THE IMPACT OF MATERIAL MANAGEMENT ON CONSTRUCTION PROJECT DELIVERY IN MALDIVES

ZAHA AHMED

A dissertation submitted in partial fulfilment of the requirements for the award of Master of Project Management

Faculty of Engineering and Science,

Universiti Tunku Abdul Rahman,

April 2017

DECLARATION

I **ZAHA AHMED** hereby declare that the dissertation is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UTAR or other institutions.

Signature: _____

Name: ZAHA AHMED

ID No: 16UEM05462

Date: _____

APPROVAL FOR SUBMISSION

I certify that this project report entitled **THE IMPACT OF MATERIAL MANAGEMENT ON CONSTRUCTION PROJECT DELIVERY IN MALDIVES**" was prepared by **ZAHA AHMED** has met the required standard for submission in partial fulfilment of the requirements for the degree of Master of **PROJECT MANAGEMENT** at Universiti Tunku Abdul Rahman.

Approved by:

Signature: _____

Supervisor: Assistant Professor Mr. Lim Chai Chai

Date: _____

ABSTRACT

THE IMPACT OF MATERIAL MANAGEMENT ON CONSTRUCTION PROJECT DELIVERY IN MALDIVES

The cost of construction material in a construction project may range from 30 – 80 % of total construction cost making it a prime uncertainty in a construction project. Maldives being a small island nation with a small domestic market; shortage of skilled manpower; difficult inter-island transport and communication and heavy dependence on imported construction material amplified the problem of material management. The main aim of this research paper is to examine the current material management practice and its impact on the delivery of building construction projects in Maldives.

A questionnaire survey administered to a purposive sample of 20 main contractors and 20 sub-contractors, eliciting current material management practices through semi structured interview and obtaining their perception root causes of ineffective material management toward 34 causes that were extracted from an extensive literature review. Moreover the relationship between different material management practices and project delivery in terms of cost overrun and delay were acquired from this questionnaire.

The study found 3 distinguish material management practices that were followed. The top 3 most common root causes of ineffective material management identified were matching price to competitor's price, time spent investigating non-qualified suppliers and unavailability of material. Moreover the findings indicated that material management practices that are depending on the limited local supplier shops suffered

worst delay problems while material management practices that relied on phase-by-phase delivery experienced severe cost overrun. This research was conducted in Maldives on building construction projects and similar research needs to be conducted in other types of construction projects to cross-reference and validate the result more widely.

Key words: Construction projects, Material management, Cost overrun, Delay, Main contractor, Sub contractor, Maldives

ACKNOWLEDGEMENTS

First of all I would like to express gratitude to Allah Almighty for the blessing and kindness in lending me to accomplish this final year project. I am very grateful for everyone who has contributed to this project. Especially I would like to extend my deepest gratitude to my research supervisor, **Mr Lim Chai Chai** for his sincere guidance and his enormous patience throughout the development of the research.

In addition I would also like to thank all the staff and lecturers of **UTAR**, especially **Dr. Chia Fah Choy** for always being an inspiration and making this journey more interesting.

Furthermore my sincere thanks goes to my beloved family, especially my husband and parents, who stood beside me, supporting and encouraging me throughout this journey.

Specially dedicated to

My husband and my family

TABLE OF CONTENTS

LIST OF TABLES

Table **Page**

LIST OF FIGURES

Figure **Page**

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1. Construction Project

Constructions projects are one of the most common activities we encounter in our lives, yet it is also known as one of the most difficult humankind endeavours. As a matter of fact each project consist of sophisticated and complex processes which need to be carried out by different individuals of different professionals, who have special set of skills and knowledge. All the talent and skills have to be channelled towards a common goal to producing the project. To accomplish this goal, time and money are required. At the end these construction projects, provide us with facilities that are useful, functional, visually pleasing and enjoyable to occupy. This journey is called the project delivery process (Construction Specification Institute, 2011). Effective delivery is all about the control and management of uncertainty. Therefore one needs to identify the uncertainty related to the project and sculpt the best strategy to deliver the project so that the chances of success are increased.

Hence steering the way for accomplishing successful project is all about knowing all the tactics to tackle our way through the impending obstacles. So identifying these obstacles are crucial in order to confront them. Thereby a lot of researchers have immersed themselves in various studies to identify the causes of delay and cost overrun happening in various projects. The analyses on these factors have been carried on different contexts over a long period of time. This continuous effort on finding the causes or the factors for delay and cost overrun are more or less generated similar

results and only the ranking have been swapped between the different context and time. Although the repetitiveness in this approach is observed, a change in perspective can provide an interesting insight in a common pattern in these factors. For instance, issues regarding construction materials have been highly ranked in both delay and cost overrun factors and also it is a common factor that is mentioned in almost all the research done on this area. Hence this ignites the curiosity to unfold the relationship between construction material and construction project.

1.2. Material management in construction projects

The main reason for construction material to be so influential in a construction project is because the cost for material handling may range from 30 – 80 % of total construction cost (Proverb, et al., 1999).Therefore ineffective material management can cause inevitable loss for a construction project.

Material management can be considered as a prime uncertainty in a construction project. Bell and Stukhart (1986) defined materials management functions which include planning and material take off, vendor evaluation and selection, purchasing, expenditure, shipping, material receiving, warehousing and inventory and material distribution. As material management is interrelated to other processes and stages of the construction project and is dependent over various other factors it has high uncertainty. Especially the nature of construction project being fragment basis with unstructured communication and no clear responsibility between the parties, increase the challenge of implementing effective material management.

Although material management problems highly impact the construction professionals all over the world, they are more critical for Maldivian construction professionals.

Being a small island nation with a small domestic market; shortage of skilled manpower; difficult inter-island transport and communication and heavy dependence on imported construction material amplified this problem (The World Bank Group, 2016).

1.3. Overview of Maldives construction industry

In Maldives, in previous time the main construction materials were obtained locally. Construction in ancient Maldives was mainly dependent on the local availability of materials (Maldives Ministry of Tourism, 2013) but with the vast increase in population and introduction of new technology these natural resources started to become scarce. “The demand for coral has increased at an enormous rate during the last decade owing to increased development in the country. Recent studies had led to concerns over the sustainability of the reefs subject to coral mining activities.” (Naseer, n.d.) . Moreover the vulnerability in the Maldives environment condition forced to prohibit the extraction of these natural resources. This lead the country’s construction projects to highly depend on the imported material. “Due to the lack of local materials and the limited scope for substitution using local materials, almost all the building materials required by the construction industry, such as cement and aggregates; base metals; wood; various fittings and finishing materials, have to be imported.” (Rashfa, 2014)

The construction sector of Maldives is an important sector of the economy and has been a key driver of economic growth. As the industry has to deal with imported materials, the delivery time of material, quality and cost of the material has high uncertainty, which directly has an impact on the project delivery. Therefore it is

important to have a thorough research on the material management area in Maldives construction projects. “Materials management is defined as a management system that is required in planning and controlling the quality & quantity of the material, punctual equipment placement, good price and the right quantity as required.” (Madhavi, et al., 2013).

This study will explore how the current material management practices in Maldives construction project are affecting the project delivery. Moreover how these various practices can be improved to deliver more successful construction projects in Maldives.

1.4. Problem Statement

Due to Maldives archipelago, islands being scattered and poor transport infrastructure resulted complications in transportation. Furthermore the unexpected weather conditions escalate the transportation difficulties. The rigorous procedure to deliver the materials to the construction site also has its own uncertainties and ambiguities. The material orders need to be quantified properly to fulfil only the present phase. Because the country is mostly described to have more sea than land therefore lack of storage space is a common problem. Without proper storage of materials it can lead to unexpected condition, which can affect the project. Therefore in this research more in depth study will be conducted to understand how materials management process practice can have an impact on the construction delivery time.

Bringing imported construction materials made-to-order for a construction project is time consuming and requires high expenditure. On the other hand those projects depending on the limited local supplier shops face the difficulty to find the right

quantity and quality of materials needed for the projects. Ultimately putting the project at stake and accelerating the cost of the project. Therefore in this research a study will be carried out to explore the relationship between different material management processes practice and project delivery in terms of cost overrun and delay.

Multiple times the researchers in the field of construction highlighted the challenges that they are facing due to the imported materials, but an in-depth study has never been conducted (Rashfa, 2014). Even though fundamental discussions have been conducted to raise concern regarding construction material, no solid solution has been reached. As the answer always tie back to Maldives limited natural resources but never raise to find the root causes of ineffective material management in construction projects and its relation to the existing material management practice.

1.5. Aim

The main aim of this research paper is to explore the current material management practice and its impact on the delivery of building construction projects in Maldives.

1.6. Objective of Study

The objectives of this study are:

1. Examine the existing material management processes in construction projects of Maldives.

2. Identify the root causes of ineffective material management in Maldives construction projects

3. Explore the relationship between material management process types and project delivery in terms of cost overrun and delay.

1.7. Research questions

a. What are the current material management practices in construction projects?
b. Is there any influencing factors determining material management process type?
c. What are the root causes of ineffective material management in Maldives construction projects?
d. Is there any relation between the root causes and the current material management practices?
e. How project delivery in terms of cost overrun and delay is related to the material management practices?

1.8. Scope of work

This research paper focuses only on the construction industry of Maldives. Moreover it concentrates specifically on building projects such as; residential and non-residential hotels, restaurants. Even though projects with various project value and size are explored in this research, a special attention to building projects in the Maldives capital city, Male' city is given as most of the building projects are concentrated in the urban area.

1.9. Significance of Research

The findings from this research will serve as a guideline to the Maldives construction industry stakeholders. As a matter of fact construction material management practices in Maldives construction industry have never been identified or recorded previously. Therefore this study will be the first to reveal the existing material management practices and the comparison between the different approaches will give the field professions a deeper insight into these practices.

Moreover this study will generate a list of root causes for ineffective material management that can be used as a benchmark to control the existing and future projects. In addition to this how these root causes are related to the current material management practices will aware the stakeholders to be more cautious.

Furthermore the most concerning issues like cost overrun and delay in terms of project delivery and its relation with the current material management practice will reveal the weakness in the current material management practices to the stakeholders.

Apart from this research being useful to the field professionals, this study will be valuable for the academicians too. As this study will serve as a support of what the past researchers have written about material management in construction projects. Furthermore it will also provide information for further researchers who are willing to investigate on this particular or similar case.

1.10. Layout of Dissertation

This research is composed of five chapters, the content of the chapters is briefed as follows:

Chapter1

This chapter introduces the role of material management in construction project delivery and also explains the vulnerability of material management in Maldivian context. Hence it explains the need for the research, aim and objectives and finally explains the significance and scope of this research.

Chapter2

Provides a review of literature in four areas related to this study. Current complications in Maldives construction industry, material management processes and techniques used in construction projects, root causes of ineffective material management faced by developing countries and consequences of ineffective material management on project delivery.

Chapter3

Describes the research approach used to develop, to achieve the objectives of this research. It describes the research design, the population and sample, questionnaire development, data collection, data analyses and pilot study that were used in this research.

Chapter4

Discuss the data analysis and the result obtained from the study. This specifically includes statistical methods such as Cronbach Alpha, mean, bar charts, pie charts, tables and analytical studies. And specific discussion of each of the factors analyzed.

Chapter5

This section contains the major findings of this study, followed by contributions of this research. Furthermore constraints and limitation of this study is summarized and also outlines recommendations for future research related to this study.

CHAPTER 2

LITERATURE REVIEW

2.1. Introduction

Unlike earlier days, today the construction industry have become highly complex due to the technological developments, globalization, uncertain economic conditions, social pressures, political instability and so on (Walker, 2015). The conventional methods are incapable to meet with the demands of today's environment that is described by the authors as being more dynamic and filled with greater uncertainty (Keith, et al., 2016). With the increasing complexity and uncertainty, project delivery is not only management of three project constraints: cost, scope and time, but perceive it to be an assessment of the uncertainty within which the project is operating and its continuing ability to respond to the reason why it was needed in the first place (Melton & Iles-Smith, 2009). Effective delivery is all about the control and management of uncertainty. Therefore one needs to identify the uncertainty related to the project and sculpt the best strategy to deliver the project so that the chances of success are increased.

There are certain sets of methods followed in delivering a construction project. Even though these processes vary from country to country and also from project to project there is a common process that is mostly recognized by a country's construction industry. Likewise the current conventional process of design and construction that is used by Maldives involves the developer or the client to proceed with the detail designing of the building. The documents and drawings are usually prepared before

selecting a contractor. Moreover the construction documents needed for tendering will be prepared by the design firm, hired by the client or the developer. The design firm also will be acting as a consultant during the design and construction of the project. In addition, the design firm will represent the developer in dealing with the contractor and the government authorities. The detail design stage and the construction will take place separately (Tholhath & Ibrahim, 2013). Below in Figure 1, illustrates the existing project delivery practice in Maldives (source from Tholhath & Ibrahim, 2013).

Figure 2.1: Project delivery practice in Maldives (source from Tholhath & Ibrahim, 2013)

2.2. Material management in construction project

Construction material is recognized to be a major component in the construction project cost. Depending on different project it is assumed that the material cost can represent from 30% to 70% of the total project (Donyavi & Flanagan, 2009). Construction materials consist of various raw materials extracted from different markets. Sadly the prices and availability of these materials are highly vulnerable to the turbulences of the varying market conditions (Christopher, 2011). Thereby making the construction materials a highly uncertain component in the construction project.

The range and variety of construction material are accelerating with the advancement of technology. This has resulted the construction industry to shift away from localized use of materials to centralized worldwide production. Gradually the simple materials are being replaced by the introduction of engineered composites and mixed assemblies. Moreover chemical additives have enhanced the materials producing a wider array of properties (Calkins, 2009). The ample options of materials with varying properties have been considered as an accomplishment to the construction industry however the availability of too many options have caused complications in making the right choice. Experts and specialists are required to select the most compatible construction material to compliment the project. The material choice will determine the machinery and workmanship required and making the right choice from initiation can pave the path for a smoother delivery.

After the selection of material till the final product is erected it involves a series of processes, which is referred as material management. This involves storage, identification, retrieval, transport and construction methods (Pellicer, et al., 2013). Material management is the system of planning and controlling to ensure the right quality and quantity of materials and equipment are specified in a timely manner. (Donyavi & Flanagan, 2009). All these process posses' high uncertainty, as they are interlinked with other series of activities with unknown variables. Therefore according to many authors effective materials management is the key to the success to construction project (Gulghane & Khandve, 2015). More researches even eloborate that effective material management can improve the productivity of the project and thus can lead to success (Pande & Sabihuddin, 2015).

According to Maldives building code (Ministry of construction and Public Infrastructure, 2008) the buildings are classified into 7 categories. They are Housing, Communal residential, Communal non-residential, commercial, Industrial, outbuilding and Auxiliary. Furthermore in another research conducted by Rashfa (2014) describes that the main types of construction project that are taken place in Maldives are categorized into residential buildings, non-residential buildings, civil engineering and resort development projects. Among these 4 categories the local contractors are mostly involved in the residential buildings and non-residential buildings projects. The residential projects are described as the projects that cover the construction of dwellings. Non-residential projects include construction of health facilities, mosque, shopping complex, restaurants and so on. Therefore this research will be focusing on exploring about the material management system practiced in these two types of projects.

Even though having an effective material management is highly crucial to building projects, there has been no such study done on this area in Maldives. The uncertainty involving in material management is inconceivable, especially because construction materials are not locally available in Maldives. Depending on imported construction material, increase the complexity in the process. These are the general problems facing by the construction industry and Maldives as a country problems that were repeatedly emphasized in these publications.

1. Limited skilled professionals
2. Lack of unskilled labourers so depending on foreign labourers
3. Unavailability of local construction materials (rely on imported materials)
4. Few suppliers in market
5. Poor infrastructure

6. Lack of space/storage

Moreover this ignites the curiosity to understand more about the material management process that is being followed in the Maldives construction industry.

2.3. Material management processes and techniques

Material management consist of a series of processes that need to be integrated, coordinated and synchronized well to ensure that material are available at their point of use when needed. Material management process begins from need generated from site followed by this information conveyed to store department and material is ordered in the store, indent is generated. Usually vender selection is to be carried out for the least value and best items. Materials are received at store departments and inspection is carried out. Below in Figure 2 is a material management process flow chart (source from Patil & Pataskar, 2013).

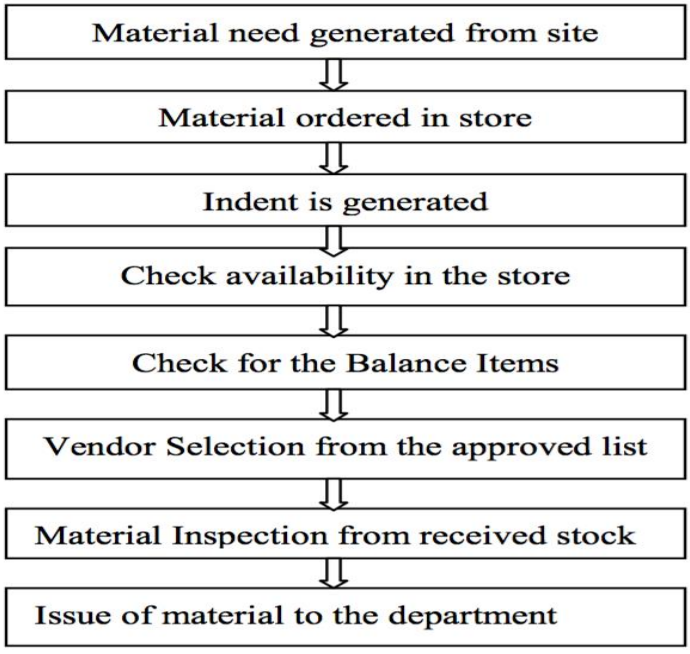

Figure 2.2: Material Management Processes (source from Patil & Pataskar, 2013)

2.3.1. Planning

Material planning is the initial process that needs to be carried out accurately in order to provide guide to all the subsequent activities. According to Gulghane & Khandve (2015) material planning includes quantifying, ordering and scheduling. The materials planning process covers the set up maintenance of records and determines the target levels and delivery frequency. Adopting a good material management plan can increase productivity and profit. Hence, it can help to increase the success of project delivery (Kasim, et al., 2005).

