ASSESSMENT OF CONSTRUCTION MATERIALS LOGISTICS MANAGEMENT IN ADDIS ABABA CITY PUBLIC PROJECTS

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A Thesis Submitted to the School of Graduate studies of Addis Collage for the Partial Fulfillment of the Requirements for the Degree of Master of Science in Construction Technology and Management

ADDIS COLLAGE

August 2021

DECLARATION

I declare that this thesis entitled "**ASSESSMENT OF CONSTRUCTION MATERIALS LOGISTICS MANAGEMENT IN ADDIS ABABA CITY PUBLIC PROJECTS."** is my original work and has not been presented for a master's degree in any other university and that all source of materials used for the thesis have been duly acknowledged.

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Place: Addis collage

School of construction technology management

Date of submission: August, 2021

LETTER OF CERTIFICATE

This is to certify that SINTAYEHU GBREYOHANNES ZEBENE has conducted this thesis work entitled “Assessment of Construction Materials Logistics Management in Addis Ababa City Public Projects” is under my supervision.

This thesis work is original and suitable for the submission in partial fulfilment of the requirement for the award of Master of Science Degree in Construction Technology and Management

BELACHEW ASTERAY (Ph.D.) _____ _____

Advisor Signature Date

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ADDIS COLLEGE

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School of Graduate Studies

THESIS APPROVAL FORM

This is to certify that the thesis entitled: "**Assessment of Construction Materials Logistics Management public project"**

Has been carried out by: **SINTAYEHU GEBREYOHANNES** ID NO. **GSR/083/2011**.

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School dean _____ _____

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Date

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LIST OF ABBREVIATIONS

AACRA	Addis Ababa city road authority
AAHDPO	Addis Ababa housing development project office
AAHP	Addis Ababa housing project
BIM	Building Information Modelling
CLC	Construction logistics Centre
CMLMOP	Construction material logistics management optimization problem
COSO	Committee of sponsoring organization
CSCMP	Control supply chain management plan
EETS	European Electronic Toll Service
ETB	Ethiopian birr
FIDIC	Federation International Des Ingenious Conseils
GDP	Growth domestic product
HGV	Heavy-Goods Vehicles
IHDP	Integrated Housing Development Program
IRP	Inventory routing problem
KPI	Key performance indicator
LC	Logistics coordinator
MDB	Multilateral Development Bank
MLP	Material Logistic Plan
MoWUD	Ministry of works and urban development Ethiopia
NGOs	Non-governmental organizations
PASDEP	Plan for Accelerated and Sustainable Development to End Poverty
PPPA	Public Procurement Property Agency
SC	Supply chain
SCC	Structured supply chain

SCC Supply Chain Council

SCM Supply chain management

TPL (3PL) Third-Party Logistics

VRP Vehicle routing problem

WRAP Waste & Resources Action Programme

MOUDH Minister of urban development housing

AACM Addis Ababa city construction minister

ABSTRACT

*Most construction projects suffer from poor construction materials logistics management, activities on site which indicates the need for improving construction materials logistics**.** Further, most public projects are suffering from time and cost overrun, due to poor logistics material management. Construction Materials Management is a vital function for improving productivity in construction projects. IN this regard, previously no study has clearly showed which about policy, factor and auditing practice of construction material logistics have affected construction material logistics management in Addis Ababa city public projects that led to time and cost overrun. This research aims the assessment of construction materials logistics management in Addis Ababa city public projects. To achieve the purpose of the research, a stratified random sampling method was used to collect 165 sample data from the total population. Mainly questionnaire, interviews and case study was used as a tool to collect the data. IN this study a descriptive statics method was used as the major technique of to analyses data using Microsoft excel spread sheet and SPSS.To suggest possible mitigation (strategy/policy), to improving construction materials logistics on public project in the country of Addis Ababa city. the finding of this study exposed a policy related issue were most significantly determine the successfulness of material logistic management in those housing project as compared to other public projects. The main focus of this study would on materials deliveries and handling, storing, distribution and production procedure in the project site. as per the study finding , due to poor logistics planning, a lot of wastage is produced which leads to unnecessary expense and delay of project, which could be one of the causes for increment of final project cost. The study was showed that, by implementing other construction materials logistics strategy/policy, and technique, it is possible to minimize cost inflation of materials, to reduce the waste and storage costs.*

***Key words**: Construction materials logistics, supply chain system and Construction industry.*

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Construction contractors are increasingly engaged in supply of material from diverse sources around the world and this process starts with design and engineering pursued at manufacturers 'workshop, and ends with a series of journeys from factories to the construction site. Planning such a long supply chain requires examining all the stages involved in terms of time and costs (Wegelius-Lehtonen, et al., 1996).

Typically 10 to 15%, but up to 45% for some materials (WRAPa, 2007) of the total materials ordered for construction projects are either unused or end-up as waste. A round 35% of reduction in material wastage could be achieved by adopting more efficient logistic practices and the key to achieving this is the development and implementation of a robust Material Logistic Plan (MLP). These plans are an important tool for the construction sector to help ensure the right materials are in the right place at the right time in the right quantity. This is achieved through rigorous attention to design, materials specification, estimating and ordering as well as preventing the generation of waste from damaged, lost or surplus materials e.g. from poor storage or resulting from multiple handling of materials.

Logistics is the management of the flow of goods and related information. The goal of logistics management is to guide the flow of materials and information throughout the supply chain. Logistics is comprised of several processes, such as procurement, manufacturing, transportation, warehousing, inventory and information systems. From these important logistics functions, outbound logistics is a major function in the entire logistics system and the key link between manufacturers or service providers and customers in a supply chain. In addition, outbound logistics is a key driver of profitability in accompany, because it has a direct impact on both the logistics cost and the Users experience. Outbound logistics functions include packing, storing and transportation of the finished products and handling the export documentation and booking the transportation from forwarding agents (Chopra, 2003).

Poor material management is commonly linked to the inaccurate or surplus ordering of materials, damage to materials, inadequate storage, and rework due to errors, poor workmanship, defective site processes, and inefficient use of materials. Ordering materials that are not used on the project due to loss, wastage or being surplus to requirements has a cost which is often overlooked as it is built into the total project price and paid for by the client. The investigation show that the material cost would probably occupy 60%~70% of the engineering project construction cost, but the delivery service expense was account for the material cost about 17%, i.e., the physical distribution expense would approximately compose the engineering project construction cost 10%~11%, obviously physical distribution activity in engineering construction project important economic impact. But in reality, the engineering construction profession far has not given emphasis on material regarding delivery services. Therefore, enhances the engineering construction project the physical distribution management level, to excavate the project delivery service the value fountainhead and the promotion entire engineering construction project benefit has the vital role (Agapiou et al. 1998). The processes of the engineering construction project logistics was shown in Figure

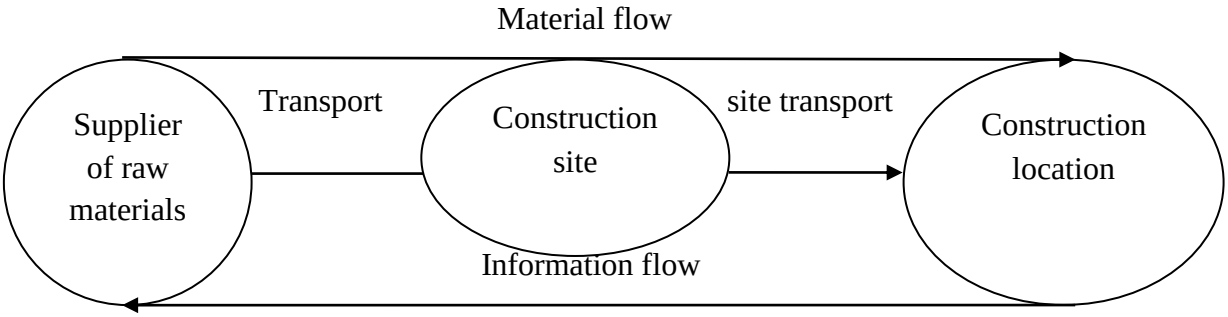

Figure1. 1 Logistics Process of Construction Project

Source (J. Chem. Pharm. Res., 2014)

Most of construction projects are delivered at least a few days or months or even years late. As its work on public projects in Addis Ababa city, at public Development Project Office, as senior supervisor and quality control officer, from the observation in different projects sites take a lot of time to be delivery, as long as two years and above, beyond expected completion time. Because of this, the stakeholders, the client, contractors, the society suffers a lot. Therefore, it takes this as an opportunity to study influence of construction material logistics in the public project office, in relation to project delay and cost overrun of projects.

The construction industry has important contributions to the Ethiopian economy, as demonstrated by its share in the GDP. For instance, the share of the sector in the total GDP averaged at about 5.2% in the period 2002/03- 2006/07. The construction industry also Contributes to the generation of revenue for the government. Public construction projects in Ethiopia are parts of the country's development initiative. It consumes considerable amount of the country's scarce financial resources since the construction industry is the highest recipient of government budget as part of government development program. Previous estimates showed that public construction projects consume an average annual rate of nearly 58.2% to 60%, of government's capital budget (MoUDHC, 2006; Wubishet, 2004). However, most public projects are suffering from time and cost overrun. Hitherto, no study has clearly showed which challenges have affected supply chain management that led to time and cost overrun. Hence, this research targets to identify the current practices and challenges that the construction supply chain is facing.

Materials supply is an important element of operation of construction enterprises and thus a factor affecting the quality of construction projects. The level of materials costs reaches up to 70% of total construction cost estimations. Therefore, any actions towards rationalization of size, structure and organization of material consumption, delivery, and planning are important in terms of project efficiency and require proper management. This study addressed some of the issue to construction materials logistics management in Addis Ababa city public projects.

1.2 Statement of the Problem

In most public construction projects in Addis Ababa, certain materials are procured and delivered to the project site for implementation by the public authorities. Logistics management is among the major project actions in the management of material flow from obtaining the raw components through the added value transformation process and delivering the final product (Henrique, 2007).

However, there is limited empirical evidence that can help to address this relevant issue to the best of the researcher's knowledge. Furthermore, there is no research conducted on public project implementation of construction material logistics management policy following project accomplishment. Hence, the shortcoming of empirical works that assess

any governmental controlling mechanism the material logistics policy, potential factor and stakeholders on projects, specifically on public project provides a rationale for new research contribution.

Most of public projects are not finalized within the given time line, cost and quality. As noted and reported in the city administration's project performance reports, unavalivitiy of material logistics policy, the existence different factors, absence of identified stakeholders, delay of audit finding are among the major logistics related problems that have an impact on project performance in one or another way .. 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). Construction material logistics has vital influence in the construction projects, in relation to project delays, incremental of material, storage cost increase and cost overrun. Therefore, this study was conducted to assess the logistics management practices of public project in Addis Ababa city with identify the gaps and propose best practice of logistics management to solve the problems stated. Underway in the study period mainly focused on, Addis Ababa: road projects, condominium housing projects, mega projects, etc. and assessment of construction material logistics management in the project office and site that influence the overall performance of the project. Furthermore it forwards a mitigation system or strategy that shows how the logistics management is better functioning.

1.3 Objectives of the Study

1.3.1 General Objective

The general objective of this research is to assess the construction material logistic management in Addis Ababa city on the case of public projects.

1.3.2. Specific Objectives

1) To assess Addis Ababa city construction material logistics management policies in reference with international practice
2) To investigate the factors affecting and the stake holders that influence construction material logistic management in Addis Ababa public projects

3) To evaluate the auditing practice of construction material logistics in Addis Ababa public projects
4) To forward a mitigation system or framework to support construction management in Addis Ababa public projects

1.4 Research Questions

1) What type of governmental controlling mechanism/policy about construction material logistics management in public projects?
2) What are the factors affecting the construction material logistics management in public project? And which stake holders influence it?
3) Which type of auditing system in public project on construction material logistics?
4) What type of mitigations/strategy they use to construction material logistics management in public projects?

1.5 Significance of the Study

The study provides information for assessment of construction materials logistics management in Addis Ababa city public projects. Therefore, this study was mainly adding additional literature for other to construction materials logistics management in Addis Ababa city public projects. The thesis can also be used as supplementary material for the construction projects to see their practices for to assessment of construction materials logistics management in Addis Ababa city on public projects.

The study would have significant inputs for the industry, especially, nowadays Ethiopia is becoming one of the fast growing countries in Africa, and one of the parameters for a county's development is the level of construction in different infrastructure, so most of the national budget is assigned in the construction industry. And this would show poor logistic management in the construction industry means a significant loss for the country. Therefore, this study would give professionals in construction area to have serious thought about what is at stake. And, the research also encourages other researchers to investigate further for improved logistic management system in the industry.

Projects are planned by considering specific resources like finance, required raw materials, material logistics system, skilled and non-skilled manpower and limited time table. As

widely believed projects involve large amount of money and a lot of stockholders like clients, contractors, consultants, suppliers, manufacturers, public, etc. Most projects take time and money more than they are required because of different reasons. And their delay cost a lot of money, for the client, the contractors well as the end user. So the author inspired that doing a study in one of the major variables in delaying in projects, inefficiency in logistics management.

The study also improves the understanding of people in the managerial position to give emphasis and spend enough amounts of money and time in planning and implementation of logistics management system that can save a huge amount of national budget.

1.6 Scope of the Study

The study only focused on public project under construction in Addis Ababa city which is registered by Ethiopian construction minister city administration.

Construction materials logistics management in Addis Ababa city on public projects assessment of strategy (policy), auditing practice, factors and stakeholders are vast issues to be addressed in this research. However, this research would like to address issues that are critical to construction material logistics management challenges and their impact on the coming public projects.

Among numerous projects being carried out in Ethiopia, the study is limited to Addis Ababa city where major public construction projects are under construction. In addition, as it is difficult to get a formally recorded data of all the currently active public construction projects, the projects selected for this research are those public projects that are being administered by MOUDH (AACM) and AACRA.

In addition, it would be focused on the construction stage and particularly on the flow (chain) of stakeholders, clients, consultant, contractors and suppliers and major construction materials.

1.7 Limitation of the study

- The study addresses only public projects that constructed in Addis Ababa due to limited time and budget. It was difficult to collect sufficient data and gave more

empirical results and finding of the result may not represent the whole public project in the country.

- Questioner data collection was limited to mega projects: ADWOA ZERO project, mayor office, housing project branch 8 offices, and Addis Ababa city road authority head office in Addis Ababa city.

1. 8 Organization of the Thesis

This thesis is divided ion to five chapters that organize, illustrate, and describe the steps taken to meet the defined research objectives. This thesis was organized as follows:

Chapter one;-containing introductory part with background of the study, statement of the problem, research objective and questions, scope and limitation of the study.

Chapter two;-is composed of the review of the relevant literature. Various books and journal article were reviewed to base the study on the existing literature, discuss relevant issues to build understanding of the subject.

Chapter three;-contains the detail of the research methodology and steps used to gather and analyse data from which finding are drawn.

Chapter four;-discuss the finding of this study which contains the analysis of the data gathered by means of data collection methods and instruments indicated in the methodology part.

Chapter five;-discusses summary, conclusion and recommendation. The references used in the study are listed at the end. Interview guide and questionnaire used are also included in the Appendix part.

1. 9 Definition of Terms

Before moving forward with the report, there are some definitions and concepts which need to be clear. From the introduction, it is obvious that logistics, construction logistics, construction material management and supply chain management would have the main part in this report.

According to (Winch, 2009), construction projects have been managed since time immemorial and traditionally this was the responsibility of the “master of the works.” Further; which states that project management is essentially an organizational innovation

meaning the identification of a team responsible for ensuring the effective delivery of the project mission for the client. In the construction management context it could be reasonable to state (Frederich Gould's 2009) view on construction. He defines construction as the concept of bringing together materials and products.

Logistics

There are many definitions for logistics, but the most commonly used is CSCMP's definition. According to CSCMP, logistics is defined as: "That part of supply chain management that plans, implements and controls the efficient, effective forward and reverse 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, 2016).

Logistic Management

The comprehensive definition of logistics given by (Taylor, 1997) was developed by the United State Council of Logistics Management in 1986 "the process of planning, implementing and controlling the efficient, cost-effective flow and storage of raw materials, in – process inventory, finished goods and related information from point of origin to point of final consumption for the purpose of conforming to customer requirements." (Sullivan et al., 2010)

Materials Management

Materials management is a process for planning, executing and controlling field and office activities in construction. The goal of materials management is to insure that construction materials are available at their point of use when needed. Poor materials management can result in increased costs during construction (Wanjogu, H., Iravo, M. &Arani, w.2015).

Supply Chain

Supply chain is a network between a company and its suppliers to produce and distribute Specific product to the final buyer. (Source: www.investopedia).

The supply chain comprises all parties from clients, contractors, consultants, suppliers and manufacturers that process the flow of project materials, information, and finances

CHAPTER TWO

REVIEW OF RELATED LITERATURES

2.1 Introduction

This part deals about different literatures' which was conducted on the area that provides the theories used for this research. Most of the literatures' discussed here under are conducted on different countries and situations to ascertain the fact that construction site involves a lot of activities and participants, and to understand the process and the interacting elements in construction material logistic management on public projects like housing program, road construction, mega project.

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 (Kini 1999; O'Brien 1989; Stukhart 1995). 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 (Kini 1999; Bell & Stukhart 1986). 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).

2.2 Theoretical Literature Review

2.2.1 Logistics Techniques

As background some logistics techniques are presented in order to get better understanding of the logistics topic. There are different logistics techniques (strategy) used by different companies in different countries. Some of these have been published and described by (WRAP, 2007) in the report Material logistics plan good practice guidance.

Construction Consolidation Centres

Construction Consolidation Centres are centres that are used to supply and distribute materials to several construction projects. These centres provide safe and efficient material flows from supplier to the construction site which makes it an effective supply chain management solution. Construction Consolidation Centres distribute materials in a right time, to the right place and in the required quantity (Gary Sullivan, et al. 2010).

Just-In-Time Delivery

Just-In Time delivery relates to frequent deliveries in work packages or loads delivered in time for usage. That helps to perform the next task without suffering from any delay. The best way of doing that is through a Construction Consolidation Centres or by suppliers themselves. Advantages with Just-In-Time deliveries are that it reduces on-site storage of materials, reduces the risk of damage of materials kept on site and even reduces risk for safety incidents (Liker, 2004). .

Demand Smoothing

Demand smoothing is a way of looking on the project activity plan as the whole and identifying how those activities could be balanced in order to reduce the amount of resources needed for transport, materials and labour to manage the actual task. Demand smoothing could be done both by contractors and clients and at any level in the supply chain (Harker et al., 2007).

On-site Market Places

A temporary storage space for consumable materials and small tools is defined as On-site Market Place. This space is only for widely used and shared between contractors materials and tools and includes normally threaded rod, metal channel, nuts, anchor fixings, screws, bolts, small drill bits and similar. Each contractor/subcontractor put their equipment and supplies to the MP for storage and distribution where a store-man is responsible when needed. When stocks become low they are refilled by the contractor individually or by the store-man who will order on their behalf (Harker et al., 2007).

Pre-assembled and Offsite Fabrication

It is considered good practice when materials, where possible, arrive to site prepared as far as possible for their final use. For example, it could be prefabricated bathroom modules where everything is installed on the factory including tiles, bathtub, mirrors and cupboards. In a smaller scale it could be materials prepared in packages where each package includes the right material type and right quantity appropriate to a room or a floor. The main point with this is to reduce the amount of thinking time during production stage and to do most of the thinking earlier in the planning stage. Also, doing as much work as possible on the factory contributes to better quality, time saving and lower transport requirements (Harker et al., 2007).

Storage and inventory management

Material tracking, inventory, and storage often lead to challenges on the job site. If there are too many people involved in the process, a simple miscommunication can lead to materials being misplaced, causing things to be held up or reordered. Keeping track of your materials is a huge challenge in construction, especially if it is a large job. A good tracking system is also important for helping minimize theft and loss, and it will help you find something quickly and easily. An easy solution is to implement an electronic tracking system. Automated systems with bar codes are popular, as you only have to scan something to mark that it has been received or removed from the site (Mangan, J., Lalwani, C., and Butcher, T. ,2008).

2.2.2 Third Part Logistics

Nowadays, some companies choose to outsource some or all their logistics activities by using Third-Party Logistics (TPL) providers to get financial benefits. The TPL provider is a firm that acts as a middleman and outsources the logistics activities but does not take the ownership of the products (Janné and Fredriksson, 2017). The TPL provider focuses on logistics issues that take place at the first steps of the planning process. The main target of the TPL provider is to deliver a safe, efficient workplace with well-planned logistics. In this way, contractors and subcontractors do not need to spend extra time to transport their materials within the construction site (Matouzko and Methanivesana, 2012; Matouzko, 2015). Some of the activities that can be outsourced are the warehousing, packaging, transportation, distribution and inventory management. It should be mentioned that the

relationship between the company and the TPL provider is based on mutual trust while it is generally accepted that their collaboration is strengthened under long-term periods (Janné and Fredriksson, 2017).

