led to the emergence of a dedicated logistics contractor who assumes the single point responsibility to integrate all the essential support services associated with construction project (Sullivan et al., 2010). Egan (1998) material acquisition. The cost variables considered when calculating the CS for one order and all incoming deliveries. The included costs are cost to order, cost to receive, cost to verify materials, cost to transfer and cost to authorize supplier payment (Thunberg and Persson, 2014) stated that to improve construction project delivery, construction industry had to develop an integrated project process.

The implementation of integrated logistics with a dedicated logistics team will benefit the construction industry for four important reasons:

- Integrated and dedicated approach can maximize the productivity and efficiency of skilled workforce. For example, in a traditional approach, some skilled workers may be diverted to help out in materials delivery while construction work will be suspended.
- Integrated and dedicated approach to logistics can maximize the quality of service by enabling a trained logistics service team to provide a holistic support service for the construction project.
- To minimize the negative environmental and social impact that construction projects create by enabling the efficient flow of materials which can minimize the indiscriminate packing of delivery vehicles around the construction site and minimize waste generation. Integrating the

supply logistics and site logistics will enable the dedicated logistics team on site to plan for delivery well in advance.

- Systematic construction logistics can enhance the attainment of the highest possible standards of health and safety, for example, by minimizing collision accidents which can result from the chaotic distribution of materials on construction site.

### 2.1.9. Success factors of a construction logistics

Effective logistical planning is imperative for any construction project as it can provide massive benefits in efficiency and productivity that significantly reduces the overall cost of the project. There's nothing more frustrating than having a workforce not being able to continue because they are missing or waiting on the arrival of materials. Construction logistics should be designed to deliver client's needs as well as satisfy the performance requirements of the contractor in the most efficient way possible and it is a process that should have the following characteristics:-

- Rationalized supply base: The number of suppliers should be minimized to ensure efficient delivery. Reasonably few suppliers can be better managed and logistical constraints will be reduced.

- Involvement of strategic suppliers at the design stage: There is need for full understanding of the implications of design, components and material choices. Involving strategic suppliers early enough will enhance the compliance of procurement and logistics with design specifications.

- Selection of supply chain members based not only on their low price but also their willingness to contribute to team effort.

- Effective, fast and accurate inter-team communication and flow of information. This will promote team spirit and sense of belonging among team members.

- Efficient tracking and control of materials and performance measurement.

Logistics is an essential process that supports and enables primary business activity such as a construction project to be accomplished (Sullivan *et al.*, 2010). A logistical view is a solid basis for productivity improvement and every construction project can be seen as an order-delivery process where all parties along the logistics chain, such as supplier, constructor and client/buyer, are involved

(Wegelius-Lehtonen, 2001). The logistics of the supply and delivery of materials to site has been identified as an area of construction supply chain management that could benefit from sustained improvement. While a few enlightened companies within the construction industry have begun to see that good logistics practices and a supply chain management view of business are essential to achieving sustainable improvement, most construction companies have yet to realize the benefits that can be achieved (Hill and Ballard, 2001).

## 2.2. The urban transport problem

Goods transports play an important role in the prosperity of the urban environment, but they also affect the urban environment negatively. Issues such as emissions, congestion, noise and accidents are frequently attributed to urban transport in general and urban goods transport in particular (Dablanc, 2007; Lindholm, 2010). These issues impact the urban environment on social, economic and ecological levels. Emissions can cause numerous health problems and affect the quality of life for inhabitants while at the same time contributing to global environmental impact through the emission of greenhouse gases (Anderson, et al., 2005). Economically, the costs incurred through congestion affects inhabitants as well as companies , and here in lies the main problem of the urban transport system; it is a complex transport system where goods and passengers utilize the same, limited infrastructure (Carlsson and Janné, 2012; Dablanc, 2007). Additionally, the transport system is populated by a combination of different vehicle types and road users, increasing the risk of accidents. This leads to the urban goods transport system not being as efficient as it could be (Lindholm, 2012). As noted, an efficient goods transport system is a necessity for the urban economy and should be a priority for cities, inhabitants and companies alike.

Urban transport systems are subjected to a vast amount of regulations regardless of if it is goods or people being transported. However, previous studies have noted that cities and authorities traditionally have not focused on strategies for urban goods transports or coordinating efforts among different urban transport stakeholders Goods transports and logistics has been treated as a problem for the logistics industry to solve (Carlsson and Janné, 2012). This lack of clarity and focus on goods transports adds to the complexity of the urban transport system. Figure 2 show problem material flows in urban areas are subjected to the urban transport.

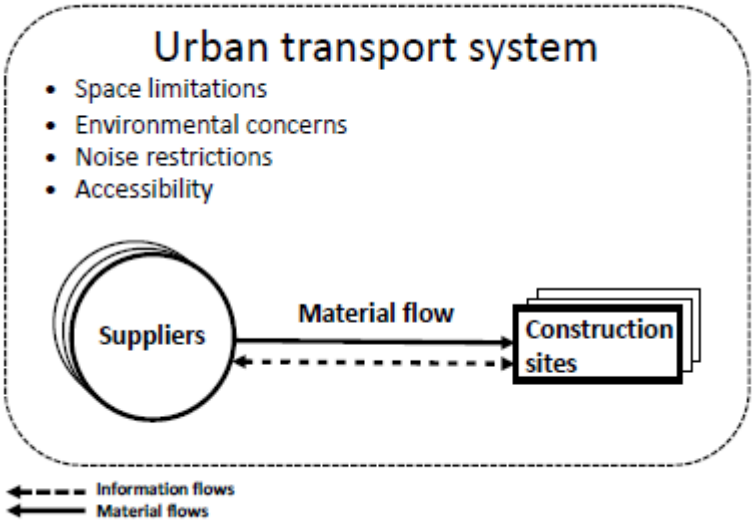


*Figure 2.2 - Material flows in urban areas are subjected to the urban transport problem*

## 2.3. Logistics System Analysis

Construction logistics is concerned with the transportation of materials from supplier/manufacturer's warehouse to the construction site storage and movement of materials within the site from the storage to the point of use. Therefore, application of the concept of nodes versus links is the most suitable concept in this case. Nodes are spatial points where materials are stored or processed while links are the transportation networks that connect the nodes together. The nodes versus links model is illustrated in Figure 2.3. The Figure 2.3 shows a simple logistics system network that facilitates the delivery of materials to the construction site and subsequent shipment of materials from the storage to the construction area.

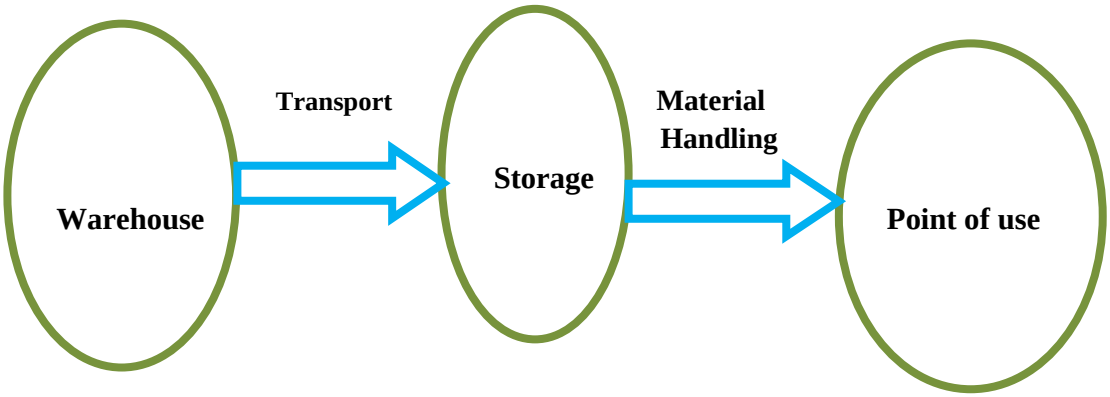


*Figure 2.3: Nodes versus Links Logistics System*

### 2.3.1 Transportation

This is the link between the spatial nodes in a logistics system through which materials are moved from one node to another. In construction, transportation enhances the flow of material from the supplier or manufacturer to the construction site.

The requirement for transportation of materials to construction sites is very significant because the construction process consumes enormous quantities of materials (Shakantu*et al.*, 2008). Apart from the need to convey large quantities of materials, transportation often account for a significant part, between one-third to two-third, of the cost of logistics in many industries. On other research, transportation of construction materials accounts for about 10-20 per cent of construction cost. This cost is intensified if the cost of the energy consumed for the transportation of materials to the construction site is included.

**Selection of mode of transportation**

The choice of any mode of transportation and carrier type for the delivery of materials to the site affects the efficiency of the construction process and contributes significantly to the overall cost of construction. Transportation adds value by creating time and place utility i.e. materials are made available at the appropriate place at the appropriate time. Therefore, the quality of transportation affects the availability of material and equipment on site and bears on the pace and quality of work on site.

The fundamental factors that determine the choice of transportation carrier are cost and time. There must be trade-off between cost and time because selecting a low cost carrier that takes longer time to deliver materials to site will cause delay of work if materials run out on site before delivery and this will definitely increase the cost of construction.

The overall parameters that determine the choice of transportation carrier stem from the cost-time principle and they are described as follows (Coyle *et al.*, 2003):

**1. Transportation Cost:** Transportation cost analysis is an important criterion in selecting the mode of conveying materials and equipment to the construction site and the analysis involves evaluating the basic modes of transportation. Transportation cost includes the rate, minimum weights, loading and unloading facilities, packaging and blocking, damage in transit and stopping in transit and the

implication of selecting any of them. These are cost factors to be considered before selecting any materials carrier.

**2. Transit Time:** Transit time is the time required for the pick-up of delivery, and terminal handling of materials i.e. the time of movement between origin and destination terminals. Transit time affects the storage level on site. While shorter transit times result in lower storage cost, longer transit time can result in materials stock out (which can cause operation down time)

**3. Reliability:** This is the consistency of the transit time a carrier provides. More reliability on the service provided by any carrier will require lower storage level than an unreliable and inconsistent delivery service. This will definitely reduce storage cost

**4. Capability:** Capability is the ability of the vehicle to provide the facilities and equipment required for the movement of the materials. Examples of capability factors include equipment that can provide required temperature, humidity or special material handling facilities.

**5. Accessibility:** Accessibility is the ability of the vehicle to reach the point of delivery. The accessibility of a carrier is affected by the construction site location, geographic limits of the carrier's route network and constraints placed by regulatory authorities.

**6. Security:** Security is concerned with the arrival of materials in the same condition they were in when tendered to the carrier. Unsafe carrier service can result in the delivery of damaged materials, which may no longer be useful for the construction work.