2.3.2. Testing

Quality is a prime factor to measure the performance of a project. Quality assurance of building materials is vital in order to create strong durable and cost effective structures (Savitha, n.d.). Each construction project has a different set of specification and requirements. The contractors are required to select and procure suitable construction materials so that they can meet the contract specification. Unless a specific brand and model number is stated, it is advisable to conduct thorough study and analysis of the different material properties to check for its compatibility in the different zones of the building. The materials are only ordered after receiving approval (Low & Ong, 2014). Proper assessment of the various materials is important to ensure quality and durability of the final product.

2.3.3. Procurement

Procurement is not only about appointing contractors and preparing contract, but is also very much a starting point in the process of delivery (Mead & Gruneberg, 2013).

Activities included in the procurement process range from purchasing of equipment, materials, labour and services required for construction and implementation of a project (Kasim, et al., 2005). Another author has defined procurement as identifying and analysing user requirements and type of purchase, selecting suppliers, negotiating contracts, acting as liaison between the supplier and the user, and evaluating and forging strategic alliances with suppliers. For many organizations, materials and components purchased from outside vendors represent a substantial portion of the cost of the end product, and hence effective procurement can significantly enhance the competitive advantage of a project (Morris & Pinto, 2007). Many authors have suggested that choosing best option of procurement can help to reduce the impact of uncertainties such as late deliveries, substandard raw material qualities, resource constraints and so on (Morris & Pinto, 2007). Therefore to successfully deliver a project it is not about adopting a procurement system with best practice tactic to fix all problems, but to embrace an approach that has the best-fit tactic that gets the job done most efficiently (Keith, et al., 2016).

2.3.4. Logistics

Logistic is defined as concept that includes movement and it may encompass planning implementing and controlling flow and storage of all goods from raw materials to the finished product to meet customer requirements (Kasim, et al., 2005). For smoothly handling the materials, space need to be carefully allocated for material handling equipment, access roads, warehouses, workshop, and laydown materials in the construction site (Pellicer, et al., 2013). Planning these tasks accurately can help to formulate an efficient construction site layout that can provide easy access and routing of materials within the construction site. Moreover introducing slopes in the

construction site can ease the circulation of materials because of the gravity effect. To control access and to increase the security of the site, setup wall or fence can be considered as a requirement for the construction site. Optimum forecasting for material movement (Mahdjoubi & Yang, 2001) and planning of access and routing of materials within construction site (Faniran & Caban, 1998) are factors that need to be taken consideration during logistics process for effective material management.

2.3.5. Handling

Various materials posses' different features and properties, that makes the handling of materials critical. Effective material handling involves handling, storing and controlling of construction material (Kasim, et al., 2005). Proper protection during storage is often ignored, and this can result poor material quality or material deterioration. Moreover it is also advised that transportation, loading and unloading of material should not be conducted in the rain. It is also recommended that the storage area needs to be enclosed, clean and dry with good air circulation and for some materials need to be stacked on pallets, not more than a certain safe height to prevent dampness and so on (Low & Ong, 2014). By adopting proper material handling and storage will help to keep the material intact and in good quality. And also will reduce loss of profit due to theft, damage and wastage as well as running out of stock (Kasim, et al., 2005).

2.3.6. Stock and waste control

Material waste is a significant factor in construction cost, Calkins (2009) states material waste is 9% by weight in the Dutch construction industry and 20-30% of

purchased materials in the Brazilian construction industry. Material wastes are caused by several sources such as design, procurement, material handling, and operation and so on. Shen et al. (2003) defined building material wastages as the difference between the value of materials delivered and accepted on site. Moreover material waste has been recognized as a major problem in the construction industry and it can also implicate inefficiency in project delivery. Adopting a proper stock control will help to increase the productivity and also can be one of the way to improve waste control in the construction site. By introducing minimizing strategies to reuse materials in both design and construction phase can be a mean to reduce waste (Dainty & Brooke, 2004).

Some authors simplify these stages into distinctive phases. As a matter of fact one of the research done by Manteau (2007) on the material management practices in Ghana explains that the current material management phases in Ghanaian construction industry are bidding phase, sourcing phase, material procurement phase, construction phase and post construction phase. A study conducted in India by Patel & Vyas (2011) has summarized the material management processes into 8 main parts. They were planning, benchmarking, purchasing, receiving, inspection, storage, issuing material and inventory control.

Therefore it is very evident that in various countries these processes are carried out in different ways. There can be many factors that might influence these processes such as culture, work environment, belief and so on. Moreover different groups have learnt to deal with uncertainty in different ways, often because they find themselves faced with different levels of uncertainty. Adams (1965) writes of 'risk thermostat' in relation to individuals' ability to deal with and be comfortable when exposed to risk. Therefore already established material management processes that are being practiced

by other countries can be used to identify the processes that are being practiced and those that are neglected in the Maldives construction industry.

2.4. Root causes of ineffective material management

During the past years, various academics researchers have conducted studies investigating to find out the issues causing ineffective materials management in construction projects. Among these studies were:

A study carried out Zakeri et al (1996) suggested that transport difficulties, waste, improper handling on site, misuse of specification, lack of proper work plan, inappropriate materials delivery and excessive paperwork all have an immense effect on materials management. Another researcher, Dey (2001) emphasized that the common issues regarding material management are as follows:

- Receiving materials before they are required which may increase inventory cost and may increase the chance of deterioration in quality;
- Not receiving materials during the time of requirement causing to decrease motivation as well as productivity
- Incorrect materials take-off from design and drawing documents;
- Constant design changes
- Theft or loss of item
- Choice of type of contract for specific material procurement
- Vendor evaluation criteria
- Piling up of inventory and controlling of the same
- Management of surplus material.

In another study conducted by Sohrab Donyavi (2009) states the common problems in material management are as follows:

- Failure to order on time which may cause delay in the projects;
- Delivery at the wrong time which may interrupt the work schedule;
- Over ordering;
- Wrong materials or wrong in direction of materials requiring re-work;
- Theft of materials from delivery into production;
- Double handling of materials because of inadequate material

Moreover a study conducted Kasim (2008) highlighted that problems could emerge due to human error, especially because some construction firms still rely on manual methods for material management which involves paper based techniques. In addition she states that problematic use of paper based reports for exchanging information relating to materials component with supply chain can result misunderstanding and poor coordination.

In another research done by Gulghane & Khandve (2015) state that problematic management of material are due to overstock materials because of improper planning, damaged materials due to logistics, handling or in application, loss of materials because of improper supervision, waiting of the materials to arrive in location due to improper tracking system, frequent movement of materials due to improper site layout, inflation, material changes in buying or purchasing situation starting from the prepared cost estimation, bulk construction material, the shortage and changes of construction materials quantity required, material inefficient on site, stealing and loss of construction material, material shipment, work repairing, delay in updating or posting storage system on site, in accurate estimation of shipment quantity of materials, uneconomical order quantity of materials poor shipping time, increasing transport cost

of materials, material over usage in location of project, choosing the wrong materials for construction, the increasing storage cost of materials, the poor buying ability of managers, delay of payment for materials.

A study done by Kasim (2008) investigates the problems in material management by conducting a research on 6 case studies. Case study A and B are two small projects from two different construction companies, while the other 4 case studies are larger or more complex studies. The interviewees under study were experience constructional professionals ranging from 8- 32 years' experience. Moreover the cost of the projects ranged from £ 1.78 million to £ 4.2 billion. 17 possible issues causing ineffective material management were revealed. The major problems that were discovered are material management activities related to constraints site storage, site logistics with regards to material handling and distribution and also ordering and delivery of materials to the construction site. The following are the identified 17 causes:

- Late delivery
- Site storage problems
- Logistics problems
- Incorrect delivery
- Inadequate loading area
- Site access problem
- Regulation consideration
- Congestion time
- Others: Incomplete delivery
- Constraints storage compound
- Material damages

- Lack of materials
- Improper handling
- Tower crane distribution problem
- Supply chain challenge
- Project size challenge
- Project location challenge

A study done by Patel & Vyas (2011) had an interesting approach to identify the problems occurring in the material management process. They have used 3 projects from Hyderabad, India to reveal the problems in the material management. Initially they divided material management process into 4 main phases, which are material identification, Vendor selection, Procurement and Construction phase. Next the problems associated with each phase were clearly identified, disclosing the usual problems occurring in these phases, this is shown in the below Table 2.1 (source is from Patel & Vyas, 2011) .

Table 2.1: Causes of ineffective material management (source is from Patel & Vyas, 2011)

A	**Material Identification**
	A1 Undefined scope
	A2 Lack of communication
	A3 Incomplete drawings
	A4 Lack of conformance to requirements
	A5 Nonstandard specification
	A6 Incomplete/ ineffective meeting

	A7	Difference between plans and specification
	A8	Not determining what and when materials needed
B	**Vendor selection**	
	B1	Uncontrollable bid list
	B2	Incomplete proposal
	B3	Time spent in investigating non-qualified suppliers
C	**Procurement Problem**	
	C1	Availability of material
	C2	Availability of quality
	C3	Matching price to competitors price
	C4	Late deliveries
	C5	Late or incorrect submittals
	C6	Poor communication
	C7	Lack of conformance to requirements
	C8	Unrealistic delivery date
	C9	Vague stated requirements
	C10	Re handling of material
	C11	Storage of materials
	C12	Theft

	C13	Damage of material
D	**Construction Phase**	
	D1	Incorrect type of material delivery
	D2	Incorrect sizes delivered
	D3	Incorrect quantity delivered
	D4	Keeping track of material
	D5	Re-handling of material
	D6	Storage of material
	D7	Loss of material
	D8	Damage of material
	D9	No supplier quality assurance
	D10	Poor communication
	D11	Receiving handling and storage of unused materials

Maldives and India being neighbouring countries share a lot of similarities in culture as well as in the work environment. Therefore these material management problems identified in India can be used to reveal the issues in the Maldives construction industry.

Even though we understand all these issues are usual problems in material management in construction industry, we need to further identify the threats and the vulnerabilities associated in Maldives construction industry related to material

management. It has been identified that in Maldives problems such as limited skilled professionals, lack of labours and unavailability of local constructional materials are major issues faced by the construction industry (Rashfa, 2014). However the relationship between these issues and ineffective material management are not recognized. Therefore to improve the construction project delivery in Maldives, further research need to be conducted to find the major root causes of ineffective material management at each phase.

2.5. Consequences of ineffective material management on project delivery

A success of a construction project lies in the ability of all the stakeholders to plan effectively, as well as properly manage the resources. Furthermore this grand plan encompass of sub plans, which helps to determine, sequence, strategize how to allocate the resources effectively. Construction projects are well known for being complex and are subjected to high uncertainty and variability. Construction materials are involved throughout the construction project and variability and uncertainty can be traced back to construction material. Therefore formulating a good material management plan is highly mandatory to support the grand plan.

Unavailability of materials when needed can affect the productivity and it may cause delay and difficulties to meet the schedule. On the other hand having excessive materials on site will also create problems to the managers. Storage of materials can increase cost of production thus increasing the overall cost of the project. Furthermore if the site lacks space to store all the materials may burden the managers to rent alternative storage areas which will cause more trouble and cost (Haddad, 2006).

In most contracts, the cost and time requires to complete the specified scope of works are defined in project documents. Control of quality of materials and workmanship is

achieved through proper quality control plan and its implementation through a preset level of quality control and inspection of various activities and materials. Budget control is done through monitoring progress payments and variation costs. The schedule is monitored by ensuring timely approval of materials, shop drawings, timely procurement of materials and execution of works as planned. Quality control and safety are achieved through inspection of works during the construction process, ensuring the use of approved materials and workmanship (Rumane, 2011).

It is a fact that those construction projects that are unable to use their resources efficiently will reduce their productivity reflecting their poor management skills. According to a study done by Baldwin & Bordoli (2014) state that 40% of the time lost on the site can be attributed to bad management, lack of materials when needed poor identification of materials and inadequate storage. By formulating an ineffective materials management plan can have a negative impact on cost, quality and time, which will affect the project delivery.

There have been various studies conducted in different countries to identify the factors causing cost overrun, delay and quality issues in construction projects. Surprisingly, the factors are more or less very similar in various cases, but the ranking of the factors were different. The fact that cannot be ignored is that factors related to construction material appeared in most of these list of factors causing cost overrun, delay and quality issues.

In a study conducted by Wanjari & Dobariya (2016), the highest factor causing cost overrun in India construction industry was identified as price escalation of raw material. In another study done by Cheng (2014) about an exploration into cost influencing factors on construction projects revealed that material shortage or supply delay is a prominent project risk that will influence the project cost. Similarly study

conducted to identify the delay factors in construction projects of Turkey found out that material is a significant factor causing project delay (Gunduz, et al., 2013). Furthermore it was explained that problems such as late delivery of materials, poor procurement of construction material and shortage of construction materials are prime factors causing project delay.

Unlike cost and time, quality is more subjective. The factors affecting the quality of a project are perceived differently by the contractor, consultant and client. This is because due to individual interest, knowledge and their own judgment. Therefore in this study the impact of project delivery will be explored in terms of cost and time. So the cost overrun and delay in current Maldives construction project will be explored to find out its relationship with the existing material management processes that are practiced in Maldives. Furthermore this study can help to justify the significance of improving material management processes in construction industry of Maldives to implement more successful project

CHAPTER 3

METHODOLOGY

3.1. Introduction

This chapter explains the method and design that was used to conduct the research. Determining a good research strategy will help to reach to a productive conclusion.

There are two types of research strategy. They are qualitative and quantitative research. Quantitative research is 'objective' in nature. It is defined as an inquiry into a social or human problem based on testing a hypothesis or a theory composed of variables, measured with numbers and analysed with statistical procedures. (Naoum, 1998)Therefore this research method can be achieved through questionnaires, surveys etc. In the most general terms, quantitative research does three main things, which are, it conceptualizes reality in terms of variables, it measures these variables and it studies relationships between these variables (Punch, 2014). Collecting data for quantitative can be time consuming as the sample size is usually greater compared to qualitative, but analysis is usually easy as it is mostly straightforward and repetitive compared to qualitative. The other type of research strategy is qualitative research. Unlike quantitative, qualitative is subjective in nature. It emphasizes meanings, experiences, descriptions and so on. This can be achieved through interviews, attitudinal surveys and so on. Where the questions are designed to be more general or explanatory answers. Conducting a qualitative research is believed to be more challenging than quantitative research especially if it needs to be done in a shorter span of time. As a matter of fact qualitative research is an in depth study which needs to be done slowly to absorb and explore to the depth of its core, revealing new theories. Moreover unlike

quantitative research, qualitative research is multidimensional and pluralistic with respect to paradigms (Punch, 2014).

Beside these two types, nowadays it is very common to find researchers using mixed method. This research method is a combination of both qualitative and quantitative methodologies. It is believed that adopting a mixed method approach has the advantage of gaining a stronger research design and achieving more valid and reliable findings. Moreover it is recognized that adopting a mixed method strategy can compensate the weakness and strengths of both qualitative and quantitative research approach. For example, quantitative research is well known for conceptualizing variables and using large representative samples, while qualitative approach has the strength to reveal the in-depth meaning and explore the context with smaller samples (Punch, 2014). Therefore by combining the strong areas of these two methods can help to give a strong logic to an underlying rationale. The mixed method is further classified into 4 major design methods. The first one includes a qualitatively driven core component and a quantitative supplementary component, where the core and the supplemental components are conducted sequentially. The second type is a quantitatively driven core component and a qualitative supplementary component, where the core and the supplement components are conducted sequentially. The third type of design consists of a qualitatively driven core component and a quantitative supplementary component where the core and the supplementary component are conducted simultaneously. The next type of design is qualitatively driven core component and a quantitative supplementary component, where the core and the supplemental components are conducted simultaneously (Clark & Creswell, 2008). In other words mixing of qualitative and quantitative can formulate triangulation designs, which can either be sequential or simultaneous. As a matter of fact using triangulation

method would involve the use of multiple methods to examine the same dimension of a research problem (Clark & Creswell, 2008). Even though many researchers have praised mixed method, some avoid doing it because following a mixed method research can be costly and time consuming.

3.2. Research design

The research strategy adopted for this research is simultaneous triangulation. As this method helps to achieve the objectives of this research. As a matter of fact data collected from one part is essential to formulate and analyse the data from the other part, both qualitative and quantitative research approach is used in this research.

The research methodology chosen for this research consists of intense literature review, mail questionnaire to stakeholders of Maldives construction industry, conduct structured interview and a statistical and qualitative analysis of the survey.

- Literature gathering
- Prepare literature review
- Identify material management processes and root causes in ineffective material management in other countries to formulate the questions
- Preparation of the questionnaire
- Identify the targeted response group
- Distribute the questionnaire to the targeted response group
- Conduct structured interview
- Data collection
- Data analysis

A questionnaire survey (refer to Appendix A) and structured interview (refer to Appendix H) were used as the main tools to collect data from the targeted response group. The questionnaire was designed into 4 sections, where the second section was enlightened by structured interview. Both the questionnaire survey and the structured interview helped to meet the 3 objectives of the study. Section-A consisted questions to determine the respondent's background.