On site construction logistics is an important and often underestimated topic within the construction industry. Third part logistics companies were the first who realized possibilities for financial benefits by focusing on logistics issues earlier in planning stage. The main point with third part logistics services is to create a safe, clean and effective workplace where contractors and subcontractors do not need to transport their materials. This gives more time for skilled workers to do valuable work what makes production more effective.

2.2.3 Material Procurement

Material procurement is one of the activities involved in logistics. Material procurement involves the analysis of various vendors, making adequate decision to ensure that materials are bought at the right quality, in the right quantity, at the right time, at the right price, and from the right source (Chand, 2016). In the construction industry, material procurement follows a procedure to ensure that adequate materials are made available on site at the right time and of the right quality which includes: material indent, searching for vendors, interviewing/comparing vendors, selecting vendors, placing order and evaluating the performance of the vendors.

(Hines 2004) noted that certain components are necessary for successful material procurement including: price, quality, quantity, capability of vendor, vendor reputation, waiting time and sales offer. These factors have both direct and indirect impacts on project outcomes. Furthermore, certain logistics factors have been found to affect material procurement for construction projects. These factors include:

- **Late delivery of materials and components** this could be as a result of several factors including people, policies and procedures (Ritte, 2010). It could also be as a result of lack of experience of the procurement officer or inability to understand specification in vendor's quotation (Richardson, 2012).
- **Inability to forecast activity period** with accuracy many procurement officers will prefer to procure materials in bulk so as to take advantage of sales discounts. However, material procurement for construction projects requires that procurement officers accurately forecast

activity periods on site. Otherwise, it will be wasteful to stock pile materials without using them almost immediately (*International Journal of Civil Engineering and Technology, 2017*).

- **Delivery Inaccuracies** this can also result in cost and time wastages. In a situation where a purchasing manager order for a material and a different material is delivered, time would have been wasted in delivering the wrong material *(International Journal of Civil Engineering and Technology, 2017).*
- **Transportation**: Most of the materials used on construction sites are not manufactured on site but are procured from other places and transported to site. Transportation is a key factor that affects the efficiency of material logistics. (Bowersox, Closs and Cooper, 2000) noted that transportation cost covers a large percentage of logistics cost.
- **Storing Materials on**: Site Storing material on site can also have some negative impact on project outcomes. Material can be damaged by weather, moving equipment's or people (Fei, 2014).
- **Increase Waiting Time** between Activities Construction activities are usually done in stages. Each stage depends on the completion of previous activity (Aibinu, A.A and Odeyinka, H.A., 2006).

2.2.4 Roles and responsibilities of the construction logistics manager

- **Responsibilitie**s

The construction logistics manager is responsible for all aspects of the logistics supply chain, stores management, development and optimisation of site logistics solutions to meet the needs of the project.

- **Role of manger**

Planning/programming

- Plan site set-up to move labour, plant, and materials around site efficiently (e.g. hoarding, gates, site accommodation, cranes, hoists, security, temporary services, material delivery and waste management strategy, catering).
- Plan internal and external logistics routes through the project phases focusing on separation of vehicles, machinery and people.

- **Mobilisation**

Create a secure site

- Manage installation of site accommodation and manage these facilities
- Create operational procedures and method statements
- Organise site inductions, ensure induction records are securely stored.
- Create a schedule of logistics meetings and ensure logistics is represented at site meetings.

Supply chain management

- Describe the characteristics of the site, including site access /egress, storage capacity and arrangement by programme, labour, hoists, cranes etc.
- Understand procurement arrangements
- Control materials in and out of site.

Delivery management

- Select a delivery management technique, process and system.
- Provide logistics instruction to all project suppliers.
- Manage all movements to and from site and keeping associated records.
- Enforce the full use of the organisation's delivery management system.

(Source PMBOK,5^{TH} ,Edition)

2.3 Empirical Literature Review

2.3.1 Addis Ababa city construction material logistics management policies in reference With international practice

Background

Logistics involves the strategic (policy) and cost-effective storage, handling, transportation and distribution of resources. It is an essential process that supports and enables the primary business activity, like the construction of a building, construction of road in a city, to be accomplished. Effective logistics management can lead to the effective execution of a construction project. The outsourcing and subcontracting increases the number of organizations involved in the construction supply chain. The result of the technical complexities and the number of participants in a construction project makes the management and optimization of logistics chains quite difficult (Dimitris Papaprokopiou, 2010).

Material Logistics Plan Good Practice Guidance (Improving Construction Logistics, 2005) states, typically 10 to 15%, but up to 45% for some materials of the total materials ordered for construction projects are either unused or end-up as waste. A 35% reduction in material wastage could be achieved by adopting more efficient logistic practices and the key to achieving this is the development and implementation of a robust Material Logistic Plan (MLP).This is achieved through rigorous attention to design, materials specification, estimating and ordering as well as preventing the generation of waste from damaged, lost or surplus materials e.g. from poor storage or resulting from multiple handling of materials.

Regarding the project logistics, four basic models of supply systems are possible:

I. Independent supply chains for individual contractors, where selection of suppliers, supply planning and scheduling is the duty of each contractor,

II. Centralized supply system managed by general contractor or other party managing the whole project, by means of their own logistics departments,

III. Centralized supply system managed by an external logistics company,

IV. Combination of the above.

Integrated logistics for the whole project means the possibility of optimizing supply chains and coordinating deliveries, which is significant for sizeable construction projects that involve many contractors working in confined space. Shifting responsibility for supplies to many subcontractors may result in the building site congestions, excessive expenses and delays. Business organizations offering service in the field of logistics may exist in the form of independent companies or be created especially for the needs of construction project. According to their scope of activities they may take over all the logistic processes within the project's life cycle or focus on some functions, e.g. supply control, transport and warehousing. The complete logistic service of construction project may comprise (Strategic Forum for Construction Logistics Group, 2005):

1. Developing logistic concepts for designing and planning:

- ✓ Feasibility study of logistic alternatives,
- ✓ Plans of logistic processes and information flows,

2. Developing strategic guidelines for bidders:

- ✓ Preparing bidding requirements,
- ✓ Assisting bidders and supervision over their logistic solutions,

3. Assisting bidders (potential suppliers, forwarders and contractors) in bid preparation:

- ✓ Developing specific logistic solution to improve the quality of service,
- ✓ Developing logistic standards for bid preparation.

4. Developing plans of the building site logistic and supervising their execution, integrating purchase, transport and execution of construction works:

- ✓ Creating operational logistic centres servicing a complex of projects,
- ✓ Implementing IT systems,

5. Controlling

- ✓ Developing and implementing systems of quality assessment for logistic processes,
- ✓ Recording feedback information on the effects of implementing integrated logistics systems.

6. Optimizing supply and purchasing process

- Within the scopes of manufacturers, general contractors and subcontractors,
- Benchmarking logistic systems of other industries. The scope of the above logistic services partly complements and partly overlaps the constituents of the logistic plan for the whole construction project life cycle

Finance and Economy Development Bureau has released manual “Stock management manual” has been developed in 2010. The manual has described in detail how stock can be handled and has created different checklists to facilitate stock controlling procedures. (Finance and Economy Development Bureau, 2010) the manual has a description on:

- ➢ Verification and identification of items
- ➢ Stock distribution and Stock inventory

- Personnel's responsibility and who does what
- Methods for stock control and Stock pile management

According to a research by Abebe Zeluel and Solomon Berhe (International Labour Organization, Geneva, 2001), the Urban Development Policy and the Plan for Accelerated and Sustainable Development to End Poverty (PASDEP) strategy, have the objectives of promoting the role of urban areas in the overall national development. The policy and the strategy are further articulated in the Integrated Housing Development Program (IHDP), which has multi-sectorial goals, viz., provision of affordable and low-cost housing,

Different country experience listed below:

Here is some country's experience about logistics of construction material. In this literature some countries have a good logistics of materials policy (strategy) and it helps us to see the difference between our country experience and other country experience. It enables us to see the best policy and strategies beside that to take the best model for our countries.

Sweden

Policies: The environment is primarily impacted through the number of transports. Stockholm, for example, uses environmental zones and off-peak deliveries to deal with this. Regarding efficiency, the county of Östergötland had a policy of no disruptions to ambulance transportation when the hospital in Linköping was renovated Stockholm: Use of a construction logistics centre. This case illustrates the development of a city area in Stockholm, Norra Djurgårdsstaden. The city of Stockholm sets the conditions for the construction logistics by applying a clear environmental vision to the project, including goals for transport to the site and accessibility issues. A logistics coordinator (LC) was appointed to manage and coordinate all logistics activities to the site. This includes operating a construction logistics Centre (CLC) that all contractors on the site are required to use. Furthermore, the LC also offers contractors additional services related to materials handling on site. In cases of direct shipments, specified unloading zones are appointed that are to be cleared within two hours after unloading.

Poland's

Logistic processes are present in various fields of activity within a company (purchase, production, sale etc.). Isolating and integrating logistic tasks performed by all organizational units of a company results in creating logistics departments that coordinate all the flows. Three basic models of logistic systems are to be observed in building companies (Anna Sobotka, AgataCzarnigowska, 2005).

- ✓ Informal: where co-ordination of logistic tasks of separate departments and fields of activity is enforced within the existing organizational structure of the company,
- ✓ Semiformal: where a logistics manager takes the responsibility for the coordination of logistic processes of the company, but is not in charge of the departments, where these processes are conducted,
- ✓ Formal: where a separate department takes over all the logistic processes of the company.
- ✓ Contractors in Poland are usually only single links of logistic chains that provide a project with products, services, information and finance. In contrast to manufacturing industries, which profit with long-lasting partnership with suppliers and customers, logistic chains in construction are considerably more difficult to manage and to optimize. This results from:
- ✓ Diversification of projects (various materials, methods, location of each project means a new constellation of supply chain members each time)technical complexity of a project, Number of participants in the project,
- ✓ Domination of the bidding system of contractor acquisition (random partnership within the chain),
- ✓ Difficulty in adjusting each member's logistic routines to the logistic system of the project.

Brussels

Policies: The Strategic Road Freight plan of Brussels Capital Region has only a limited explicit focus on construction logistics transport, and expresses a preference for

1) Making more use of inland waterway transport via the inland port of Brussels and

2) Reducing the impact of building sites on mobility. Environmental aspects of construction logistics are mainly impacted indirectly by changes in urban mobility policies such as the enlargement of the pedestrian zone in the city Centre (2016), the introduction of a Low-Emission Zone in Brussels (2018) and the existing noise legislation (which prohibits evening and night operations, unless exceptions are granted for works for which the duration of significant impacts needs to be minimized). At the national level, which is also applicable to Brussels as stipulated by the European directive on the interoperability of European Electronic Toll Service (EETS), Belgium implemented a road pricing scheme for Heavy-Goods Vehicles (HGV), resulting in on board units with GPS logging for taxation.

Sweden

Logistics knowledge is seldom represented in the organizations in the industry, and rained logisticians are in principle not seen, at least not in the construction companies. This makes difficulties related to logistics hard to solve, since there is a lack of terminology as well as ideas of possible solutions. And in the Swedish as well as international research related to the construction industry, logistics is an almost non-existing field. A number of studies have come to the conclusion that there is an enormous potential concerning logistics in the construction field. (ErdalÇakir ,Stanbul, 2009).

Brazil's

Increasing competition among Brazilian building companies has led them to develop new strategies focused on production aspects of construction. They are giving more importance to constructive rationalization, quality management systems, labour productivity, and material loss studies (Silva and Cardoso, 1999). The study indicates logistics improvement also becomes an important element for building companies wishing to develop competitive advantage. The paper discusses how logistics concepts and management tools can be applied to building construction in order to achieve competitive advantage.

From random selection of construction companies in Brazil selected, three case studies were conducted in order to identify:

(1) General difficulties in logistics management process;

(2) New visions, methods and tools that are being applied on building companies;

(3) The opportunity of using these visions, methods and tools in building companies. Some key points for logistics efficiency improvement identified in the first company are:

- ✓ Strategic politics for supplier's relationship definition;
- ✓ Site layout planning considering the different site phases;
- ✓ Agent's roles and responsibilities definition in site logistics activities;
- ✓ Duplicity elimination and velocity increasing in data processing and information exchange. For the second case the company concentrates efforts on developing management techniques to obtain reduction costs and competitive advantage. Some key points for logistics efficiency improvement identified in the second company are:

- ✓ Logistics coordination function definition;
- ✓ General procedures for acquisition process definition;
- ✓ Supply plans elaboration;
- ✓ Duplicity elimination and velocity increasing in data processing and information exchange. In the third case study taken, the main key points for logistics efficiency improvement identified are:
- ✓ Process integration with suppliers increase;
- ✓ Information vehicles improvement including Electronic Data Exchange (EDE) implementation;
- ✓ Interference reduction among subcontractors and agents roles and responsibilities definition in site logistics activities

Vienna

Policies: The environment is mainly impacted through the number of transports. An environmental impact assessment was performed for Seestadt Aspern that stated that a maximum number of transports per day must not be exceeded.

Guidelines: To impact the number of transports, overall site organization, the management of transport logistics and trip data acquisition and environmental assistance for the Seestadt Aspern urban development project were analysed. The logistic area was prepared and

managed by a construction logistics and environmental management agency, which coordinated and checked the primary guidelines and objectives by holding regular meetings and conducting site visits. Use of logistics coordination this case concerns the construction of a new city area in Vienna, Seestadt Aspern. Examples of tasks handled by the LC are: logistics centre for material storage, temporary construction roads, loading zones, areas for storage of equipment, gravel processing for excavation material and a concrete plant on the construction site.

Before few years ago there is no clear manual about construction material logistics by on itself now a day it developed. The manual developed by Ethiopian construction project management manual series on construction project material management working manual under theses manual it describe every construction material logistic management system as policy of the country. Checks that guidelines are fulfil by using sensors and gates, plans the number of truck movements to and from the public transport network and at site through a check-point. Although the LC is responsible for coordinating deliveries to the construction site, each contractor can act independently regarding material handling on site as long as it follows the EIA's and LC's regulations. As a result, each contractor manages their own equipment for material handling (lifts, fork lifts, load carriers, cranes, etc.).

Amsterdam

Policies: The city's urban (freight plan, 2016) stated that the City of Amsterdam would develop guidelines for constructions logistics. There are no formal guidelines for tendering for sustainable construction logistics.

According to study (Silva and Cardoso, 1999) facing all the challenges to develop logistics management some general guidelines are proposed as follows. These guidelines are organized in three different levels: strategic, structural and operational. Although the companies have different production rationalization strategies it is believed that this proposition is valid for all of them. Some strategic guidelines for logistics improvement are:

- ✓ Decision of customer service level desired, what means, desired stock levels and acquisition request attendance time;
- ✓ Decision of logistics goals to be reached in short, middle and long time and performance indicators for them;

- ✓ Decision of relationship politics with suppliers, seeking supply chain process integration and partnering.
- ✓ These strategic guidelines are general logistics management politics and procedures for decision making. The firm must understand what logistics is and must establish clear objectives to control its performance.

Structural Level

- ✓ Structural level guidelines are related to structural organization of firms through a systemic view. Some of them are:
- ✓ Determination of agents‟ responsibilities in logistics process, especially the logistics coordination responsible. Here it is suggested two ways to structure logistics within a company's organization. The firms can operate to develop a new administrative function that will be responsible to coordinate these activities or can create a "logistic pole", which consists of a collective forum involving multiple agents for logistics coordination.
- ✓ Definition of an information system design and a mechanism for information exchange among actors of logistic process. Firms must seek in a later future to implement tools, which will permit information exchange in "real time".
- ✓ Definition of a general procedure for purchase practice (centralized or decentralized). Operational Level In an operational level it is necessary at least to develop the following guidelines:
- ✓ Definition of critical materials for physical flow rationalization;

Operational Level

In an operational level it is necessary at least to develop the following guidelines:

- ✓ Definition of critical materials for physical flow rationalization;
- ✓ Elaboration of supply plans considering the three hierarchical levels of planning. It should be developed a general initial plan, an intermediate plan for a shorter period and a commitment plan in a weekly basis for daily activities;

- ✓ Elaboration of site layout planning considering technical and economic feasibility of several internal transport alternatives for handling materials and previewing different arrangements for the different site phases;
- ✓ Planning of vertical transport equipment use in a daily schedule;
- ✓ Elaboration of designs for production for critical services;
- ✓ Incorporation of constructive system changes seeking to let them more rationalized or industrialized. Also mainly use logistics techniques as policy of the company

2.3.2 Factors affecting the construction material logistics management

Construction Materials logistics management is the system for planning and controlling to ensure that the right quality and quantity of materials are specified in a timely manner (Donyari and Flanagan, 2009). Material management is a management system that integrates purchasing, shipping and material control from suppliers. Based on those definitions, generally materials management can be defined as a process of planning, executing, and controlling the right source of materials with the exact quality, at the right time and place suitable for minimum cost construction process. Selection of personnel for marketing, purchasing, inventory control, stores management and materials handling and their training and placement is also to be seen by the construction materials logistics management department.

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

1. Unclear division of responsibilities between site and supply chain

   This causes negative effects such as congestion around construction sites since vehicles are often unable to be unloaded and loaded immediately upon arrival. Instead, they

should wait for further instructions before being directed to the right location on site (nordmann, D., 2012),

2. Inefficient supply chain

   Incoming transports are not coordinated due to a lack of data and supply chain planning, and unnecessary high numbers of transport movements are sent to the site. Furthermore, contractors experience low delivery performance and thereby lack materials and resources when needed, this hinders the progress of the project and generates express transports, thus further increasing the number of transports close to the construction site (Usman and Muhammad, 2015).

3. Inefficient logistics on site

   Lack of control at the construction site and inferior planning lead to material losses and extra costs as well as hazards for workers at site: Furthermore, even more transports are generated to replace the lost materials, as will trucks with low fill rates due to small shipments (Fadiya, 2012)

4. Lack of coordination between construction project and society

   By which we mean all parties related to the construction project. The surrounding society impacts the on construction site in the form of the residents and shop owners close to the construction site and share, for example, streets and parking with the construction activities. The stakeholder's would also affect the construction site through shared utilities such as water, electricity and heating (Agapiou, et al. (1998). The emergency services also have demands regarding the construction site as they require access to the site and the surrounding activities. Generally below listed most factors

1. Planning and Scheduling

2. Monitoring and Controlling

3. Organization and Personnel

4. Delivery, Storage and Storage facilities

5. Usage and Surplus and Waste control

6. Delay due to rejection of materials from quality control team

7. Transportation problems, Seasonal problems

8. Labour strikes

9. Improper handling of materials, Lack of material management

10. Communication problems, Hike in material prices

The following factors, as currently practised, contribute to inefficient logistics in the construction industry (Strategic Forum, 2005):

Short-Term nature of construction process:

Construction work is seen as a one-off job in which teams are built for a short period of time. This makes it difficult to build optimised logistics system in a way that is possible in manufacturing and retail industries. Each project is regarded as unique; every project is a prototype and because each site is different, hence the design is different (Wegelius-Lehtonen, 2001).

Fragmentation of activities within the construction process:

The various teams, such as design team and construction team, involved in construction process are fragmented. This may cause suppliers not to fully understand the implications of design, materials and components choices making them, sometimes, to supply wrong materials and/or wrong quantities of material to site. The primary focus of logistics functions in construction is to improve coordination and communication among project participants during the design and construction phases (Shakantu *et al.*, 2008).

Lack of transparency in costs:

Costing in construction is less transparent than in other industries like retail and manufacturing because decisions are often based on cash flows. The way costs are recorded does not portray the benefit of logistics in removing non-value-added activities from construction process

Inadequate tracking facilities on site:

There is lack of adequate and real-time tracking and monitoring facilities for materials and equipment on site (Jang and Skibniewski, 2008). At site level, research has shown that very few major contractors have any systems, either paper or computer-based, for tracking and

controlling materials. Hence, they have almost no data that give any information on the quantities, values or location of materials on site, or anywhere else in the supply chain (Hill and Ballard, 2001). Inadequate tracking facilities can also affect the quality of construction because a material such as ready-mixed concrete requires timely delivery and placing in the construction area. Therefore, concrete mixer trucks require real-time positioning and tracking. One key objective of that will be to automatically record important events of the truck so as to derive operations data such as travel times along designated travel routes, on-site queuing times and unloading times. Such data will provide valuable input for keeping quality control, analysis of logistical efficiency of ready-mixed concrete deliveries and simulation modelling of concrete production-delivery-placing operations for productivity improvement (Lu *et al.*, 2007)

Unclear definition of responsibility and authority;

There is no clear definition of responsibility and authority for logistics, expected in a supply chain, in the construction industry.