### 2.3.2 Warehouse/Site Storage

This is a node component within nodes versus links logistics system where materials are stored. It is a place where materials are kept prior to being used or fixed on the construction site. In spite of the importance of storage, site inventory should be kept at the minimum level to reduce cost because the unnecessary storage of large quantities of materials on site will lead to interruption of work, extra handling and waste (Bertelsen and Nielsen, 1997). Materials that are procured in large quantities without complying with the production needs on site will result in waste of resources during stocking, handling and transporting. However, construction contract must make provision for temporary storage because of some uncertainty in the period between ordering and receiving materials. Material buffers on construction sites will help to manage unpredictability in the construction process (Hill and Ballard, 2001).

Furthermore, contractor's ability to carry inventory is often limited due to restricted storage capacity that can be provided on site especially in major cities (Sullivan *et al.*, 2010). The inability of contractors to provide adequate inventory can result in inefficiencies such as backlogs, capacity mismatch and unavailability of materials. The ordering of materials after construction comes to a halt due to lack of required materials leads to delays and additional cost charged by express delivery (Bertelsen and Nielsen, 1997). However, the problem of materials unavailability on construction sites goes beyond inadequate storage. Frequently, materials are not registered in any inventory control system which will enhance visual control of materials and ensure they are available.

### 2.3.3 Materials handling

Materials' handling on a construction site is the short distance movement of materials within the confines of the site. It is a construction logistics system component that links storage or point of delivery with the construction area. Material handling may be manual, mechanical or combination of both. As Shapira*et al.* (2007) emphasized, today's construction projects are highly mechanized and the working environment is dominated by materials handling equipment. The typical applications of plant and equipment include materials handling and lifting operations. The utilization of plant and equipment improves the productivity, efficiency and cost effectiveness of construction projects. An efficient materials handling equipment strongly improves competitiveness through reduction of handling cost, enhances production process, provides effective utilization of manpower and reduces lead time.

There are four attributes which impart the efficiency of material handling: movement, time, quantity and space (Johnston, 1984). Efficient material handling requires the use of appropriate handling equipment or method to move an appropriate quantity of materials within a minimum space and over the shortest period of time possible. Materials handling equipment should be operated at its highest rated speed subject to the site condition and without affecting safety.

- **Movement:** The movement dimension of materials handling involves the conveyance of materials into the storage facility, within the storage facility and from the storage facility to the construction areas.

- **Time:** The time dimension of materials handling is concerned with making materials ready for use at the point of use. The shorter it takes to get materials to the point of use the lower the

chance of work stoppage. This also makes it possible to create more space quickly in the storage facility.

- **Quantity:** The quantity dimension of materials handling deals with the different usage of handling equipment. Materials handling equipment is designed to carry appropriate quantity of loads, and move them to the point of use.

- **Space:** The space dimension of materials handling has to do with the conformity of the handling equipment with the space within the storage facility and within the site compound. Since the storage and site space are fixed, the material handling system must maximize the use of this space.

Construction site materials handling equipment include fork lift trucks, dumpers, hoists and cranes. The selection of equipment can affect the effectiveness and efficiency of the construction site depending on the operating environment of the equipment. In a construction environment where only limited number of materials handling equipment is available, careful planning for the operation of equipment is needed for efficient logistics management on site.

## 2.4 Conceptual Framework

A conceptual framework is an analytical tool with several variations and contexts. It can be applied in different categories of work where an overall picture is needed. It is used to make conceptual distinctions and organize ideas. Strong conceptual frameworks capture something real and do this in a way that is easy to remember and apply.

As it can be seen from the (***Figure 2.4***), late delivery of construction material causes work interruption, decrease workers productivity and loss of project efficiency. Poor communication in construction projects caused wrong delivery of materials and also ordered materials not arrive on time on construction site. Generally each impacts on each construction processes sum up and made the project to be delayed and finally leaded to the project to cost overrun.

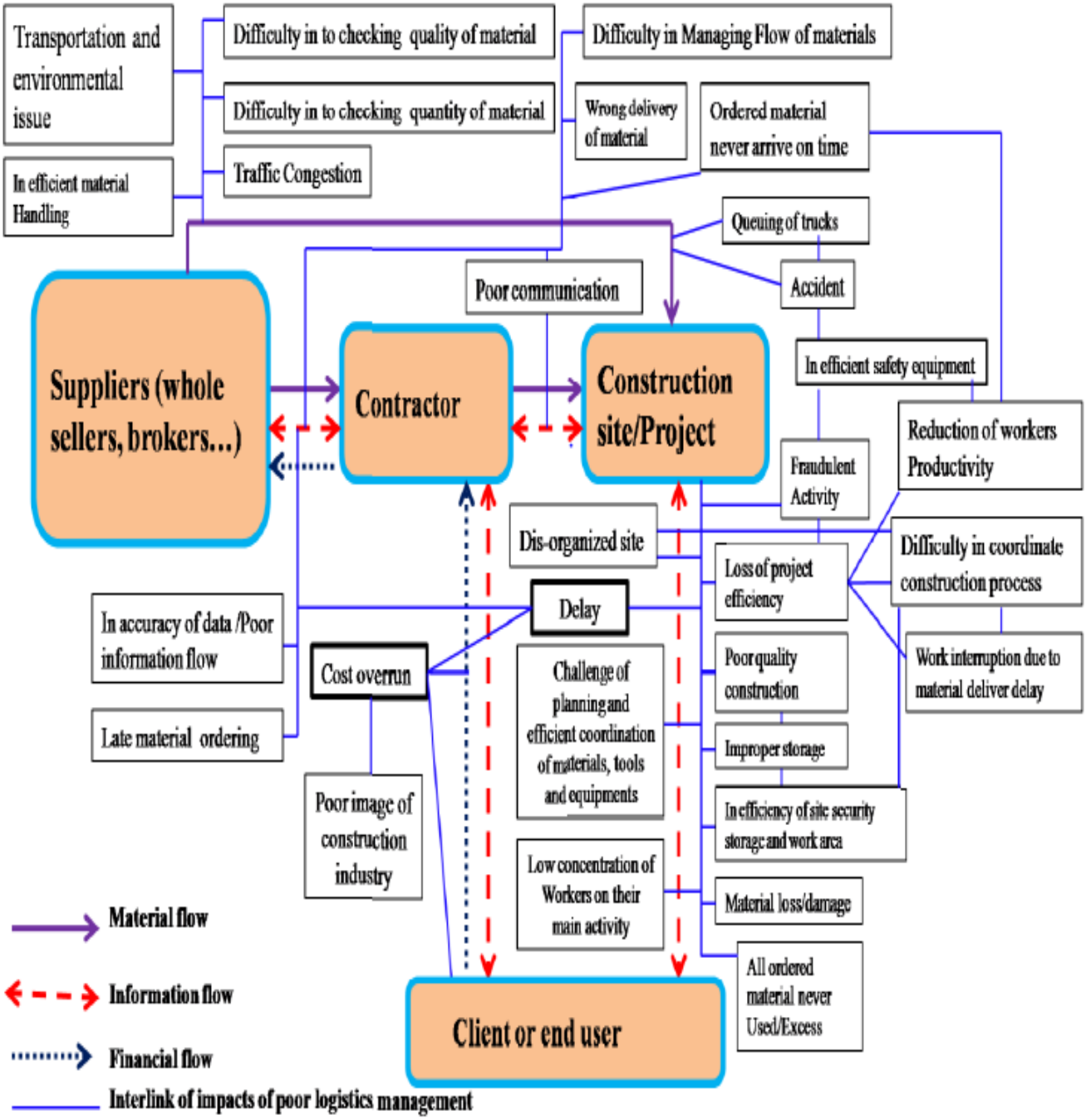


***Figure 2.4. Inter relationships of impacts of poor logistics management in building construction projects***

# CHAPTER THREE: THE RESEARCHMETHODOLOGY

## 3.1 Introduction

Research technique could be a way to systematically solve the research issue. It may be understood as a science of studying how research is done scientifically. As data and methodology are highly interdependent, the strategy to be utilized for a specific research issue must always take into consideration the nature of the information that will be collected to resolve the research issue (Kothari, 2004).

This chapter comprises of the method and the design that was used to conduct the research. It was a qualitative research in which the data was collected using questionnaires. The population was made of clients, contractors, consultants and suppliers. There was collection of both primary and secondary data. The primary data was obtained using questionnaires while the secondary data was gathered from the literature. The research methodology chosen for this study comprised of intensive literature review, questionnaire to building construction stakeholders in Addis Ababa Housing Development Agency and a statistical analysis of the Survey.

## 3.2. Research Approach and Design

Research design is defined as a framework of methods and techniques chosen by researchers to combine various components of research in reasonably logical manner so that the research problems efficiently handled (Bhat, et, al 2019). It is the blueprint for conducting the study that maximizes control over factors that could interfere with the validity of the findings. Designing a study helps the researcher to plan and implement the study in a way that will help the researcher to obtain intended results, thus increasing the chances of obtaining information that could be associated with the real situation (Burns & Grove, 2005).

The research was designed to get perceptions from clients, consultants, contractors and suppliers of construction project in regard to the important and challenges of construction logistic management in the urban construction project. This makes it appropriate for the study to implement descriptive research design.

## 3.3. Target population

The target group considered in the research was stakeholders who participate in Addis Ababa 40/60 condominium projects (clients, consultants, contractors and suppliers).

The sample for this study is relatively small. As a result, the analysis was combined all groups of respondents (clients, consultants, contractors and suppliers) in order to obtain significant results.

## 3.4. Sampling Techniques and Procedures

Purposive sampling and cluster sampling techniques was used to select target respondents acting in the construction projects (project manager, project consultant, site engineer, supplies and client was identified for the questionnaire as the target population of the study.

Cluster sampling techniques was used to select target respondents acting in the Addis Ababa 40/60 condominium projects (client, consultant, contractors, and suppliers) will be identified for the questionnaire as the target population of the study. Based on this; one urban construction projects (condominium project) randomly will be selected. The questionnaire was design to analyze the perspective of construction site actors toward construction logistics management in urban construction projects.

These different respondent categories; were used to obtain fair answer from different perspective and to support scientific analysis based on their responses.

After having designed a questionnaire survey, in order to avoid biasness cluster sampling method is taken: the process start from list all the clusters in the population in this case sites, the sites that are active or under construction which is 40/60 condominium projects i.e. Bole Arabesa, bola bulebula and KuyaFicha. Active sites are selected for the research work since it is easy to collect data and to know the real challenge in the site. Then selecting the cluster usually by simple random sampling here Bole Arabesa randomly selected.

### 3.5 Source of the Data

#### 3.5.1 Primary Data

The source of the primary data was in a form of questionnaire, designed to gather a large volume of data from client, contractors, consultants and supplier who participated on 40/60 condominium projects found in Addis Ababa are main source of information. Furthermore, I had informal discussion with professionals within the industry on subjects that were difficult to understand. The primary function of the survey is to collect information that can be analyzed.