One of the main aims of this research is to examine the material management processes used in Maldives construction industry. Collecting a set of statistical data is not enough to reveal the existing practice in Maldives therefore material management processes used in other countries were gathered and analysed in the literature review. From the extensive literature review, series of pre-established questions with pre-set response categories were formulated. With the limitation of the short span of time for this research, structured questions helped to minimize flexibility and variation while standardization was maximized (Punch, 2014).

3.2.1. Structured Interview

The Section-B of the questionnaire survey was reinforced by conducting a structured interview. The interviews were conducted through phone. The time and date were set according to the convenience for the interviewees. The time frame allocated to conduct the interview was set from mid-January 2017 to mid- March 2017. Hence the interviews were conducted between this time periods. The participants who fill the questionnaire survey and agreed to take part in the interview were included in the present interview study. Participants were informed that only interviewer knew about their identity and their participation was voluntary. They were assured that they could

withdraw from the study anytime without giving any explanation. The interviews were recorded to make it useful for the further analysis.

The questions that were asked to all the participant were, “Tell me more about the material management process that you follow?” and “Please explain why you are not following some of the processes that are mentioned in Section B of the questionnaire?” The sessions usually lasted 20- 40 minutes, but the participants were given opportunity to talk as much as they wish without time restriction. The main focus of this interview was to examine the material management processes that are currently in practice in Maldives construction projects. To unfold the substance in the transcribed text a manifest content analysis was conducted.

3.2.2. Content Analysis of the interviews

The collected data was analysed qualitatively at the end of data collection. Content analysis was used to analyse the collected data (Hsieh & Shannon, 2005). Every respondent has been asked the same question in the same order, so the different types of “courses of typical interviews” were tabulated (Morse & Niehaus, 2009). Processes that were not followed were identified and respondents who share similarities were tabulated. Saturation helped to categorize the different material management processes. Further analysis helped to distinguish each material management type and define each type more distinctively. The analysis was performed according to the following steps.

- The text were first read and simultaneously the author listened to the recorded interviews several times to grasp a sense of whole

- After reading and listening to interviews, meaning units were recognized and summarised the content, but essence was maintained.
- The condensed units were coded and then grouped into sub-categories and categories so as to organize the text in a way that reflected the central content in the interviews.

3.2.3. Questionnaire survey Section C

Next objective of the study was to identify the root cause of ineffective material management in Maldives construction projects. Root causes of ineffective material management identified by other countries' construction projects are discussed in the literature review. This information helped to formulate the questions for the section C. And these questions were designed based on 5-point Likert Scale, which measures from 1- 5 according to the level of contribution and impact of each factor (Jackson, 2012).

Strongly Agree (5)

Agree (4)

Neutral (3)

Disagree (2)

Strongly Disagree (1)

Use of Likert scale is very common as it is very simple to develop. Section C consists of subjective questions, where opinions vary according to their various experience in the field therefore using a scale helps to measure it. This data can be analysed

statistically using SPSS. To ensure that the data is consistent and reliable, Alpha Cronbach test can be conducted.

3.2.4. Questionnaire survey Section D

The last objective of this research is to explore the relationship between project delivery and existing material management processes in practice. Section D included close ended questions to find out about cost overrun and delay in construction project. The data from this section are cross-analysed with the findings of section B and section C. This analysis will help to find out the impact of material management on the project delivery.

The main reason for choosing simultaneous triangulation for this research was because the aim of this research is not to examine material management solely or investigate project delivery only, but to enrich our understanding from multiple perspectives by allowing a deeper relationship to emerge between these two elements (Clark & Creswell, 2008). With the time constraint and budget limitation this research methodology is the best approach to conduct this research and this is illustrated in Figure 3.1.

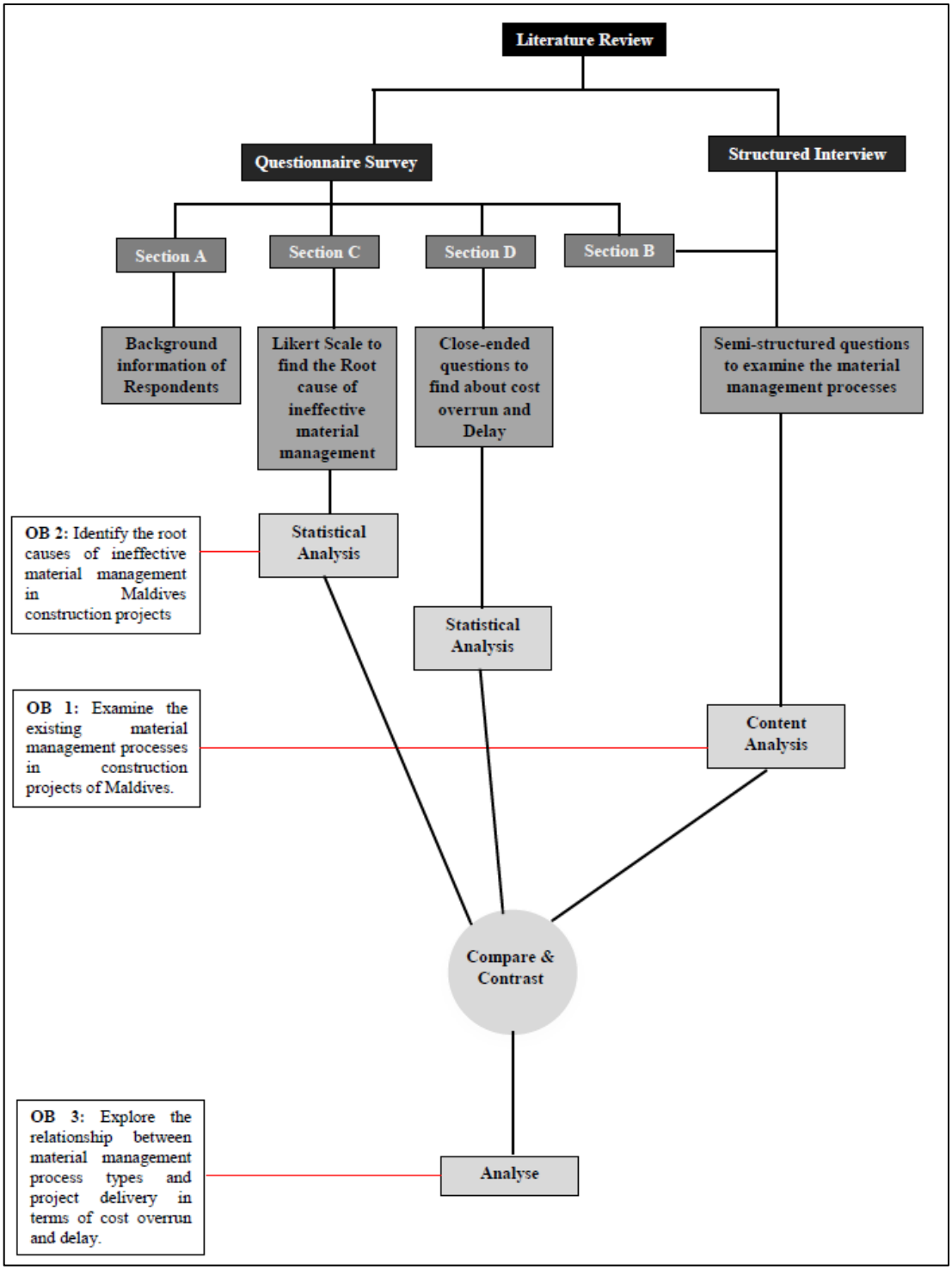

Figure 3.1: Research Design

3.3. Population and population size

The population of Maldives construction industry consists of clients, contractors and consultants. It is impossible to test everyone in the population so it is highly crucial to select a good sample to represent this population. Moreover this sample should consist of potential participants who are able to contribute to the research. Even though client and consultants represent a significant portion of the construction industry population, their involvement in material management is insignificant. Therefore this narrowed down the population into contractors and subcontractors. Moreover contractors and subcontractors having experience over 10 years and high qualifications were purposely selected for this research. As these respondents have filled high positions in construction field, their long exposure to the work environment and their educational background helped to provide fruitful information and insight for this research.

It is a common myth to believe that increasing the sample size and frame can help to capture more data that can help to enlighten a research area. This can be very applicable if the research is concentrating very much on quantitative or statistical analysis. However in this study, the main focus is on a specific field of interest and is more concentrating on adopting a more qualitative approach. Hence increasing the number was not the main target of this research, but selecting a considerable number with high potential sample was more important. Therefore with the time and cost constrain even though it was targeted to gain 50 respondents to the study, we were able to gain successful response from 40 stakeholders. This ended the population consisting of 40 respondents, which included 20 contractors and 20 subcontractors. The population size was narrowed down to this number to effectively maximize the cost and time allocated for the research. Moreover this survey consisted of many questions that required thoughtful answers. The time consuming nature of the survey might

discourage some respondents from participating. In addition this survey is concentrating more on construction material management and this might not be within the competence of some of the construction stakeholders. However purposive selection of the target respondents with competence and experience helped to overcome these challenges in data collection.

3.4. Sampling technique

In this study purposive sampling technique was used as this research followed a mixed method strategy. Usually purposive sampling is used in qualitative studies where, the participants are purposely selected based on specific purposes associated with answering a research study question (Naoum, 1998).

In this research the sample size depended on two things. Firstly, in order to examine the material management process types that is practiced in Maldives, data needed to be collected until the saturation point. Therefore this is the first element to decide the sample size. Next is that even though saturation point is reached within a sample size of for example 10, the data collection cannot be stopped at that point because quantitative analysis is also conducted in this research. Therefore a minimum 30 sample is needed to conduct a statistical analysis. Furthermore according to Morse & Niehaus (2009), if the research design follows qualitative and quantitative design, the sample size can be larger (at least 30). Hence in order to satisfy all these conditions 40 respondents were selected. Some of the respondents were first reached out from the registered contractors' list that is published in Maldives construction Ministry's website (Ministry of Housing and Infrastructure, 2016). This list helped to provide contacts of the field professional, but not all the people on the list were competent to provide their input into this research.

Moreover careful consideration was given to select a wide array of contractors. Therefore among contractors' knowledgeable main contractors who are involved in different project value was carefully selected. Unlike contractors, sub-contractors details were not accessible from the ministry's website, so snowball sampling techniques was used to select the subcontractors. Snowball sampling is a non-probability sampling technique that is used by the researcher to identify potential subjects in studies where it is hard to find. So with the help of the contractors and other professional contacts, sub-contractor samples were selected (Punch, 2014). Furthermore another significant criterion that was considered in this research while selecting the sample was that to select respondents who are involved in building projects. By clearly defining these boundaries helped to gather a sample that can provide a data that is more focused on this research.

3.5. Data Collection

The weight and the authenticity of the research rely greatly on the validity and reliability of the collected data. Data are often thought as 'the facts' – the things that are known to be true. But the truth is that data are social products. "The records created are not reality itself; rather they are a result of researchers' attempts to observe or measure traces or evidence of phenomena situated within a complex systems" (Byrne, 2002). In this study, data was obtained using 2 different methods.

3.5.1. Primary Data Collection

The primary data collection refers to the first-hand information collected directly by the researcher for the use of his/her study (Kent, 2015). Only the researcher gains the

first accessibility for this information. Moreover this information can be obtained by conducting personal investigations through respondents and survey using questionnaires. The collection modes of this information can be through various modes such as, personal interview, email, phone interviews and so on. Among the advantages of this method includes that it will provide highly accurate and reliable data. Furthermore this type of data collection is the best fit for in-depth investigations. On the other hand the disadvantage of this method is that it is time consuming and costly. As this study is following a mixed method strategy, the primary data was collected using questionnaires and telephone interviews. The questionnaires were emailed to the targeted respondents and they were expected to fill this form and return them through emails.

3.5.2. Secondary Data Collection

Unlike primary data, secondary data refers to the information that have been already collected, analysed, documented and published by another researcher or institute (Kent, 2015). This information is usually used to support the current research of the researcher. Gathering this information is not as hectic as collecting primary data, as this information can be easily accessible from libraries, archives, online journals and so on. But the pitfalls of secondary data collection are that some information may by false or outdated. Therefore in this study, the secondary data was collected cautiously from authentic sources such as information from well-known publishers, university library and reports published by the government bodies. Moreover a special attention was given to obtain recent information.

3.6. Pilot test

To ensure that the data constructed enable the researcher to address the objectives of which the research was undertaken, a pilot test was conducted. This test involved testing the questionnaire with a subset of the targeted respondent population. Therefore the questionnaire was given to 10 respondents. The main aim to conduct this test was to identify any mistakes in the questionnaire and also to make sure that questionnaire is easily comprehensible to the respondents.

The pilot test was conducted in Maldives, where questionnaire was distributed to the contractors and sub-contractors in Male' City. These respondents gave feedbacks regarding the layout and the content in the questionnaire. The feedbacks obtained were as followed;

- The questionnaire needs to be given in both language English and Dhivehi so that it will be easier to understand
- Some questions need to be modified to fit into Maldivian context as some of the processes that are mentioned in the questionnaire is not practiced in Maldives.

The questionnaire was modified and adjusted according to the feedbacks. Conducting this pilot test helped to improve the questionnaire to get better response from the respondents (refer to Appendix B). A total of 50 questionnaires were prepared and emailed to the sub-contractors and contractors of Maldives construction industry. Telephone interviews were conducted with the sub-contractors and contractors to gain more insight about material management processes in Maldives. Out of 50 questionnaires 43 questionnaires came back successfully. Among these 43 respondents, 3 people were not available for the interview. Hence data from 40 respondents were used for this research study. All the questionnaires were returned via

email after 4 weeks. But the phone interviews were continued for 8 weeks. The results were obtained and analysed qualitatively and statistically.

3.7. Conclusion

For the ease of the respondents the questionnaires were transformed into a Google form, where the respondents can fill the form directly and do not have to go through the vigorous procedure of scanning and mailing it back. But some of the respondents who are not familiar with the Google form just followed the old procedure of filling the questionnaire and mailing it back to the researcher. Moreover interviews were also arranged accordance with the respondent's convenience. Providing this flexibility for the respondents made the data collection procedure easy for both parties. In order to gather the data within the time framework, the respondents were constantly given gentle reminder through emails as well as by calling them. Only questionnaires that were fully completed were accepted while the partially filled once were discarded. However the number of questionnaires that were fully completed was enough to provide valid and reliable results.

CHAPTER 4

DATA ANALYSIS AND RESULTS

4.1. Introduction

A series of statistical test and analytical study was conducted to find the current material management processes practiced in construction projects in Maldives, root causes of ineffective material management and the relationship between the current material management practice and project delivery in Maldivian construction industry. The data collected using the questionnaire (refer to the appendix 2) was analysed using an array of descriptive and inferential statistical analyses, facilitated by Microsoft of Excel and Statistical Package for Social Scientist (SPSS). The result was presented using tables and descriptive statistics such as bar graph and the mean. The Cronbach Alpha test that shows the reliability of the questionnaire is also presented in this chapter.

4.2. Cronbach Alpha Test

Before conducting an analysis based on the results obtained from the questionnaire, Cronbach analysis was carried out to ascertain the internal consistency of the questions using the Likert scale. The result of the reliability test that was conducted on the Section C is represented on the table below. (Carver & Nash, 2009).

Table 4.1: Result of Reliability test

Part	Cronbach's Alpha	Number of questions
A	0.889	8
B	0.890	3
C	0.889	13
D	0.887	10

The result indicates that all items in Section-C are correlated. There is internal consistency between the items. This is because the Cronbach Alpha coefficient for all the components is high or close to 1. As a matter of fact the overall Cronbach Alpha value for the 34 items is 0.89. Therefore we can conclude that the test and questions were reliable (Kirkpatrick & Feeney, 2015).

4.3. Demography

4.3.1. Participants job position

The below Table 4.1 illustrates the job descriptions of the participants that took part in the survey.

Table 4.2: Job Descriptions of participants

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Main Contractor	20	40	50	50
	Sub-Contractor	20	40	50	100
	Total	40	80	100	
Missing		10	20		
Total		50	100		

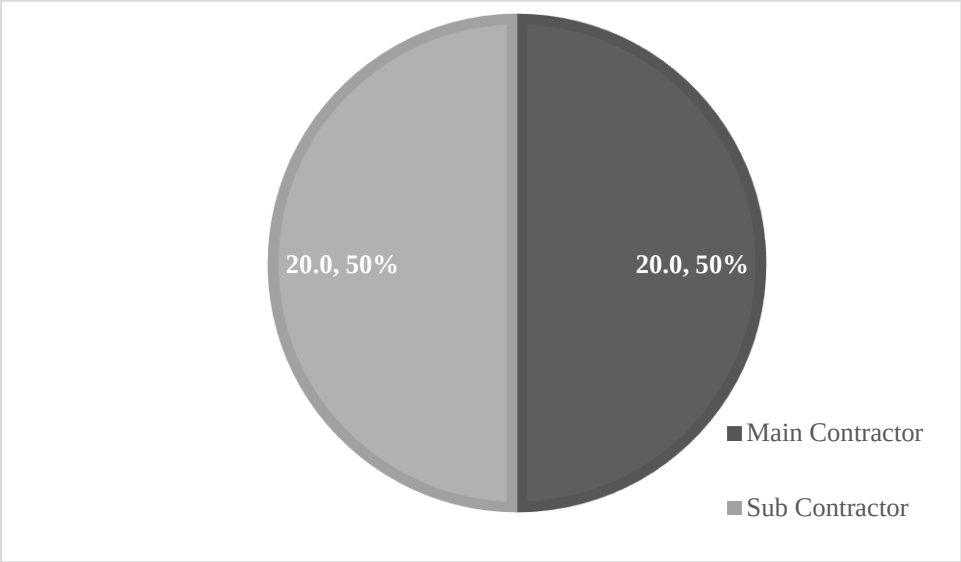

Figure 4.1: Participants job positions

The result indicates that out of 50 questionnaires that were distributed, 40 were successfully completed and returned. Out of the 40 questionnaires returned, 20 (50%) were answered by contractor and the rest 20 (50%) were responded by the sub-contractors (Figure 4.1).