Lack of proper performance measurement:

There is lack of proper performance measurement for construction logistics e.g. delivery performance, stock availability, timeliness of waste removal, quality and site storage quantity. Because of competitive bidding in the construction industry, the lowest bidder gets the contract and the project is rejected or accepted based only on conformance to technical specification. Other performance measures which relate to the process itself are then neglected. Therefore, the construction industry has to find new process oriented approaches to improve its operations. (Wegelius-Lehtonen, 2001).

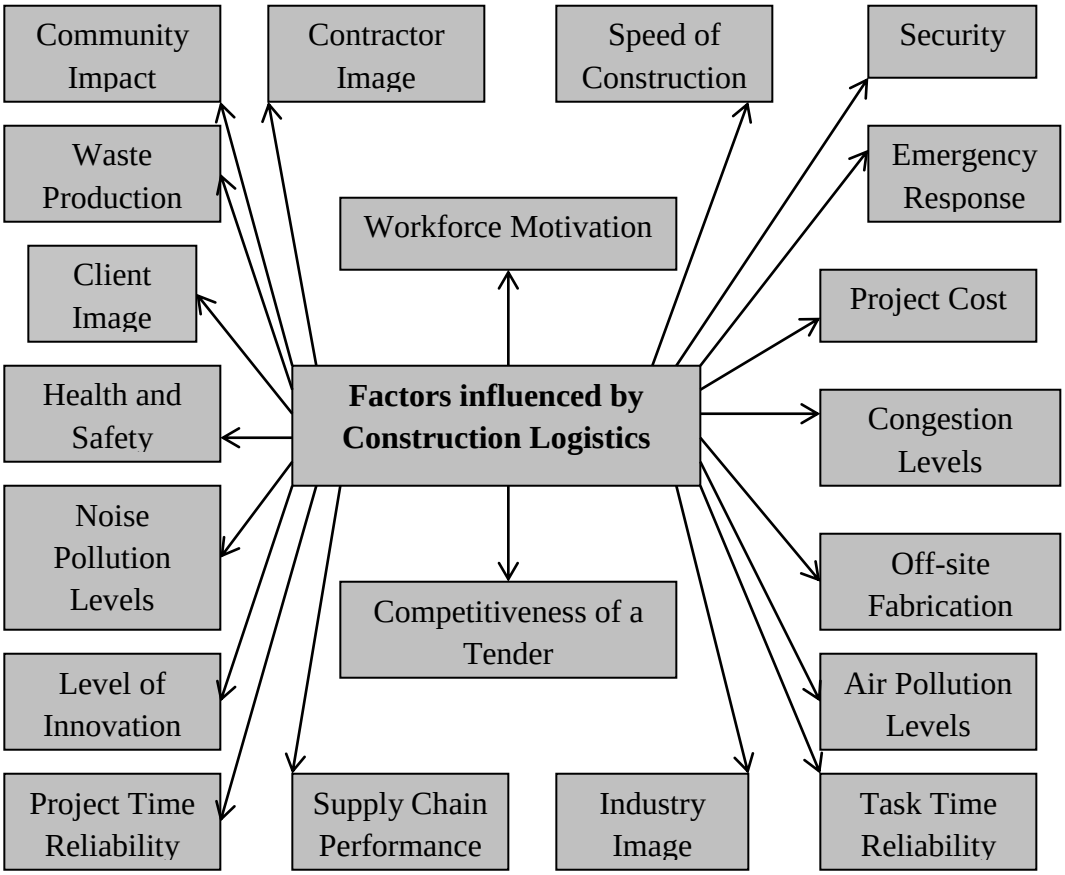

Figure 2-1: Factors influenced by Construction Logistics

(Source: Sullivan *et al.*, 2010)

2.3.2 Stake holder that influence construction material logistics management

A stakeholder is a person or group of persons who are affected directly or indirectly by a project. In the field of project management a stakeholder is an individual and/or organization having an interest in the success of a project. Project stakeholder management includes the processes required to identify the people, groups or organization that could impact or be impacted by the project. (PMBOK). Stakeholder's as described by (Freeman, 1984) is any group, or individual, who can affect, or may be affected by the outcomes of a corporation's objectives. Based on the power and intention to impact the outcomes stakeholders can value or delay a project according to their individual concerns and expectations (Olander and Landin, 2008). This supports the importance and relevance of doing a comprehensive study of stakeholder involvement and identifying the key methods which can help in increasing the stakeholder involvement during planning stage, in order to understand better how to commence good management of stakeholders in the construction industry.

In the past, passive approach was mostly developed by the organizations for informing stakeholders about project developments, depending upon traditional communication methods such as newsletters, printed publications and annual meetings. One-way communication strategy was adopted by such organizations (Mark Ritchie, 2008). Gradually, organisations choose to involve stakeholders more actively in the decision-making process particularly with respect to new project developments. They aim of increasing project stakeholders involvement is to encourage and ensure more positive commitment with the project outcomes.

Whenever a certain project is started the actions you take in completing that project and the projects you run will affect people. As a project manager more people you affect, the more probable it is that your actions will impact people who have power and influence over your projects. These people could be strong supporters of the project or they could block it. (Mark Ritchie, 2008). In running a project successfully Stakeholder Engagement is an important area that can help in winning support from others. It helps the Project Manager ensure that his/her projects succeed where others fail (Naresh Chappidi, 2008) states that there are two major elements to Stakeholder Engagement: Stakeholder Analysis and Stakeholder Planning. Stakeholder Analysis is the technique used to identify the key people who have to be won over for the project. Stakeholder Planning is then used to build the support that helps the project succeed.

Construction industry consumes huge amount of investment which is usually provided by invest Stakeholders are the backbone of a construction project and without them a project can never come into existence. Construction projects, from their early stages to the post project completion phases are executed through the efforts and involvement of various groups of people. These groups are referred to as the project stakeholders' (Amir hossein, 2014). The importance of the project initial and planning phases has been advocated by scholars (Zwikael 2009; Cleland and Ireland 2006). Several of the most important decisions such as establishing different project requirements, identifying project needs and objectives, agreement on project financing, schedule and organization and setting up strategic directions are completed at these phases. Needs and expectations of every stakeholder need to be understood as every stakeholder in a construction project has some interest.

Identifying stakeholders, then engaging, gaining and maintaining their support and commitment is a continuous process.

Stakeholders can be classified into four areas Power, Legitimacy, Proximity and Urgency. This classification depends on their position in relation to the organisation or project (Yang et el., 2009)

Through positive engagement with stakeholders, project managers, procurement managers and purchasing staff would be able to improve the quality of the outcome. This is because stakeholders can provide important and often unknown information as well as support once communication takes place rather than putting obstacles in the way of progress.

Analysis of stakeholder is a substantial practice to recognize and evaluate the competence and salience of significant participants (Bal, 2013). A complete analysis would help to bring the most capable and significant people into the strategic and decision making process (Nguyen et al., 2009). Merely identifying the stakeholders is not adequate; managers and owners are required to evaluate the interest of each stakeholder in order to clear their prospects on decisions of the project (Johnson and Scholes 1999). In the project life cycle the number and nature of stakeholders may change, it is therefore recommended to review the identification throughout the project (Moodley, 2002). (Olander ,2007) encouraged that it is the key responsibility of project leaders to answer the requirements and needs raised by their project participants and to be able to carry out, control and manage the project decision making process. Inappropriate management and supervision of stakeholder can cause problems in the technical and management mechanism of a project. In addition, Bourne and Walker (2005) highlighted that the conflicting and unseen stakeholder agendas, if not well managed, can lead to many project failures. As stated by Olander, 2005 for a project management team an important issue is the identification of those stakeholders who can affect the project, and then managing their opposing requirements through good communication in the early stages of a project. That is why this research has been focused on evaluating the level of involvement of stakeholder during planning stage. As the stakeholders influence is not fixed. During the entire life cycle of the project the analysis of stakeholder must be conducted and updated, to attain the purpose of gaining knowledge

about the potential influence various stakeholders have at different stages of the project (Olander, 2005).

According to (Cleland,1995), successful implementation and completion of projects is reliant on fulfilling the anticipations of different groups of stakeholders including clients, project managers, designers, subcontractors, suppliers, funding bodies, users, owners, employees and local communities (Newcombe,2003). Participants with extraordinary influence and great importance such as project manager and owners should be closely involved in the entire project lifecycle to increase their provisions to the project (Post et al. 2002). However, when in certain situations, their involvement cannot be assisted; it can result in serious problems such as wrong planning and resourcing, time and cost overruns, quality issues, confusing objectives and other similar problems (Mohammed and Abdullah 2006; Doloi 2013, Hossein et al. 2015). In his study examined the existing level of stakeholder participation during the project's process of quality planning. According to the writers stakeholders have the capability of controlling the communication and movements of resources in the project and frequently provide the needed resources. Proper managing and participation of significant project participants should be an essential part of any project management plan because they have a solid influence on an organization's continued existence. For identifying and categorizing substantial phases involved in the planning of the project a series of literature reviews was conducted in this study. Outcomes of the study validate the levels of engagement of the four stakeholder groups involved in the process of planning and create a basis for further improvement of involvement of stakeholder.

Classification according to stakeholder attitudes towards the project Olander (2007) view stakeholders as being either proponents or opponents of the project and similarly (Aaltonen et al., 2008; Chinyio and Akintoye, 2008) consider stakeholders as being supportive, neutral or anti to the project. These are very important for the purpose of decision making and resource allocation by the project management especially to be able to convert the neutral, opponents/anti to supportive stakeholders.

In the context of Supply chain management, stakeholders may be part of the considered Supply chain (e.g., in the form of suppliers or customers) or, while being supply chain-external actors, recognize the impact of the supply chain actors' performance. According to this distinction, stakeholders comprise primary stakeholders, such as customers and

suppliers or employees and top managers, and secondary stakeholders, such as government and non-governmental organizations (NGOs), trade associations and competitors, or media and community (Meixell and Luoma 2015). In this study, the author assess stakeholder influences as an obligation to manage the supply chain sustainably or as a penalty for unsustainable behaviour, which reflect pressures, as well as the motivation or stimulus for sustainability in the supply chain, which can be understood as incentive.

These include the client, project sponsor, project manager, members of the project team, technical and financial services providers, internal/primary or external /secondary consultants, material and equipment suppliers, site personnel, contractors and subcontractors as well as end users. They are also known as internal stakeholders

Primary stakeholder's	**Secondary stakeholder's**
Customers,	Government, trade unions,
Suppliers,	NGOs, wider public Competitors,
Employees,	Local community and,
Shareholders and,	Media
Top management	Funding Bodies/Sponsors
Consultant and designing team	
Contractor/ Subcontractor	

Criteria for Stakeholders Interaction

(1) Knowledge dissemination,

(2) Consultation,

(3) Stakeholder diversity,

(4) Stakeholder interest,

(5) Existing collaborations and network, and

(6) Information

Stakeholders' interests and influences are not constant and can vary from one stage to another and even from time to time in a particular stage of the project lifecycle (Cleland, 1995; Jergeas et al., 2000; Olander, 2007; Aaltonen et al., 2008; Ward and Chapman, 2008;). This is an indication of the dynamic relationships that exist among the stakeholders themselves as well as between the stakeholders and the project which also shows that events and actions are interdependent on each other (Pajunen, 2006; Olander, 2007; Nash et al., 2010). The stakeholders involved may have their respective expectations from the project and satisfying the expectations of project stakeholders throughout the life cycle of the project is instrumental to the successful completion of construction projects (Atkin and Skitmore, 2008)

2.3.3 Auditing system of construction material logistics management on public project

"Companies that were once leaders in their sector, including Kodak, Blackberry, Sears, and Marcy's, have suffered massive declines in value and sector status." Whole industries, like taxi cabs, travel, and retail, have seen massive business model shifts with the arrival of game-changing players like Uber and Amazon." (Leech, 2017) In addition, to purely strategically risks, companies must be aware of a wide range of financial and reputational risks (Alma, 2016).

In order to assure shareholders and to manage those risks, companies increased their interest in internal control and internal audit. "Internal Audit's objectivity, perspective, and skills can assist stakeholders and provide valuable insight". (McDonnell, Kinsella and Healy, 2017) "Internal control is recognized as a key corporate governance mechanism and disclosure of information about internal control systems is viewed as a significant component in the process of restoring public trust in corporate probity in the wake of financial scandal." (Spira & Gowthorpe, 2008)

Audits are often viewed as falling into three major types:

1) Audits of financial statements,

2) Operational audits, (performance) and

3) Compliance audits.

1. Audits of financial statements: - The goal is to determine whether the financial statements have been prepared in conformity with generally accepted accounting principles.

2. Operational audits: - An operational audit is study of some specific unit of an organization for the purpose of measuring its performance. The operation of a unit can be evaluated for its effectiveness and efficiency.in our case construction material logistics auditing practices.

Five main components, application which creates control (Graham and Rutgers Accounting Web, 2015):

- ✓ Control environment - what kind of message the management sends to its employees about the importance of internal control?
- ✓ Control Activities - actual controls that are in place, for example, segregation of duties, authorization and transactions
- ✓ Information and Communication - how are the results and to whom are the results communicated in the organization? How the departments communicate between each other? Is it internal communication (within organization) and also external? (to shareholders)
- ✓ Monitoring - how are the controls monitored by management; regular monitoring to uncover issues and ensure that the problem is communicated and solutions are found; an answer to dynamically changing environment.

COSO Framework's role is to drive internal controls and to allow the realization of these goals using improved organizational performance and governance. Therefore it is vital that all structures comply with internal control principles. Principles must also be relevant to the organization. Only in this way the value-adding internal control is created.

Key benefits of implementing internal control are increased efficiency of operations and management of risks. However, management will also be supported by (Uzun, 2009):

- ✓ Application of standardized procedures, rules, and regulations;
- ✓ Securing entity's current assets;
- ✓ Providing reliable financial reporting;
- ✓ Ensuring compliance with laws and regulations;

- ✓ Elimination of income or resource losses;
- ✓ Goal-oriented and accurate decision making;
- ✓ Identification and prevention of fraud

The audit checklist is just one of the many tools which are available from the auditor's toolbox that help ensure your audits address the necessary requirements. It stands as a reference point before, during and after the audit process and if developed for a specific audit and used correctly will provide the following benefits:

1. Ensures the audit is conducted systematically

2. Promotes audit planning

3. Ensures a consistent audit approach

COSO Framework's 17 Principles of Effective Internal Control

Table: 2.1 COSO Framework's 17 Principles of Effective Internal Control

Internal Control Component	Principles
Control environment	1. Demonstrate commitment to integrity and ethical values 2. Ensure that board exercises oversight responsibility 3. Establish structures, reporting lines, authorities and responsibilities 4. Demonstrate commitment to a competent workforce 5. Hold people accountable
Risk assessment Control	1. Specify appropriate objectives 2. Identify and analyses risks 3. Evaluate fraud risks 4. Identify and analyses changes that could significantly affect internal controls

Control activity	1. Select and develop control activities that mitigate risks 2. Select and develop technology controls 3. Deploy control activities through policies and procedures
Information and communication	1. Use relevant, quality information to support the internal control function 2. Communicate internal control information internally 3. Communicate internal control information externally
Monitoring	1. Perform ongoing or periodic evaluations of internal controls (or a combination of the two) 2. Communicate internal control deficiencies

Source :(www.coso.org)

In the government sector, a commission of trade inspectors was established by government regulation in 1917 to undertake monitoring of trade and customs in the country. The inspectors were required to report their "negative" and "positive" findings on (1990):

- ✓ Income raised and amounts expended on maintenance (consumption needs);
- ✓ Employees who did little work, but have much expended on their maintenance (consumption needs);
- ✓ Those who worked hard and brought much income with little expenditure on their maintenance;
- ✓ The period of service of an employee and the type of service he rendered;
- ✓ Ways and means of minimizing cost by folding jobs to be performed by few employees;
- ✓ Suggestions for improving departments whose expenditures were too high relative to the income they generated;
- ✓ Existence of proper and sufficient top executive authorization for all types of expenditures; and
- ✓ Observing that surplus (more than necessary) employees were placed in market places and check-points.

2.3.4 Conceptual framework/model for construction material logistics (some mitigation)

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.

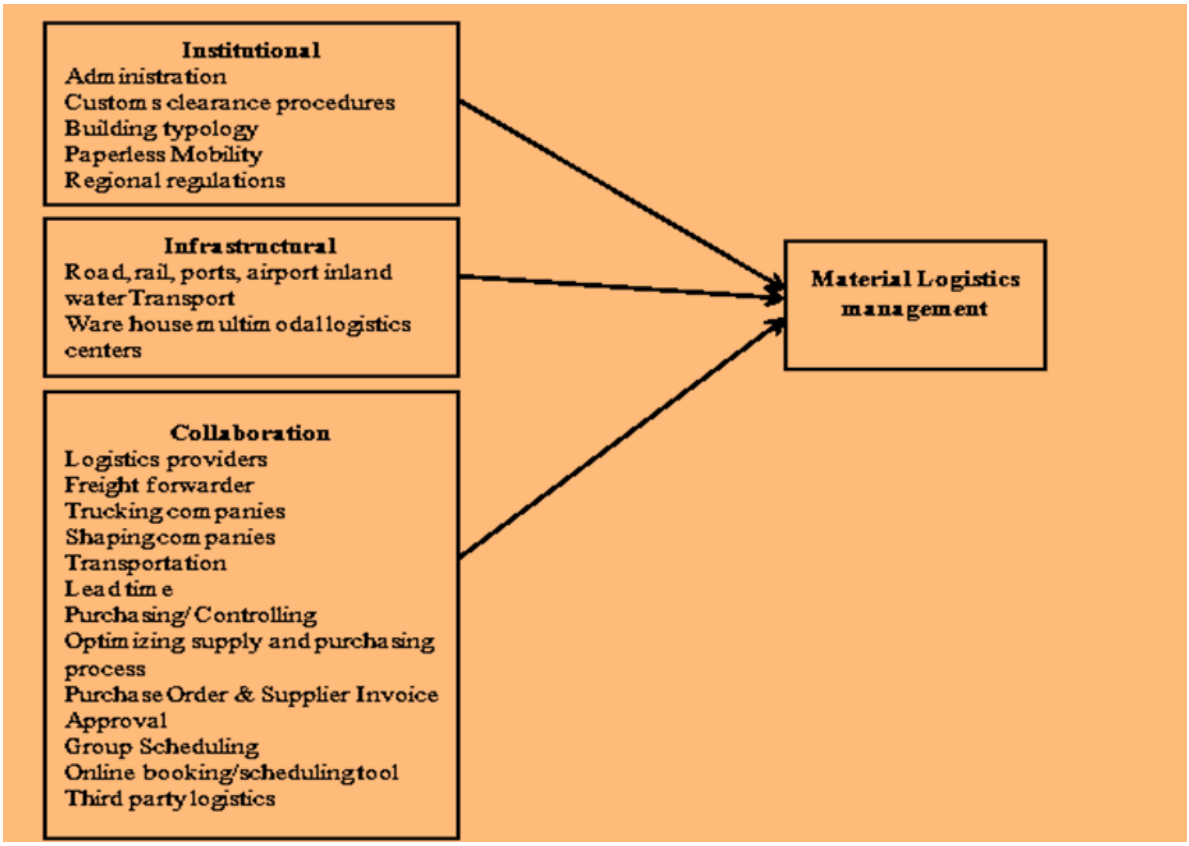

Figure: 2.2 Frame work model construction material logistics (source…Google)

2.4 Summary of Research Gaps

Based upon the above review of literatures many studies have explored different aspects of material logistics management in various Projects**.** Even though adequate study about the construction logistics conducted by different researchers for different areas for example general logistics in construction, only supply chain management, software based logistic of material, there are few studies effectively conducted in most of African countries, Europe country.

There are several factors within the scope of construction material logistics management and each of these factors can give rise to potential problems. There are many factors which contribute to poor material management in construction projects (Zakeri et al. 1996).

Many workers recognized the importance of construction material logistics management on public project with site work strategy however the practical application of this strategy is limited because the absence of developed frame work as whole public projects, so: This paper rule out this research gap. Assessment of potential factors and stakeholder that highly impact on construction material logistics management, information's concerning both the potential exposure to give material logistics factors and its impacts such as project delay, quality of work decrease in this study address the dominant factor and stakeholders for logistics of material.

Few studies have been conducted in Ethiopia on logistics issues mainly focused on the investigation of importance of logistics, software and supply chain related to the construction activities and their causes as well as the consequences. None of these studies dealt with development of a system/frame work/ policy and auditing system to in construction material logistics in the construction industry. Thus the aim of this research was to sufficiently explore the ground facts of construction material logistics management in Addis Ababa public construction projects to fill the knowledge gap in the area.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter is discussed research design, population and sampling method, sources and tools/ instruments of data collection, data analysis methods and general the study procedures and the method used to conduct the study related to its objective that discussed in chapter

3.2 Research Design

For this research the study uses descriptive research design method for assessment of construction materials logistics management in Addis Ababa city public projects.