#### 3.5.2 Secondary Data

Secondary data which involves information from published text such as research journals, government publications, past dissertations and Internet resources was used to compliment the primary data.

## 3.6. Research Instruments and Sample size determination

The research instruments employed in the study mostly are closed questioner survey. Questioner survey is the most preferred choice in logistics and supply chain survey research (Kotzab, 2005). Although, questionnaires have its own inherent limitations, they are particularly relevant in the research of supply chains because it can help collect better information about the realities of supply chains and develop better and more complete theories (Eisenhardt, 1989; Yin, 2003).

The potential suppliers for the study were identified after the response from the public bodies and contractors were received.

Likert‘s-scale is important to know respondents' feelings or attitudes about something. The respondents must indicate how closely their feelings match with the question or statement on a rating scale. The study employs a five Likert‘s - scale ordinal measures (from 1 to 5) as shown in the following sections. The scales are:

1- Unimportant/ Negligible/ Not at all

2- Less important/ Low/ little

3- Somewhat important/ Moderate/ average

4- Important/ High/ Greatly

5- Very important/ very high/ A lot

The questionnaires are prepared in such a way that detailed information can be gathered in a systematically prepared matrix table.

### 3.6.1 Questionnaire validity

The objective of literature review includes many of relevant materials from text books, professional journals, papers, research report, and internet to develop a framework for the research study and to prepare structured interviews and Questionnaire survey. The identified factors have been verified through literature review and series of interviews with a number of selected experts in construction projects such as managers, engineers, owners, academic and contractors.

### 3.6.2 Questionnaire distribution

Questionnaire was distributed in several ways to increase the number of response research sample and theses methods include Distribution of questionnaire by hand, by contacting them and making an appointment to meet, finding out their address and then going to their office and their companies. Distribution of questionnaire by phoning, by making calls to sample search to obtain their email. It was difficult to get their office to be delivered by hand due to several reason, there is no enough time

for some people to meet personally and due to world global pandemic case. Questionnaire was distributed to fifty Six (56) stakeholders (public body, contractors, consultant and suppliers)

## 3.7. Methods of Data Collection

Clients, contractors and consultants who participated on 40/60 condominium projects found in Addis Ababa are main source of information. Furthermore, I also had informal discussion with professionals within the industry on subjects that were difficult to understand. The method of data collection is based on the purpose of the evaluation, how the respondent can be reached, how they might respond and on available resources such as time and budget. Thus, considering all of these factors, the data collection approach employed is questioner and unstructured interviews. In order to design a questionnaire one needs to identify various factors extracted from literature review. Hence a conceptual literature review was extensively made and various concepts that help in the study of logistics management practice, to assess the perception of stakeholders on the importance of logistic management in construction projects. After having designed a questionnaire survey, in order to avoid biasness cluster sampling method is taken. The study employed both qualitative and quantitative data collecting tools. The use of mixed methods approach for this research was intended to drive the benefits of both quantitative and qualitative approaches. The bulk of the data were collected through administering questionnaires survey (closed ended questions). The quantitative data obtained from the questionnaire survey is organized, coded and categorized using the SPSS software; which facilitates analysis and the presentation of the statistical outcomes.

## 3.8. Ethical Considerations

This study was conducted according to the ethical guidelines of research requirements. The privacy and confidentiality of the respondents of this study was protected by keeping in secrecy the information collected. Deception was avoided by informing construction companies about the purpose of the research and its implications on the respondents.

## 3.9. Methods of Data Analysis

The collected raw data was first sorted, edited, coded and then entered into computer software. Two programs used where the excel sheet and statistical package for Social Science (SPSS). The method analysis combined both quantitative and qualitative types of data. Descriptive statistics method was use to analyze the responses in numbers. Percentages are easier to interpret and in this analysis, they

are implemented to express the findings as a proportion of the whole. The findings were presented in the form of tables and charts to help understand easily.

The study used relative importance index (RII) method to ordinals arranges variables in terms of importance and agreement and it is calculated as follows (Aibinu and Jagboro, 2002).

$$RII = \frac{\sum_{i=1}^{N} fi * wi}{N * A}$$

Where:

N = Total number of respondents

wi= the variable expressing the frequency of the *i*th response.

fi= frequency or count of variables

A= the maximum scale

The results was analyzed from fifty Six (56) questionnaires using MS Excel 2010 and SPSS and the analysis and results are presented in form of graph and tables as shown in Chapter 4. The results were prepared to present the information about the sample size, response rate and urban construction characteristics. It also includes the ranking of factors affecting the perception of construction stakeholders on the benefits of construction logistics management and the current practices and challenges in construction logistics management based on their relative mean ranks, in addition to the different approaches of construction logistics management and the solutions for the impacts of poor construction logistics management.

# CHAPTER 4: DATA PRESENTATION, ANALYSIS AND INTERPRETATION

This chapter presents the findings from data analysis and is divided into seven sections. Section 4.1 presents results from pilot study and descriptive statistics, section, 4.2 respondents Background Information, 4.3Perception of construction stakeholders on the benefits of logistics management, section, 4.4 Current practices and challenges in logistics management, 4.5 Stakeholders proposed solutions for challenges faced in delivery of materials, 4.6 Impact of poor logistic management and Methods and techniques to Improving poor construction logistics managements and section 4.7 Discussion.

## 4.1. Response Rate Respondents

The study sought to collect data Out of the 36 questionnaires distributed to clients, contactors and consultants, 25 responses are received with 69.44% return rate in this study. This represents a response rate of 69.44% percent which is very good for analysis. According to (Babbie, 2004) a response rate of 60 percent is good.

The following bar chart shows distribution of the respondents, i.e. Building Contactors (28 %), General Contactors (16 %), Consultants (32 %) and Client (24 %). Furthermore, the potential suppliers were identified after collecting responses ‘from the public bodies, contractors and consultants. And twenty questionnaires are distributed to supplier, among which only ten of them were retuned.

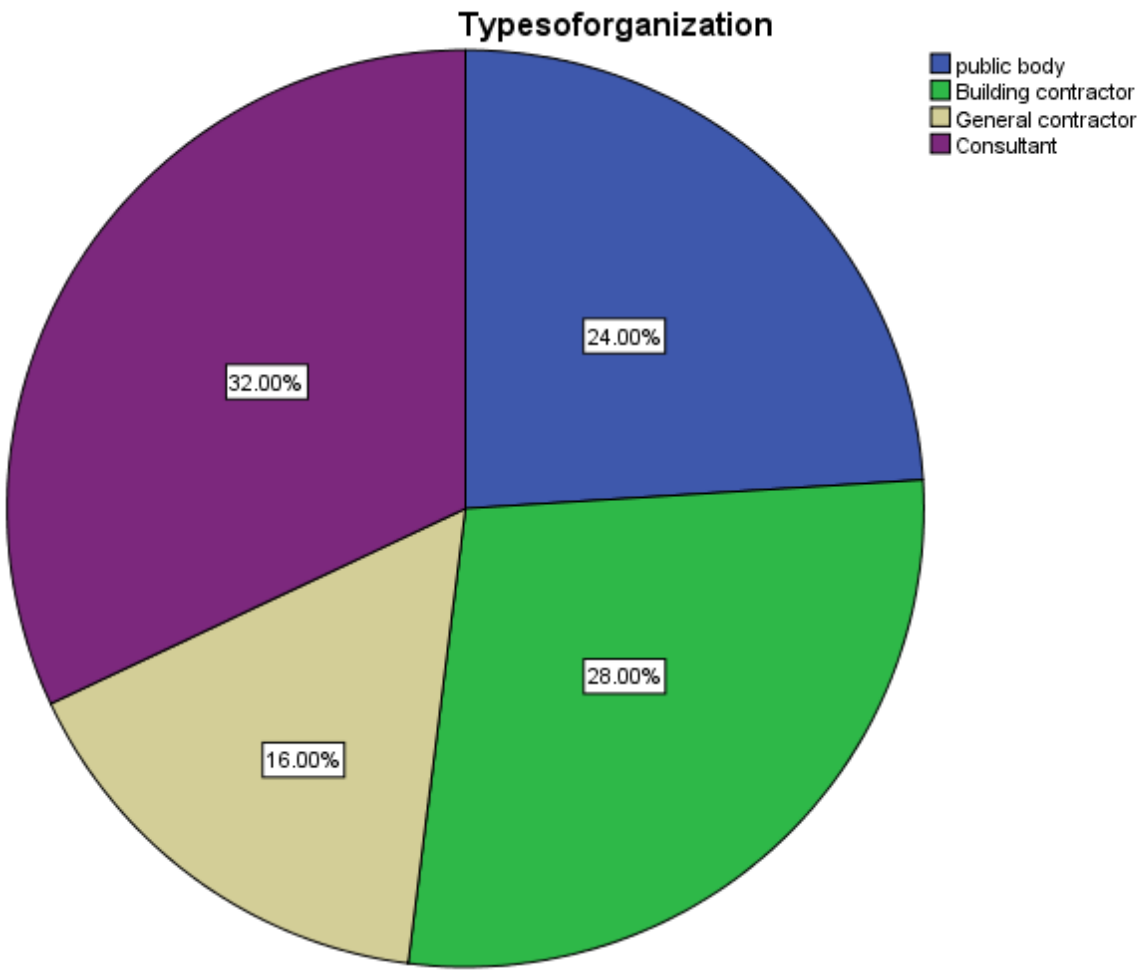


***Figure 4.1 Classification of questionnaires general response rate***

## 4.2. Respondents Background Information

This section presents background information of the responding firms. Figure 4.2 shows the years of experience for the surveyed respondents in the Addis Ababa Housing Development Agency. In the chart below which shows the characteristics of the respondents; about 40% of the respondents have 5-10 years of experience, 32% have 10-15 years, and 20% have an experience less than 5 year sand the rest 8% have an experience above 15 years. This suggests that the respondent companies have wide and long experience in the sector. Consequently demands and existing operations to the logistics perspective of the firms is well understood concept by those companies.