4.3.2. Participants work experience

Table 4.3: Participants' work experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5-10 yrs.	17	34.0	42.5	42.5
	11-15 yrs.	8	16.0	20.0	62.5
	> 15 yrs.	15	30.0	37.5	100.0
Missing		10	20.0		
Total		50	100.0		

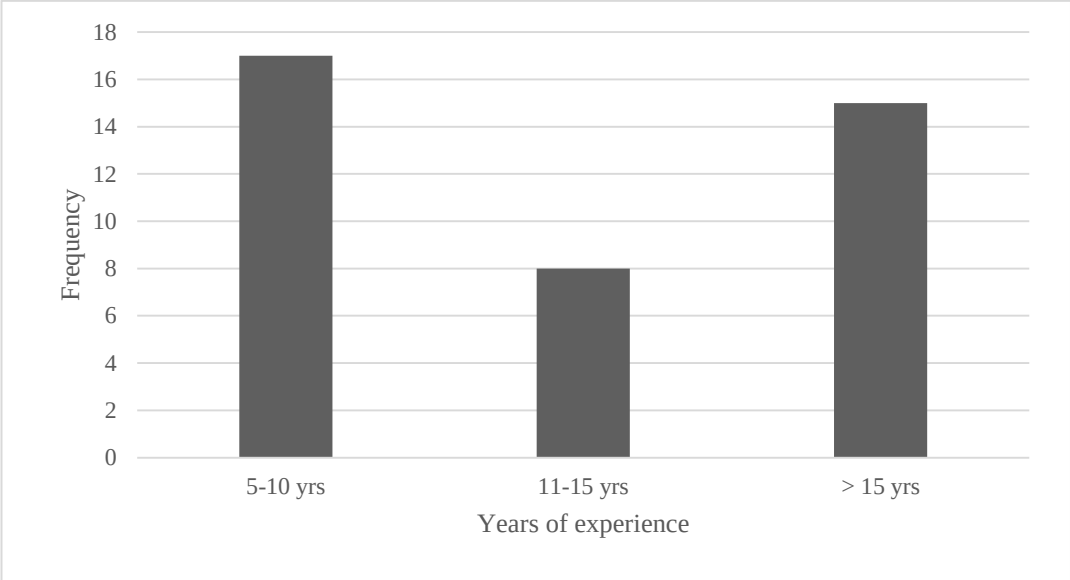

Figure 4.2: Participants' years of experience

It is obvious from the above result that among the 40 questionnaires that were successfully returned, 17 (42.5%) of the respondents had 5-10 years of work experience, 8 (20.0%) of the respondents had 11-15 years of work experience and 15 (37.5%) of the participants had more than 15 years' experience in the construction industry. Majority of the participants of this survey are among the extremely experience professionals from the construction industry.

4.4. Material Management process

4.4.1. Content Analysis

The semi-structured questions (refer to Appendix A) were designed to explore the common material management processes that are practiced in the Maldives construction projects.

Initially the data collected from the section B was analysed using content analysis (Refer to Appendix H). Respondents were asked to sequence 9 material management processes and to mark the processes they were not practicing. It was found that 'check availability from warehouse (P2)' were not practiced by 25 respondents, while the other 15 respondents were involved in this process. Furthermore, splitting the respondents into two groups, respondents with a warehouse and respondents without a warehouse. Next a deeper analysis within each group were conducted and it was found that respondents without warehouse had some conflicting processes between them. As a matter of fact processes such as 'check availability from local supplier shops (P3)' and 'Indent is generated' (P4) were only practiced by 11 respondents among the 25 respondents. Hence the respondents without a warehouse again split into 2 groups into respondents depending on local supplier shops and respondents who were not. There was no significant difference observed in the material management process followed by the 15 respondents with a warehouse (Refer to Appendix D). Therefore based on the content analysis, the responses gathered were categorized into groups; subsequently 3 material management process types were identified. The Figure 4.3 below illustrates the different material management processes that were identified.

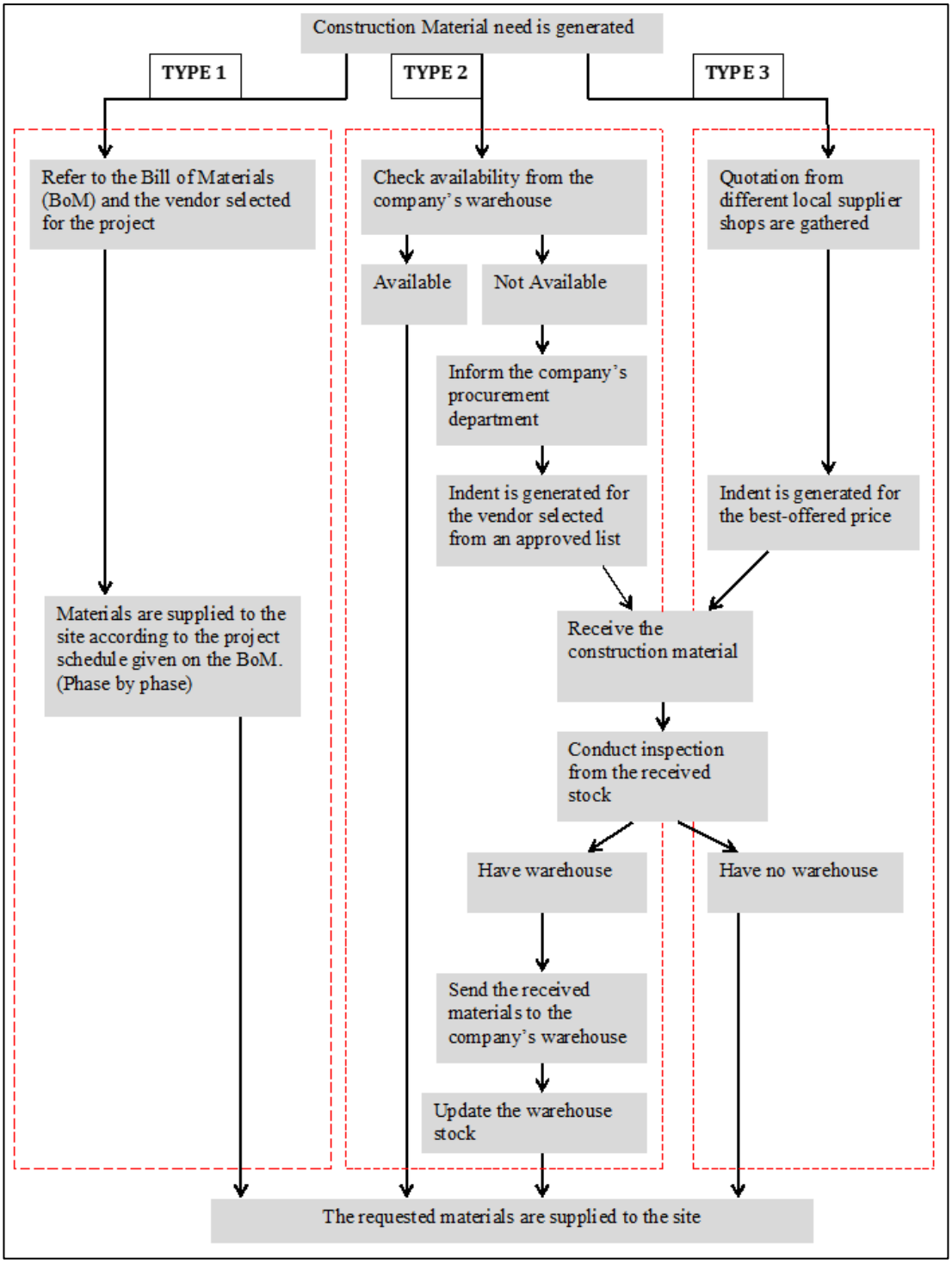

Figure 4.3: Existing material management process types

It was found that 14 respondents have similarities in their practice of material management processes. They have identified that once materials are needed for the site, they are delivered according to a pre-planned schedule. Moreover the respondents following this type rely on the prepared Bill of Materials (BoM) and upon the selected vendor to purchase the material. The vendor is provided with a schedule of the project and the periods in which the material will be required are identified. The main reason for not bulk purchasing the material is due to lack of storage space and one respondent explains this "We still do not operate with a central supply store or warehouse so need to buy materials per stage basis to avoid storage space shortcoming." The client/ consultant approves the materials that need to be purchased for the project before the project begins. The distinguish feature of this material management type is being dependent over phase-by–phase delivery.

On the other hand another 15 respondents have showed similarities in the material management process they were following. The material management process they were following was identified as material management type 2. The sequences of the material management processes slightly differ between the respondents, but major matching processes between the respondents remained prominent. Moreover from the data gathered it showed that all the respondents following this material management type have a warehouse. So once the construction material need is generated from the site, the company warehouse is informed and the needed materials are supplied to the site. The stock of the warehouse is managed to be equipped according to the ongoing projects.

11 respondents who are following similar material management process were identified as material management type 3. This type follows a very typical material management process, because when the material need is generated from the site,

quotations from different supplier shops are gathered and indent is generated for the best price offered shop. Materials inspections are carried out once the stock is received. If there is no problem the materials are delivered to the site. The distinguish feature of this type is being dependent over local supplier shops.

4.4.2. Project value against the identified material management types

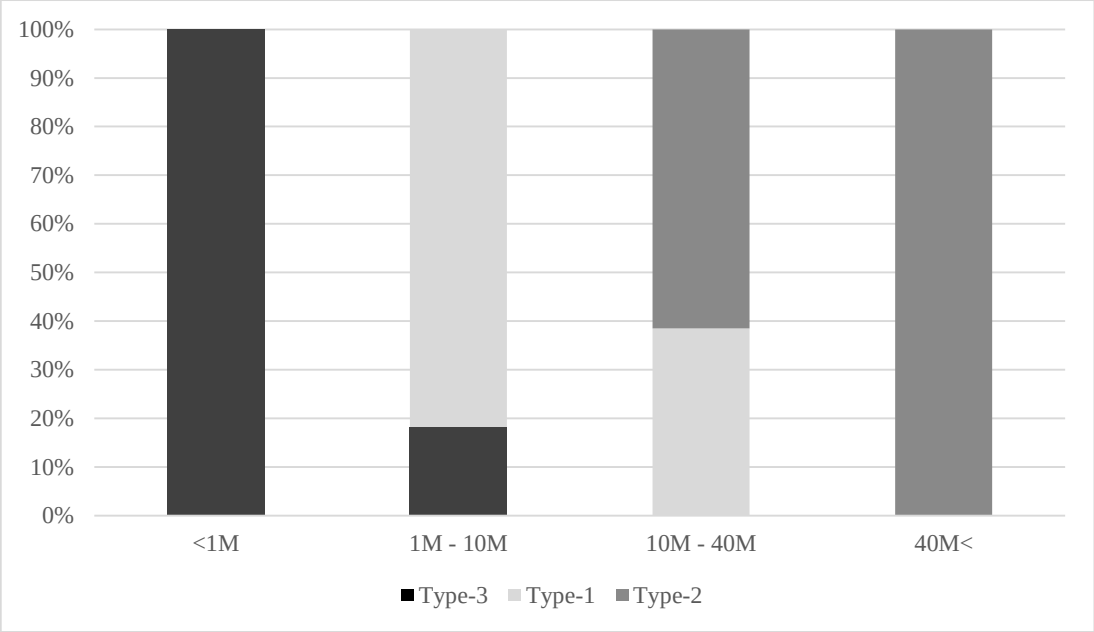

Figure 4.4: Project value against material management type

From the above analysis it shows the distribution of the different material management type against the project value (Figure 4.4) (Refer to Appendix C).

4.4.3. Discussion

It is noticed from the analysis that material management type 1 are involved in average value projects (1MVR – 40 MVR). Among all the MMP types the most precise delivery is required in this type as material delivery is based on the project schedule,

phase by phase. Even though the respondents following this material management type do not have their own warehouse and still they do not depend over local supplier shops. This is because they are involved in average value projects so they will have the capability of hiring their own material suppliers for the projects.

Furthermore from the data analysed there is an apparent trend that material management type 2 followers are involved in projects having high value (more than 40 MVR). Moreover looking at the material management process type 2 (Figure 6), it shows that they do not conduct one project at a time, but carry out several projects in a row and also have their own material supply unit and warehouse. Construction materials that are common for the projects are bulk purchased and are stored in their warehouse and this is reflected in this material management type. Moreover the material management followers of this type being involved in high value project indicate that they will have a good material supplier network to cater for their projects.

Likewise another trend that is noticed from the analysis is that most the material management type 3 are involved in least value projects (less than MVR 1M). Due to the small project value it justify their dependence over the local supplier shops. As a matter of fact it is inconvenient for these respondents following material management type 3 to hire their own supplier and also it is not economically effective to import such a small quantity.

Hence this analysis has helped to better define the existing material management processes that are practiced in Maldives building projects.

4.5. Root causes of ineffective material management

To analyse the root cause of ineffective material management, SPSS was used to calculate the mean distribution of each possible cause. The possible causes were classified into 4 phases in the project, which are material identification (A), vendor selection (B), procurement phase (C) and construction phase (D). Next the possible causes were ranked based on the frequency of response by the respondents. The possible causes that scored the highest mean were ranked top possible causes of ineffective material management faced in building projects (Refer to Appendix E).

4.5.1. Material Identification

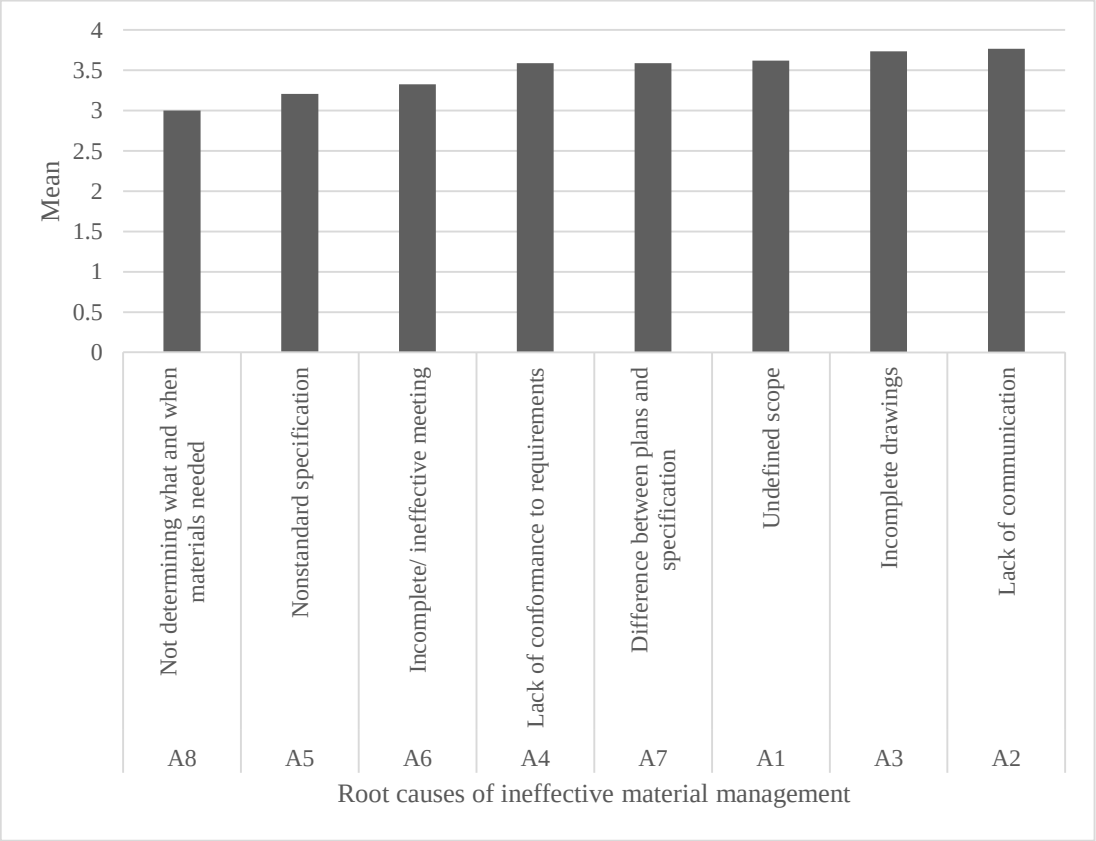

Figure 4.5: Root causes of ineffective material management in Material Identification phase

From the above analysis (Figure 4.5) it shows that in the material identification phase 'lack of communication (A2)' (mean = 3.76) is ranked as the top root cause for ineffective material management. However the least concerning cause in this phase is identified as 'Not determining what and when material needed (A8)' (mean = 3.0) (Refer to Appendix F).

4.5.1.1. Discussion

Initial stage of a project usually considered having the highest risk factor, as many elements remain unknown at the beginning. Even though effective communication is crucial throughout the project life cycle, it is even more important to communicate more at the beginning of a project. Especially in Maldives building projects, materials are imported therefore correct specification, quantity and delivery dates need to be clearly communicated at the beginning stage, if not cost can escalate and can cause unnecessary complications to the project. Hence many respondents have ranked lack of communication to be a root cause of ineffective material management in the material identification phase.