In this study, both qualitative, quantitative methods were used data related to the target population of the selected construction companies and workers. For each approaches had its limitations and advantages; using the approaches in combination is vital in order to find better result from the analysis and investigation regarding construction material logistics management in Addis Ababa public projects. The qualitative design approach deals with data which are primarily verbal and derive meaning from the participant's perspective. It is used to collect relevant data through methods such as interview, field observation, company document and manuals review. Qualitative approach whereas the quantitative data were collected using questionnaires. Further the study applied a qualitative approach by interviewing a selected respondent as a survey tool. When this study using a descriptive research designs, it is to describe assessment of construction materials logistics management in Addis Ababa city public projects.

Research Methodology Flowchart

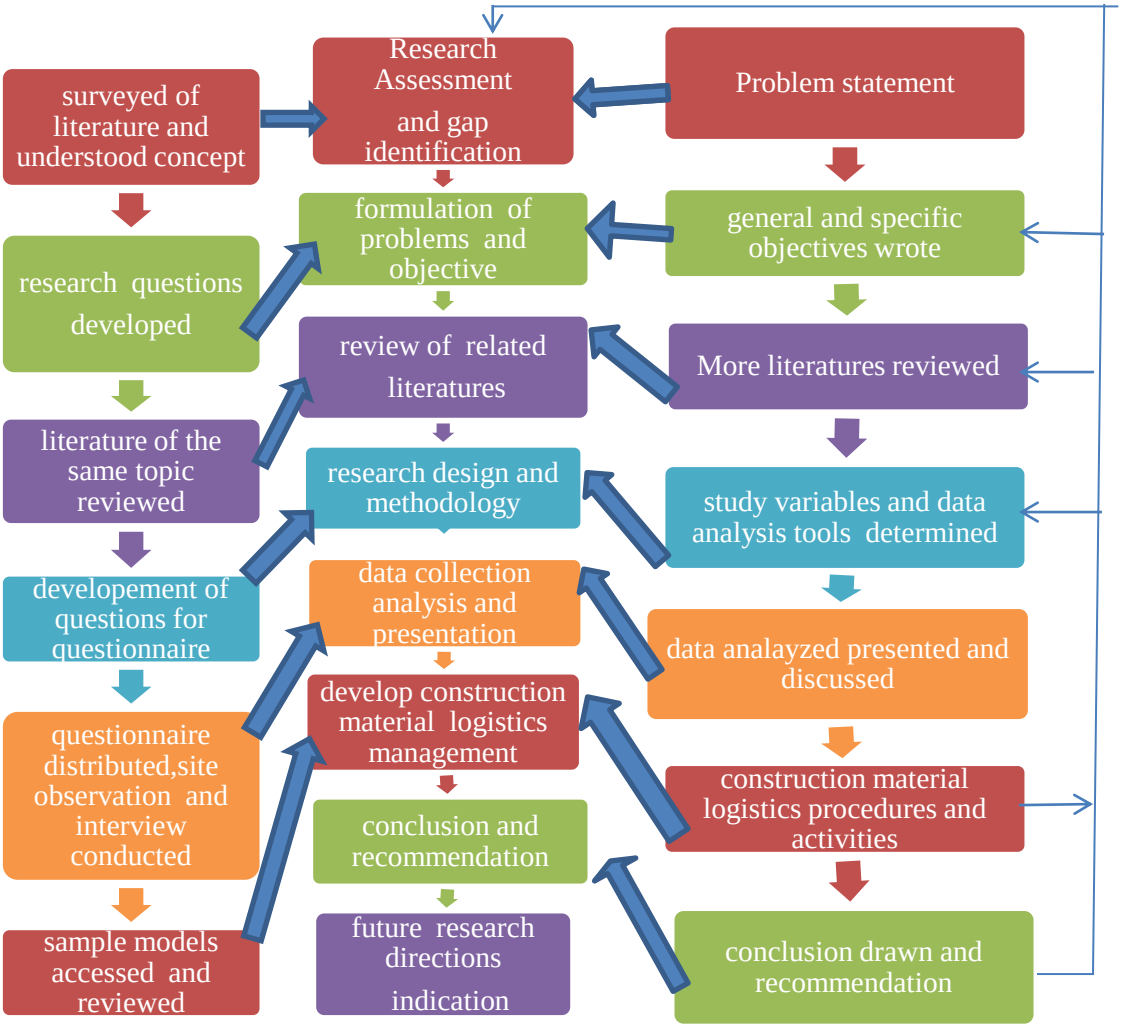

Figure: 3. 1 Research methodology and Design flaw chart

3.3. Sources of Data

Both primary and secondary data sources are used for collecting relevant information that are required for reviewing and analysing in order to draw conclusion and forward recommendation in this study beyond provision of a system for managing construction material logistics in construction industry.

Qualitative data is usually non-numerical and used to provide meaning and understanding. Quantitative data is believed to have great validity and depth.

3.3.1 Primary data sources

Primary data are the data obtained from the original source of information and they are more reliable and with high confidence level of decision making with the trusted analysis having

direct intact with the occurrence of the events. The following techniques were some of the mechanism of primary data obtaining approaches.

Construction sites/ or work environment and employees in construction site are taken in to account and preferred as sources of primary data rather than the business centre and workers at office, Because in Ethiopian companies are not feasible economically.

3.3.2 Secondary Data sources

Secondary data sources are data those provide information gathered from published materials of various types and easier to get. Among these sources, widely used for this study are constriction minister manual's related logistics of material and local articles and literatures are reviewed in order to acquire deeper understanding about construction material logistics in Addis Ababa city public projects related concerns.

In general the study uses different type of data source these are

- ✓ People – survey or interview individuals and/or groups.
- ✓ Documents- review existing documents.
- ✓ Observations- observe organizational practice and programs

3.4. Sampling technique and sample size determination

A stratified random sampling technique that is considered as a technique fairly represents all of the public project logistics workers in those public projects was implemented to select the representative sample size for the study. The public construction projects with three groups were stratified into their project capital and tasks and based on division and category of ministry of Ethiopian construction and housing development agency. The projects were stratified in to three strata as: mega projects (Adwa zero and mayor office), Addis Ababa housing projects (branch8 housing office) and Addis Ababa road construction authority head office based on their capital budget and work they executed.

3.4.1. Sample Size Determination Procedure

For construction on public projects and the employees of these public project to be included in questionnaire survey of this study, the representative sample sizes are required to be determined using some scientific procedures and methods. The following sub sections focused on the determination of sample companies and construction workers.

3.4.2. Sample Size Determination Procedure for Construction Companies

In this study first collected information which population are main role in each company by the performing pilot project of human resource management on construction material logistics and finally it demonstrate as follows:

Out of 280 sample size from the three major strata's, among these construction project the majority 150 (53.5%) are AACRA, whereas only 80(28.6%) and 50(17.9%) are AAHP and Mega projects, respectively. To select proportional sample size of different projects, using simple random sampling technique they are grouped in to three strata of AACRA, AAHP and Mega projects. For these research paper from the above sample population I take 165 sample population using simple random sampling these are 88(53.3%) are AACRA, 47(28.48%) are AAHP and 30(18.22%) for Mega project.

Table: 3. 1 Indicates sampling Frame

S/No	Department	Target Population		
		AACRA	AAHPDO	Mega
1	Internal Audit	33	18	11
2	Material engineers	31	17	12
3	Purchasers	43	23	12
4	Transport Facilitators	13	7	5
5	Suppliers	12	6	3
6	Project managers	2	1	2
7	ICT Monitoring Unit	16	8	5
	Total target sample	**280**		

Source: Human Resources Database AACRA, Mega project office, AAHPB8 office, 2021)

From these projects the relevant data are obtained to analysis, draw fundamental conclusions and provide recommendation for respective specific objectives for logistics of Construction Company. On the basis of facts mentioned above, the results of analysis from these sample companies is believed to be convenient to represent the logistic construction materials status

and practices and related issues in other construction projects in Addis Ababa as well as country level.

3.4.3. Sample Size Determination for Questionnaire

Since the total population of the three public project that mainly focus construction material logistics is known, the sample size (n) of the employees to participate in questionnaire is obtained using single population proportional formula (Singh, 2014) for finite population as follows:

$$\boldsymbol{n=\frac{N}{1+N(e)2}}$$

Where,

n = sample size of employees of the public projects from all strata;

N= total number of population/or employees in 3 sample public projects during the survey time; which is total of (N) =280 construction materials logistics workers were estimated.

Sampling error (e) of the sample population =0.05 and Z0.05=1.96, 95% confidence level

The sample size on which this study would be conducted is calculated based on the above strata as:

$$\boldsymbol{n=\frac{N}{1+N(e)2}} \quad = \quad \boldsymbol{\frac{280}{1+280(.05)2}}$$

(n) = 165employees (sample workers)

Therefore, for the questionnaire survey 165 public workers were taken from the 6 mega project, 12 branch of housing office and one head office for AACRA selected sample public projects.

The calculated sample size (n= 165) is allocated to three strata taking the size of projects and number of employees in proportion to the companies' total population of workforce (MoUDC, 2013), AACRA, mega human resource document

Table: 3. 2 construction companies and sample respondents

SN	Size	Levels included	No of public projects	No for survey	Remark
1	>1bn birr	Mega project	1	30	
2	Function	AACRA	1	88	
3	<1bn birr	AAHP	1	47	
Total	All public projects		3	165	

These 165 employees have equal chance to participate as respondent in this study. As provided in data analysis and presentation section only 145 respondents have correctly responded the questionnaire whose opinion and response are taken in to consideration for analysis and decision making.

The target populations for this study would assessment of construction materials logistics management in Addis Ababa city public projects located three- sub city (project location). The population size of assessment of construction materials logistics management in Addis Ababa city public projects any public project in city (condominium housing), road construction and mega project and the basic data collection instrument assumed to be utilized is questionnaires, an interview and case study for respondent and reviewing their documents and preparing of questioner. This method is selected because it helps me to get more reliable result for this research.

3.5 Data Collection Tools

The study was used the data sources to produce the following basic documents: respondent's documents and archival documents. The respondent's documents were collected using questionnaires from material engineer, foreigner purchaser head local purchaser head,, store keeper, transporters, property managers, top manager of public projects, trade union consultants (project owner's representatives) and contractors. Interviews for department head and case study from ongoing projects are performed. This questionnaire survey has closed-ended questionnaires. Archival documents were from ongoing and completed

projects, in which contract documents, project construction work progress reports (Records), minutes of meeting; site book, site diaries, and material logistics report document were investigated thoroughly which were very important in assessment of construction materials logistics management in Addis Ababa city on public projects

3.6 Data Collection Methods

Data collection is a process of collecting information from all the relevant sources to find answers to the research problem, test the hypothesis and evaluate the outcomes. Data collection methods can be divided into two categories: secondary methods of data collection and primary methods of data collection. For this research were used both primary and secondary data collection methods. Primary data are interview those face to face interview had conducted department heads (material engineer head, auditor head, purchaser head), observation and preparation of questioner. Secondary data is referring of their construction material logistics management recording books and purchasing directive. Qualitative data was obtained through administration of questionnaires using 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) the construction material logistics on public project variables. Descriptive and Inferential statistical techniques were used for the analysis.

It preferred to use probability type of Stratified random sampling data collection technique for this thesis because of different project to be observed.

3.7 Reliability & validity

Reliability refers to the extent to which the data collection techniques or analysis procedures will yield consistent findings (Saunders, Lewis and Thornhill, 2007). The data reliability test is measured by using Cronbach's Alpha. According to William and Barry's scales exhibiting a coefficient alpha between 0.80 and 0.96 are considered to have very good reliability, between 0.70 and 0.80 are considered to have good reliability, and alpha value between 0.60 and 0.70 indicates fair reliability and when the coefficient alpha is below 0.60, the scale has poor reliability (William,G.Z, and Barry J. B., 2010). Accordingly, the Cronbach's Alpha values of the survey indicate good reliability and from SPSS the result are presented in table below:

Table: 3. 3 Reliability Statistics of the variables

Variables	Cronbach's Alpha	Number of Items
Policy	0.706	16
Factors that influence construction material logistics	0.765	20
Stake holders that influence construction material logistic	0.901	11
Auditing practice	0.795	16
Conceptual frame work (best model)	0.926	16

Source: Own survey result, 2021

3.8. Method of Data Analysis

In this study, descriptive statics was the major technique of statically analysis through using Microsoft Excel spreadsheet and SPSS. The quantitative data collected from sample respondents who are working in the Addis Ababa housing projects, Addis Ababa road construction authority and Addis Ababa mega project were analyzed. Using mean score, frequency, and standard deviation and raking to assess the construction material logistics management system, the qualitative data's were gathered from general comments and interview and analyzed separately but presented in combination with the quantitative information.

The research method is structured in theoretical exploring of relevant topics for an assessment construction material logistics Addis Ababa city on public project (road, condominium housing and mega projects), practical participation of the stakeholders through questionnaires, case studies and observations.

In order to have same ground for evaluation, the questionnaires are designed to according to the firms all of the respondents from the perspective of consultant (client) and contractors (supplier).This research has highlighted the touchiest issues in relation to supply chain management policy, logistics policy on construction for public project ideal or real in the city of Addis Ababa to answer.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1. Introduction

This chapter focuses on the data analysis and presentation ways based on the data collected through interview, observation and questionnaire. Total of 165 employees within three projects were included in this study as respondents for questionnaire. In addition, to implement construction material logistics management system that incorporate policies and procedures to promoting logistics of materials in a project, the detail analysis of the data obtained from site observation and company records carried out.

4.2 Response Rate

A total of 165 questionnaires were distributed to respondents. From 165 questionnaires a total 145(87.8%) were returned and while the remaining 20 (12.2%) were not returned at all therefore, 145 (87.8%) questionnaire was valid for analysis, Furthermore, the data extracted from completed questionnaires were coded and entered to Statistical Package for Social Sciences (SPSS) IBM version 25 and analysed using descriptive and inferential statistics as discussed below. The subsequent parts present the data along with its statistical analysis. The findings are then discussed and analysed according to research objectives.

Table: 4. 1 response rate

SN	Segments included	Distributed question	Response rate	
			Number	%
1	Mega	30	26	86.6
2	AACRA	88	79	89.8
3	AAHP	47	40	85.1
	Total	165	145	87.8

4.3. General information

4.3.1. Company type

The main general information of respondents considered in this study are project location, age, gender, project type, organization type, highest contract value, classification of firm, number of project implement in five years, work experience, number of storey or length of road and job category. Among 145 employees selected as a sample size for questionnaire survey 79(54.5%) are from AARCA, 40(27.6%) are from AAHP and 26(17.9%) for Mega project.

Table: 4. 2company type included in the study

Company's	Frequency	%
AACRA	79	54.5
Mega	26	17.9
AAHP	40	27.6
Total	145	100

4.3.2. Project location

Regarding the project location among 145 respondents 6(4%) of the respondents have been worked for Adwa 0 project, 20(14%) have been worked under the mandate of mayor office of Addis Ababa city administration, 79(54%) of the respondents have been regulated under the control of Addis Ababa city road authority and 40(28%) of the respondents have been employed under the mandate of Addis Ababa housing program branch offices.

Table: 4. 3 Project location

Project location	Mega projects		AACRA		AAHC		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Adwa 0	6	23					6	4
Mayor office	20	77					20	14
AACRA Head office			79	100			79	54
AAHC Branch offices					40	100	40	28
Total	26	100	79	100	40	100	145	100

As indicated from the findings of the research relative to other projects 54% of the respondents were from Addis Ababa city road authority head office.

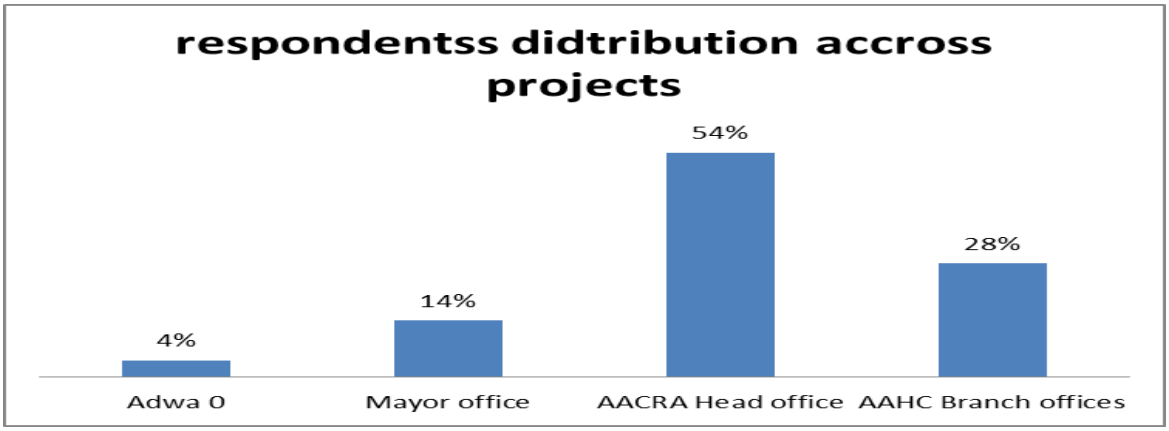

Figure: 4. 1indicating the respondent's distribution in the projects

4.3.3 Gender category of respondents

With respect to the gender distribution of respondents 108 (74.4%) of the respondents were male and the rest 37(25.5%) of the respondents were females.

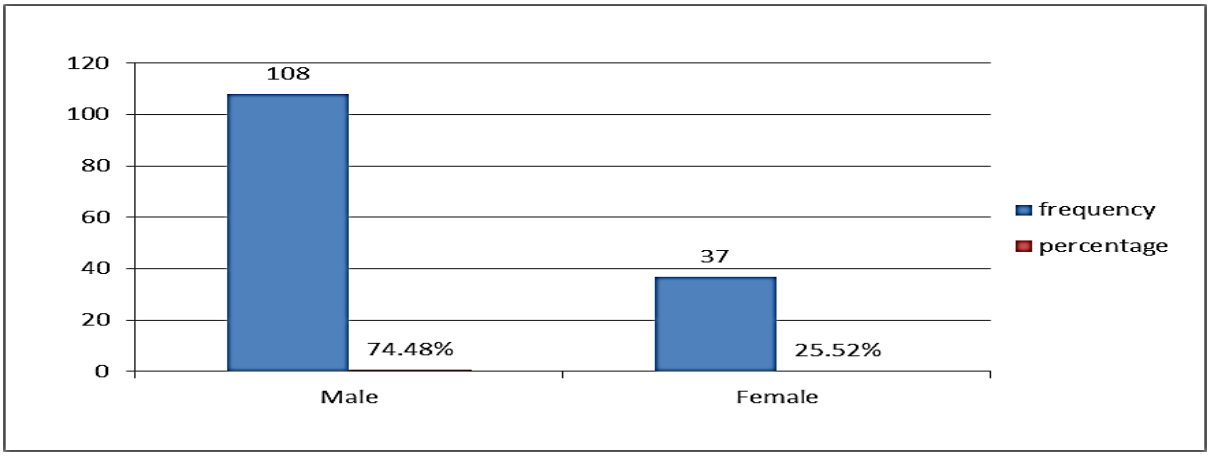

Figure: 4. 2 Gender category of respondents

As compared to other projects more female (29.1%) involvement was observed in road projects.

Table: 4. 4 Gender category of respondents

Gender	**Mega projects**		**AACRA**		**AAHC**	
	Frequency	**%**	**frequency**	**%**	**frequency**	**%**
Male	16	61.5	56	70.9	36	90
Female	10	38.5	23	29.1	4	10
Total	26	100	79	100	40	100

4.3.4 Age of respondents

In the table below which shows the age of the respondents; about 42.8% of the respondents have 36-45 years of experience, and 57.2% have 20-35 years. This suggests that the respondents have a wide and long experience in the sector. Relatively younger respondents were appeared in all projects. Consequently demands and existing operations to the logistics perspective of the firms is well understood concept by those companies**.**

Table: 4. 5Age of respondents

Age group	**Mega projects**		**AACRA**		**AAHC**	
	Frequency	**%**	**frequency**	**%**	**frequency**	**%**
20-35	16	61.5	31	39.2	36	90
36-45	10	38.5	32	40.5	4	10
46-55			16	20.3		
Total	26	100	79	100	40	100

4.3.5 Organizational representation

In this study it was found that, 9 (6.2%) consultants, 8 (5.5%) contractors and 124 (85.5%) clients participated in the study. In general out of 124 clients, 78 (62.9%) participated in road projects, 18 (14.5%) participated in mega projects but only 28 (22.6%) were in housing projects.