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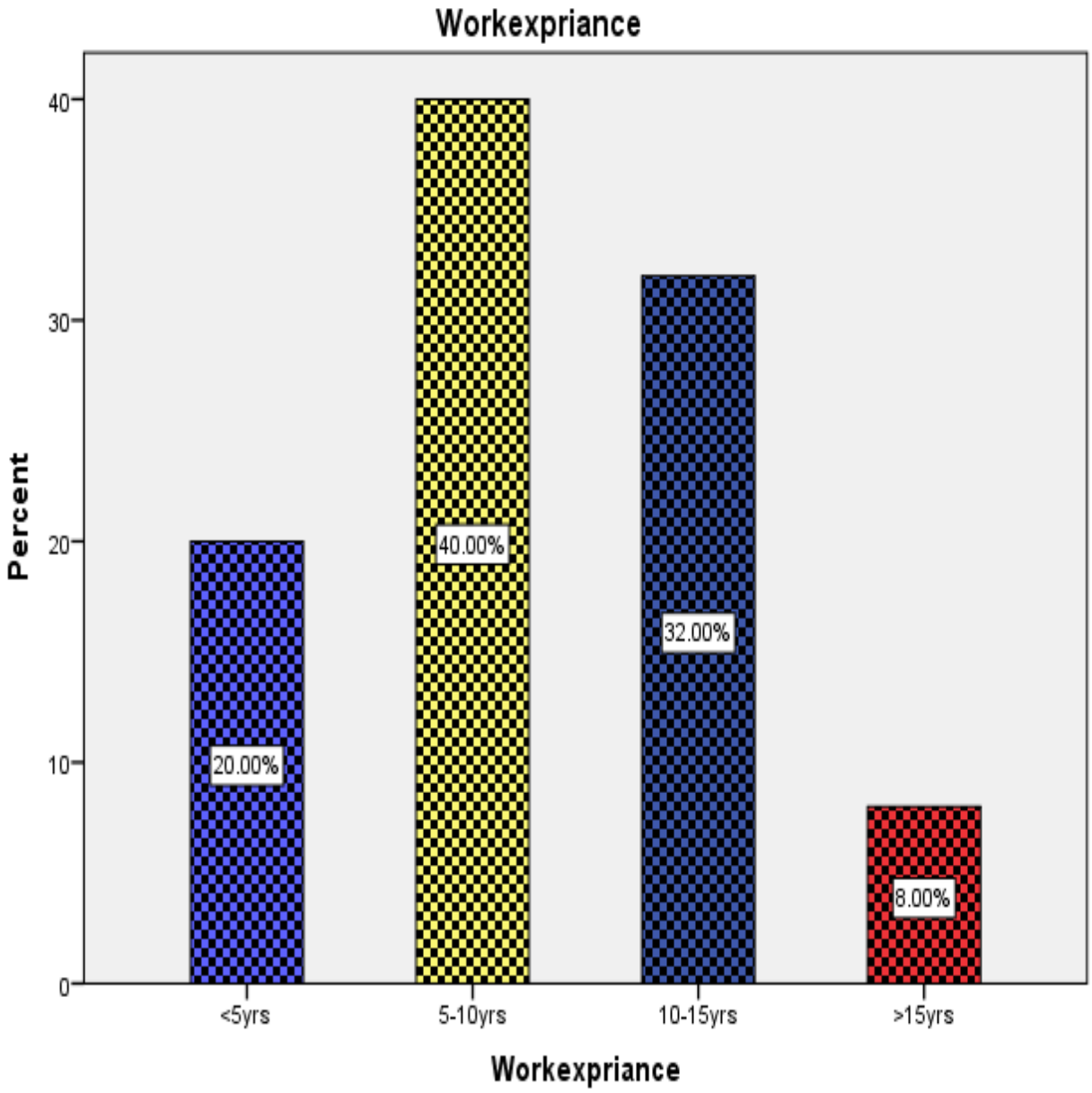


***Figure 4.2Respondent's experience on the construction industry***

## 4.3. Perception of construction stakeholders on the benefits of logistics management

This segment presents expressive investigation for factors utilized within the model. As described below in the table 4.1, the key variables that are important of logistic process collaboration for client.

- From the point views of Public bodies, contractors and consultants the top five factors are:- Improved delivery, theft reduction, waste minimization, increased productivity, and improve quality assurance.
- From the point views of suppliers the key factors that are important of logistic process collaboration include; theft reduction, waste minimization, achievement of company goals and objectives, improved delivery and increased market competitiveness.

Evidently, theft reduction, improved delivery, and waste minimization are seen to be common components for the importance of logistic collaboration to the organizations.

Construction waste has different rationale to its existence but its existence in construction sector is undeniable. Therefore, the firm has to devise way in order to mitigate it. The existence of a lot of material and equipment deliveries, and high number of stakeholders involving in the construction sector makes it vulnerable to theft. Therefore, the above factors that should be mitigated on a construction site by applying construction logistic management.

***Table 4.1 RII analysis on the importance of Logistics management collaboration to your organization***

| Factors | Public body, Contractor and Consultant response | | Suppliers' response | |
|---|---|---|---|---|
| | RII | Rank | RII | Rank |
| Waste minimization | 85.6 | 3 | 76 | 2 |
| Reducing bureaucracy/ paperwork | 79.2 | 7 | 78 | 8 |
| Increased profitability | 82.4 | 4 | 86 | 6 |
| Theft reduction | 88.8 | 2 | 100 | 1 |
| Benefits to your supplier | 72.8 | 8 | 78 | 8 |
| achievement of company goals and objectives | 60 | 10 | 96 | 2 |
| Overall supply chain reduction | 72 | 9 | 64 | 10 |
| Delivery improvement | 90.4 | 1 | 92 | 4 |
| Increased market competitiveness | 80 | 6 | 88 | 5 |
| Improved quality assurance | 80.8 | 5 | 80 | 7 |

## 4.4. Current practices and challenges in logistics management

On the table below, the examination show that at construction projects, the most grounds given for inefficient logistics relationship between organizations and clients are linked to the following key components:

- Cash flow problems due to late and reduced payments
- Design/engineering interface - incorrect documents, design changes, extended wait for architect‘s approval or design changes
- Difficulties in finding out client‘s desires, changes of client‘s requirements, long procedures to discuss changes
- Inaccurate data, engineering drawings not fitting the use
- Deliveries not in conformance with planning, wrong and defective deliveries, long storage period, awkward packing, large shipments

From suppliers ‘point of see, the most reasons given for unsuccessful logistics relationship between organizations and provider are connected to the following key potential variables:

- Cash flow problems due to late and reduced payments
- Design/engineering interface - incorrect documents, design changes, extended wait for architect‘s approval or design changes
- Difficulties in finding out client‘s desires, changes of client‘s requirements, long procedures to discuss changes
- Inaccurate data, information needs not met, adversarial bargaining and other changes
- Problematic completion due to quality problems

There are significant challenges in applying logistics management within the construction industry, variables such as cash flow issues due to late and decreased payments, challenges in finding out client‘s wants, changes of client‘s requirements, long methods to talk about changes, wrong information, and engineering drawings not fitting the utilize and incorrect documents, plan changes, extended hold up for architect‘s approval or plan changes are highlighted as the common issues related with the usage of successful logistics management.

***Table 4.2 RII Analysis on Factors affecting of successful logistics management relationship with organizations***

| Factors | Public body, Contractor and Consultant response | | Suppliers' response | |
|---|---|---|---|---|
| | RII | Rank | RII | Rank |
| Subcontracted work not delivered according to main design, contract and planning | 63.2 | 10 | 68 | 7 |
| Threat for substitute products | 65.6 | 8 | 72 | 6 |
| Cash flow problems due to late and incorrect payments | 82.4 | 1 | 92 | 1 |
| Difficulties in finding out client‘s desires, changes of client‘s requirements, long procedures to discuss changes | 76 | 3 | 80 | 3 |
| Retention | 56 | 12 | not applicable | |
| Design/engineering interface - incorrect documents, design changes, extended wait for architect‘s approval or design changes | 80.8 | 2 | 82 | 2 |
| Problematic completion due to quality problems | 70.4 | 6 | 76 | 5 |
| Unresolved quality problems, delayed occupation due to late completion | 69.6 | 7 | 60 | 9 |
| Bidding process | 65.6 | 8 | not applicable | |
| Inaccurate data, engineering drawings not fitting the use | 72 | 4 | 64 | 8 |
| Deliveries not in conformance with planning, wrong and defective deliveries, long storage period, awkward packing, large shipments | 72 | 4 | 60 | 9 |
| Inaccurate data, information needs not met, adversarial bargaining and other changes | 62.4 | 11 | 80 | 3 |

From the capacities recorded within the table 4.3 the degree in which the factors influence the effectiveness of logistics: Purchasing of materials has been the most effective work that influenced the effectiveness of logistics. Not having a lead time for requesting of material, the transportation of materials to the project location and the Stock level of material at the project site influenced the efficiency of the logistics within the individual order as shown within the following table.

While, for providers, purchasing of materials is an effective work among the capacities that are recorded. Not having sufficient stocks within the stock influences he efficiency of logistics. Additionally having a lead time for requesting of material and the transportation of materials to the project location influences the viability of logistics for providers.

The strategies the respondents are utilizing for the delivery of material, from the options proposed: building up stock or Just-in-Time delivery, both ways are similarly utilized at the construction location as appeared within the Table 4.4.

***Table 4.3RII Analysis on functions affecting efficiency of logistics management***

| Factors | Public body, Contractor and Consultant response | | Suppliers' response | |
|---|---|---|---|---|
| | RII | Rank | RII | Rank |
| Inventory | 72 | 4 | 80 | 2 |
| Purchasing | 80 | 1 | 84 | 1 |
| Lead Time | 73.6 | 2 | 76 | 3 |
| Transportation | 73.6 | 2 | 68 | 4 |

***Table 4.4 RII Analysis on method of delivery of materials***

| Factors | Public body, Contractor and Consultant response | | Suppliers' response | |
|---|---|---|---|---|
| | RII | Rank | RII | Rank |
| Based on inventory levels | 73.6 | 2 | 74 | 2 |
| Just exactly as the materials are needed | 75.2 | 1 | 86 | 1 |

On the figure 4.3, gives different challenges which come across in material delivery. From the perspective of public body, contractor and consultant the main reasons given for problems on material delivery are mainly linked to:-

- Design change
- Incomplete contract document
- Inappropriate storage
- Ordering error

On the figure 4.4, gives different challenges which come across in material delivery. From the perspective of supplier the main reasons given for problems on material delivery are mainly linked to:-

- Delay in passing information to the contractor on type and size of products to be used
- Ordering error
- Incomplete contract document

Other challenges include inappropriate storage leading to damage or deterioration, purchasing products that do not comply with specification and using of incorrect material, thus requiring replacements.

Material procurement coordination's problem, leads to a lot of damage in all firms rather than just the construction firm. It's occurrence in construction firms is a great extent and most respondents have homogeneous responses on the benefit of applying logistic management in reduction of material procurement coordination problems.