Difficulties and complications regarding material management is a known fact among the Maldives building projects. Therefore most of the professionals determine what and when materials are needed for the project. So it is not among the crucial causes of ineffective material management as these paper works are prepared in almost all the building projects.

4.5.2. Vendor Selection

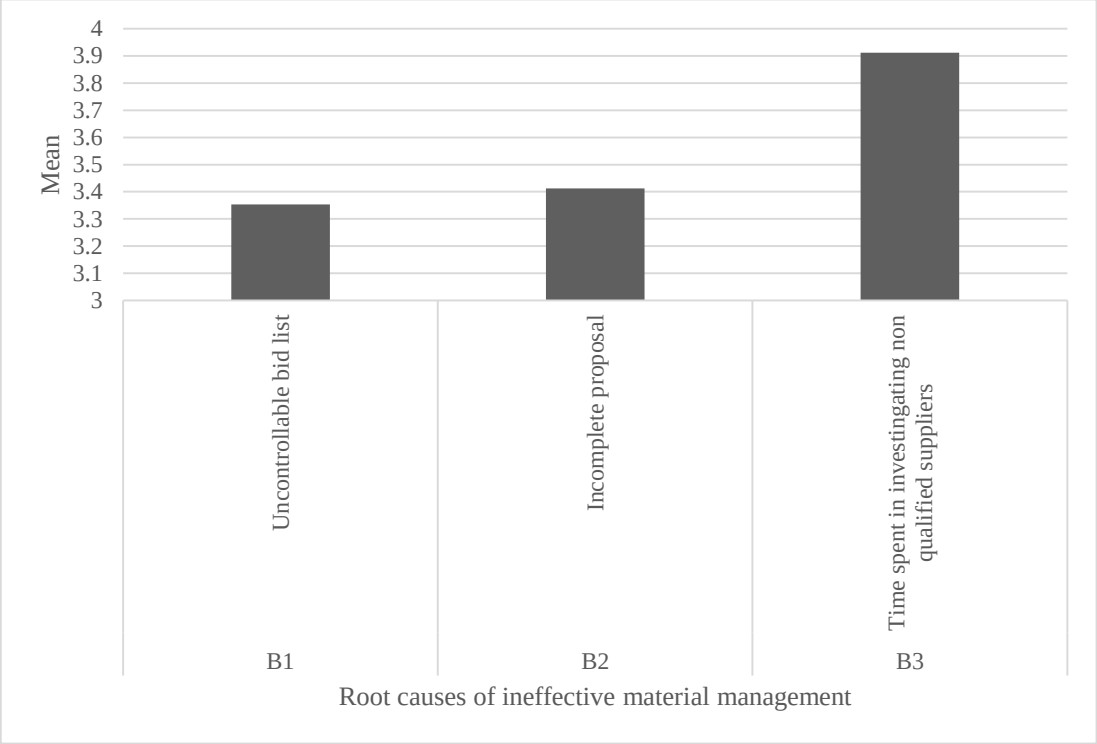

Figure 4.6: Root causes of ineffective material management in Vendor selection phase

In the vendor selection phase, as per the result (Figure 4.6) it shows highest ranking is 'time spent investigating non-qualified suppliers (B3)' (mean = 3.91) and the lowest ranking is 'Uncontrollable bid list (B1)' (mean = 3.35). (Refer to Appendix F).

4.5.2.1. Discussion

Selecting the most suitable supplier to undertake the work is a rigorous process. Especially in Maldives being a country with a small base of supplier make this even more challenging. With the limited options available, according to the respondents their biggest concern is tied up with wasting time in investigating non-qualified suppliers. As the contractors / sub-contractors do not want to leave any stone unturned as the bargaining power of the suppliers are higher in Maldives.

The least ranking being uncontrollable bid list, again gives support to the fact that Maldives have limited numbers of suppliers. As uncontrollable bid list is not experienced in most of the projects therefore it is not considered as a concerning issue causing ineffective material management.

4.5.3. Procurement phase

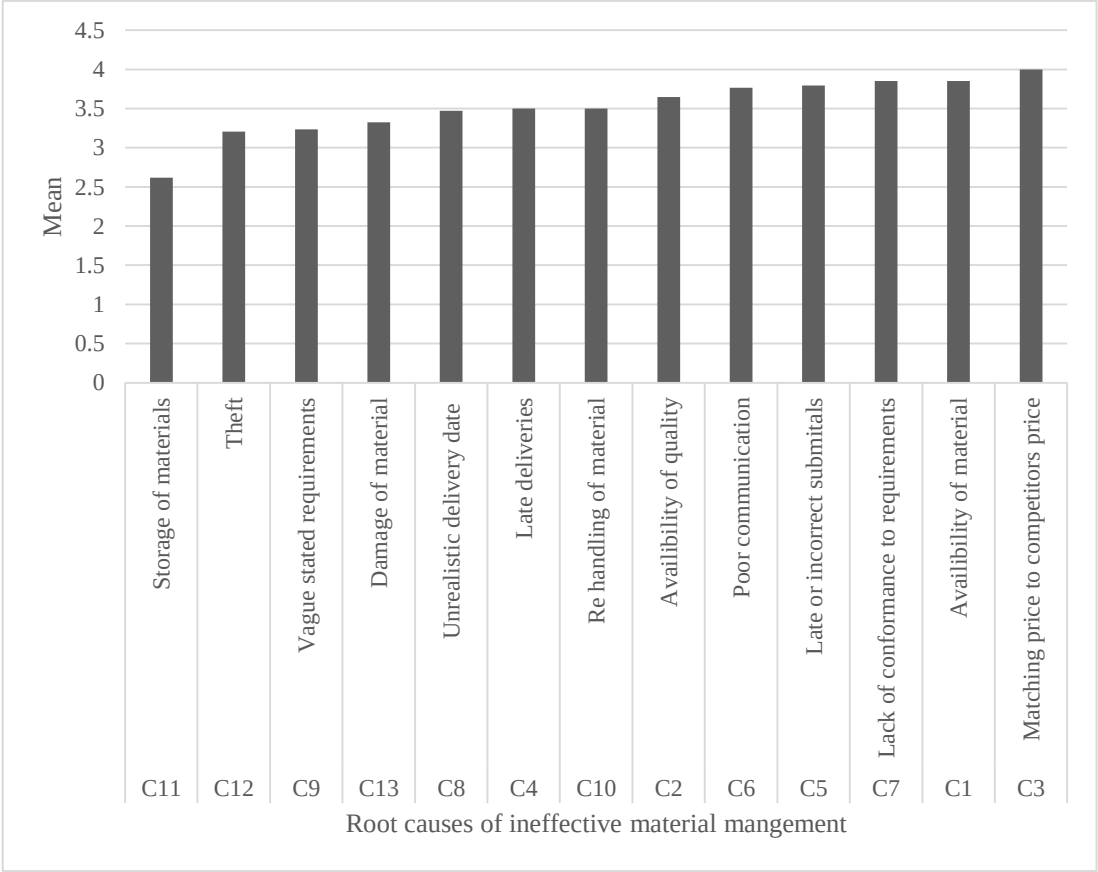

Figure 4.7: Root causes of ineffective material management in Procurement phase

It is observed (Figure 4.7) that the highest-ranking cause in procurement phase is 'matching price to competitors price (C3)' (mean = 4.00), while the lowest ranking cause is 'storage of material (C11)' (mean = 2.62) (Refer to Appendix F).

4.5.3.1. Discussion

In order to gain the projects, contractor/ sub-contractors bid at the lowest possible value. In this process the biggest challenge that the contractors/ sub-contractors face is to find ways to beat the price of the competitors. Construction material being the dominant factor of a project cost the ultimate sacrifice in the cost reduction is related to project material. Hence this is identified to be a root cause of ineffective material management in the building projects of Maldives.

Maldives having more sea than land is a known fact, so the construction industry professionals have been adapted to this constrain. Due to this the least concerned cause noticed is storage of materials. Because respondents either have their own warehouse or if they do not have it the material management type that they are following is designed by eliminating the need of storing material. Therefore storage of material is among their least concerns.

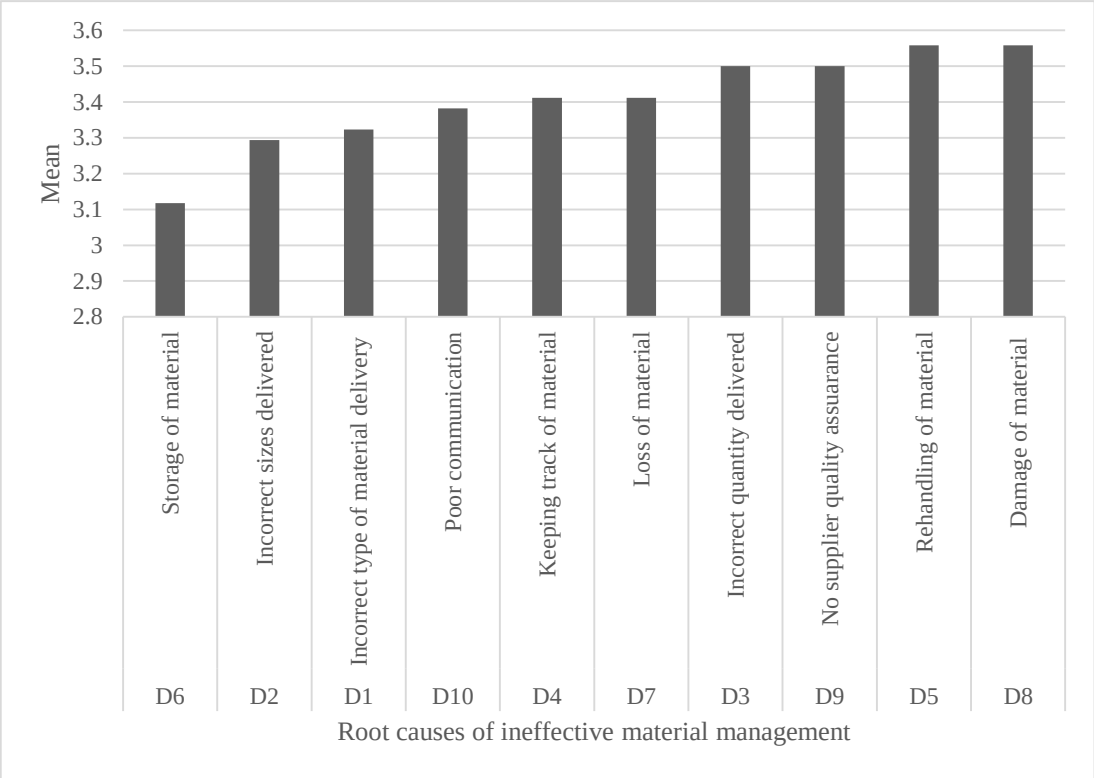

Figure 4.8: Root causes of ineffective material management in Construction phase

4.5.4. Construction Phase

It is noticed (Figure 4.8) that the highest-ranking cause in the construction phase are identified as ‘damage of material (D8)’ and ‘re-handling of material (D5)’ (Mean = 3.56). On the other hand the least ranking cause is ‘storage of material (D6)’ (Mean = 3.12) (Refer to Appendix F).

4.5.4.1. Discussion

In Maldives construction industry, especially the workers in the construction phase are majority expatriate workers (unskilled worker), so the handling of materials is not done properly. Moreover site supervisors are not dedicated to be present in the site most of the time, as there are few skilled professionals available in the industry, so many projects hire staff to multi-task. Thereby poor re-handling of material lead to damage

of material and this can contribute to great loss for the contractor/ subcontractor. As mentioned earlier construction material are imported therefore time takes to replace the damaged material, which will cause complications in the project.

Similar to procurement phase, even in this phase storage of material is identified as the least concerning cause. As a matter of fact this is because respondents either have their own warehouse or if they do not have it the material management type that they are following is designed by eliminating the need of storing material.

4.5.5. Overall root causes for ineffective material management

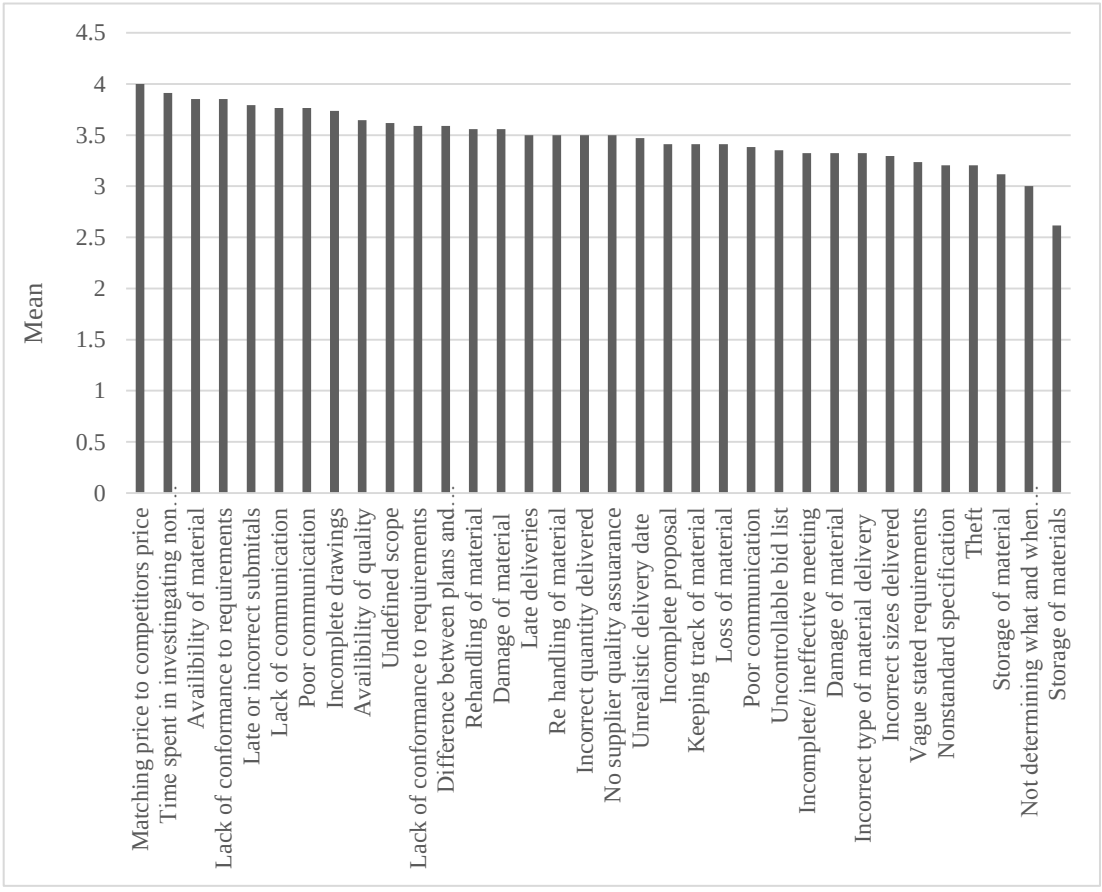

Figure 4.9: Root causes of ineffective material management in construction project

From the above bar graph (Figure 4.9), it shows that the top 3 root causes for ineffective material management are identified as matching price to competitors price (mean = 4.00), time spent investigating non-qualified suppliers (mean = 3.91) and availability of materials (mean = 3.85). (Refer to Appendix G).

4.5.5.1. Discussion

The top 3 causes belong to procurement and vendor selection phase. This shows that in Maldives building projects the most critical phases related to material management is linked with these both phases. As a matter of fact the choice of the material supplier can have a dominant influence on the effectiveness of the material management process. Therefore to find the best among the limited capable suppliers to carry out the project is a challenge that is faced by the Maldives building projects, this issue have been highlighted in the literature review as one of the problem faced in the construction industry of Maldives.

4.6. Relation between project delivery and material management types

To analyse the relationship between project delivery in terms of cost overrun and delay and Material management, Microsoft Excel was used to show the distribution of project delivery of each identified group. The percentage of cost overrun was categorized into 3 groups and they were 0 to 10 %, 11% to 20% and more than 20%. Likewise delay was also categorized into 3 groups and they were 0 to 6 months, 7 to 12 months and more than 1 year. Below illustrates the result (Refer to Appendix C).