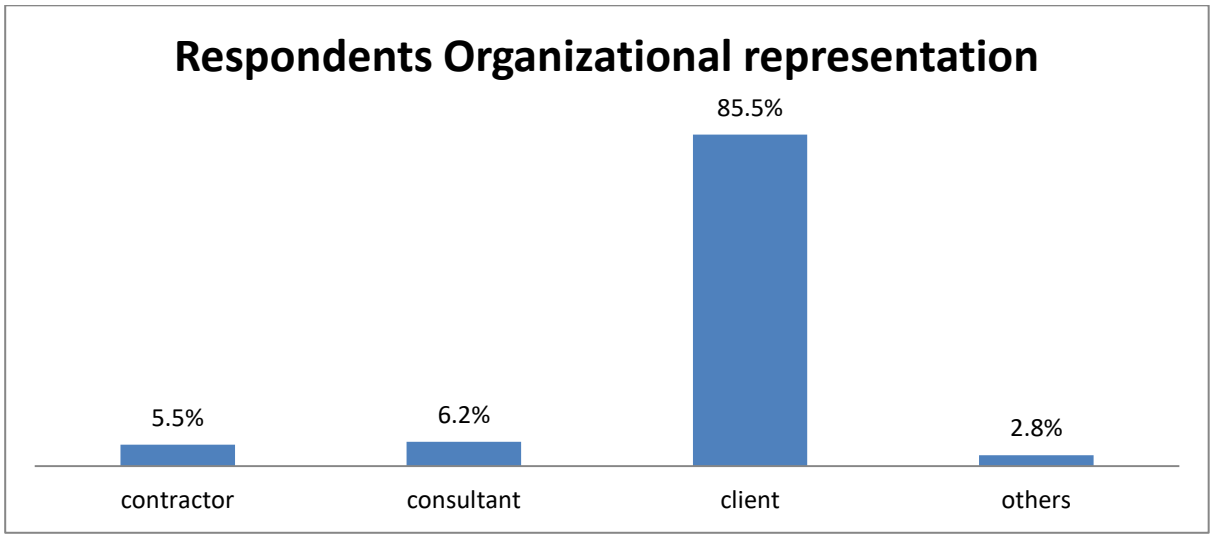

Figure: 4. 3 indicating the Organizational representation

Table: 4. 6 Organizational representations

Type of organization	Mega projects		AACRA		AAHC		Total	
	frequency	%	frequency	%	Frequency	%	frequency	%
contractor	3	11.5			5	12.5	8	5.5
consultant	5	19.3	1	1.3	3	7.5	9	6.2
Client	18	69.2	78	98.7	28	70	124	85.5
Others					4	10	4	2.8
Total	26	100	79	100	40	100	145	100

4.3.6 Respondent's job positions

As shown in the table below 62 (42.8%) of the respondents were supervisor engineers whereas 27(18.6 %) were material engineers. It has been found that 19 (13.1%) of respondents were purchase heads, 12 (8.3%) were Project manager. Further it has been found that majority of the respondents in all projects were supervisor engineers which was followed by material engineers.

Table: 4. 7 indicates the respondent's job positions

Respondents position	Mega projects		AACRA		AAHC		Total	
	frequency	%	frequency	%	frequency	%	frequency	%
Resident engineer					10	25	10	6.9
Project manager	2	7.7	7	8.8	3	7.5	12	8.3
supervisor engineer	14	53.8	31	39.2	17	42.5	62	42.8
material engineer	6	23.1	16	20.3	5	12.5	27	18.6
purchasing head	4	15.4	10	12.7	5	12.5	19	13.1
Lead engineer			5	6.3			5	3.4
other			10	12.7			10	6.9
Total	26	100	79	100	40	100	145	

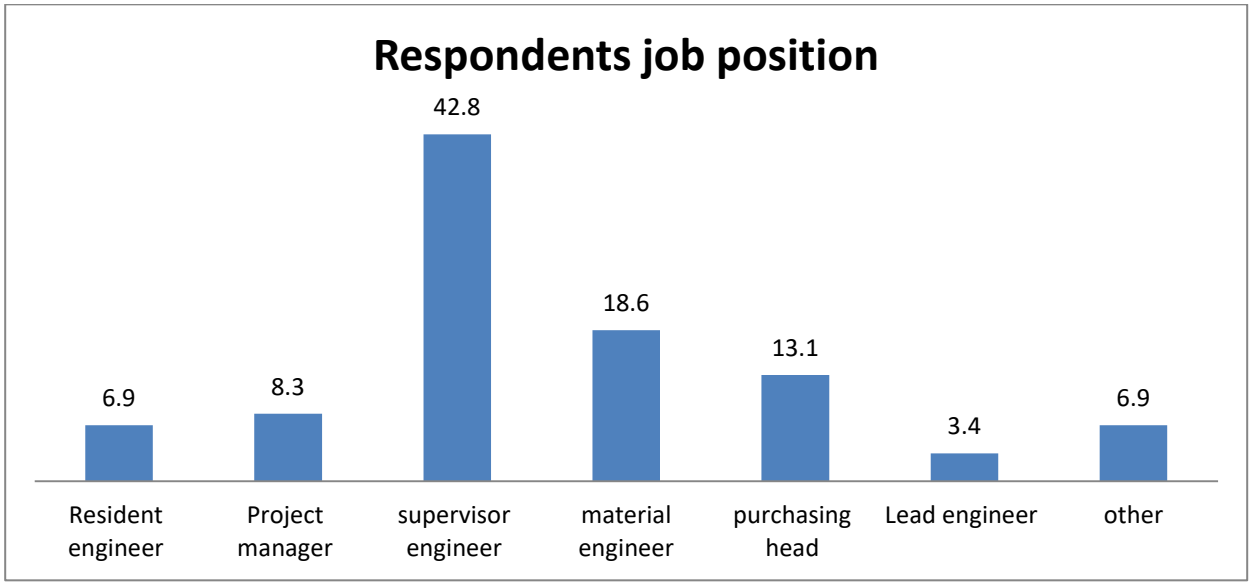

Figure: 4. 4 indicates the respondent's job positions

4.3.7 Respondent's work Experience

In the table below which shows the work experience of the respondents; and accordingly about 40% of the respondents have 5-10 years of experience, 31.7% have less than 5 years, 15.2% have 10-15 years of experience and 13.1% have an experience less than 15-20 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.

Table: 4. 8 Experience related to building, road and mega project construction project

Experience in years	Mega projects		AACRA		AAHC	
	Frequency	%	frequency	%	frequency	%
<5	10	38.5	24	30.4	12	30.0
5-10	6	23.1	32	40.5	20	50.0
10-15	5	19.2	13	16.5	4	10.0
15-20	5	19.2	10	12.7	4	10.0
Total	26	100	79	100.0	40	100.0

Regarding the respondents experience in terms of contract value they have been worked indicated in table below. Accordingly, those respondents who were worked in projects with a contract value of 50-100 million birr were 60(41%), greater than 100 million birr were 34

(23%), less than 10 million were 28(19%) and in the range between 10 and 50 million birr were 23(16%). Thus majority of respondents were having attending in project contract value I the range of above 50 million birr.

Table: 4. 9 the highest contract value you ever worked (in birr, million)

Birr in million	Frequency	%
<10	28	19%
10-50	23	16%
50-100	60	41%
>100	34	23%
Total	145	100

4.3.8 Firm type and project engagement

The firm type that the respondents working for were evaluated in the study and accordingly 135 (93.1%) of the respondents were engaged in government projects, whereas the rest 10(6.9%) were engaged in privately owned projects. Further majority of the respondents were engaged in road projects that were owned by the government followed by housing projects.

Table: 4. 10 Classification of your firm in construction business

Firm type	Mega projects		AACRA		AAHC	
	Frequency	%	frequency	%	frequency	%
Governmental	25	96.1	78	98.7	32	80
Private	1	3.9	1	1.3	8	20
Public						
Other						
Total	26	100	79	100	40	100

In addition, the company's project practice and analysis was analysed and accordingly the company had previously participated in 2 or fewer projects (16%). 32 (22.1%) participated in 6-8 projects and 71 (49%) participated in more than 9 projects. The remaining 26 (17.9%) engaged in 3 to 5 projects. Therefore, most companies are involved in a number of projects and are not questionable in terms of project management experience.

Table: 4. 11 Number of projects implemented during last five years by the company

Number of projects	Mega projects		AACRA		AAHC	
	Frequency	%	frequency	%	frequency	%
<2					16	40
3-5	6	23.1	8	10.1	12	30
6-8	5	19.2	23	29.1	4	10
>9	15	57.7	48	60.8	8	20
Total	26	100	79	100	40	100

In addition to the above survey was conducted to find out how many kilo meters they participated in the road construction project. Accordingly, 32 (40.5%) participated in the project covering less than 50 km and 26 (32.9%) participated in the 50 to 100 km road project. 21 (26.5%) participated in over 100 km of road projects. The results of the study show that most companies have better experience in road construction.

Table: 4. 12 Indicating length of road in Km

General information	AACRA	
Length of road in km	Frequenc	%
<50km	32	40.5
50km-100km	26	32.9
>100km	21	26.5
Total	79	

4.3. Policy/ rules on construction material logistics management

4.3.1 Mega projects

Mega Projects represents systematic Option to achieve sustainable development goals in developing countries. On the one hand, these are projects the need for advanced design knowledge and Technical skills; Qualified manpower and manager Skills as well as excessive investment. Further it needs a policy support in achieving their objective with respect to construction material logistics. These study objectives were intended to identify policy related factors that help a successful construction material logistics in Addis Ababa city mega projects to achieve this purpose the study selected top five success factors.

Table: 4. 13 Policy related issues of mega projects

Policy/rule	Mean score	Std. dev.	Rank
enhanced logistics management techniques are lower logistics costs	4.00	0.010	3
Developing strategic guidelines for bidders	4.42	0.504	1
The existence of Grading system for suppliers	4.00	0.895	3
The development of regional manufacturing and trading Centers.	4.23	1.177	2
The coordination of policies regarding each mode of transport;	4.00	0.894	3
grand mean	**4.02**		

The study results were ranked based on the mean results obtained and accordingly issues related to development of strategic guidelines were the most important success factor to the projects which followed by the development of regional manufacturing and trading Centers. Other factors like enhanced logistics management techniques are lower logistics costs, The existence of Grading system for suppliers and The coordination of policies regarding each mode of transport have equal importance to the successfulness of the projects.

4.3.2 Road projects

The same way the study results were ranked based on the mean results obtained for the road projects. Based on the findings the most important success factors to determine the logistics management was the centralized supply system managed by general contractor and evaluating inventory performance in every quarter was also have equal importance. Furthermore applying global material management guideline was the second most important success factor in the logistics management of the road projects.

Table: 4. 14 Policy related issues of road projects

Policy/rule	Mean score	S. dev.	Rank
Independent supply chains for individual contractors	4.19	0.395	4
Centralized supply system managed by general contractor	4.3	0.463	1
Every quarter inventory performed	4.3	0.648	1
Apply global material management guideline	4.22	0.872	2
Providing funding to research institutes	4.2	0.404	3
grand mean	**4.24**		

4.3.3 Housing projects

Housing projects also assessed for policy related issues that help a successful construction material logistics in the projects. Therefore, the study found out that the independent supply chains for individual contractors were the most important and significant success factor in the logistics management of the projects. Secondly the developing logistics clusters and providing funding to research institutes were the second most significant factors to determine the successfulness of the housing projects in Addis Ababa city.

Further factors like developing strategic guidelines for bidders and developing logistic concepts for designing and planning had played a significant role in determining the success of the housing projects.

Table: 4. 15 Policy related issues of housing projects

Policy/rule	**Mean score**	**S. dev.**	**Rank**
Independent supply chains for individual contractors	4.50	0.506	1
Developing strategic guidelines for bidders	4.20	0.758	3
Developing logistic concepts for designing and planning:	4.20	0.405	3
Logistics clusters	4.30	0.464	2
Providing funding to research institutes	4.30	0.648	2
grand mean	**4.30**		

In general the grand mean score for housing projects (M=4.30) is significantly higher than road (M=4.24) and mega projects (M=4.02) thus indicates policy related issues were most significantly determine the successfulness of material and logistics management in those housing projects as compared to road and mega projects in Addis Ababa city. Further independent supply chains for individual contractors were the common success factor for road and housing projects to determine material and logistics management.

Table: 4. 16 Comparison between from the study and literature review for policy and Strategies on logistics of materials

This study	From litterateur review
Independent supply chains for individual contractors policy but, it need some adjustment for best logistic of material in the project.	Most of developed countries use third party logistics strategies.
Developing strategic guidelines for bidders. But as we see that it is have high cost than JIT (just in time) strategy because the material deliver in the project early than it need.	Logistics technique or strategy like; JIT (just in time)
Providing funding to research institutes to increase research on logistics policy and strategies.	Strengthening the institutional support through inter-ministry and agency coordination in the planning, implementation and monitoring of policies and measures affecting the industry

4.4. Factors and stake holders that influence construction material logistics

4.4.1 Factors that influence construction material logistics

Further the study evaluated those factors that are barrier to the construction materials logistics management from the respondent's perspective in the three project types. Accordingly for the road and housing projects lack of materials was the most significant barrier to influence construction materials logistics management. Whereas, inaccurate data/ Communication problems was the major barrier to significantly influence the logistics management in mega projects. Whereas, inaccurate data/ Communication problems is the second and the third most affecting barrier in housing and road project respectively.

Table: 4. 17 Indicating barriers in construction material logistics

Factors	Road			Mega			Housing		
	Mean score	**Std. dev.**	**Rank**	**Mean score**	**Std. dev.**	**Rank**	**Mean score**	**Std. dev.**	**Rank**
Monitoring and Controlling	4.51	0.503	2	4	1.095	4	4.40	0.672	2
Design/engineering interface-incorrect documents design changes extended wait for architect's approval or design changes	4.00	0.784	8	3.81	0.402	5	4.20	0.608	4
Inaccurate data/ Communication problems	4.42	0.653	3	4.62	0.804	1	4.40	0.672	2
Planning and Scheduling	4.11	0.698	7	4.58	0.504	2	4.30	0.464	3
Unresolved quality problems, delayed occupation due to late ,completion	4.39	0.668	4	3.58	0.809	7	4.30	0.464	3
Reliability of supply and Transportation problems	4.11	0.698	7	3.62	1.023	6	4.30	0.464	3
Organization and Personnel/Top management support	4.19	0.752	6	3.62	1.023	6	4.10	0.545	5
Improper handling of materials	4.51	0.677	2	3.42	1.027	8	4.20	0.608	4
Lack of material management/	4.59	0.494	1	4.04	0.916	3	4.60	0.672	1
Closer links between demand/supply	4.30	0.463	5	3.42	1.027	8	4.00	0.453	6
Grand mean	**4.31**			**3.87**			**4.28**		

Monitoring and controlling was the second most important barrier to significantly influence the logistics management both in road and housing projects. Design related issues were most in the case of housing projects with relative to mega and road projects.

In general with respect to the occurrence of those barriers road projects were the mostly subjected to those factors with the mean value of 4.31 which is followed by housing projects with the mean value of 4.28. The least vulnerability to barriers was observed in the mega projects.

Table: 4. 18 Indicating the correlation result of factors

Correlations					
			Road	**Mega**	**Housing**
Spearman's rho	Road	Correlation Coefficient	1.000		
		Sig. (2-tailed)	.		
		N	10		
	Mega	Correlation Coefficient	.037	1.000	
		Sig. (2-tailed)	.920	.	
		N	10	10	
	Housing	Correlation Coefficient	.516	.717*	1.000
		Sig. (2-tailed)	.127	.019	.
		N	10	10	10
*. Correlation is significant at the 0.05 level (2-tailed).					

Further spearman's correlation analysis was done based on the relative rank of those barriers project wise to understand the relative association of the factors in across the projects. Based on the result relatively high degree of association was seen between mega and housing projects with the value $r=0.717$ ($p<0.05$). But, there is no significant association of factors was observed in the case of road and mega, road and housing projects.

4.4.2 Stake holders that influence construction material logistics

Regarding the stake holders influence level suppliers were the most influencing stake holders in the case of road projects whereas it was the third most significant influencers in the housing projects. Employees are the most influential stakeholders in the case of housing and mega projects where as they are the fifth influencing party in the case of road projects. Top managers were the second influencing stake holders for mega projects where as these top managements were the fifth influencing body in the housing projects. Trade associations had as significance role in all projects. Further competitors as a stake holder has a significant role in all project types. In addition local community has also a significant role in all projects.

With respect to stake holder's influence, road projects (M=4.20) were most likely to influence by stake holders stated below compared to the mega (M=4.09) and housing projects (M=4.08).

Table: 4. 19 Indicating the stake holders influence level in projects

stakeholders	Mega			Road			housing		
	Mean score	**Std. dev.**	**rank**	**Mean score**	**Std. dev.**	**rank**	**Mean score**	**Std. dev.**	**rank**
Suppliers	4.23	0.43	2	4.51	0.503	1	4.1	0.545	3
Top managers	4.23	0.765	2	3.8	0.607	9	3.9	0.841	5
Share holder	3.56	1.384	5	4.19	0.752	4	4	1.013	4
Investor	4.23	0.992	2	4.29	0.457	3	4.1	0.709	3
Employees	4.23	0.992	2	4.11	0.698	5	4.4	0.496	1
Government and non-government organization	4.04	1.113	3	3.99	0.776	7	3.7	0.464	6
Trade association	4.42	0.504	1	4.39	0.668	2	4.1	0.709	3
Competitor	4.23	0.43	2	4.51	0.503	1	4.3	0.648	2
Media	4.04	1.113	3	3.9	0.841	8	3.9	0.545	5
Local community	4.23	0.765	2	4.51	0.503	1	4.3	0.648	2
Technologists /software developers	3.65	1.384	4	4.09	0.95	6	4.1	0.545	3
Grand mean	**4.09**			**4.20**			**4.08**		

Further spearman's correlation analysis was done based on the relative rank of those stake holders project wise to understand the relative association of their influences across the projects.

Based on the result relatively high degree of association was seen between road and housing projects with the value r=0.679 ($p<0.05$). But, there is no significant association of factors was observed in the case of road and mega, mega and housing projects.

Table: 4. 20 Indicating the correlation result of stake holders

Correlations					
			Mega	**road**	**Housing**
Spearman's rho	mega	Correlation Coefficient	1.000		
		Sig. (2-tailed)	.		
		N	11		
	Road	Correlation Coefficient	.461	1.000	
		Sig. (2-tailed)	.153	.	
		N	11	11	
	housing	Correlation Coefficient	.470	.679*	1.000
		Sig. (2-tailed)	.144	.021	.
		N	11	11	11
*. Correlation is significant at the 0.05 level (2-tailed).					

Table: 4. 21 Comparison between from the study and

Literature review factor affecting logistics of materials

This study	From literature review
In the study lack of material management one of the factor affecting most projects especially in AAHP and AACRA.	In the most literature lack of material management is one of the factors affecting logistics of material in the project.
Monitoring and Controlling of logistic material is then common factor in the three studied project types.	Inefficient logistics on site lack of control at the construction site is the factor in the literature.
Improper handling of materials is the most common factor that seen in AAHP that the two projects.	Improper handling of materials, Lack of material management is the factor affecting logistics of material.

4.5 Auditing practice exist in projects

The study further evaluated the audit practices exist in the projects and ten top measure audit practices that were apparently exercised were selected to analyses the practical level in the projects. Accordingly identification and prevention of fraud/ Evaluate fraud risks were the most apparent practice of road and mega projects whereas it the fifth most selected practice by housing projects. The presence of supplier monitoring system were most practiced aspect of audit practice in road and housing projects whereas it the fourth audit aspect selected by the mega projects. Approval in all steps were the most apparently practice by the mega projects whereas the second and the fourth audit mechanism in the case of road and housing projects respectively.

Table: 4. 22 Indicating the audit system practice by the projects

	Mega			Road			housing		
Auditing systems	**Mean score**	**Std. dev.**	**rank**	**Mean score**	**Std. dev.**	**rank**	**Mean score**	**Std. dev.**	**rank**
identification and prevention of fraud/ Evaluate fraud risks	3.19	0.749	2	4.61	0.491	1	4	0.641	5
elimination of income or resource losses/	3.19	0.749	2	3.91	0.701	8	4.1	0.709	4
Communication internally and externally information	3.04	0.916	4	4.09	0.95	6	4.1	0.709	4
Perform ongoing or periodic evaluations of internal controls	3.04	0.916	4	4.19	0.601	5	4.3	0.648	3
Availability of technology controls	2.42	0.504	6	4.39	0.491	3	3.9	0.545	6
The presence of supplier monitoring system	3.04	0.916	4	4.41	0.809	2	4.6	0.496	1
Apply global material management guideline	3.08	1.164	3	4.19	0.752	5	3.9	0.841	6
A recorded key logistics data	2.85	1.008	5	4.39	0.668	3	3.9	0.545	6
customer notification/approval occur for changes to control plans, manufacturing site, product transfers, raw material or product obsolescence	3.38	1.023	1	4.22	0.872	4	4.4	0.672	2
Hold people accountable	3.04	0.916	4	3.99	0.776	7	4.1	0.545	4
Grand mean	**3.02**			**4.23**			**4.13**		

Elimination of income or resource losses control were most apparently practice by the mega projects as compared to housing and road projects. As a drawback, technology control is less likely habited by all project types except in road projects. Similarly applying global material management guideline is less likely experienced by road and housing projects whereas in mega projects relatively exercised as a part of the audit system.