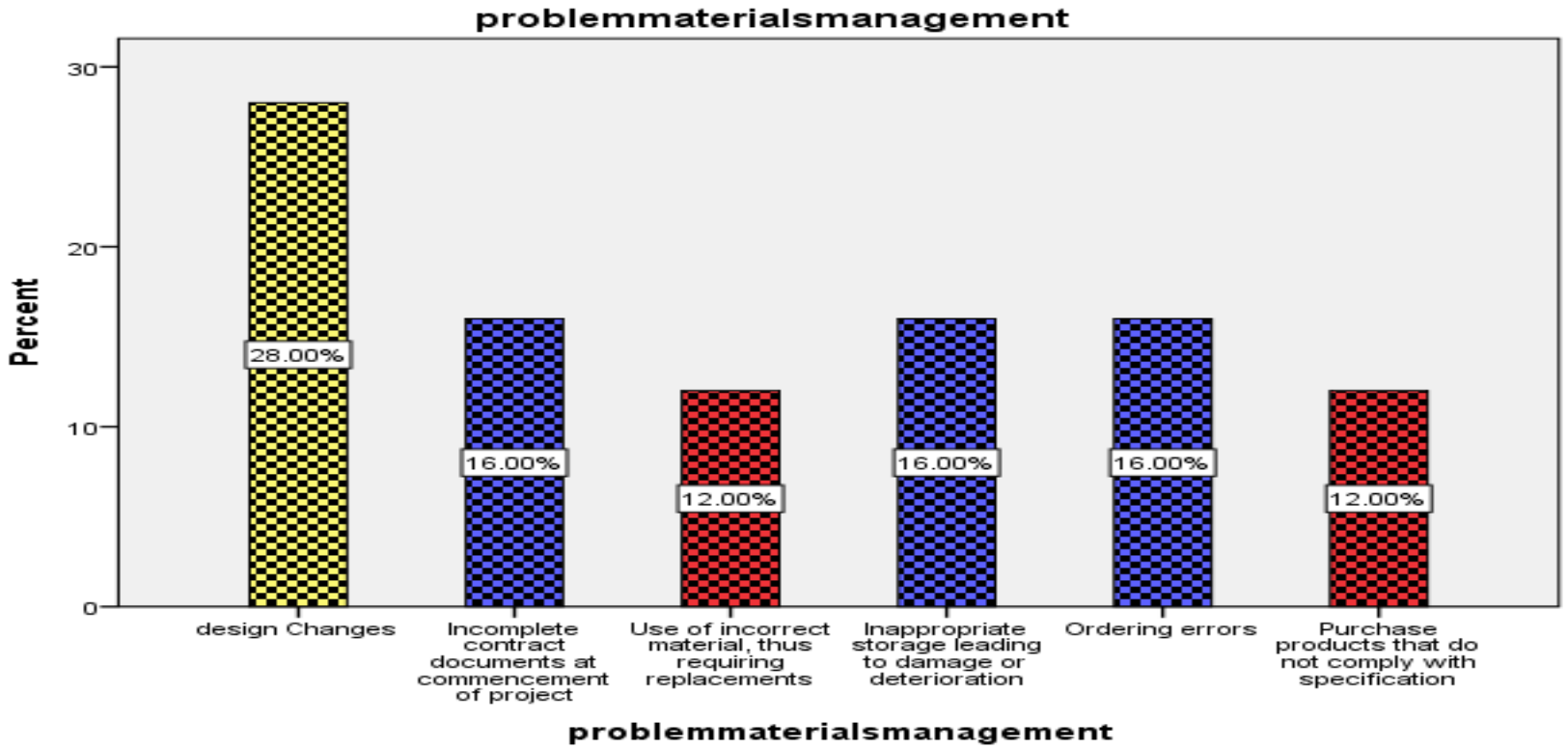


*Figure 4.3 Frequency of challenges encountered in material delivery (public bodies, contractors and consultants.)*

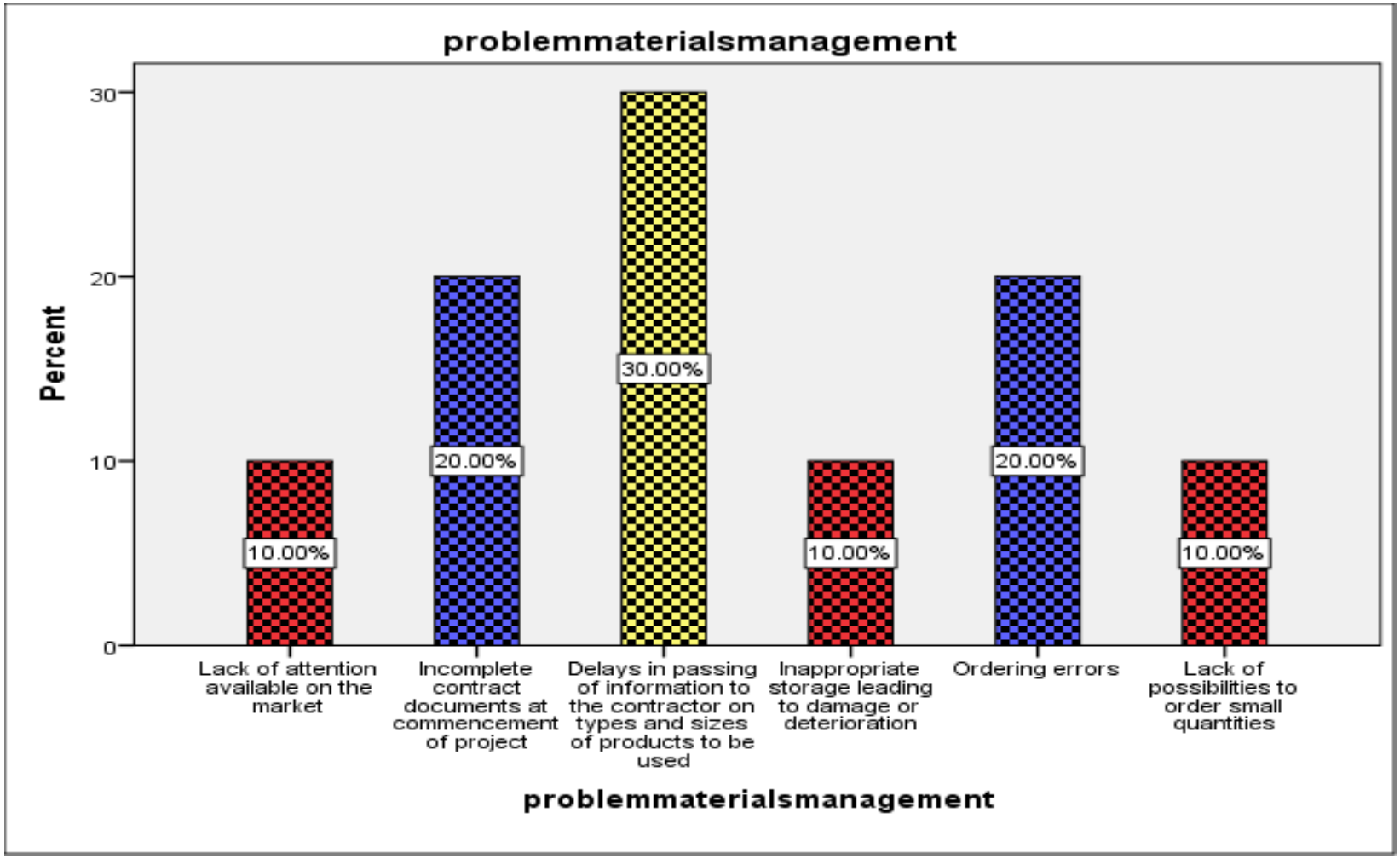


*Figure 4.4 Frequency of challenges encountered in material delivery (suppliers)*

As shows in figure 4.5 among the measures that are taking in case of lack of materials on the projects from the perspective of public bodies, contractors and consultants are prepare for other work 40% and move people to other construction site 32%.

It can be seen from the chart 4.6 that suppliers point of view, ordinarily hold up or take a break until the issues related to delivery of material are illuminated40%. The second alternative the use is to move people to other project sites.

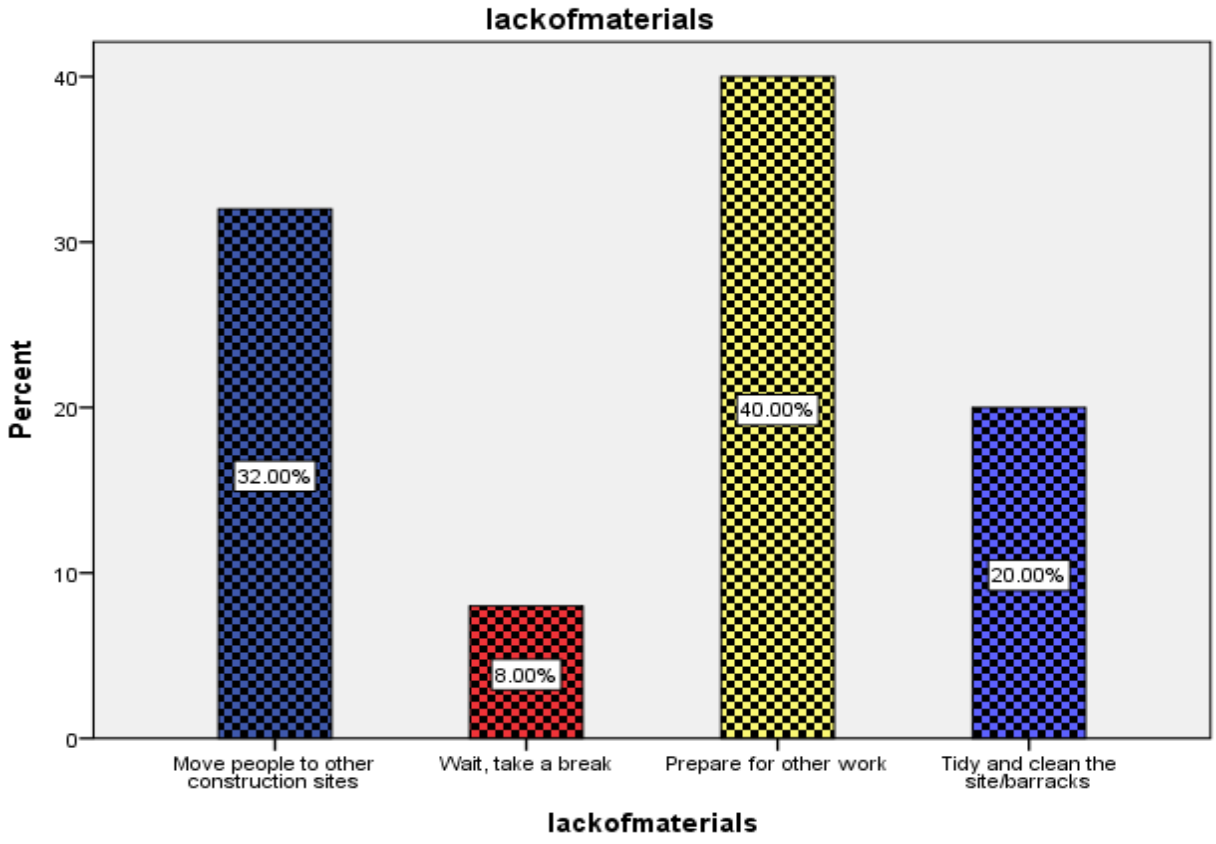


***Figure 4.5 Frequency of measures taken in the case of lack of materials (public bodies, contractors and consultants.)***