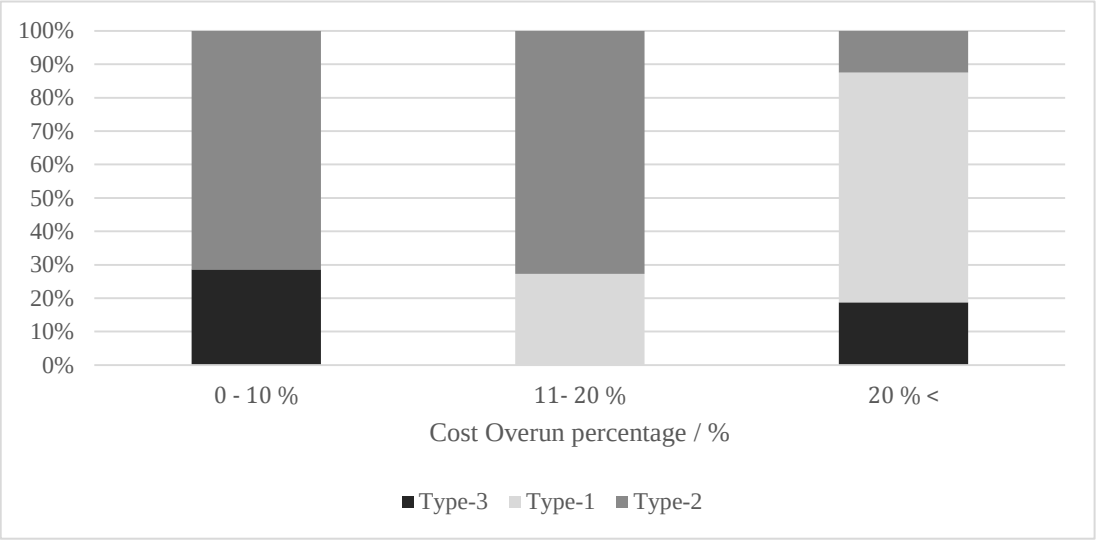

Figure 4.10: Material management type vs Cost overrun

Table 4.4: Material management type vs Cost overrun

	0 - 10 %	11- 20 %	20 % <
Type-1	0	3	11
Type-2	5	8	2
Type-3	2	3	6

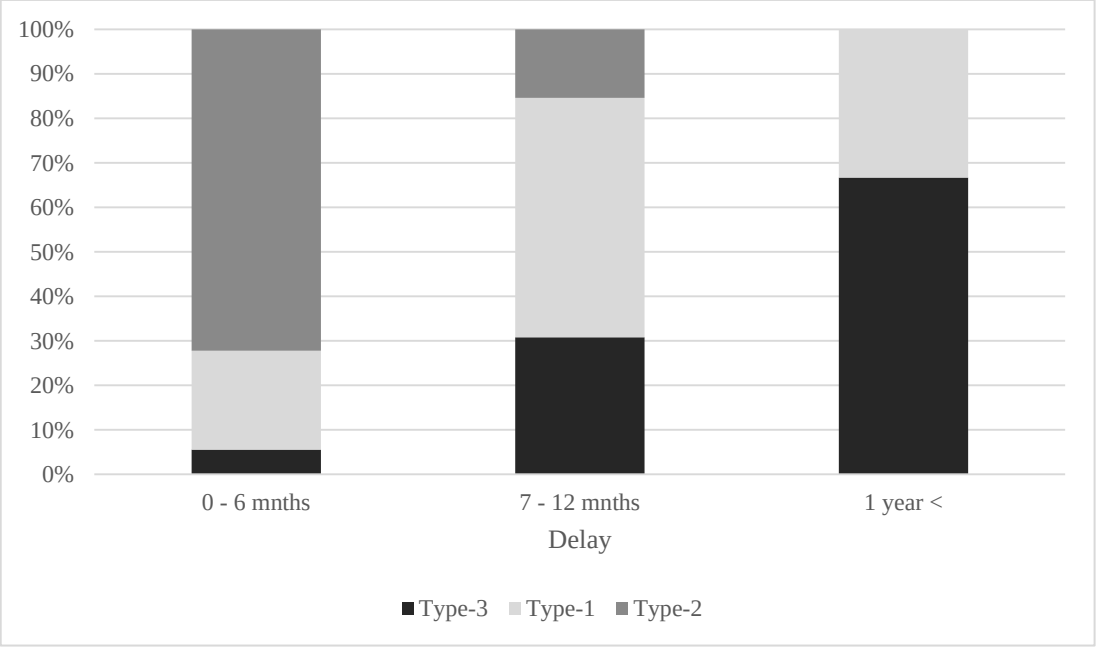

Figure 4.11: Material management type vs Delay

Table 4.5: Material management type vs Delay

	0 - 6 months	7 - 12 months	1 year <
Type-1	4	7	3
Type-2	13	2	0
Type-3	1	4	6

4.6.1. Discussion

Usually cost overrun and delay goes hand in hand. This means that if a project gets delay it usually experience cost overrun and vice versa. This trend is seen from the above result, but the material management process type that suffered most in cost overrun and delay are not the same. It is noticed that material management process type 1, is the most complicated compared to others as they depend on phase-by-phase delivery. So if processes are not carried out in sync with each other complication occurs. Next observation was that the MMP type 1 were involved in higher project value compared to MMP type 3 therefore cost overrun they experience are higher in percentage compared to MMP type 3.

Just like MMP type 1, MMP type 2 are also involved in high value projects, but the material management process type helps them to experience mild cost overrun. Because MMP type 2 has the cost risk distributed over the multiple projects that are ongoing. Moreover having a central warehouse gives them the opportunity to bulk purchase and experience perks of discount. Even in the phone interviews MMP Type 1 respondents have used words like “cost escalate”, “long procedure”, “dragging

causes more cost", "wrong delivery", "pay high for logistic companies" and "high transaction cost" implicating that this type experiences delay and cost overrun.

All the MMP types experienced delay, but MMP type 3 experienced the worst. This can relate back to the project value and material management process type. The MMP type 3 are involved in small value projects and depend solely on the local supplier shops. Not being able to bring materials specifically for the project and trying to find the quality and quantity required for the project is a challenge faced by MMP type 3. Moreover the materials that are brought to the local supplier shops are from abroad and their shipments are not decided based on the needs of these respondents' projects. Hence unavailability of materials is the major reason for delay for them. This is evident from the phone interviews, MMP type 3 followers have frequently used words like "wait", "not available", "unreliable", "difficult to get" and "delay" which emphasize the project delay issue in this type. Compared to MMP type 1, MMP type 3 are usually involved in low value projects hence pressure from the client is less compared to the high value projects. Therefore MMP type 3 tend to experience more delay projects than MMP type 2.

4.7. Conclusion

Based on this research in the Maldivian construction (building) projects, we discovered 3 distinguish material management process types that were followed. Further analysis even elaborated significant relationship between the material management type and project value.

As for the root causes of ineffective material management that is faced in Maldivian construction project, the top 3 root causes were matching price to competitor's price, time spent investigating non-qualified suppliers and unavailability of material.

Furthermore it was found that MMP type 1, phase-by-phase delivery suffered severe cost overrun compared to the other types. And MMP type 3 depending on local supplier shops experienced worst delay problems.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1. Introduction

Apart from construction projects being fragmented and complicated, the Maldivian context of difficult transportation, lack of skilled workers, small market base and highly dependent over imported construction material have increased complexity to achieve successful project delivery. This study has identified the existing material management practices and their impact on project delivery. By uncovering this relationship allow construction professionals to gain insight into possible causes of ineffective material management that is causing unsuccessful project delivery as perceived by building projects contractors.

In this chapter major findings of this study will be addressed, followed contributions of this study. Furthermore constraints and limitation of this study is summarized and also outlines recommendations for future research related to this study.

5.2. Major findings

This research had three goals; in order to achieve these goals initially an extensive literature review was carried out to identify the pitfalls in Maldives construction industry and gain insights about the root causes of ineffective material management faced by other developing countries and their impact on project delivery. Second, based on the literature review a questionnaire was developed and the data collected helped to underpin the following major findings.

1. There are 3 distinctive material management process types practicing in Maldives building projects.

2. There is a significant relationship between these material management process types and project value.

3. Top 3 root causes of ineffective material management were identified as matching price to competitor's price; time spent investigating non-qualified suppliers and availability of material.

4. The identified top root causes of ineffective material management are consequences of existing problems in Maldives construction industry such as depending on imported construction material, few suppliers in market and lack of skilled workers.

5. Storage issues have been a well-known problem among the construction professionals that it is no longer categorized as a threat as they are well prepared and mitigated from this problem.

6. There is a significant relationship between material management process type and project delivery in terms of delay and cost overrun.

7. Material management type 1, phase-by-phase delivery suffered severe cost overrun compared to the other types and material management type 3 depending on local supplier shops experienced worst delay problems.

5.3. Contribution of this research

This study has implication on both contractors and future researchers. The contractors involved in construction building projects in Maldives can use this research as a guideline to identify the material management type they are following. Moreover the contractors can be more informed about the root causes of ineffective material

management. Hence this gives the contractors opportunity to develop mitigation and get themselves prepared for these impending issues. Thereby this can improve the project delivery of building projects implemented in Maldives. Future researchers can use the material management process types and the root causes identified in this study to compare it with different context. This study will be a contribution to the limited body of knowledge on Maldivian construction field and can further open more doors for new areas to investigate.

5.4. Limitation of study

Like any research study, there is a possibility of flaw in design, data and interpretation. In this study, one consideration that needs to be taken into account is the fact that the study was designed to investigate impact of material management on building projects delivery in Maldivian construction industry. Hence, the generalizability of the study result to other types of construction projects would be limited. Furthermore due to limited time and budget, even though project delivery consists of time, cost and quality, in this study it only focused on cost and time.

5.5. Recommendation for future research

Research into effective material management is a vast area of study, which can be explored with new approaches and perspectives. This research has managed to discover the current material management practices in Maldives building projects through semi-structured questionnaires. However a case study or a site observation based research would be desirable to reinforce the discovered material management practices. Moreover in this research due to time and budget constraint, it only

concentrated on time and cost in terms of project delivery. So a further research is recommended to look upon the impact of material management on project delivery in terms of quality. In addition, a larger industry wide sample would be suitable to expand upon the generalizability of what have been represented in this study. Especially the root causes of ineffective material management can be identified industry wide. Finally, mitigation methods for the identified root causes can be carried out and this could be valuable for the field professionals to improve the project delivery.

5.6. Concluding remarks

The material management process types used in construction projects are constantly evolving due to the introduction of new technologies and due to embracing new best practices. At the same time the complication within the context also changes. This research can be more applicable to the current period, but with the new impending issues new research and study need to be conducted to find out the best practices, that can counterbalance these obstacles.

REFERENCES

Adams, J. S., 1965. Inequity in social exchange. *Advances in experimental social psychology*, Volume 2, pp. 267-299.

Baldwin, A. & Bordoli, D., 2014. *A handbook for Construction planning and scheduling.* West Sussex: John Wiley & Sons Ltd.

Bell, L. C. & Stukhart, G., 1986. Attributes of Material Management Systems. *Journal of Construction Engineering and Management,* 112(1), pp. 14-21.

Byrne, D., 2002. *Interpreting Quantitative Data.* London: SAGE Publications.

Calkins, M., 2009. *Materials for Sustainable Sites.* New Jersey: John Wiley & Sons,Inc.

Carver, R. H. & Nash, J. G., 2009. *Doing Data Analaysis with SPSS Version 16.* Boston: Cengage Learning.

Cheng, Y. M., 2014. An exploration into cost-infleuncing factors on construction projects. *International Journal of Project Management ,* 32(5), pp. 850-860.

Christopher, M., 2011. *Logistics & Supply Chain Management.* London: Pearson Education Limited.

Clark, V. L. P. & Creswell, J. W., 2008. *The mixed methods readers.* Los Angeles: SAGE Publications,Inc.

Construction Specification Institute, 2011. *The CSI Project Delivery practice guide.* New Jersey: John Wiley & Sons. Inc.

Dainty, A. R. & Brooke, R. J., 2004. Towards improved construction waste minimisation: a need for improved supply chain integration?. *Survey Structural,* 22(1), pp. 20-29.

Dey, P. K., 2001. Re-engineering materials management- a case study on an Indian refinery. *Buisness Process Management Journal,* Volume 7, pp. 394-408.

Donyavi, S. & Flanagan, R., 2009. *The Impact of Effective Material Management on Construction Site Performance for Small and Medium Sized Construction*

Enterprises. Nottingham, Assosiation of Researchers in Construction Management , pp. 11-20.

Faniran & Caban, 1998. MInimizing Waste on construction project sites. *Engineering Construction and Architectural Management ,* 5(2), pp. 182-188.

Gulghane, A. A. & Khandve, P. V., 2015. Management for Construction and Control of Construction Waste in Construction Industry: A Review. *International Journal of Engineering Research and Application Vol 5,* April, pp. 59-64.

Gunduz, M., Nielsen, Y. & Ozsdemir, M., 2013. Quantification of Delay Factors Using Relative Importance Index Method for construction projects in Turkey. *Journal of Management in Engineering,* 29(2), pp. 133-139.

Haddad, E. A. E.-Q. A., 2006. *A Construction Materials Management system for Gaza Strip Building Contractors,* Gaza: The Islamic University of Gaza.

Hsieh, H.-F. & Shannon, S. E., 2005. Three Approaches to Qualitative Content Analysis. *SAGE Journals,* 15(9), pp. 1277-1288.

Jackson, S. L., 2012. *Research Methods and Statistics a critical thinking approach.* California: Wadsworth.

Kasim, N. B., 2008. *Improving materials management on construction project,* Loughborough : Loughborough University.

Kasim, N. B., Anumba, C. J. & Dainty, A. R., 2005. *Improving materials management practices on fast-track construction projects.* London, Assosiation of Researchers in Construction, pp. 793-802.

Keith, B., Vitasek, K. & Kling, J., 2016. *Strategic Sourcing in the New Economy - Harnessing the potiential of sourcing Models for Modern Procurement.* London: Palgrave Macmillan.

Kent, R. A., 2015. *Analysing Quantitative Data.* Scotland: SAGE Publications.

Kirkpatrick, L. A. & Feeney, B. C., 2015. *A simple Guide to IBM SPSS for version 22.0.* Boston: Cengage Learning.

Low, S. P. & Ong, J., 2014. *Project Quality Management Critical Sucess Factors For Buildings.* Singapore: Springer.

Madhavi, T. P., Mathew, S. V. & Sasidharan, R., 2013. Materal Management in Construction - A Case Study. *International Journal of Research in Engineering and Technology,* pp. 400-403.

Mahdjoubi, L. & Yang, J. L., 2001. An intelligent materials routing system on complex construction sites. *Logistics Information Management,* 14(5/6), pp. 337-344.

Maldives Ministry of Tourism, A. a. C., 2013. *UNESCO.* [Online] Available at: http://whc.unesco.org/en/tentativelists/5812/

Manteau, E. K., 2007. *The developement of an information management system for materials management in large construction companies operating in the Ghanian construction industry,* Kumasi: Kwame Nkrumah University of Science and Technology.

Mead, J. M. & Gruneberg, S., 2013. *Pragramme Procrement in Construction learning from London 2012.* West Sussex: John Wiley & Sons Ltd.

Melton, T. & Iles-Smith, P., 2009. *Managing Project Delivery - Maintaining Control and Achieving Success.* Oxford: Butterworth-Heinemann.

Ministry of construction and Public Infrastructure, 2008. *Ministry of Housing and Infrastructure.* [Online] Available at: http://www.housing.gov.mv/v1/building-code/ [Accessed 12 December 2016].

Ministry of Housing and Infrastructure, 2016. *Ministry of Housing and Infrastructure.* [Online] Available at: http://www.housing.gov.mv/cid/national_contractors_registry.php [Accessed 30 December 2016].

Morris, P. W. & Pinto, J. K., 2007. *Project Technology , Supply Chain & Preocrement Management.* New Jersey: John Wiley & Sons Inc..

Morse, J. M. & Niehaus, L., 2009. *Mixed Method Designs principles and procedures.* New York: Routledge.

Naoum, S. G., 1998. *Dissertation Research and Writing For Construction Students.* Oxford: Reed Educational and Professional Publishing Ltd.

Naseer, A., n.d. *FAQ Corporate Document Respository.* [Online] Available at: http://www.fao.org/docrep/X5623E/x5623e0o.htm

Pande, A. A. & Sabihuddin, S., 2015. Study of Material Management Techniques on Construction Project. *International Journal of Informative & Futuristic Research Vol 2 Issue 9*, May, pp. 3479-3486.

Patel, K. V. & Vyas, C. M., 2011. *Construction Materials management on project sites.* Gujrat, B.V.M Engineering College, pp. 2-6.

Patil, A. R. & Pataskar, S. V., 2013. Analyzing Material Management Techniques on Construction Projects. *International Journal of Engineering and Innovative Technology (IJEIT),* 3(4), pp. 96-100.

Pellicer, E. et al., 2013. *Construction Management.* Oxford: Wiley Blackwell.

Proverb, D. G., Holt, G. D. & Love, P. E., 1999. Logistics of materials handling methods in high rise in-situ construction. *International Journal of Physical Distibution & Logistics Management,* 29(10), pp. 659-675.

Punch, K. F., 2014. *Introduction to Social Research quantitaive and qualitative approaches.* 3rd ed. Melborne: SAGE Publication.

Rashfa, M., 2014. A Review of the Maldivian Construction Industry. *MMA research Paper*, 01 June, pp. 75-104.

Rumane, A. R., 2011. *Quality Management in Construction Projects.* Boca Raton: CRC Press.

Savitha, R., n.d. *Importance of quality assurance of materials for construction work,* Colombo: National Building Research Organization.

Shen, L. Y., Tam, V. W., Tam, C. M. & Drew, D., 2004. Mapping Approach for Examining Waste Management on Construction Sites. *Journal of Construction Engineering and Management,* 130(4), pp. 472-481.

The World Bank Group, 2016. *Maldives country snapshot,* Washington DC: The World Bank.

Tholhath, A. & Ibrahim, R., 2013. Utilising Building Information Modelling (BIM) For implementation of Sustainable Resort Development in Maldives. *Alam Cipta Vol 6,* pp. 37-46.

Walker, A., 2015. *Project Management in construction.* Oxford: Wiley Blackwell.

Wanjari, S. P. & Dobariya, G., 2016. Identifying factors casuing cost overrun of construction projects in India. *Sadhana,* 41(6), pp. 679-693.

Zakeri, M., Olomolaiye, P., Holt, G. D. & Harris, F. C., 1996. A survey on constraints on Iranian construction operatives' productivity. *Construction management and Economics,* 14(5), pp. 417-426.