In general the availability and practices of audit system was observed more in road projects with the mean value of 4.23 which followed by housing project (M=4.13) and less was seen in the case of mega projects(M=3.02).

Table: 4. 23 Comparison between from the study and literature review in auditing of logistics.

This study	From the literature review
Identification and prevention of fraud/ Evaluate fraud risks available mostly AARCA and AAHP than Mega project office.	Audits of financial statements are available in all projects and it is best system to manage logistics.
The presence of supplier monitoring system available in all projects and it is best for logistics of material.	Perform ongoing or periodic evaluations of internal controls (or a combination of the two)

4.6. Conceptual frame work /system on construction material logistic

Further the respondents were asked about the possible recommendation on the conceptual frame work /system on construction material logistic based on the level of importance material logistic system from three perspectives.

4.6.1 Institutional

From the institutional point of view four questions were presented to the respondents in all projects and accordingly respondents from mega projects underline the importance of administration and custom related issues and good city logistics is adaptive as ways to resolve institution related problems. The respondents from road projects point out that Good city logistics is adaptive. Further they recommend paperless mobility as second most important institutional issue.

Table: 4. 24 Indicate the institutional conceptual frame work

	Mega			**Road**			**Housing**		
framework	**Mean score**	**Std. dev.**	**Rank**	**Mean score**	**Std. dev.**	**Rank**	**Mean score**	**Std. dev.**	**Rank**
Administration ,customs clearance procedures,	4.42	0.504	1	3.9	0.709	3	4.1	0.841	2
A good city logistics is adaptive: a generic urban and building typology	4.42	0.504	1	4.61	0.461	1	3.8	0.608	3
Paperless Mobility	3.85	1.19	2	4	0.784	2	4.4	0.496	1
Grand Mean	**4.23**			**4.17**			**4.10**		

In general the conceptual frame work or systems that focuses on institutional view were more significantly were recommended by the respondents from mega projects which are followed by housing projects.

4.6.2 Infrastructure

From the infrastructure point of view two questions were presented to the respondents in all projects and accordingly respondents from all projects underline the importance of road**,** rail, ports, airport inland transportation systems in relation to the logistics management in all projects. Furthermore emphasize ware house and multimodal logistics centers as a second most important area to facilitate logistics in all construction projects.

Table: 4. 25 Indicate the Infrastructure conceptual frame work

	Mega			Road			Housing		
framework	**Mean score**	**Std. dev.**	**Rank**	**Mean score**	**Std. dev.**	**Rank**	**Mean score**	**Std. dev.**	**Rank**
Road ,rail, ports, airport inland water Transport	4.81	0.402	1	4.2	0.404	1	4.40	0.496	1
Ware house multimodal logistics centers	4.62	0.804	2	4.09	0.835	2	4.00	0.641	2
Grand mean	**4.71**			**4.15**			**4.20**		

In summary, the conceptual frame work or systems that focuses on infrastructural view were more significantly were recommended by the respondents from mega projects which are followed by housing projects.

4.6.3 Collaboration with Service providers

From the collaboration point of view eleven options were presented to the respondents in all projects and accordingly respondents from mega projects underline the importance of suppliers in relation to the logistics management. Respondents from road projects emphasize collaboration from shipping companies and transport providers as the most important area to facilitate logistics in all construction projects. Furthermore respondents from housing project underline the importance of collaboration with transport providers and trucking companies.

In general respondents from road projects were significantly believe the importance of collaboration with service providers as compared to mega and housing projects in construction projects.

Table: 4. 26 Indicate the importance of collaboration with service providers

framework	Mega			Road			Housing		
	Mean score	**Std. dev.**	**Rank**	**Mean score**	**Std. dev.**	**Rank**	**Mean score**	**Std. dev.**	**Rank**
Logistics providers	3.85	1.008	4	3.80	0.883	10	4.20	0.608	4
Trucking companies	3.65	1.056	5	4.09	0.835	7	4.30	0.464	3
Reverse logistics	4.04	1.113	3	4.61	0.491	1	4.20	0.608	4
Suppliers	4.42	0.809	1	4.00	0.641	8	4.00	0.641	6
Transportation	4.23	0.765	2	4.61	0.491	1	4.60	0.672	1
purchasing/controlling	4.42	0.504	1	4.30	0.648	3	3.50	0.679	8
purchase order and supplier invoice approval	4.23	0.765	2	4.59	0.494	2	4.10	0.545	5
Group Scheduling(like helicopter view)	3.23	0.765	6	4.11	0.947	5	4.40	0.672	2
Supervisor Productivity & Efficiency	3.85	1.008	4	3.91	0.536	9	4.30	0.648	3
Online booking/scheduling tool	3.65	1.231	5	4.10	0.545	6	4.30	0.648	3
Third party logistics	3.65	1.24	5	4.29	0.457	4	3.70	0.791	7
Grand mean	**3.92**			**4.22**			**4.15**		

Conceptual frame work for construction material logistic management

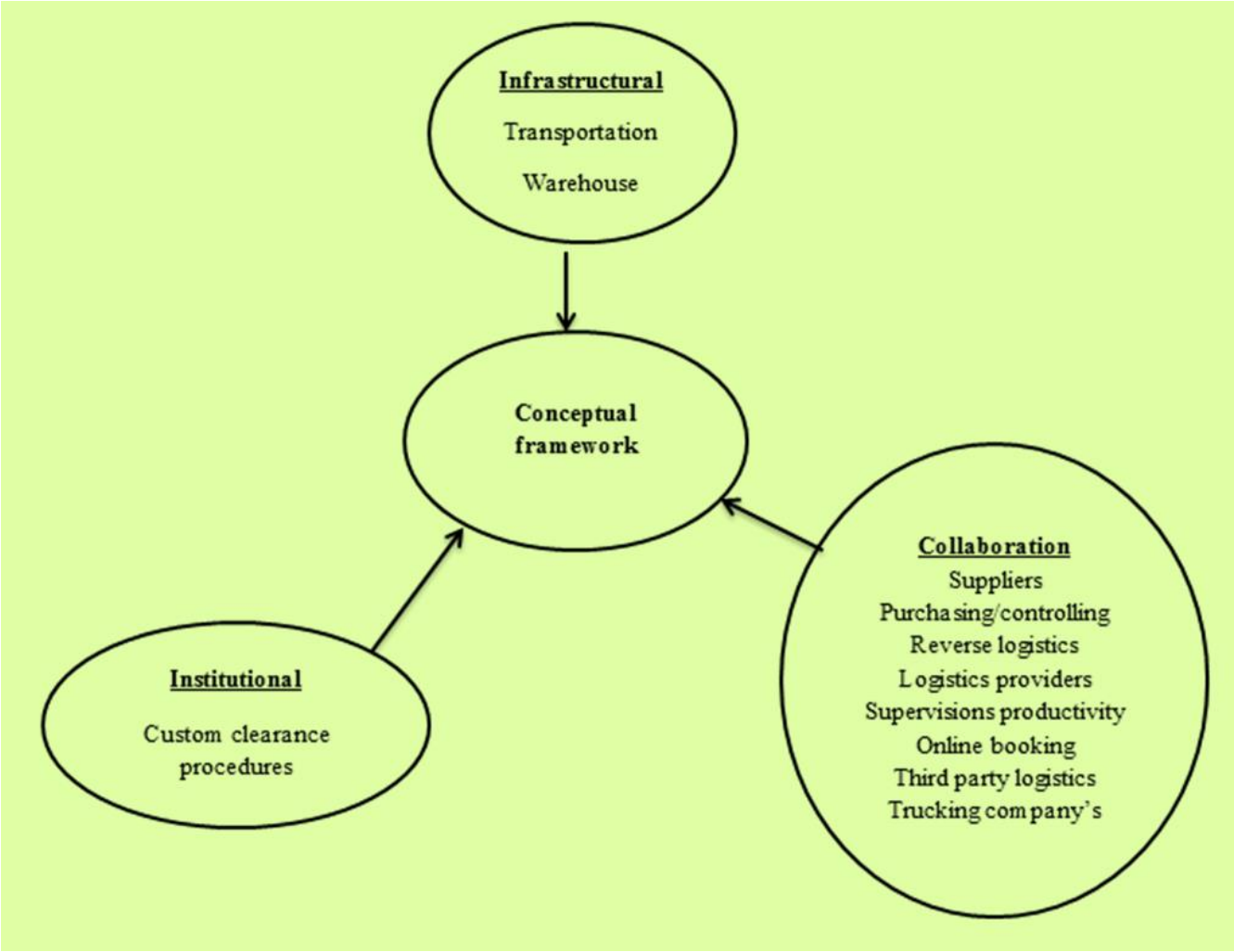

Figure: 4. 5 Conceptual frame work chart for construction material logistic management

Some mitigation

Mitigation strategy may be optimal for alleviating the impact of construction material logistics that may occur frequently in construction material logistics management.

Though many companies are devoting increased resources and attention to security efforts, little guidance is available to firms seeking to minimize their exposure to unexpected and potentially damaging or disruptive events impacting their logistics management (supply chains). The use of Information communication technology (ICT) has permitted the development of faster, more reliable and precisely timed logistics strategies, which leads to information-intensive transportation services. Adopting lean and flexible principles, firms now require current and immediate information about the location of productive activities as well as information linking the locations with available transport opportunity. It should be

develop an intelligent transportation system several key technologies such as digital maps for positioning, sensors, communication, vehicle control, and route planning. The predefined requirements enabling through real-time visibility the proactive risk management in transportation logistics, the concept concentrates on the three technology field's localization, sensor systems, and communication.

Generate high-inventory turns and minimize inventory throughout the chain through ability to respond quickly relationship with supply chain members. Focus on transactional relationships with multiple suppliers in order to hedge risks and focus on collaborative and long-term relationships with key members of supply chain.

The development of the construction industry can be supported with the promotion of harmonization and minimum standards in the industry, either through development of regulation or other means, such as providing incentives to those who adopt standardized systems. The working conditions of employees working in the logistics sector, particularly truckers, may be addressed through a national strategy and master plan.

National strategies may also develop new forms of institutional support for the development of the logistics industry. The most comprehensive approach can be the development of a national logistics council/committee in charge of the implementation and further development of logistics policy. Institutional support can also include establishment of logistics research institutes to promote innovation and creation and sharing of knowledge. Minimize each dominate factors that are identified in the analysis before.

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

Applying Integrated/Systematic Construction Logistics: 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

According to General and Specific Standards for the Professional Practice of Internal Auditing issued by the IIA in 1978 and Performance Standards of the IIA process of internal audit should include:

Audit planning (Engagement Planning) - internal auditors should plan each audit;

Examining and evaluating information (Performing the Engagement) - internal auditors should collect, analyse, interpret, and document information to support audit results;

Communicating results - internal auditors should report the results of their audit work; − Following up (Monitoring Progress) - internal auditors should follow up to ascertain that appropriate action is taken on reported audit findings.

Case study

Addis Ababa Housing Development Project Office has started its program thirty years ago, in 2003,building condominium houses and Addis Ababa Housing Development Project Office has started its program thirty years ago, in 2003,building condominium houses and managing its logistics with no polices and strategies until 2013. By taking a manual developed by Finance and Economy Development Bureau as a reference the project office has developed its own check list, as a guideline for the management of logistics. Using this check list, the office tried to ease problem related to material supply, distribution and handling. Addis Ababa mega projects owned by mega project office it is office located in Addis Ababa. Addis Ababa road authorities construct and maintain road in Addis Ababa city.

The check list has favoured bulk transaction for the major construction materials. The most important sector in the management of logistics is its skilled manpower and communication between the stakeholders. But the check list has indicated that gaps were still identified, under payments (may lead to corruption) for its workers, qualified personals still in short and continuous upgrading trainings are not enough (system not being automated). In managing the MSE, producing and delivering construction materials like HCB for slab and wall, precast beams, floor tiles, window and door frame, roofing work, etc… for the project, quality control and material distribution strategies have not been set in detail that would create gaps related to material wastage and delay in material delivery.

Figure: 4. 6 indicates Material storage in Addis Ababa housing project office

Addis Ababa Housing Development Project Office (AAHDPO) is handling almost all the logistics supply and delivering to the site. These includes, Construction materials: cement, reinforcement bars, coarse aggregate (02), prefabricated elements like beams, HCB, tiles, sanitary fittings, electrical fittings, roofing elements, windows and doors, etc…and most of the materials are produced by Micro and Small Enterprises. These enterprises joined the sector for the reason, one to create job opportunity, two to satisfy a huge demand for the construction material. Accordingly, about 10 thousand enterprises with various trades of

construction and production have been participating in the program creating job opportunity to about 200 thousand members embraced by the enterprises. (Housing Development Program, 2006 – 2010 Plan Implementation Report Ministry of Works and Urban Development, July 2010). By taking a manual developed by Finance and Economy Development Bureau as a reference the project office has developed its own check list, as a guideline for the management of logistics. Using this check list, the office tried to ease problem related to material supply, distribution and handling.

The check list has favoured bulk transaction for the major construction materials. The most important sector in the management of logistics is its skilled manpower and communication between the stakeholders. But the check list has indicated that gaps were still identified, under payments (may lead to corruption) for its workers, qualified personals still in short and continuous upgrading trainings are not enough (system not being automated). In managing the MSE, producing and delivering construction materials like HCB for slab and wall, precast beams, floor tiles, window and door frame, roofing work, etc… for the project, quality control and material distribution strategies have not been set in detail that would create gaps related to material wastage and delay in material delivery.

In generally Material deliveries to Projects are organized in a traditional way. Lorries are coming directly from the supplier to the construction site. Such deliveries do not have reserved time and the contractor does not know what time materials are arriving to the construction site.

Addis Ababa city road authority office (AACRO) is handling almost all the logistics supply and delivering to the site. These includes, Construction materials: cement, reinforcement bars, coarse aggregate (02), prefabricated elements in the case of on force work whereas the outsource work only provided little amount of material for example asphalt and bitumen etc…also some of the materials are produced by Micro and Small Enterprises in the case of condominium housing road . These enterprises joined the sector for the reason, one to create job opportunity, two to satisfy a huge demand for the construction material.

Adequate, reliable communication systems will be essential to most advances in transport and logistics envisioned.

The network must be planned now with overcapacity allowing for future advances.in

addition to this AACRA have those strong experience on logistic

- Software is readily available for a wide variety of logistics services.
- Electronic exchange of data and electronic control mechanism of company property
- AACRA can encourage the development of storage, distribution and collection centers strategically placed through making land available to private contractors
- AACRA has performance auditing system establishing in order to audit the different unit in the organization.

Figure: 4. 7Addis Ababa city road authority material storage, material checking and Final structural road image

The mega project also have good logistics service this service mostly cover by the contractor

almost all project covered by chaise government construction company so The logistics sector will switch from freight forwarding to third party logistics providers (3PLs) of warehousing, consolidation, order management, value-adding processing, warranty work and product recycling. The 3PLs will provide a full range of warehousing services including bonded storage, cold storage and automated warehouses. Much of the value they provide will be management of information and transactions. Training and self-regulation will be provided by industry associations. At mega Project, Construction Consolidation Center is used. This center is also called Logistics Center and is primarily used for inside wall materials and windows. All deliveries to mega Project have reserved time. For this reason we used mostly mega Project for material delivery observations.

Figure: 4. 8 ADWA ZERO public project under construction

Figure: 4. 9 Grand place car parking and multi-complex public project

Interview

The interview method was non-standardized by electronic interview because of the limited

available source and access. In this case, there was only the oral preventative answering the questions. However, it still gained the main valued information which could help the study collating and comparing with the theoretical parts. In this interview, it was noticed that the less formal the interview the more "open" respondent.

A good transportation system in logistics activities could provide better logistics efficiency through improvement in the moving load, delivery speed, service quality and operation costs. However this is not implemented in the company well due to policy/strategy not clearly place as whole. The most factors which delay the project late payment and inaccurate data/ Communication problems followed by controlling and monitoring of material at site where as the other two public project shear this idea .the auditing practices in road project more available rather the other two projects**.**

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 would enhance the compliance of procurement and logistics with design specifications in the case of mega projects.

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 more security problem happen in Addis Ababa housing projects next to road whereas mega project not observed still.

4.7 Summary of Findings

This part provides detailed discussion on the research findings in light of the theoretical foundations presented in the literature review section.

- In general the grand mean score for housing projects (M=4.30) is significantly higher than road (M=4.24) and mega projects (M=4.02) thus indicates policy related issues were most significantly determine the successfulness of material and logistics management in those housing projects as compared to road and mega projects in Addis Ababa city. Further independent supply chains for individual contractors were the common success factor for road and housing projects to determine material and logistics management.

- With respect to the occurrence of those barriers road projects were the mostly subjected to those factors with the mean value of 4.31 which is followed by housing projects with the mean value of 4.28. The least vulnerability to barriers was observed in the mega projects. High degree of association was seen between mega and housing projects with the value $r=0.717$ ($p<0.05$). But, there is no significant association of factors was observed in the case of road and mega, road and housing projects.
- With respect to stake holder's influence, road projects ($M=4.20$) were most likely to influence by stake holders stated below compared to the mega ($M=4.09$) and housing projects ($M=4.08$). High degree of association was seen between road and housing projects with the value $r=0.679$ ($p<0.05$). But, there is no significant association of factors was observed in the case of road and mega, mega and housing projects
- The availability and practices of audit system was observed more in road projects with the mean value of 4.23 which followed by housing project ($M=4.13$) and less was seen in the case of mega projects ($M=3.02$).
- The conceptual frame work or systems that focuses on institutional view were more significantly were recommended by the respondents from mega projects which are followed by housing projects. The conceptual frame work or systems that focuses on infrastructural view were more significantly were recommended by the respondents from mega projects which are followed by housing projects. Respondents from road projects were significantly believe the importance of collaboration with service providers as compared to mega and housing projects in construction projects.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

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

The main objective of this study investigates the factors affecting and the stake holders that influence construction material logistic management and its auditing practice, asses the strategy in construction projects specially in public projects. As discussed in the literature review, one of the indicators in a country's development is level of its infrastructure development. And major characteristics of construction projects are its huge amount of budget which is assigned to it, and also which absorbs a lot of manpower, skilled and unskilled. Due to uniqueness of projects and lots of stakeholder's involvement, managing logistics is a very difficult task.

Logistics management in the construction industry is the discipline which is very important, but we can see from this study that it is not given the attention it deserves. From the study we can conclude that,

1. From different countries experiences, we can see that considering logistics management as independent department is a waste of money. Logistics knowledge is seldom represented in the organizations in the industry, and trained logisticians are in principle not seen, at least not in the construction companies. This makes difficulties related to logistics hard to solve, since there is a lack of terminology as well as ideas of construction material logistics strategy (policy). Study conducted shows there is a lack of knowledge regarding the third party logistics associated with construction material logistics.

2. The study clearly shows that he stake holder that involve in construction material logistics management highly affected the construction industry. The factor affecting construction

material logistics are lack of material management, Monitoring and Controlling of logistic material and improper handling of materials.

3. The availability and practices of audit system was observed more in road projects rather than the other two public projects. In the study also all projects have not well developed frame work for logistics of material.

5.2 Recommendations

This study shows how logistics management is very important in the construction industry. To improve Logistic management system in the project office, the first thing which needs to be changed is the attitude towards it. This includes, not just establishing independent logistics department in project offices, but strengthening it with appropriate equipment and man power, which can be functional.

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. Third party logistics (logistics technique) for example 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

5.2.1. Recommendations from this Study

Based on the findings of the study and the discussions above and taking into consideration that a continuous improvement will require more fundamental changes than the simple adoption of the recommendations mentioned above, a summary of some general recommendations are offered to support the construction of future public projects.

These are listed below:

1. As it can be seen from the outcomes of the research good auditing practices in road project whereas housing and mega project slightly observed. And communication 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.