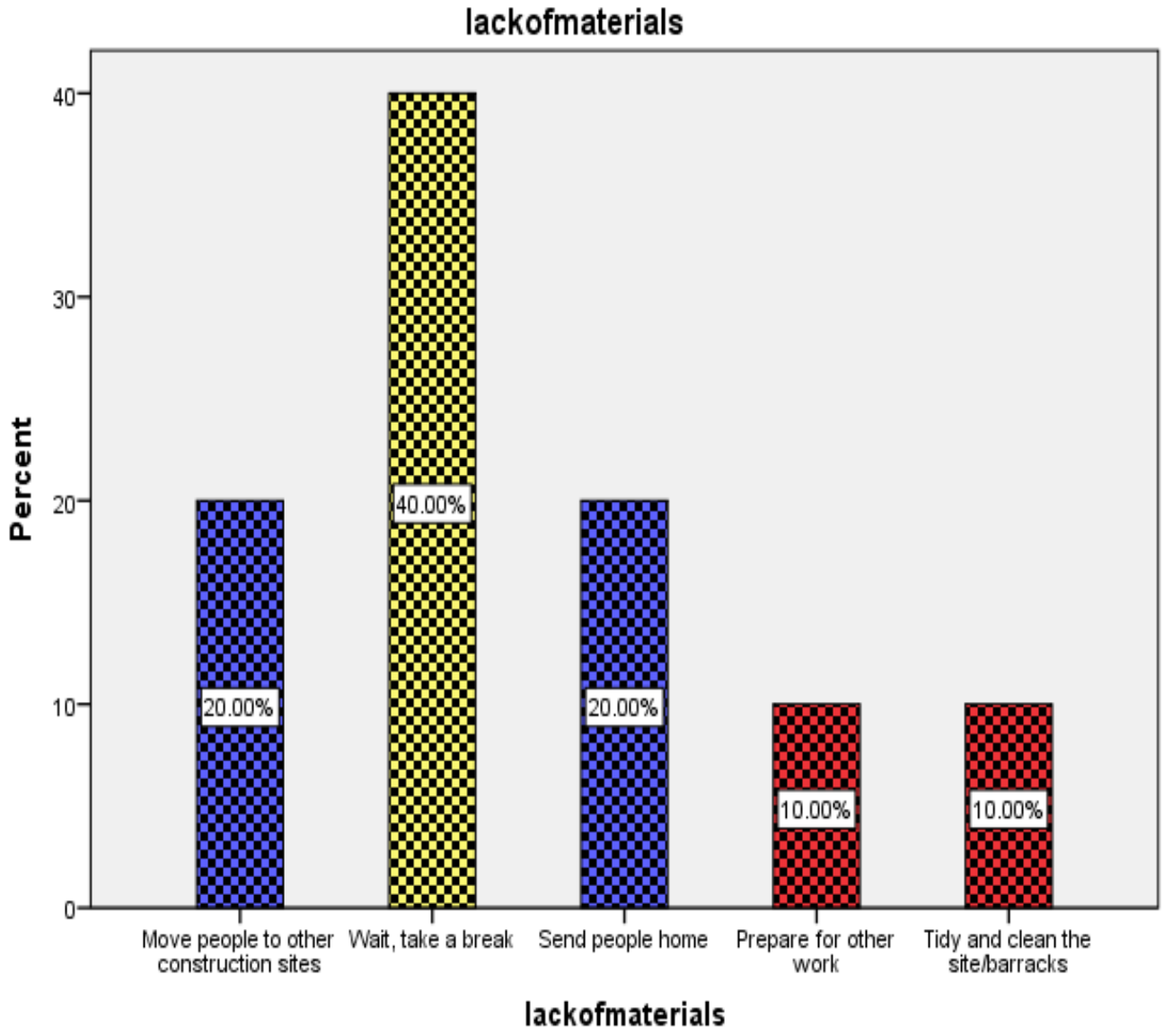


*Figure 4.6 Frequency of measures taken in the case of lack of materials (suppliers)*

## 4.5. Stakeholders proposed solutions for challenges faced in delivery of materials

The activities respondents ordinarily take to overcome the challenges they confronted within the delivery of material are a good coordination between store and construction staff which help in avoiding over requesting. They moreover recommended minimizing design changes and good construction management practice. Moreover, they propose that having precise and good specifications of materials to maintain a strategic distance from wrong requesting can have favorable affect on material delivery. Checking materials provided or right amounts and volumes to progress schedules for deliveries are moreover suggested.

From the suppliers 'point of see the activities they ordinarily take to overcome the challenges they confronted in delivery of material are:-

- Checking materials provided are in right amounts and volumes
- Good coordination between store and construction personnel to avoid over ordering.
- Additionally, taking exact and good specifications of materials help them to avoid wrong requesting and estimations of materials during batching.

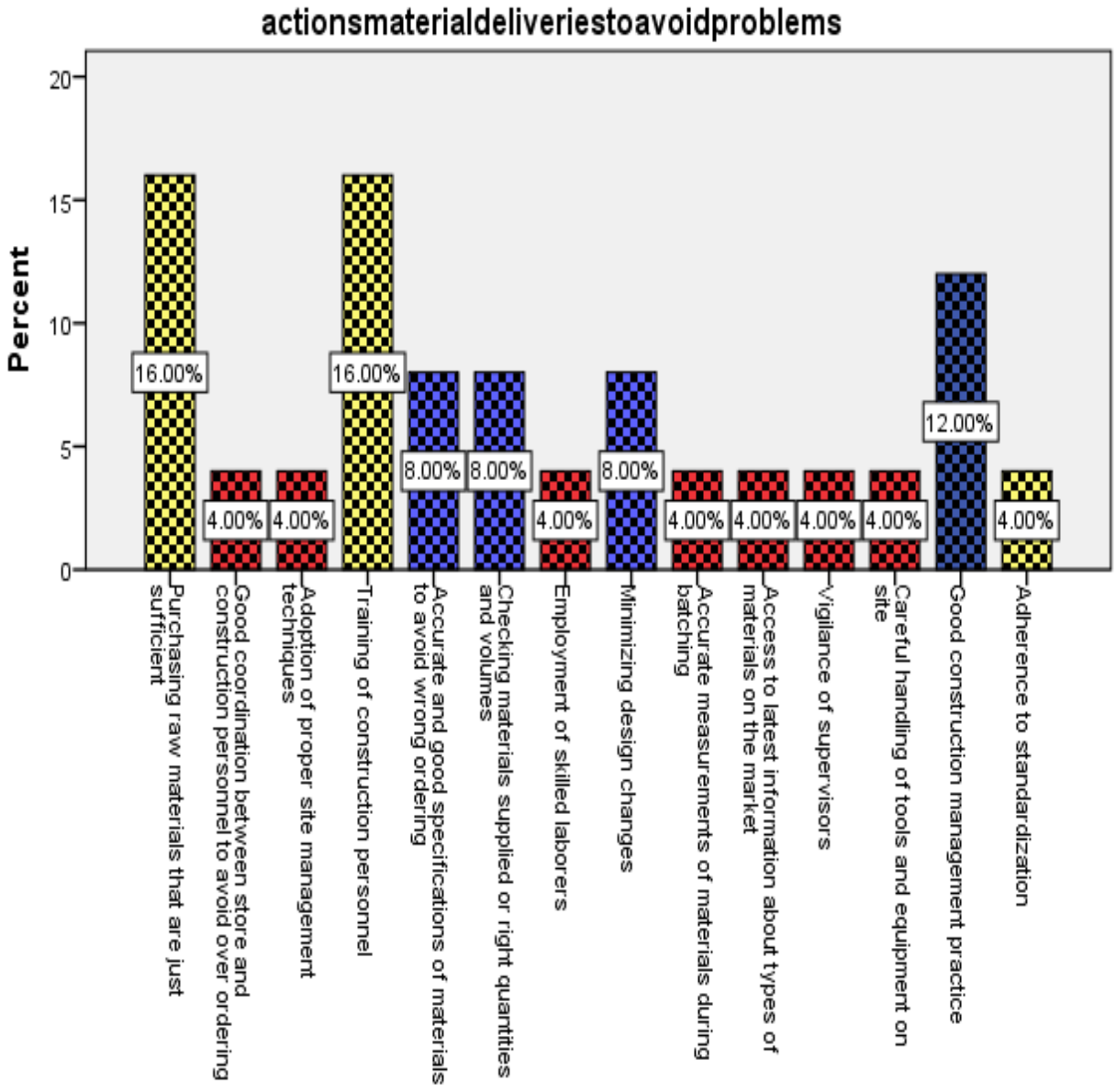


***Figure 4.7Frequency of actions to overcome challenges faced in delivery of materials (public bodies, contractors and consultants.)***