APPENDICES

APPENDIX-A: Questionnaire form in English

Survey on the Impact of Material Management on Construction Project Delivery in Maldives

* Required

SECTION A: BACKGROUND INFORMATION

1. **Which of the following best describe your highest academic qualification in construction industry? Please select one.** *

   Mark only one oval.

   - A. Below 'O' Level
   - B. 'O' Level
   - C. 'A' Level
   - D. Bachelors Degree
   - E. Masters
   - F. PHD

2. **Which of the following best describe your profession or area of specialization in construction industry? Please select one.** *

   Mark only one oval.

   - A. Contractor
   - B. Sub Contractor

3. **Which of the following best describe your work experience in construction industry? Please select one.** *

   Mark only one oval.

   - B. 5-10 years
   - C. 11-15 years
   - D. More than 15 years

4. **Which of the following best describe the type of building projects that you are mostly involved in? Please select one.** *

   Mark only one oval.

   - A. Residential Building
   - B. Non-Residential Building

5. **Which of the following best describe the money value of the building projects that you are mostly involved in? Please select one.** *

Mark only one oval.

- A. Less than MVR 1M
- B. MVR 1M - MVR 10M
- C. MVR 10M - MVR 40M
- D. More than MVR 40M

SECTION B: MATERIAL MANAGEMENT PROCESSES

Please select the construction material management process that you / your company/ organisation currently follow during a construction project in the correct order : (Please ignore the processes that you do not follow by selecting NA)

6. **Process-1:** *

Mark only one oval.

- Construction Material need generated from site
- Check availability from the company warehouse
- Check availability from local supplier shops
- Inform the procurement department
- Indent is generated (Purchase order)
- Vendor is selected from an approved list
- Conduct inspection from the received stock
- Update the warehouse stock
- The requested materials are supplied to the site
- NA

7. **Process-2:** *

Mark only one oval.

- Construction Material need generated from site
- Check availability from the company warehouse
- Check availability from local supplier shops
- Inform the procurement department
- Indent is generated (Purchase order)
- Vendor is selected from an approved list
- Conduct inspection from the received stock
- Update the warehouse stock
- The requested materials are supplied to the site
- NA

8. **Process-3:** *
Mark only one oval.

- ◯ Construction Material need generated from site
- ◯ Check availability from the company warehouse
- ◯ Check availability from local supplier shops
- ◯ Inform the procurement department
- ◯ Indent is generated (Purchase order)
- ◯ Vendor is selected from an approved list
- ◯ Conduct inspection from the received stock
- ◯ Update the warehouse stock
- ◯ The requested materials are supplied to the site
- ◯ NA

9. **Process-4:** *
Mark only one oval.

- ◯ Construction Material need generated from site
- ◯ Check availability from the company warehouse
- ◯ Check availability from local supplier shops
- ◯ Inform the procurement department
- ◯ Indent is generated (Purchase order)
- ◯ Vendor is selected from an approved list
- ◯ Conduct inspection from the received stock
- ◯ Update the warehouse stock
- ◯ The requested materials are supplied to the site
- ◯ NA

10. **Process-5:** *
Mark only one oval.

- ◯ Construction Material need generated from site
- ◯ Check availability from the company warehouse
- ◯ Check availability from local supplier shops
- ◯ Inform the procurement department
- ◯ Indent is generated (Purchase order)
- ◯ Vendor is selected from an approved list
- ◯ Conduct inspection from the received stock
- ◯ Update the warehouse stock
- ◯ The requested materials are supplied to the site
- ◯ NA

11. **Process-6:** *

Mark only one oval.

- Construction Material need generated from site
- Check availability from the company warehouse
- Check availability from local supplier shops
- Inform the procurement department
- Indent is generated (Purchase order)
- Vendor is selected from an approved list
- Conduct inspection from the received stock
- Update the warehouse stock
- The requested materials are supplied to the site
- NA

12. **Process-7:** *

Mark only one oval.

- Construction Material need generated from site
- Check availability from the company warehouse
- Check availability from local supplier shops
- Inform the procurement department
- Indent is generated (Purchase order)
- Vendor is selected from an approved list
- Conduct inspection from the received stock
- Update the warehouse stock
- The requested materials are supplied to the site
- NA

13. **Process-8:** *

Mark only one oval.

- Construction Material need generated from site
- Check availability from the company warehouse
- Check availability from local supplier shops
- Inform the procurement department
- Indent is generated (Purchase order)
- Vendor is selected from an approved list
- Conduct inspection from the received stock
- Update the warehouse stock
- The requested materials are supplied to the site
- NA

14. **Process-9:** *

Mark only one oval.

- ◯ Construction Material need generated from site
- ◯ Check availability from the company warehouse
- ◯ Check availability from local supplier shops
- ◯ Inform the procurement department
- ◯ Indent is generated (Purchase order)
- ◯ Vendor is selected from an approved list
- ◯ Conduct inspection from the received stock
- ◯ Update the warehouse stock
- ◯ The requested materials are supplied to the site
- ◯ NA

15. **Tell me more about the material management process you follow? Please explain the reason why you are not following some processes?** *

SECTION C: CAUSES OF INEFFECTIVE MATERIAL MANAGEMENT

Please tick the most appropriate one 1 - Strongly Disagree 2- Disagree 3- Neutral 4- Agree 5 - Strongly Agree

Causes for ineffective material management.

A. Material Identification

16. **A1. Undefined scope** *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

17. **A2. Lack of communication** *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

18. **A3. Incomplete drawings** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

19. **A4. Lack of conformance to requirements** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

20. **A5. Nonstandard specification** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

21. **A6. Incomplete/ ineffective meetings** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

22. **A7. Difference between plans and specifications** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

23. **A8. Not determining what and when materials needed** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

B. Vendor selection.

24. **B1. Uncontrollable bid list** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

25. **B2. Incomplete proposal** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

26. **B3. Time spent in investigating non qualified suppliers** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

C. Procurement Problem

27. **C1. Availability of material** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

28. **C2. Availability of quality** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

29. **C3. Matching price to competitors price** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

30. **C4. Late deliveries** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

31. **C5. Late or incorrect submittals** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

32. **C6. Poor communication** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

33. **C7. Lack of conformance to requirements** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

34. **C8. Unrealistic delivery date** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

35. **C9. Vague stated requirements** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

36. **C10. Re handling of material** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

37. **C11. Storage of materials** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

38. **C12. Theft** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

39. **C13. Damage of material** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

D. Construction Phase

40. **D1. Incorrect type of material delivery** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

41. **D2. Incorrect sizes delivered** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

42. **D3. Incorrect quantity delivered** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

43. **D4. Keeping track of material** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

44. **D5. Re-handling of material** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

45. **D6. Storage of material** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

46. **D7. Loss of material** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

47. **D8. Damage of material** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

48. **D9. No supplier quality assurance** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

49. **D10. Poor communication** *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

50. **D11. Receiving handling and storage of unused materials** *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

51. **Comments and Recommendation:**

_____

_____

_____

_____

_____

SECTION D: PROJECT DELIVERY IN TERMS OF COST AND TIME

52. **Currently have you participated in projects that have experienced cost overrun? (* If yes go to 53 & if no go to 54)** *

Mark only one oval.

- ◯ Yes
- ◯ No

53. **If yes, what is the usual percentage of cost overrun experienced in those projects? Please select one**

Mark only one oval.

- ◯ Less than 5%
- ◯ 5% - 10%
- ◯ 11% - 15%
- ◯ 16% - 20%
- ◯ More than 20%

54. **Currently have you participated in projects that have experienced delay? (* If yes go to 55 & if no go to 56)** *

Mark only one oval.

- ◯ Yes
- ◯ No

55. **If yes, what is the usual degree of delay that you have experienced in those projects? Please select one**

Mark only one oval.

- ◯ Less than 1 month
- ◯ 1 - 6 months
- ◯ 7 - 12 months
- ◯ More than 1 year

56. **Comments and Recommendation:**

_____

_____

_____

_____

_____

APPENDIX-B: Questionnaire form in Maldivian local (*Dhivehi*) Language

ތިމާގެއަށް ވައްދާ ފަރާތުގެ (ކައުންސިލަރުންގެ ފުރިހަމަ) ގޮތް، ބަލައިގަތުމަށް

ކުރިއަށް ގެންދާ ތިމާގެއަށް ވައްދާ ފަރާތުގެ ކަނޑައެޅިފައި (ދިވެހިންނަށް) ގެ

ތަކެއް) ގެ ތެރެއިން ތިރީގައިވާ ކަންތައްތަކާ ގުޅޭ ސުވާލު

ސުވާލު ١ : ތަކެއް

1. ތިމާގެ ބަދަލުކުރުމާ ގުޅޭ ކަންތައްތަކުގެ ތެރެއިން ތިބާ ބޭނުންވާ ކަންތައް
ގުރައްހާ ގޮތް:

- ☐ ١. ބަންދަށް ގެންދާ ގޮތް
- ☐ ٢. ބަންދަށް
- ☐ ٣. ބަދަލުކުރުން
- ☐ ٤. ބަދަލުކުރުމުގެ ދަށް
- ☐ ٥. ފައިސާ ދައްކާ ގޮތް
- ☐ ٦. ފާސްކުރުން

2. ތިމާގެ ބަދަލުކުރުމާ ގުޅޭ ގަދަ ކަންތައްތަކުގެ ތެރެއިން ތިބާ ބޭނުންވާ ކަންތައް
ކޮބައިކަން ބަލައިގަތުމަށް ގުރައްހާ ގޮތް:

- ☐ ١. ކައުންސިލަރ
- ☐ ٢. ސޮއި ކައުންސިލަރ

3. ތިމާގެ ބަދަލުކުރުމާ ގުޅޭ ފައިދާތަކުގެ ތެރެއިން ތިބާ ބޭނުންވާ ކަންތައް
ތަފާތުވާ ގޮތަށް ބަހައްޓާ ފައިދާތަކުގެ ތަރުޖަމާ ގުރައްހާ ގޮތް:

- ☐ ١.. 5 - 10 ދަރަޖަ ދެނެގަތުން
- ☐ ٢. 11 - 15 ދަރަޖަ ދެނެގަތުން
- ☐ ٣. 16 ދަރަޖަކުން ފަހަ

4. ތިމާގެ ބަދަލުކުރުމާ ގުޅޭ ގަދަ ކަންތައްތަކުގެ ތެރެއިން ތިބާ ވަކި
ކަމެއް ގުރައްހާ ގޮތް:

- ☐ ١. ގެއްލުން ދިގުކުރުމުގެ ގަދަ (ތަފާސްކުރާ ބަދަލު)
- ☐ ٢. ގެއްލުން ދުއްސުމުގެ (ސަބަބު - ތަފާސްކުރާ ބަދަލު)

5. ތިރީގައި ބަޔާންކޮށްފައިވާ ފައިސާގެ އަދަދު ތަކުގެ ތެރެއިން ތިމާ އާންމުކޮށް މަޝްރޫޢުގެ އަގު މަޝްރޫޢުތަކުގެ ފައިސާގެ އަދަދާއި ދިމާގައި ހުރި ފާހަގައެއް ޖައްސަވާ:

ހ. 1 މިލިއަން ރުފިޔާ އަށްވުރެ ދަށް ☐

ށ. 1 - 10 މިލިއަން ރުފިޔާ އާއި ދެމެދު ☐

ނ. 10- 40 މިލިއަން ރުފިޔާ އާއި ދެމެދު ☐

ރ. 40 މިލިއަން ރުފިޔާ އަށް ވުރެ މަތި ☐

ސެކްޝަން ބީ : އިމާރާތްކުރުމަށް ގެންގުޅޭ ތަކެތި ބަލަހައްޓާ ގޮތުގެ މަރުޙަލާތައް

6. ތިމާ / ތިމާގެ ކޮންފުނިން މަޝްރޫޢުތަކެއް ކުރިއަށް ގެންދާއިރު ތިރީގައި ބަޔާންކޮށްފައިވާ މެޓީރިއަލް މެނޭޖްކުރުމުގެ މަރުޙަލާތަކުގެ ތެރެއިން ތިމާ / ތިމާގެ ކޮންފުނިން ޢަމަލު ކުރާ ތަރުތީބު ނަންބަރު ޖައްސަވާ (މަރުޙަލާތަކުގެ ތެރެއިން ތިމާ / ތިމާގެ ކޮންފުނި ބޭނުން ނުކުރާ މަރުޙަލާއެއް ނަމަ X ޖައްސަވާ) ☐

ހ. ފާސްކޮށްފައިވާ ލިސްޓުން ވެންޑަރުން / ސަޕްލައިއަރުން ހޯދުން ☐

ށ. ޕާޗޭސް އޯޑަރ (ޕީ.އޯ) ތައްޔާރުކުރުން ☐

ނ. ކޮންސްޓްރަކްޝަން ސައިޓުން ބޭނުންވާ ތަކެތި އެންގުން ☐

ރ. ކޮންސްޓްރަކްޝަން ތަކެތި ބޭނުންވެގެން އެދުން ޕްރޮކިއުމަންޓަށް އެތަކެތި ހަވާލުކުރުން ☐

ބ. ކޮންސްޓްރަކްޝަން ތަކެތި ގަންނަން ބޭނުންވާ ފިހާރަތަކުން އެ ތަކެތި ލިބެން ހުރިތޯ ބަލާ އެތަކެއްޗަކަށް އޯޑަރ ކުރުން ☐

ޅ. ކޮންސްޓްރަކްޝަން ތަކެތީގެ ބެލެންސް ޗެކް ކުރުން ☐

ކ. ބޭނުންވާ ކޮންސްޓްރަކްޝަން ތަކެތި ލިބުމުން އެ ތަކެތީގެ މައްސަލައެއް ހުރިތޯ ބަލާ ފާސްކުރުން ☐

ސެކްޝަން ސީ : އިމާރާތްކުރުމަށް ގެންގުޅޭ ތަކެތި ރަނގަޅަށް ނުބެލެހެއްޓުމުން ދިމާވާ ސަބަބުތައް

އެންމެ އެކަށީގެންވާ ތަނުގައި ފާހަގައެއް ޖައްސަވާ. (1- ވަރަށް ބޮޑަށް ދެކޮޅު 2- ދެކޮޅު 3- ވަކި ފަރާތަކަށް ނުޖެހޭ 4- އެއްބަސް 5- ވަރަށް ބޮޑަށް އެއްބަސް)

ހ. ތަކެތި ދެނެގަތުން

1ހ. މަޝްރޫޢުގެ ސްކޯޕް ކަނޑައެޅިފައިނުވުން

ވަރަށް ބޮޑަށް ދެކޮޅު 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ ވަރަށް ބޮޑަށް އެއްބަސް

2ހ. މުޢާމަލާތްކުރުން މަދުވުން

1 2 3 4 5

ވަކަންތައް ދެއްކުމުގެ ☐ ☐ ☐ ☐ ☐ ވަކަންތައް ދެއްކުމަށް

3ـ. ފުރިހަމަ ނުކުރާ ކަންތައް ކިތަންތެރި

5 4 3 2 1

ވަކަންތައް ދެއްކުމުގެ ☐ ☐ ☐ ☐ ☐ ވަކަންތައް ދެއްކުމަށް

4ـ. ތަކެއްގައި ފަރާތްތަކާ ބައްދަލުވާ ގޮތް

5 4 3 2 1

ވަކަންތައް ދެއްކުމުގެ ☐ ☐ ☐ ☐ ☐ ވަކަންތައް ދެއްކުމަށް

5ـ. ތިމާއަށް ކިބައިން ކުރެވޭ ކަންތައް ދެނެގަތުމަށް ކިބައިން ކުރެވޭ ކަންތައް ކިތަންތެރި