2. Construction stakeholders are usually influenced the logistics management system especially in AAHDPO because of different party involvement. It concerned with improving supply chain of material. In this way, advancement in logistics management has been proven to be an important ingredient for success. Although reducing costs of logistics can benefit involved parties, it should not direct them to the pitfall of overlooking time management in movement of material. Moreover, time is a readily available measure that can be used as an indication of performance in cost management. Consequently, it is essential to spend efforts on developing cautious time schedule for inventory checking, purchasing transportation of construction material and carry out this plan. The factor that

3. Obstacles for construction material logistics management policy /rule are found to be poor level of logistical competence, lack of guidance for creating strategic alliances, strong project focus as well as the attitudes and traditions in the construction industry construction material logistics management policy /rule is a great opportunity for the construction industry primarily to reduce cost and time, and thus improve profitability. Logistics principles seem to have much strength to smoothen and integrate the construction processes. The logistics in construction could be divided into two major groups as materials chain and the construction chain, which would help to separate the procurement and management operations. Both chains are linked through a SCM database this more showed in road rather than other two public projects. This would ensure the smooth flow of information within the different chains and results in increased collaboration within the supply chain partners.

4. The occurrence of those barriers road projects, housing projects, mega projects respectively were the mostly subjected to those factors. High degree of association was seen between mega and housing projects but, there is no significant association of factors was observed in the case of road and mega, road and housing projects

5.2.2. Recommendations for Further Study

In this study it is attempted to assessment construction material logistics management on public project which existing practices of industrial sectors specifically the construction companies regarding policy, auditing system, factors and stake holders in their construction projects. Finally, based on the results and findings of the study, conceptual logistics management model is developed. However, this study never touch every aspect of the project sites and some of the following areas in construction material logistics management

aspect are indicated as if additional studies were conducted they could come up with better understanding on the issue. These are

- ✓ The impact of construction material logistics management on public project involvement in promoting safety and health in workplace
- ✓ The influence of technology on construction material logistics management public projects
- ✓ The contractors', consultants' and clients' commitment and accountability in considering construction material logistics management on public project
- ✓ The development of well-organized model for all public project

REFERENCES

Aaltonen et al., 2008, Stakeholder salience in global projects. International Journal of Project Management, 26(5).

Abebe Zeluel and Solomon Berhe (International Labour Organization, Geneva, 2001

Adulyasak Y, Cordeau JF, Jans R (2014) Formulations and branch-and-cut algorithms for multivehicle production and inventory routing problems. INFORMS J Comput 26(1):103–120

Addis Ababa Housing Development Project Office, 2011, Check List

Agerberg, John-Niclas., Johansson, Jesper and Hohansson, Niclas, 2010. Tredjepartslogistik I ett nybyggnadsprojekt. Chalmers University of Technology, Gothenburg.

Anna Sobotka, AgataCzarnigowska, 2005, Analysis of Supply System models for Planning Construction Project logistics, 73-82

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

Archetti C, Bertazzi L, Laporte G, Speranza MG (2007) A branch-and-cut algorithm for a vendor-managed inventory-routing problem. Transp Sci 41(3):382–391

Artigues C, Koné O, Lopez P, Mongeau M (2015) Mixed-integer linear programming formulations. In: Schwindt C, Zimmermann J (eds) *Handbook on project management and scheduling*, vol 1. Springer, Berlin, pp 17–41

Alma Thomas, 2016 application of information systems in logistics industry and E-logistics.

Anna Sobotka, AgataCzarnigowska, 2005, Analysis of Supply System models for Planning Construction Project logistics.

Atkin, Brian & Skitmore, Martin (2008) stakeholder management in construction Volume 26, 2008 - Issue 6

Azhar S (2011) Building information modeling (BIM): trends, benefits, risks, and challenges for the AEC industry. Leadersh Manag Eng 11(3):241–252

Baker KR (1997) An experimental study of the effectiveness of rolling schedules in production planning. Decis Sci 8(1):19–27

Bartusch M, Möhring RH, Radermacher FJ (1988) Scheduling project networks with resource constraints and time windows. Ann Oper Res 16(1):199–240

Bell WJ, Dalberto LM, Fisher ML, Greenfield AJ, Jaikumar R, Kedia P, Mack RG, Prutzman PJ (1983) Improving the distribution of industrial gases with an on-line computerized routing and scheduling optimizer. Interfaces 13(6):4–23

Bertazzi L, Savelsbergh M, Speranza MG (2008) Inventory routing. In: Golden B, Raghvan S, Wasil E (eds) The vehicle routing problem: latest advances and new challenges. Springer, Berlin, pp 49–72

Bourne, L., & Walker, D. H. T. (2005). Visualising and mapping stakeholder influence

Campbell AM, Hardin JR (2005) Vehicle minimization for periodic deliveries. Eur J Oper Res 165(3):668–684

Christopher M. International Journal of Logistics Research and Application, 1999, 103-104.

Chinyio and Akintoye, 2008 Construction Management and Economics (Construct Manag Econ)

Cleland, D.I. & King, W.R. (Eds.), Project management handbook. New York

Donyari, S. and Flanagan, R. 2009, the impact of effective material management on logistics

Damodara U.Kini 1999; Bell & Stukhart 1986, material management the key to successful project management.

Dimitris Papaprokopiou, 2010, an application of construction logistics analysis

ErdalÇakir _Stanbul, 2009, Logistics Outsourcing and Selection of Third Party Logistics Service Provider

Fadiya, O. (2012). Development of an integrated decision analysis framework for selecting-based logistics systems in the construction industry, PhD dissertation, University of Wolver Hampton

Freeman, R.E. (1984) Strategic Management: A Stakeholder Approach. Pitman, Boston.

Finance and Economy Development Bureau, 2010, Stock management manual

Gould, Frederick and Joyce, Nancy, 2009. *Construction Project Management*. Third edition, Prentice Hall.

Gary Sullivan, et al. (2010), managing construction logistics. A John Wiley & Sons, Ltd., Publication, Printed in Singapore.

Harold Kerzner. Project Management: A Systems Approach to Planning, Scheduling, and Controlling (seventh edition).Canada: John Wiley Sons lnc,2001,43-44

Housing Development Program, 2006 – 2010 Plan Implementation Report Ministry of Works and Urban Development, July 2010

Harker, Anthony., Allcom, Wendy and Taylor, David, 2007. Material Logistics Plan Good Practice Guidance. Waste & Resources Action Programme, UK, December 2007.

Hill, R.M. and Ballard, R. (2001) Construction Logistics: An Introduction. Building Research Establishment.

H.Doloi, 2013, cost overruns and failure in project management (journal of construction engineering and management volume 139 issue 3

Jang, W.-S. and Skibnewski, M.J. (2008) A Wireless Network System for Automated Tracking of Construction Materials on Project Sites. Journal of Civil Engineering and Management

Janné, M., Fredriksson, A., (2017), Construction logistics governing guidelines in urban area.

Jergeas et al. (2000) identified two aspects of improvements for managing stakeholders, which are: communication with stakeholders and setting.

J.Mangan,C.Lalwari.T.bucher ,2008,global logistics and supply chain management.

Josephoson, Per-Erik and Saukkoriipi, Lasse, 2007. Waste in construction projects: Call for a new approach. Chalmers University of Technology, Gothenburg

Johnson, G. and Scholes, K., 1999. Exploring corporate strategy. London: Prentice Hall Europe

International Journal of Civil Engineering and Technology, 2017

Kagioglou M. ,Cooper R. ,Aouad G. Re-engineering the UK construction industry: The process protocol.2nd International Conference on Construction Process Re-Engineering, University of New South Wales,Sydney,Australia,1999.981-986

Laura F. Spira & Gowthorpe, (2008) importance of internal control in an organization

London, K, Kenley, R and Agapiou, A (1998) Theoretical supply chain techniques as logistics

Liu Yuming, Wang Yaoqiu. Logistics Technology, 2007, 76-78(in Chinese) .

Liker, J. (2004), the Toyota Way, New York: 14 management principles from the world's greatest manufacture. McGraw-Hill.

Lu,M.,Chen, W., Shen, X., Lam, H.-C. and Liu, J. (2007) Positioning and tracking construction vehicles in highly dense urban areas and building construction sites.

Usman, N. and Muhammad,A.I (2015). Efficient Management of Construction Logistics: A Challenge to both Conventional and Technological Systems in the Developing Nations, Saud Arabic

Nordmann, D., 2012, Deeping governance in water and sanitation services, discussion paper for water services regulation board, Kenya

Michael J.Harkers, 2007, journal of marketing management.

Mangan, J., Lalwani, C., and Butcher, T. (2008). Global Logistics and Supply Chain Management, John Wiley & Sons, Hoboken, New Jersey.

Matouzko, (2015) problems and solution urban construction logistics management

Mark Ritchie,(2008) Architecture Building Culture

Meixell and Luoma (2015) systematically review empirical studies on stakeholder pressures and find that stakeholder pressure leads to split.

MoUDHC Standard Conditions of Contract for Civil Work Projects [Journal]. - 2006.

McDonnell Kinsella and Healy, 2017 Essentially of internal control in audit process (importance of internal audit and internal control in an organization).

Olander S.2007, stakeholder impact analysis in construction project management

Pryke, Stephen, 2009. Construction Supply Chain Management: Concepts and Case Studies. First edition, Wiley-Blackwell.

R.bower Sox J.closs and M.B.Cooper, 2000, supplies chain logistics management. Boston

Robert leech, 2017, IBM SPSS for intermediate statistics use and interpretation, 5th edition.

Silva and Cardoso, 1999, Applicability of Logistics Management in Lean Construction: a Case Study Approach in Brazilian Building Companies

Shakantu W., Muya M., Tookey J. and Bowen P. (2008) Flow Modeling of Construction Site Materials and Waste Logistics. Engineering, Construction and Architectural Management

Silva and Cardoso, 1999, Applicability of Logistics Management in Lean Construction: a Case Study Approach in Brazilian Building Companies

Singh, A., and Masuku, M.(2014) sampling techniques and determination of sample size in applied statistics research: an overview.ljecm.Co.Uk,II

Sunil chopra (2003), designing the distribution network in a supply chain ,Northwestern University

Sullivan, Gary. Barthorp, Stephen and Robins, Stephen, 2010. Managing Construction Logistics. Wiley-Blackwell.

Taylor, J.R. (1997) introduction to error analysis: the study of uncertainties in physical measurements.2nd edirion, university science book Sausalito.

Valeriy et. al (2012), Improving Construction Logistics

Voigtmann, J. and Bargstadt, H. (2010) Construction logistics planning by simulation. Proceedings of the 2010 Winter Simulation Conference (WSC)

Wanjogu, H., Iravo, M. & Arani, w. (2015). Factors affecting materials management: a survey of small and medium-sized manufacturing firms in industrial area.

Wanjogu, H., Iravo, M. &Arani,w.(2015). Factors affecting materials management

Ward and Chapman, 2008 stakeholders and uncertainty management in projects volume 26 issue 6.

Wegelius-Lehtonen, T. (2001) Performance Measurement in Construction Logistics. International Journal of Production Economics

Wegelius-Lehtonen, T. and Pahkala, S. (1996) Developing material delivery processes in cooperation: An application example of the construction industry. International Journal of Production Economics,

Winch, Graham M., 2009. Managing Construction Projects. First edition, Wiley-Blackwell.

Winch, Graham M. 2010. Managing Construction Projects. Second edition, Wiley-Blackwell.

You Jianxin,Cai Yiping. Industrial Engineering and Management, 2006, (Chinese).

Zakeri et al. (1996) surveyed Iranian construction operative productivity. Materials shortage, weather and site conditions, equipment breakdown,

Zwikael 2009; Cleland and Ireland 2006, Impact of Project Planning on Project Success with Mediating Role of Risk Management and Moderating Role of Organizational Culture.

Zhang Yuang, Wu Lingfei. Logistics Technology, 2007, (Chinese)

APPENDICES

Annex a

ADDIS COLLEGE COSTRUCTION TECHNOLGY MANEGEMET MSC GRADUATEPROGRAM

RESEARCH QUESTIONNAIRE'S ON CONSTRUCTION MATERIAL LOGISTICSMANAGEMENT IN ADDIS ABABA CITY IN THE CASE OF PUBLIC PROJECT

Dear Respondents:

Currently, I am doing an academic research for Master of Science (MSc) in the Addis College. The study is intended to construction material logistics management in Addis Ababa city in the case of public project

So, this questionnaire is designed to draw your honest view regarding your considerations. The information you provide will be treated with high confidentiality and used for academic purpose only. Please be honest in all responses; hence your co-operation, truthfulness and assistance will be highly appreciated for the needed outcome.

Thank you so much in advance for your precious time and cooperation!

May, 2021G.C

QUESTIONNAIRE FOR CONSTRUCTION MATERIAL LOGISTICS MANAGEMENT IN ADDIS ABABA CITY IN THE CASE OF PUBLIC PROJECT

Section I General information

1. Your company name
□ Addis Ababa housing corporation □ Addis Ababa city road authority
□ Mega project
2. Project location ……
3. Sex □ Male □ Female
4. Age
□ 20-35 □ 36-45 □ 45-55 □ Above 55
5. Project type
□ Road □ Housing project □ Mega project
6. Please specify what most represents your organization
□ Contractor □ consultant □ client □ others
7. Your position
□ Resident engineer □ Project manager □supervisor engineer □ material engineer
□ □purchasing head □ other

8. Your experience relating to building, road and mega project construction project
□ <5 □ 5-10 □ 10-15 □ 15-20
9. The highest contract value you ever worked (in birr, million)
□ <10 □ 10-50 □ 50-100 □ >100
10. Classification of your firm in construction business

□ Governmental □ Private □ public □ other specify_____

11. Number of projects implemented during last five years by the company
□ <2 □ 3-5 □ 6-8 □ >9
12. Number of stories in your building project and length of road
□ <3 □ 3-6 □ 7-9 □ >10 / □ <50km □ 50km-100km □ >100km

Section II – policy /rule on construction material logistics management

Do the following policy /rule help a successful construction material logistics in project?

Policy/rule	Not at all	Little	Average	Greatly	A lot
	1	2	3	4	5
increase in the number of logistics service providers,					
enhanced logistics management techniques are lower logistics costs					
Independent supply chains for individual contractors					
Centralized supply system managed by general contractor					
centralized supply system managed by an external logistics company					
Developing strategic guidelines for bidders					
Developing logistic concepts for designing and planning:					
Developing plans of the building site logistic and supervising their execution					
The existence of Grading system for suppliers					
Every quarter inventory performed					
Assembled of auditing committee					
The presence of assessment and supplier monitoring system					
Apply global material management guideline					
transport and logistics network optimization					
The development of regional manufacturing and trading Centers.					
Harmonization and standardization					
Logistics clusters					
Providing funding to research institutes					
The coordination of policies regarding each mode of transport;					

Section III: factors and stake holders that influence construction material logistics

To what extent do you believe the following factors are a barrier to logistics of material?

On construction site integration?

Factors	**Negligence**	**Low**	**Moderate**	**High**	**Very high**
	1	**2**	**3**	**4**	**5**
Late and incorrect payments					
Bidding process/material procurement procedure					
Difficulties in finding out client's desires, changes of client's requirements, long procedures to discuss changes					
Monitoring and Controlling					
Hike in material prices					
Design/engineering interface-incorrect documents design changes extended wait for architect's approval or design changes					
Inaccurate data/ Communication problems					
Delay due to rejection of materials from quality control Team					
Planning and Scheduling					
Problematic completion due to quality problems.					
Unresolved quality problems, delayed occupation due to late ,completion					
Inaccurate data, information needs not met, adversarial bargaining and other changes					
Reliability of supply and Transportation problems					
Organization and Personnel/Top management support					
Improper handling of materials					
Lack of material management/Mutual interest					
Labor strikes/Manpower development					
Closer links between demand/supply					
Seasonal problems					
More frequent meetings					
Simplify the whole construction process					

Creating standardization of processes					
Simplify bid process					
Delivery, Storage and Storage facilities					
Usage, Surplus and Waste control					

To what level of do the following stakeholders influence a successful construction material logistics in project?

Stakeholders	Never	Rarely	Seldom	Frequently	Always
	1	2	3	4	5
Customers					
Suppliers					
Top managers					
Share holder					
Investor					
Employees					
Academic institutions					
Government and non- government organization					
Trade association					
Competitor					
Media					
Local community					
Agents					
Technologists /software developers					

System/frame work	Not important	Less important	Somehow important	Important	Very important
	1	2	3	4	5
Institutional					
Administration ,customs clearanceprocedures,					
A good city logistics is adaptive: a genericurban and building typology					
A good city logistics has greening: a central green area to buffer and to connect					
Paperless Mobility					
Regional protocol, relevant laws andregulations (bonded transport and Warehouse, traffic regulations, etc...)					
Infrastructure					
Road ,rail, ports, airport inland waterTransport					
Ware house multimodal logistics centers					
Work together with Service providers					
Logistics providers					
Freight forwarder					
Trucking companies					
Shaping companies					
Inventory					
Transportation					
Lead time					
Purchasing/ Controlling					
Optimizing supply and purchasing process					
Purchase Order & Supplier Invoice Approval					
Group Scheduling(like helicopter					
Supervisor Productivity & Efficiency					
Online booking/scheduling tool					
Third party logistics					

Section IV: Auditing practice on construction material logistics

Does the auditing system exist in your project?

Auditing systems	Not at all	Little	Average	Greatly	A lot
	1	2	3	4	5
providing reliable financial reporting					
the audit is conducted systematically					
identification and prevention of fraud/ Evaluate fraud risks					
elimination of income or resource losses/					
consistent audit approach					
Communication internally and externally Information					
Perform ongoing or periodic evaluations of internal controls					
Availability of technology controls					
Registered suppliers					
The existence of Grading system for suppliers					
Every quarter inventory performed					
Assembled of auditing committee					
The presence of supplier monitoring system					
Apply global material management guideline					
A recorded key logistics data					
Material quantity before and after completed the work counted					
reliability test plans developed and routinely					
customer notification/approval occur for changes to control plans, manufacturing site, product transfers, raw material or product obsolescence					
Hold people accountable					

<u>Section V</u>: conceptual frame work /system on construction material logisticthe level of importance material logistic system/framework

Annex b

Interview question

Part v: Interview questioners

1. Name of the organization/firm
2. Do you know the concept of construction material logistics management?
3. Do you know techniques/ methods of construction material logistics management?
4. Construction material logistics management implemented or not? If yes, How? If no, Why?
5. Explain details of storage/inventory/transportation facilities for materials purchased?
6. Describe auditing procedure in the firm and is there any audit finding before? How it judged?
7. Do you have best practice /system on construction material logistics management? If yes list it? If no why?
8. Explain the factor that affect and stakeholders influence the construction material logistics management in your firm?
9. Any software used for construction material logistics management?
10. Explain the policy of the Addis Ababa city administration on construction material logistics?