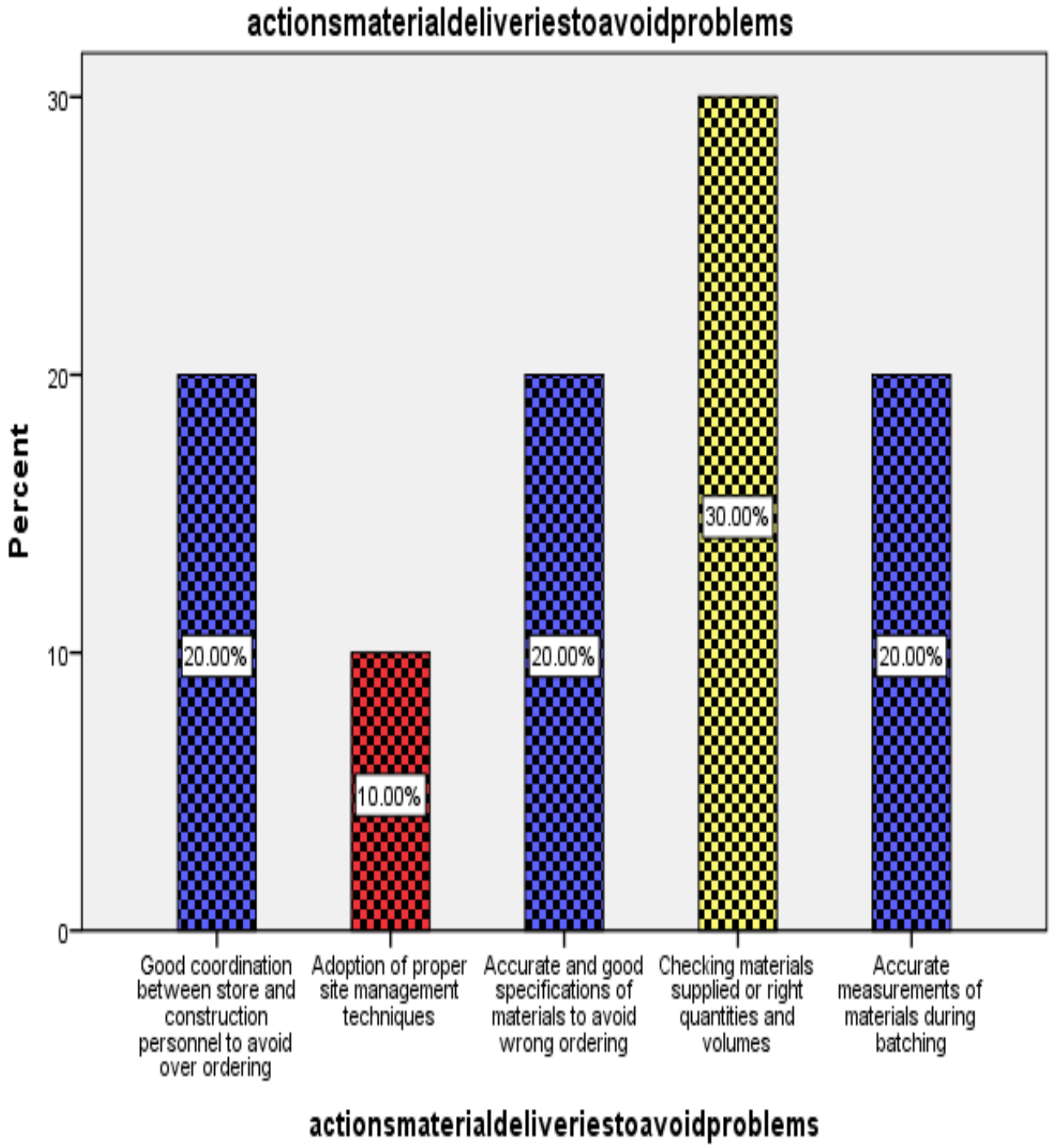


***Figure 4.8 Frequency of actions to overcome challenges faced in delivery of materials (suppliers)***

## 4.6. Impact of poor logistic management and Methods and techniques to Improving poor construction logistics managements

The impact of poor logistic management ranked in the top six as shown in the table below based on the perspectives of public bodies, contactors and consultants are: Cost overrun, Loss of project efficiency, Delay, Material loss (Damage), Order material are never arrived on time, Poor quality construction and Difficult in checking quality of material.

The impact of poor logistic management ranked in the top six as shown in the table below based on the perspectives of suppliers are: Delay, Loss of project efficiency, Cost overrun, Order material are never arrived on time, Transportation and environmental issue, Fraudulent activities and Unwise use of trucks.

***Table 4.5RII Analysis on Impact of Poor Logistics Management***

| Factors | Public body, Contractor and Consultant response | | Suppliers' response | |
|---|---|---|---|---|
| | RII | Rank | RII | Rank |
| Loss of project efficiency | 79.2 | 2 | 82 | 2 |
| Cost overrun | 80 | 1 | 80 | 3 |
| Delay | 77.6 | 3 | 90 | 1 |
| Disorganize site | 66.4 | 13 | 50 | 15 |
| Accident | 68.8 | 11 | 66 | 9 |
| Traffic congestion | 63.4 | 15 | 52 | 14 |
| Difficult in checking quality of material | 68.8 | 6 | 68 | 8 |
| Too late material ordering | 67.2 | 12 | 56 | 13 |
| Poor image of the construction industry | 65.3 | 14 | 60 | 12 |
| Material loss (Damage) | 76.8 | 4 | 64 | 10 |
| Poor quality construction | 75.2 | 6 | 62 | 11 |
| Transportation and environmental issue | 74 | 8 | 74 | 5 |
| Unwise use of trucks | 73.6 | 10 | 72 | 6 |
| Order material are never arrived on time | 76 | 5 | 76 | 4 |
| Fraudulent activities | 74 | 8 | 72 | 6 |

Construction logistic tools have a huge part to play within the coordination of different construction partners. This new node will “force” stakeholders to address coordination issues to guarantee effective material deliveries. This will take an attitude adjustment towards more collaboration in the supply chain.

As can be seen within the table below, the respondents have recommended that applying of Construction Consolidation Centre (CCC) is highly improving construction logistic management.

Just In time material delivery framework needs to be improved for a stronger logistics management. In any case, JIT is mostly practice by other businesses such as the manufacturing and food industry; or maybe, the stock management on location must be improved. And improving their relationship with the few suppliers they are currently involved with. They also suggested that the vertical integration of their organization need to be enhanced. Planning strategically and holding safety stock will also enhance the logistics management better.

For providers, the measures that they got to progress in order to oversee its logistics better are third party logistics, use of external consultant , few suppliers, holding safety stock, Plan strategically, subcontracting and close partnership with clients will increment the capabilities and adequacy of a company‘s logistics.

***Table 4.6 RII Analysis on measures for a better Logistics management***

| Factors | Public body, Contractor and Consultant response | | Suppliers' response | |
|---|---|---|---|---|
| | RII | Rank | RII | Rank |
| Construction Consolidation Centre(CCC) | 75 | 1 | 92.5 | 1 |
| Close partnership with Suppliers | 52 | 6 | 60 | 7 |
| Just In Time delivery | 59 | 3 | 52.5 | 9 |
| Subcontracting | 46 | 9 | 60 | 7 |
| Third Party Logistics | 35 | 11 | 85 | 2 |
| Applying Integrated | 47 | 7 | 52.5 | 9 |
| Plan strategically | 56 | 4 | 65 | 5 |
| Holding safety stock | 47 | 7 | 62.5 | 6 |
| Few suppliers | 60 | 2 | 72.5 | 3 |
| Many suppliers | 40 | 10 | 45 | 11 |
| Use of external consultants | 55 | 5 | 72.5 | 3 |

## 4.7. Discussion

In this discussion the researcher was discussed on the impacts of construction logistic management. As it was seen from the table 4.5, it could be confirmed that; logistics management that construction project uses are not developed well. Such result has also been reported by earlier researchers (Strategic Forum, 2005, Fediya, 2012, Regassa, 2015). According to the authors the main factors that had impacts on poor logistics management on construction projects were: short-term nature of construction process, fragmentation of activities within the construction process, lack of transparency in costs, inadequate tracking facilities on site, non existence of clear definition of responsibility and authority for logistics in construction industry, lack of proper performance measurement for construction logistics etc.

The result obtained in the current work based on survey conducted on selected condominium project sites and result obtained from Table- 4.5 shows that most condominium projects are impacted by poor construction logistics managements.

- ❖ Cost overrun:

As it can be observed from the Table-4.5 from the perspective of public body, contractor and consultant cost overrun is ranked first major impact of poor construction logistics management, with (RII=80%). It was ranked the third by suppliers with RII=80%.

Based on results obtained cost overrun was becoming problems of most of the condominium projects. This caused because poor planning and forecast material cost and labor, and due to lack of coordination and communication. The result also supported by Usman, Ahmad Muhammad Ibrahim (2015) construction sites project was affected construction logistics management by different obstacles resulted into project cost overruns. Fadiya (2012) also shared these ideas that, the inefficiency of construction logistics creates excessive cost (cost overrun). In line with Navon and Berkovich, (2005) poor logistics makes the cost of construction to be excessively high because excess supply of materials, theft and materials damage are non-value-added costs.

- ❖ Loss of project efficiency:

As indicated in Table 4.5, loss of project efficiency is ranked as the 2nd main impacts of poor logistics management in construction projects in all public body, contractors, consultant and supplier perspective. This shows that all stakeholders give attention to project efficiency and related loss. The result confirmed that if construction site logistics is poor, the project cannot be maintaining its efficiency. Because of this reason most construction are not meet the expected goal. In line with

Usman, Muhammad (2015); Ineffective management of logistics will result in affecting the efficiency of workforce, by reducing their overall productivity. Almohsen and Ruwanpura (2011) confirmed that such a loss of efficiency interferes with the performance of an entire project, and reduces management's chances of meeting project quality, budget, and time objectives.

- ❖ Delay:

As it can be seen from Table 4.5, the result suggested that project delay with RII (90%) is ranked as first impact of poor logistics management on condominium site projects. It was selected as first impacts by Suppliers. And based on the public body, contractor and consultant ranks, delay is the third impacts of poor logistics management on condominium projects with RII (77.6%). This shows that poor logistics management has been delayed the construction projects and makes the projects not to meet the intended purpose. In line with this; Usman and Muhammad, (2015) confirmed that, poor construction logistics management affected construction sites by different obstacles resulted into delay. Poor logistics can cause bottlenecks which literally strangle the life out of project. It impacts production and productivity causing delays and adding to costs. An unexpected delay will extend the overall duration of the project activities and entails an increase in project costs. It produces time-associated cost effects that will increase the resource consumption and will require extra time to reach project success. Matouzko, (2015), also confirmed that logistics results in delayed projects and Lundesjo,(2015), agrees that most of those feature of construction projects that point to poor logistics will add to the time of construction projects (delay). Regassa, (2015) confirmed that; most of the government construction projects are not delivered on time (delay) because of poor logistics management in the construction sector.

- ❖ Material loss (damage):

The research results (Table-4.5), shows that the rank and RII given for material loss (Damage) by public body, contractors and consultants were 4th and 10th by suppliers with (RII 76.8%, 64%) respectively.

This shows that material loss (damage) is seen as the major problem of construction sector. This because poor logistics management in the sector. Most of the construction sector has the problem of material planning, handling and storage. Some of the materials are damaged during the material transportation whiles others are poor handling and storage place. Some material deteriorated at storage place before using. As it was seen in condominium projects reinforcement bar, cement and hollow concrete block are store on site at inappropriate place. This brings the material loss and damage. The research result proof that; poor logistics management brings material loss or damage.

- ❖ Ordered materials are never arrived on time:

The research results (Table-4.5), shows that the rank and RII given for ordered materials are never arrived on time by public body, contractors and consultants were 5th and 4th by suppliers with (RII 74%,76%) respectively. This shows most of the condominium projects suffers material delivery problems.

Most of the time; material ordered for construction projects never arrived on time and the work was stopped for some times. When the wok stopped, it leads the project to delay and cost increase because of poor logistic management especially in material procurement, the material used for the construction projects .This the survey also showed that ordered materials were not arrived on time because of poor logistics management. The reason why ordered material were not arrive on time is: supplies problems, unavailability of material on market. Temporary social instability and weather conditions, lack of transportation facility, traffic congestion, supplier performance, market inflation, distance of the site from material production or supply, makes material not to arrive on time when needed at construction site. The result also supported by Sullivan et al., (2010) that; a lot of quality time will be wasted when materials run out of stock because construction activities may have to stop while waiting for the next delivery of materials.. Therefore, the result confirms that, in construction, material delivery has been a problem and also, the manual process of assessing materials at the point of delivery on construction site is time consuming.

- ❖ Difficulty in checking quality of materials:

The research results (Table-4.5), shows that the rank and RII given for difficulty in checking quality of materials by public body, contractors and consultants were 6th and 8th by suppliers with (RII 68.8%,68%) respectively. The consultants are mostly assigned by client to supervise the construction projects. The consultant has the responsibility to check the quality of material used and construction. But when project is complex and volume of material used on the site is large in number, the quality control needs more attention as it is difficult to check quantity and quality different materials used on construction site.

Because good method and procedures were not established at construction site, the way of checking the quality of the material is very difficult. If material quality deficiencies are not discovered in time, extensive reworks could be a fact if the materials are assembled (Vrijhoef and Koskela 2000).

If the number of supplier is maximum and the project scope is complex; ensuring quality was difficult on project site. Some suppliers show the real material for samples and brought the other phony material that is completely similar to the previous one. Because of the complexity and tidiness of the

construction site sometimes it is too difficult check all material one to one on site. When the volume of the material supplied on the site increases it also very difficult to check each piece quality of material (e.g reinforcement bar). Poor logistics management in construction site brought the difficulty in checking quality of material.

- Poor quality construction:

The research results (Table-4.5), shows that the rank and RII given for poor quality construction by public body, contractors and consultants were 6th and 11th by suppliers with (RII 75.2%,62%) respectively. The result from the study shows that poor quality construction is one of the challenging problems in the construction industry. In most of the condominium project site in Addis Ababa, the quality of construction is below the standard because contractors look its own benefits by minimizing the overall project cost this could be, doing by using unskilled workers, using substandard material, reducing the ratio of materials mixed on site to form components (like concrete work). This shows that the poor logistics management is one problem in quality of construction projects.

- Transportation and environmental issue:

The research results (Table-4.5), shows that the rank and RII given for transportation and environmental issue by public body, contractors and consultants were 8th and 5th by suppliers with (RII 74%, 77%) respectively. Unplanned truck movement in urban construction sector creates to use more energy and increase air pollution that contributes to global warming through emission of carbon dioxide. As it can be seen from the result transport and environmental issue is one of the urban construction industries problems because of poor construction logistics management. In most of the construction project the construction trucks whether they are loaded and unloaded most of them moving here and there in city of Addis Ababa. Most of the trucks moving in the city increase the impacts such as noise and carbon monoxide emissions create direct and harmful effects on the environment. This also has its impact on health.

- Fraudulent activities:

The research results (Table-4.5), shows that the rank and RII given for fraudulent activities by public body, contractors and consultants were 8th and 6th by suppliers with (RII 74%, 72%) respectively. This is problems which some contractors use as a means of increasing their profits comprising quality of buildings. Construction sector is complex sector in which maintaining construction fraudulent activity is difficult without promising efficient logistics management. The result from the survey also shows that fraudulent activity is one that affecting construction activity in construction sector. Fraudulent activity such as bribe, using less standard material, paying for extra time to rented machine

for the time they are not operated, unclear overtime payment for daily labor. In line with this idea; Usman and Muhammad (2015) confirmed that "Ineffective management of logistics will result due to certain obstacles that affect the construction logistic management which resulted into fraudulent activity in the sector".

- ❖ Unwise use of trucks:-

The research results (Table-4.5), shows that the rank and RII given for unwise use of trucks by public body, contractors and consultants were 10th and 6th by suppliers with (RII 73.6%,72%) respectively. It indicated that, the problems of the trucks management in the project has been one of problems of the poor logistics management.

Unwise use of trucks is one of the problems on construction sites, especially in conjugated site. When construction trucks are not wisely used the trucks are simply become idle on site, and make queue and make the site more congested. Sometimes if the appropriate time delivery of material is not maintained and storage place is not prepared well, it is difficult to unloading the material. When volume of the site work increases congestion and trucks queue will increases traffic during peak hour, high volume traffic in urban areas, special event traffic congestion and increase of heavy construction trucks movement in urban areas make construction trucks to queue and make idle. Amornsaw adwatana (2011) shows in a study that number of unloading activities and the total waiting time for a truck on-site can be reduced with about 24 % and 33 %, respectively, therefore to solve such problem construction consolidated centers (CCC) are used. Therefore result from the survey showed that condominium projects have the same problems of managing construction trucks. These shows there are poor logistics management in the sector.

# CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## 5.1 Summary of the Research findings

The study intended to achieve specific objectives and based on these specific objectives, research summarized the findings in the following section.

- The findings of the study suggest that the construction industry stakeholder‘s awareness on the need and importance of logistics management collaboration has helped in the construction industry as it improves theft reduction, improve delivery and waste minimization. In addition, it increase profitability by reduces the cost of organizations.
- The research has assessed that construction is ineffective and many problems can be observed. Analysis of these problems has shown that a major part of them are logistics problems originating at the interfaces of different parties or functions, among which late and incorrect payments, design/engineering changes and difficulties in finding out client‘s needs, changes of client‘s requirements, long procedures to discuss changes are few of them.
- The findings show the main factor that leads to poor logistics in construction sectors. Poor logistics management impacts building construction sector in several ways, makes construction projects to be delayed, increase construction costs, decreases the efficiency of construction projects, makes difficulty to check quality and quantity of material, it makes congested site, material delivery delay, material damage , unwise trucks management etc..
- One of the common practices in the Addis Ababa Housing Development Agent, which can be taken as main cause for waste is bulk purchase for major construction material which the project office is supplying for the project. Even the main idea for this system is discount and transportation easiness, the drawback is much higher. Communication between the project office and branch project offices is underestimated considering huge amount of materials and items are at hand. The reasons for this are, there is no detail guideline in the check list how to go about it, no continuous training for the staffs in upgrading their skills, and introducing them to the modern systematic approach how to handle new stock, material at hand and distribution to the project sites.
- The results show that the actions that are usually taken to avoid the problems with material deliveries are good coordination between store and construction personnel helps in avoiding over ordering. It is also suggested minimizing design changes and good construction

management practice. Moreover, they suggest that having accurate and good specifications of materials can have favorable impact on material delivery.

## 5.2. Conclusion

The current study showed that poor logistics management compromises efficiency of building construction projects. For efficient construction logistics management, an integrated process is needed to ensure that the projects to be finished on time, within the budget and within the scope of contract specifications. Further, efficient logistics management is a crucial factor in increasing labor productivity and also effective logistics management systems will also assist the integration and coordination among contractors, sub-contractors and suppliers, which could increase construction workers productivity.

Most of construction projects are delivered at least many days or months or even a long time late beyond expected completion time. Because of this, the partners, the client, contractors, the society suffers a lot. Numerous reasons have been raised for project delay and cost overrun. For case, inadequate design, contractor's capacity, design change order, climate condition, fund, etc. But, problems caused by poor logistics management are not taken as one of the main reason for projects delay.

The main objective of this study is in identifying the major role of logistics management in the urban construction industry and its significance in construction projects specially in building projects. As discussed in the literature review, construction logistic technologies can give a multitude of benefits such as better control of material flows and coordination, as well as prerequisites for a more collaborative construction environment. With terminal-based construction logistic technologies, the most benefits lie within the consolidation impact and the opportunity of storing materials for later call-offs, giving superior control of how and when materials are delivered to site. Additionally the utilization of construction logistic technologies can reduce the negative impact from construction material flows on the urban transport system through the coordination impacts that arise. This is, however, under the prerequisite that the solution is designed with this in mind and takes the urban transport framework setting into consideration.

Urban construction affects the everyday urban life both through the construction site, and the material flows. Adding construction logistic technologies can reduce unnecessary impact on other stakeholders in the urban transport system in that coordinated material flows can lead to a reduction in the amount of material delivery vehicles that travels to site.

A successful project requires careful planning, organization and control throughout the project to achieve the correct result for the client. For the contractor, good planning, organization and control are essential in order to achieve a timely and satisfactory outcome for the client, and to ensure a financial profit. To ensure the successful implementation of construction projects there should be an effective teamwork between all parties. To ensure proper teamwork on construction sites, managers should be committed to change, workers should be able to work in teams, companies should be more clients focused, firms should be willing to change organizational cultures that do not promote partnering to maximize team building and team members should be empowered in decision-making to make partnerships meaningful.

## 5.3. Recommendation

Construction project is a complex and tedious process to manage each and every activity on the project sites. Efficient construction logistics management plays great role in reducing construction costs, by reducing wastage and extra costs. Therefore; if the logistics management of the construction sector is efficient, construction materials will arrive in appropriate time, place, quantity and quality and the construction work will be not interrupted by the waiting for materials. Construction sector should have logistics management department and each sector should have site logistics plan guide. The logistics plan guide helps to accomplish each activity according to the plan. When effective logistics guide followed, site wastage will be reduced, proper material storage will be maintained and easy to locate material on the site. Appropriate construction logistics guide, speeds up the project, and improves efficiency the work force. It also makes safer and clean working environment. Good logistics management also maintains health and safety on the construction site.

Concerning material procurements, bulk purchase order is one of major cause of wastage; this can be avoided by doing this bulk purchase for selective items not for all materials. Just in Time technique can be used instead, but this would need precession and very well coordination between the project office and suppliers to avoid delay.

To improve disciplinary problems like theft and bribe, some corrective measures must be done, like competitive salary for the employees in the stock controlling areas, establishing transparent and easy systems and controlling mechanisms, giving continuous relevant training and establishing competiveness between the workers and give some incentives.

Based on the findings of the study and the discussions above some general recommendations are listed below:

- ❖ As it can be seen from the outcomes of the research good coordination between store and construction personnel helps in avoiding over ordering of materials; hence, enhancing the material delivers systems. Public bodies should hire a logistic manager or facilitator to support and sustain the implementation in the management of material and also for the construction activity. The facilitator would have the responsibility to train the key players of the project in material handling and procedures and assists them in developing a schedule.
- ❖ Managers in construction firms should incorporate ways of reducing wastes and theft in their construction process which starts from the procurement of raw materials, transportation, storage and movement within the construction site for actual use in other words the whole supply chain of the construction process. There are some methods that can be employed to alleviate such challenges from the construction sites proposed in previous researches. For example on the research of (Jang and Skibniewski, 2008) they proposed a wireless sensor network system that can help protect materials from damage by real-time temperature measurement of humidity sensitive materials which results in mitigating waste from the construction site..
- ❖ For the construction sectors that are in congested urban centers like Addis Ababa introducing logistics centers and JIT is can be used to improve logistics systems in the sector which also used for improving urban traffic congestion.

This study has pursued to obtain knowledge concerning the problems related to Logistics management on a very limited scale. There is a lot of room for further explorations and research.

- This research project has taken four different stakeholder perspectives into consideration; contractors, consultants, public body, and suppliers. Future research should take other stakeholder perspectives into considerations as well. Some suggestions are transport ministers office, transporters, and residents. This would create a wider understanding for how construction logistics management affects the urban environment.

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