Annex c

SPSS results

1. Descriptive analysis on Mega projects

1.1 policy and rules

Policy/rule	Not at all		Little		Average		Greatly		A lot		Mean score	Std. dev.
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
increase in the number of logistics service providers,					10	38.5	16	61.5			3.62	0.496
enhanced logistics management techniques are lower logistics costs							26	100			4.00	0.000
Independent supply chains for individual contractors			10	38.5	5	19.2	6	23.1	5	19.2	3.23	1.177
Centralized supply system managed by general contractor					15	57.7	11	42.3			3.42	0.504
centralized supply system managed by an external logistics company			5	19.2			21	80.8			3.62	0.804
Developing strategic guidelines for bidders							15	57.7	11	42.3	4.42	0.504
Developing logistic concepts for designing and planning:			5	19.2	5	19.2	5	19.2	11	42.3	3.85	1.190
Developing plans of the building site logistic and supervising their execution					15	57.7	11	42.3			3.42	0.504
The existence of Grading system for suppliers					10	38.5	6	23.1	10	38.5	4.00	0.894
Every quarter inventory performed					5	19.2	21	80.8			3.81	0.402
The presence of assessment and supplier monitoring system					15	57.7			11	42.3	3.85	1.008
Apply global material management guideline				10	38.5	5	19.2		11	42.3	3.46	1.392
The development of regional manufacturing and trading Centers.				5	19.2		5	19.2	16	61.5	4.23	1.177
Logistics clusters					10	38.5	16	61.5			3.62	0.496
Providing funding to research institutes			5	19.2	6	23.1	10	38.5	5	19.2	3.58	1.027
The coordination of policies regarding each mode of transport;					10	38.5	6	23.1	10	38.5	4.00	0.894

1.2 factors barrier to logistics of material

Factors	Negligence		Low		Moderate		High		Very high		Mean score	Std. dev.
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
Late and incorrect payments					16	61.5	10	38.5			3.38	0.496
Bidding process/material procurement procedure					5	19.2	11	42.3	10	38.5	4.19	0.749
Monitoring and Controlling			5	19.2			11	42.3	10	38.5	4.00	1.095
Design/engineering interface-incorrect documents design changes extended wait for architect's approval or design changes					5	19.2	21	80.8			3.81	0.402
Inaccurate data/ Communication problems					5	19.2	21	80.8			4.62	0.804
Delay due to rejection of materials from quality control Team					11	42.3	15	57.7			3.58	0.504
Planning and Scheduling					11	42.3	15	57.7			4.58	0.504
Problematic completion due to quality problems.					16	61.5	5	19.2	5	19.2	3.58	0.809
Unresolved quality problems, delayed occupation due to late ,completion					16	61.5	5	19.2	5	19.2	3.58	0.809
Inaccurate data, information needs not met, adversarial bargaining and other changes			5	19.2	10	38.5	11	42.3			3.23	0.765
Reliability of supply and Transportation problems			5	19.2	5	19.2	11	42.3	5	19.2	3.62	1.023
Organization and Personnel/Top management support			5	19.2	5	19.2	11	42.3	5	19.2	3.62	1.023
Improper handling of materials			5	19.2	10	38.5	6	23.1	5	19.2	3.42	1.027
Lack of material management/Mutual interest			10	38.5	5	19.2	6	23.1	5	19.2	4.04	0.916
Closer links between demand/supply			5	19.2	10	38.5	11	42.3	5	19.2	3.42	1.027
Seasonal problems	5	19.2	5	19.2	11	42.3	5	19.2			2.62	1.023
Creating standardization of process	5	19.2			11	42.3	10	38.5			3.00	1.095
Simplify bid process			5	19.2	15	57.7	6	23.1			3.04	0.662
Delivery, Storage and Storage facilities					5	19.2	16	61.5	5	19.2	4.00	0.632
Usage, Surplus and Waste control			5	19.2	5	19.2	16	61.5			3.42	0.809

1.3 stakeholders

Stakeholders	Never		Rarely		Seldom		Frequently		Always		Mean score	Std. dev.
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
Suppliers							20	76.9	6	23.1	4.23	0.430
Top managers					5	19.2	10	38.5	11	42.3	4.23	0.765
Share holder	5	19.2			15	57.7			6	23.1	3.56	1.384
Investor					10	38.5			16	61.5	4.23	0.992
Employees					10	38.5			16	61.5	4.23	0.992
Government and non- government organization			5	19.2			10	38.5	11	42.3	4.04	1.113
Trade association							15	57.7	11	42.3	4.42	0.504
Competitor							20	76.9	6	23.1	4.23	0.430
Media			5	19.2			10	38.5	11	42.3	4.04	1.113
Local community					5	19.2	10	38.5	11	42.3	4.23	0.765
Technologists /software developers			10	38.5			5	19.5	11	42.3	3.65	1.384

1.4 Auditing practice on construction material logistics

Auditing systems	Not at all		Little		Average		Greatly		A lot		Mean score	Std. dev.
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
providing reliable financial reporting			10	38.5	6	23.1	10	38.5			3.00	0.894
identification and prevention of fraud/ Evaluate fraud risks			5	19.2	11	42.3	10	38.5			3.19	0.749
elimination of income or resource losses/			5	19.2	11	42.3	10	38.5			3.19	0.749
Communication internally and externally Information			10	38.5	5	19.2	11	42.3			3.04	0.916
Perform ongoing or periodic evaluations of internal controls			10	38.5	5	19.2	11	42.3			3.04	0.916
Availability of technology controls			15	57.7	11	42.3					2.42	0.504
Registered suppliers			10	38.5	10	38.5	6	23.1			2.85	0.784
The existence of Grading system for suppliers			10	38.5	5	19.2	6	23.1	5	19.2	2.23	1.117
Every quarter inventory performed			10	38.5	5	19.2	11	42.3			3.04	0.916
Assembled of auditing committee			5	19.2	5	19.2	5	19.2	11	42.3	2.85	1.190
The presence of supplier monitoring system			10	38.5	5	19.2	11	42.3			3.04	0.916
Apply global material management guideline			10	38.5	10	38.5	6	23.1			3.08	1.164
A recorded key logistics data			15	57.7	11	42.3					2.85	1.008
Material quantity before and after completed the work counted			10	38.5	16	61.5					3.23	0.992
customer notification/approval occur for changes to control plans, manufacturing site, product transfers, raw material or product obsolescence			5	19.2	11	42.3	5	19.2	5	19.2	3.38	1.023
Hold people accountable			10	38.5	5	19.2	11	42.3			3.04	0.916

1.5 Conceptual frame work /system on construction material logistic the level of importance material logistic system/framework

Auditing systems	Not important		Less important		Somehow important		important		Very important		Mean score	Std. dev.
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
Administration ,customs clearance procedures,							15	57.7	11	42.3	4.42	0.504
A good city logistics is adaptive: a generic urban and building typology							15	57.7	11	42.3	4.42	0.504
Paperless Mobility			5	19.2	5	19.2	5	19.2	11	42.3	3.85	1.190
Road ,rail, ports, airport inland water Transport							5	19.2	21	80.8	4.81	0.402
Ware house multimodal logistics centers					5	19.2			21	80.8	4.62	0.804
Logistics providers			5	19.2	15	57.7			6	23.1	3.85	1.008
Trucking companies			5	19.2	5	19.2	10	38.5	6	23.1	3.65	1.056
Shipping companies			5	19.2	10	38.5	10	38.5	11	42.3	4.04	1.113
Inventory			5	19.2	5	19.2	16	61.5			4.42	0.809
Transportation			5	19.2	10	38.5	11	42.3			4.23	0.765
purchasing/controlling							15	57.7	11	42.3	4.42	0.504
purchase order and supplier invoice approval					5	19.2	10	38.5	11	42.3	4.23	0.765
Group Scheduling(like helicopter view)			5	19.2	10	38.5	11	42.3			3.23	0.765
Supervisor Productivity & Efficiency					15	57.7	11	42.3			3.85	1.008
Online booking/scheduling tool			5	19.2	10	38.5	11	42.3	11	42.3	3.65	1.231
Third party logistics			10	38.5	10	38.5			6	23.1	3.65	1.240

2. Descriptive analysis on A.A Road projects

2.1 policy and rules

Policy/rule	Not at all		Little		Average		Greatly		A lot		Mean score	Std. dev.
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
increase in the number of logistics service providers,							72	91.1	7	8.9	4.09	0.286
enhanced logistics management techniques are lower logistics costs					7	8.9	64	81	8	10.1	4.01	0.438
Independent supply chains for individual contractors							64	81	15	19	4.19	0.395
Centralized supply system managed by general contractor							55	69.6	24	30.4	4.30	0.463
centralized supply system managed by an external logistics company					16	20.3	47	59.5	16	20.3	4.00	0.641
Developing strategic guidelines for bidders			8	10.1	16	20.3	24	30.4	31	39.2	3.99	1.006
Developing logistic concepts for designing and planning:			8	10.1	8	10.1	39	49.4	24	30.4	4.00	0.906
Developing plans of the building site logistic and supervising their execution					24	30.4	31	39.2	24	30.4	4.00	0.784
The existence of Grading system for suppliers					32	40.5	24	30.4	23	29.1	3.89	0.832
Every quarter inventory performed					8	10.1	39	49.4	32	40.5	4.30	0.648
The presence of assessment and supplier monitoring system					24	30.4	31	39.2	24	30.4	4.00	0.784
Apply global material management guideline					23	29.1	16	20.3	40	50.6	4.22	0.872
The development of regional manufacturing and trading Centers.					16	20.3	48	60.8	15	19.0	3.99	0.630
Logistics clusters			8	10.1	24	30.4	24	30.4	23	29.1	3.78	0.983
Providing funding to research institutes							63	79.7	16	20.3	4.20	0.404
The coordination of policies regarding each mode of transport;			7	8.9	8	10.1	40	50.6	24	30.4	4.03	0.877

2.2 factors barrier to logistics of material

Factors	Negligence		Low		Moderate		High		Very high		Mean score	Std. dev.
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
Late and incorrect payments					16	20.3	47	59.5	16	20.3	4.00	0.641
Bidding process/material procurement procedure			8	10.1	16	20.3	40	50.6	15	19.0	3.78	0.872
Monitoring and Controlling							39	49.4	40	50.6	4.51	0.503
Design/engineering interface-incorrect documents design changes extended wait for architect's approval or design changes			8	10.1			55	69.6	16	20.3	4.00	0.784
Inaccurate data/ Communication problems					7	8.9	32	40.5	40	50.6	4.42	0.653
Delay due to rejection of materials from quality control Team			8	10.1	8	10.1	48	60.8	15	19.0	3.89	0.832
Planning and Scheduling					15	19	40	50.6	24	30.4	4.11	0.698
Problematic completion due to quality problems.			8	10.1	16	20.3	32	40.5	23	29.1	3.89	0.947
Unresolved quality problems, delayed occupation due to late ,completion					8	10.1	32	40.5	39	49.4	4.39	0.668
Inaccurate data, information needs not met, adversarial bargaining and other changes							56	70.9	23	29.1	4.29	0.457
Reliability of supply and Transportation problems					15	19	40	50.6	24	30.4	4.11	0.698
Organization and Personnel/Top management support					16	20.3	32	40.5	31	39.2	4.19	0.752
Improper handling of materials					8	10.1	23	29.1	48	60.8	4.51	0.677
Lack of material management/Mutual interest							32	40.5	47	59.5	4.59	0.494
Closer links between demand/supply							55	69.6	24	30.4	4.30	0.463

Seasonal problems					16	20.3	24	30.4	39	49.4	4.29	0.787
Creating standardization of process			7	8.9	64	81	8	10.1			3.92	0.675
Simplify bid process					31	39.2	32	40.5	16	20.3	3.81	0.752
Delivery, Storage and Storage facilities			8	10.1	16	20.3	24	30.4	31	39.2	3.99	1.006
Usage, Surplus and Waste control							55	69.6	24	30.4	4.30	0.463

2.3 stakeholders

Stakeholders	**Never**		**Rarely**		**Seldom**		**Frequently**		**Always**		**Mean score**	**Std. dev.**
	Freq.	**%**	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**		
Suppliers							39	49.4	40	50.6	4.51	0.503
Top managers					24	30.4	47	59.5	8	10.1	3.80	0.607
Share holder					16	20.3	32	40.5	31	39.2	4.19	0.752
Investor							56	70.9	23	29.1	4.29	0.457
Employees					15	19	40	50.6	24	30.4	4.11	0.698
Government and non- government organization					24	30.4	32	40.5	23	29.1	3.99	0.776
Trade association					8	10.1	32	40.5	39	49.4	4.39	0.668
Competitor							39	49.4	40	50.6	4.51	0.503
Media			8	10.1	8	10.1	47	59.5	16	20.3	3.90	0.841
Local community							39	49.4	40	50.6	4.51	0.503
Technologists /software developers			8	10.1	8	10.1	32	40.5	31	39.2	4.09	0.950

2.4 Auditing practice on construction material logistics

Auditing systems	Not at all		Little		Average		Greatly		A lot		Mean score	Std. dev.
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
providing reliable financial reporting			8	10.1	8	10.1	47	59.5	16	20.3	3.90	0.841
identification and prevention of fraud/ Evaluate fraud risks							31	39.2	48	60.8	4.61	0.491
elimination of income or resource losses/					23	29.1	40	50.6	16	20.3	3.91	0.701
Communication internally and externally Information			8	10.1	8	10.1	32	40.5	31	39.2	4.09	0.950
Perform ongoing or periodic evaluations of internal controls					8	10.1	48	60.8	23	29.1	4.19	0.601
Availability of technology controls							48	60.8	31	39.2	4.39	0.491
Registered suppliers			8	10.1	24	30.4	47	59.5			3.49	0.677
The existence of Grading system for suppliers			8	10.1	32	40.5	23	29.1	8	10.1	3.44	0.841
Every quarter inventory performed			8	10.1	8	10.1	55	69.6	8	10.1	3.80	0.758
Assembled of auditing committee			8	10.1	8	10.1	47	59.5	16	20.3	3.90	0.841
The presence of supplier monitoring system					8	10.1	39	49.4	24	30.4	4.41	0.809
Apply global material management guideline					16	20.3	32	40.5	31	39.2	4.19	0.752
A recorded key logistics data					8	10.1	32	40.5	39	49.4	4.39	0.668
Material quantity before and after completed the work counted			8	10.1	8	10.1	47	59.5	16	20.3	3.90	0.841
customer notification/approval occur for changes to control plans, manufacturing site, product transfers, raw material or product obsolescence					23	29.1	16	20.3	40	50.6	4.22	0.872
Hold people accountable					24	30.4	32	40.5	23	29.1	3.99	0.776

2.5 Conceptual frame work /system on construction material logistic the level of importance material logistic system/framework

Auditing systems	Not important		Less important		Somehow important		important		Very important		Mean score	Std. dev.
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
Administration ,customs clearance procedures,					24	30.4	39	49.4	16	20.3	3.90	0.709
A good city logistics is adaptive: a generic urban and building typology							31	39.2	48	60.8	4.61	0.461
Paperless Mobility			8	10.1	55	69.6	16	20.3			4.00	0.784
Road ,rail, ports, airport inland water Transport							63	79.7	16	20.3	4.20	0.404
Ware house multimodal logistics centers					24	30.4	24	30.4	31	39.2	4.09	0.835
Logistics providers			8	10.1	16	20.3	39	49.4	16	20.3	3.80	0.883
Trucking companies			8	10.1			48	60.8	23	29.1	4.09	0.835
Shipping companies							31	39.2	48	60.8	4.61	0.491
Inventory					16	20.3	47	59.5	16	20.3	4.00	0.641
Transportation							31	39.2	48	60.8	4.61	0.491
purchasing/controlling					8	10.1	39	49.4	32	40.5	4.30	0.648
purchase order and supplier invoice approval							32	40.5	47	59.5	4.59	0.494
Group Scheduling(like helicopter view)			8	10.1	7	8.9	32	40.5	32	40.5	4.11	0.947
Supervisor Productivity & Efficiency					15	19	56	70.9	8	10.1	3.91	0.536
Online booking/scheduling tool					8	10.1	55	69.6	16	20.3	4.10	0.545
Third party logistics							56	70.9	23	29.1	4.29	0.457

3. Descriptive analysis on A.A Housing projects

3.1 policy and rules

Policy/rule	Not at all		Little		Average		Greatly		A lot		Mean score	Std. dev.
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
increase in the number of logistics service providers,							40	100			4.00	0.000
enhanced logistics management techniques are lower logistics costs					8	20	24	60	8	20	4.00	0.641
Independent supply chains for individual contractors							20	50	20	50	4.50	0.506
Centralized supply system managed by general contractor					4	10	28	70	8	20	4.10	0.545
centralized supply system managed by an external logistics company					12	30	16	40	12	30	4.00	0.784
Developing strategic guidelines for bidders					8	20	16	40	16	40	4.20	0.758
Developing logistic concepts for designing and planning:							32	80	8	20	4.20	0.405
Developing plans of the building site logistic and supervising their execution					4	10	36	90			3.90	0.304
The existence of Grading system for suppliers							36	90	4	10	4.10	0.304
Every quarter inventory performed					16	40	4	10	20	50	4.10	0.955
The presence of assessment and supplier monitoring system			4	10	20	50			16	40	4.20	0.883
Apply global material management guideline							36	90	4	10	4.10	0.304
The development of regional manufacturing and trading Centers.					4	10	24	60	12	30	4.20	0.608
Logistics clusters							28	70	12	30	4.30	0.464
Providing funding to research institutes					4	10	20	50	16	40	4.30	0.648
The coordination of policies regarding each mode of transport;					12	30	20	50	8	20	3.90	0.709

3.2 factors barrier to logistics of material

Factors	Negligence		Low		Moderate		High		Very high		Mean score	Std. dev.
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
Late and incorrect payments					16	40	8	20	16	40	4.00	0.906
Bidding process/material procurement procedure					12	30	20	50	8	20	3.90	0.709
Monitoring and Controlling					4	10	16	40	20	50	4.40	0.672
Design/engineering interface-incorrect documents design changes extended wait for architect's approval or design changes					4	10	24	60	12	30	4.20	0.608
Inaccurate data/ Communication problems					4	10	16	40	20	50	4.40	0.672
Delay due to rejection of materials from quality control Team			4	10			32	80	4	10	3.90	0.709
Planning and Scheduling							28	70	12	30	4.30	0.464
Problematic completion due to quality problems.							28	70	12	30	4.30	0.464
Unresolved quality problems, delayed occupation due to late ,completion							28	70	12	30	4.30	0.464
Inaccurate data, information needs not met, adversarial bargaining and other changes					8	20	24	60	8	20	4.00	0.641
Reliability of supply and Transportation problems							28	70	12	30	4.30	0.464
Organization and Personnel/Top management support					4	10	28	70	8	20	4.10	0.545
Improper handling of materials					4	10	24	60	12	30	4.20	0.608
Lack of material management/Mutual interest					4	10	8	20	28	70	4.60	0.672
Closer links between demand/supply					4	10	32	80	4	10	4.00	0.453
Seasonal problems							28	70	12	30	4.30	0.464
Creating standardization of process					4	10	24	60	12	30	4.20	0.608
Simplify bid process					4	10	20	50	16	40	4.30	0.648
Delivery, Storage and Storage facilities					8	20	28	70	4	10	3.90	0.545
Usage, Surplus and Waste control					4	10	28	70	8	20	4.10	0.545

3.3 stakeholders

Stakeholders	Never		Rarely		Seldom		Frequently		Always		Mean score	Std. dev.
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
Suppliers					4	10	28	70	8	20	4.10	0.545
Top managers					16	40	12	30	12	30	3.90	0.841
Share holder			4	10	8	20	12	30	16	40	4.00	1.013
Investor					8	20	20	50	12	30	4.10	0.709
Employees							24	60	16	40	4.40	0.496
Government and non- government organization					12	30	28	70			3.70	0.464
Trade association					8	20	20	50	12	30	4.10	0.709
Competitor					4	10	20	50	16	40	4.30	0.648
Media					8	20	28	70	4	10	3.90	0.545
Local community					4	10	20	50	16	40	4.30	0.648
Technologists /software developers					4	10	28	70	8	20	4.10	0.545

3.4 Auditing practice on construction material logistics

Auditing systems	Not at all		Little		Average		Greatly		A lot		Mean score	Std. dev.
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
providing reliable financial reporting					8	20	16	40	16	40	4.20	0.758
identification and prevention of fraud/ Evaluate fraud risks					8	20	24	60	8	20	4.00	0.641
elimination of income or resource losses/					8	20	20	50	12	30	4.10	0.709
Communication internally and externally Information					8	20	20	50	12	30	4.10	0.709
Perform ongoing or periodic evaluations of internal controls					4	10	20	50	16	40	4.30	0.648
Availability of technology controls					8	20	28	70	4	10	3.90	0.545
Registered suppliers							20	50	20	50	4.50	0.506
The existence of Grading system for suppliers					8	20	28	70	4	10	3.90	0.545
Every quarter inventory performed							24	60	16	40	4.40	0.496
Assembled of auditing committee					4	10	16	40	20	50	4.40	0.496
The presence of supplier monitoring system							16	40	24	60	4.60	0.496
Apply global material management guideline					16	40	12	30	12	30	3.90	0.841
A recorded key logistics data					8	20	28	70	4	10	3.90	0.545
Material quantity before and after completed the work counted					4	10	36	90			3.90	0.304
customer notification/approval occur for changes to control plans, manufacturing site, product transfers, raw material or product obsolescence					4	10	16	40	20	50	4.40	0.672
Hold people accountable					4	10	28	70	8	20	4.10	0.545

3.5 Conceptual frame work /system on construction material logistic the level of importance material logistic system/framework

Auditing systems	Not important		Less important		Somehow important		important		Very important		Mean score	Std. dev.
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
Administration ,customs clearance procedures,					12	30	12	30	16	40	4.10	0.841
A good city logistics is adaptive: a generic urban and building typology					12	30	24	60	4	10	3.80	0.608
Paperless Mobility							24	60	16	40	4.40	0.496
Road ,rail, ports, airport inland water Transport							24	60	16	40	4.40	0.496
Ware house multimodal logistics centers					8	20	24	60	8	20	4.00	0.641
Logistics providers					4	10	24	60	12	30	4.20	0.608
Trucking companies							28	70	12	30	4.30	0.464
Shipping companies					4	10	24	60	12	30	4.20	0.608
Inventory					8	20	24	60	8	20	4.00	0.641
Transportation					4	10	8	20	28	70	4.60	0.672
purchasing/controlling					24	60	12	30	4	10	3.50	0.679
purchase order and supplier invoice approval					4	10	28	70	8	20	4.10	0.545
Group Scheduling(like helicopter view)					4	10	16	40	20	50	4.40	0.672
Supervisor Productivity & Efficiency					4	10	20	50	16	40	4.30	0.648
Online booking/scheduling tool					4	10	20	50	16	40	4.30	0.648
Third party logistics					20	50	12	30	8	20	3.70	0.791