5 4 3 2 1

ވަކަންތައް ދެއްކުމުގެ ☐ ☐ ☐ ☐ ☐ ވަކަންތައް ދެއްކުމަށް

6ـ. ތަންތަނުގައި ގޮތްތަކާ ގުޅުން ހުރުމަށް

5 4 3 2 1

ވަކަންތައް ދެއްކުމުގެ ☐ ☐ ☐ ☐ ☐ ވަކަންތައް ދެއްކުމަށް

7ـ. ގޮތްތަކުގައި ވާނެ ކަންތައް ކިބައިން ދިމާ ދިމާ ކަންތައް

5 4 3 2 1

ވަކަންތައް ދެއްކުމުގެ ☐ ☐ ☐ ☐ ☐ ވަކަންތައް ދެއްކުމަށް

8ـ. ހުށަހެޅުމަށް ގަތުމާ، ގަތުމަށް ހުށަހެޅުމަށް ބަދަލު ދިނުމުގެ ކަންތައް

5 4 3 2 1

ވަކަންތައް ދެއްކުމުގެ ☐ ☐ ☐ ☐ ☐ ވަކަންތައް ދެއްކުމަށް

ނ. ގަބޫލުކުރުން ހިންގުން

1ނ. ހިންގުމުގެ ތެދުވެރިކަން ބަލައިގަތުން

	1	2	3	4	5	
ވަކިން ދެކެވޭ ގޮތް	☐	☐	☐	☐	☐	ވަކިން ދެކެވޭ ގޮތް

2ނ. ފުރިހަމަކަމާއި ވަގުތުން ހިންގުން

	1	2	3	4	5	
ވަކިން ދެކެވޭ ގޮތް	☐	☐	☐	☐	☐	ވަކިން ދެކެވޭ ގޮތް

3ނ. ފާސްވަރު ކުރިމަތަށް ގެންދާނެ ބައެއްގެ ބައިވެރިވުން ލިބިގެންދާ ގޮތް

	1	2	3	4	5	
ވަކިން ދެކެވޭ ގޮތް	☐	☐	☐	☐	☐	ވަކިން ދެކެވޭ ގޮތް

ރ. ވަގުތުން ފާހަގަ ކުރުން

1ރ. ތަކެތި ލިބުން ކަށަވަރުކުރުން

	1	2	3	4	5	
ވަކިން ދެކެވޭ ގޮތް	☐	☐	☐	☐	☐	ވަކިން ދެކެވޭ ގޮތް

2ރ. ތަކެތި ލިބުމުގެ ގުޅުން ހިންގުން

	1	2	3	4	5	
ވަކިން ދެކެވޭ ގޮތް	☐	☐	☐	☐	☐	ވަކިން ދެކެވޭ ގޮތް

3ރ. ކަންކަން ކުރިއަށް ގެންދާ ގޮތް ބަލައިގަތުން

	1	2	3	4	5	
ވަކިން ދެކެވޭ ގޮތް	☐	☐	☐	☐	☐	ވަކިން ދެކެވޭ ގޮތް

4ސ. މުދާ / ތަކެތި ލިބުން ލަސްވުން

	5	4	3	2	1	
ވަރަށް ބޮޑަށް އެއްބަސް	☐	☐	☐	☐	☐	ވަރަށް ބޮޑަށް ދެކޮޅު

5ސ. އޯޑަރާއި ދިމާނުވާ ގޮތަށް ތަކެތި ލިބުން

	5	4	3	2	1	
ވަރަށް ބޮޑަށް އެއްބަސް	☐	☐	☐	☐	☐	ވަރަށް ބޮޑަށް ދެކޮޅު

6ސ. މުޢާމަލާތްކުރުން ގަދުވުން

	5	4	3	2	1	
ވަރަށް ބޮޑަށް އެއްބަސް	☐	☐	☐	☐	☐	ވަރަށް ބޮޑަށް ދެކޮޅު

7ސ. އެކަށައަޅާފައިވާ މިންގަނޑުތަކާއި ބައްދަލުނުވުން

	5	4	3	2	1	
ވަރަށް ބޮޑަށް އެއްބަސް	☐	☐	☐	☐	☐	ވަރަށް ބޮޑަށް ދެކޮޅު

8ސ. ތަކެތި ލިބޭނެ ކަދަން ޒަބުތު ނުކުރެވޭ ތާރީޚު ބުނުން

	5	4	3	2	1	
ވަރަށް ބޮޑަށް އެއްބަސް	☐	☐	☐	☐	☐	ވަރަށް ބޮޑަށް ދެކޮޅު

9ސ. ބޭނުންވާ މިންގަނޑުތައް ސާފުކޮށް ބަޔާންނުކުރުން

	5	4	3	2	1	
ވަރަށް ބޮޑަށް އެއްބަސް	☐	☐	☐	☐	☐	ވަރަށް ބޮޑަށް ދެކޮޅު

10ށ. ތަކެތި ހޯދުމުގައި ފައިދާ ލިބެނީ

	5	4	3	2	1	
ވަރަށް ގިނައިން	☐	☐	☐	☐	☐	ވަރަށް ހަނދާނެ

11ށ. ތަކެތި ހޯދުމަށްޓަކައި ފައިދާ ލިބެނީ

	5	4	3	2	1	
ވަރަށް ގިނައިން	☐	☐	☐	☐	☐	ވަރަށް ހަނދާނެ

12ށ. ވަގުތަށް ބަލާ

	5	4	3	2	1	
ވަރަށް ގިނައިން	☐	☐	☐	☐	☐	ވަރަށް ހަނދާނެ

13ށ. ތަކެތިތަކާ ގުޅުންހުރި

	5	4	3	2	1	
ވަރަށް ގިނައިން	☐	☐	☐	☐	☐	ވަރަށް ހަނދާނެ

ށ. <u>ތިމާއަށްޓަކައްޗާ ދިވެހިންނަށް</u>

1ށ. ފުޅާތަކުގެ ބިދާންތަކާ ގުޅޭ ތަކެތި ހޯދުން

	5	4	3	2	1	
ވަރަށް ގިނައިން	☐	☐	☐	☐	☐	ވަރަށް ހަނދާނެ

2ށ. ފުޅާ ބައި ބަލާ ތަކެތި ހޯދުން ތަކެތީގެ ބިދާންތަކާ ގުޅުންހުރި

	5	4	3	2	1	
ވަރަށް ގިނައިން	☐	☐	☐	☐	☐	ވަރަށް ހަނދާނެ

3ނ. އޯޑަރު ކުރި އަދަދާއި ލިބުނު ތަކެތީގެ އަދަދު ދިމާނުވުން

ވަރަށް ބޮޑަށް ދެކޮޅު	1	2	3	4	5	ވަރަށް ބޮޑަށް އެއްބަސް
	☐	☐	☐	☐	☐	

4ނ. ތަކެތި ހެރުކް ކުރި ގޮތުން

ވަރަށް ބޮޑަށް ދެކޮޅު	1	2	3	4	5	ވަރަށް ބޮޑަށް އެއްބަސް
	☐	☐	☐	☐	☐	

5ނ. · ތަކެތި ހިފާގެންގުޅާ ގޮތުގެ ސަބަބުން

ވަރަށް ބޮޑަށް ދެކޮޅު	1	2	3	4	5	ވަރަށް ބޮޑަށް އެއްބަސް
	☐	☐	☐	☐	☐	

6ނ. ތަކެތި ރައްކާތެރިކުރާ ގޮތުގެ ސަބަބުން

ވަރަށް ބޮޑަށް ދެކޮޅު	1	2	3	4	5	ވަރަށް ބޮޑަށް އެއްބަސް
	☐	☐	☐	☐	☐	

7ނ. ތަކެތި ގެއްލުމުގެ ސަބަބުން

ވަރަށް ބޮޑަށް ދެކޮޅު	1	2	3	4	5	ވަރަށް ބޮޑަށް އެއްބަސް
	☐	☐	☐	☐	☐	

8ނ. ތަކެތި ހަލާކުވުމުގެ ސަބަބުން

ވަރަށް ބޮޑަށް ދެކޮޅު	1	2	3	4	5	ވަރަށް ބޮޑަށް އެއްބަސް
	☐	☐	☐	☐	☐	

9ނ. ސަޕްލަޔަރުގެ ކޮލިޓީގެ ގެރެންޓީ ނުދިނުން

		1	2	3	4	5	
ވަރަށް ބޮޑަށް ދެކޮޅު		☐	☐	☐	☐	☐	ވަރަށް ބޮޑަށް އެއްބަސް

10ނ. މުއާމަލާތްކުރުން މަދުވުން

		1	2	3	4	5	
ވަރަށް ބޮޑަށް ދެކޮޅު		☐	☐	☐	☐	☐	ވަރަށް ބޮޑަށް އެއްބަސް

11ނ. ބޭނުންނުކުރާ / ދިރަވެފައިވާ ތަކެތި ހިފާގެންގުޅޭ ރައްކާކުރާ ގޮތުގެ ސަބަބުން

		1	2	3	4	5	
ވަރަށް ބޮޑަށް ދެކޮޅު		☐	☐	☐	☐	☐	ވަރަށް ބޮޑަށް އެއްބަސް

7. ކޮމެންޓެއް ނުވަތަ ޚިޔާލެއް

....

....

....

ސެކްޝަން ޏ : މަޝްރޫޢު ކުރިއަށް ގެންދާ ގޮތް އާ މަޝްރޫޢުއުއްމެއްގައި ކުރި ފަރާތުން އަދި ހާދަތު މުއްދަތުން އަށާ ހިތުން

8. އެންމެ ފަހުން ބައިވެރިވި މަޝްރޫޢުތަކުގައި އަކަރައާޔާފައިވާ ބަޖެޓްކުރެވުނު އިތުރުވެފައިވާތޯ؟ (މި ސުވާލުގެ ޖަވާބަކީ އާއެކޭ ނަމަ 9 ވަނަ ސުވާލުން ކުރިއަށް ގެންދާ ނަމަވެސް ނޫނެކޭ ނަމަ 10 ވަނަ ސުވާލުން ކުރިއަށް ގެންދާ)

☐ ހ. އާއެކޭ

☐ ނ. ދާދޫ

9. ތާއީދު ކުރާ، ތާދާ ގެއަކުން ދެކޮޅަށް ހެދޭ ތަށި ތަކުގެ ގާތްގަނޑު ؟ ތާދާ ތަކެއްގެ ތެރެއިން ގާތް ގަނޑު ކިތަންތަނެއް ލިޔުއްވާ:

☐ ހ. 5% ދަށުގެ ގަދުން

☐ ށ. 5% - 10%

☐ ނ. 11% -15%

☐ ރ. 16% - 20%

☐ ބ. 20% ދަށުގެ ތަކެއް

10. ބަލިވެރިކަމުގެ ތަކެއްގެ ތެރެއިން ދިވެހި ރައްޔިތުންގެ ދަށުގެ ބަލިވެރިކަމުގެ ތަކެއް ލިޔުއްވާ؟ (ދެ ވާހަކަ ދެކެވޭ ގޮތަށް ތާދާ ކުރާ 11 ވަނަ ވާހަކަދެކުންވެ ކުރިއަށް ދާ ގޮތަށް ލިޔުއްވާ 12 ވަނަ ވާހަކަދެކުންވެ ކުރިއަށް ދާ ގޮތަށް)

☐ ހ. ތާދާ

☐ ށ. ދާދޫ

11. ތާއީދު ކުރާ، ތާދާ ގެއަކުން ބަލިވެރިކަމުގެ ތަކެއް ދެކޮޅަށް ހެދޭ ގާތްގަނޑު ތަކެއްގެ ތެރެއިން ބަލިވެރިކަމުގެ ތަކެއް ؟ ތާދާ ކުރާ ގާތްގަނޑު ކިތަންތަނެއް ގާތް ގަނޑަކަށް ލިޔުއްވާ:

☐ ހ. 1 ދަނޑުވަރަށް ދަށު

☐ ށ. 1 – 6 ދަނޑު

☐ ނ. 7 – 12 ދަނޑު

☐ ބ. 1 ބަބަށް ދިގު

12. ދެކޮށްދެވޭ ތަކެއް ލިޔުއްވާ

.....

.....

.....

APPENDIX-C: Raw data of Questionnaire Section A & D

Respondent	Section A					Section D			
	E1	E2	E3	E4	E5	F1	F2	F3	F4
R35	3	1	3	1	1	1	3	1	4
R40	4	1	4	1	1	1	2	1	4
R37	4	1	3	1	1	1	3	1	4
R36	3	1	3	2	2	1	2	1	3
R38	2	2	4	1	2	1	3	1	3
R39	4	2	4	1	1	1	2	1	4
R3	4	2	2	1	1	1	4	1	4
R6	4	1	2	1	1	1	3	1	4
R21	4	1	2	1	1	1	1	1	3
R27	4	2	4	1	1	1	3	1	3
R32	2	1	3	1	1	1	1	1	2
R2	4	2	2	1	3	1	3	1	2
R4	5	2	4	1	2	1	2	1	1
R5	4	2	2	1	3	1	2	1	3
R9	3	1	3	1	2	1	4	1	3
R10	4	2	2	2	2	1	4	1	3
R13	5	2	3	2	3	1	5	1	3
R14	3	1	2	1	3	1	3	1	4
R19	4	1	2	2	2	1	2	1	3
R20	4	2	4	2	3	1	3	1	2
R25	4	2	4	1	2	1	3	1	2
R26	4	2	2	2	2	1	3	1	4
R28	4	2	2	2	2	1	4	1	3
R30	1	1	4	2	2	1	3	1	3
R31	1	1	3	1	2	1	3	1	4
R1	4	1	2	2	4	1	1	1	1
R7	4	2	2	2	4	1	2	1	1
R11	5	1	4	1	4	1	2	1	1
R12	5	1	2	2	4	1	1	1	3
R17	4	2	3	2	4	1	1	1	2
R24	4	1	2	2	4	1	2	1	2
R15	5	2	4	2	3	1	4	1	3
R16	4	2	4	2	3	1	2	1	2
R18	4	2	2	1	3	1	2	1	1
R22	4	2	4	1	3	1	3	1	1
R23	3	2	2	2	3	1	1	1	1
R29	4	1	4	1	3	1	2	1	2
R33	1	1	4	1	3	1	1	1	1
R34	1	1	4	1	3	1	2	1	1

R8	4	1	2	1	4	1	2	1	1

Project Value (E5)

	<1M	1M - 10M	10M - 40M	40M<
Type-3	9	2	0	0
Type-1	0	9	5	0
Type-2	0	0	8	7

Cost Overrun % (F2)

	0 - 10 %	11- 20 %	20 % <
Type-1	0	3	11
Type-2	5	8	2
Type-3	2	3	6

Delay (F4)

	0 - 6 mnths	7 - 12 mnths	1 year <
Type-1	4	7	3
Type-2	13	2	0
Type-3	1	4	6

APPENDIX-D: Raw data of Questionnaire Section B

Respondent	Section B								
	P1	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**
R35	1	0	2	0	4	3	5	0	6
R40	1	0	2	0	3	4	5	7	6
R37	1	0	2	0	3	0	4	0	5
R36	1	0	2	0	4	3	5	0	6
R38	1	0	2	0	4	3	5	0	6
R39	1	0	2	0	3	4	5	7	6
R3	1	0	2	0	3	0	4	0	5
R6	1	0	2	0	4	3	5	0	6
R21	1	0	2	0	3	0	0	0	4
R27	1	0	2	0	3	4	0	0	5
R32	1	0	2	0	3	4	5	7	6
R2	2	0	0	0	0	1	3	0	4
R4	2	0	0	0	0	1	0	0	3
R5	1	0	0	0	0	2	0	0	3
R9	1	0	0	2	0	3	4	0	5
R10	1	0	0	0	0	2	0	0	3
R13	2	0	0	0	0	1	3	0	4
R14	1	0	0	0	0	2	0	0	3
R19	1	0	0	0	0	2	0	0	3
R20	2	0	0	0	0	1	0	0	3
R25	1	0	0	2	0	3	4	0	5
R26	1	0	0	0	0	2	0	0	3
R28	2	0	0	0	0	1	3	0	4
R30	2	0	0	0	0	1	3	0	4
R31	2	0	0	0	0	1	3	0	4
R1	1	2	0	3	4	5	6	7	8
R7	1	2	0	3	5	4	0	6	7
R11	1	3	0	2	5	4	6	7	8
R12	1	2	0	0	4	3	0	5	6
R17	1	2	0	3	4	5	6	7	8
R24	1	3	0	2	5	4	6	7	8
R15	1	2	0	3	5	4	0	6	7
R16	1	3	0	2	5	4	6	7	8
R18	1	2	0	3	4	5	6	7	8
R22	1	3	0	2	5	4	6	7	8
R23	1	3	0	2	5	4	6	7	8
R29	1	2	0	3	4	5	6	7	8
R33	1	2	0	3	5	4	0	6	7
R34	1	2	0	3	4	5	6	7	8
R8	1	2	0	3	5	4	0	6	7

APPENDIX-E: Raw data of Questionnaire Section C

Respondent	Section C																																				
	A 1	**A 2**	**A 3**	**A 4**	**A 5**	**A 6**	**A 7**	**A 8**	**B 1**	**B 2**	**B 3**	**C 1**	**C 2**	**C 3**	**C 4**	**C 5**	**C 6**	**C 7**	**C 8**	**C 9**	**C 10**	**C 11**	**C 12**	**C 13**	**D 1**	**D 2**	**D 3**	**D 4**	**D 5**	**D 6**	**D 7**	**D 8**	**D 9**	**D 10**	**D 11**
R35	1	3	2	4	4	1	3	3	2	3	4	4	4	4	3	4	3	3	4	4	3	4	2	2	4	4	2	2	3	4	3	3	4	3	3
R40	3	5	2	4	2	4	2	2	4	2	3	4	2	2	2	2	4	4	2	2	5	5	4	4	4	4	4	3	4	4	4	2	5	4	2
R37	4	3	2	4	4	1	3	3	2	3	4	4	4	4	3	4	3	3	4	4	3	4	2	2	4	4	2	2	3	4	3	3	4	3	2
R36	1	3	3	3	4	4	4	3	3	3	3	3	3	3	4	3	3	3	4	4	3	4	2	2	3	2	2	4	3	2	2	2	4	3	1
R38	1	3	4	3	3	3	3	3	2	2	4	3	3	3	3	4	4	4	3	3	3	3	4	4	3	3	3	3	3	3	3	4	3	4	1
R39	3	4	3	3	2	2	3	3	3	4	2	5	4	3	3	2	4	4	2	2	1	2	1	2	3	2	2	4	2	2	1	2	3	2	1
R3	4	3	5	5	5	3	1	4	3	3	3	5	5	3	3	3	2	3	5	1	1	4	2	3	4	3	2	3	2	4	2	2	5	4	1
R6	1	3	2	4	4	1	3	3	2	3	4	4	4	4	3	4	3	3	4	4	3	4	2	2	4	4	2	2	3	4	3	3	4	3	3
R21	5	4	5	4	4	4	4	5	3	4	4	4	4	5	5	5	5	4	5	5	3	4	3	3	4	4	4	4	4	4	4	5	5	4	3
R27	4	4	5	3	2	3	3	4	3	3	2	4	5	5	4	4	4	4	4	3	2	2	2	3	4	4	4	4	4	4	4	4	4	3	4
R32	3	5	1	3	1	1	1	2	2	1	3	3	4	4	4	3	3	5	3	5	5	3	1	1	1	2	5	3	5	3	1	3	1	2	5
R2	2	3	4	5	5	3	2	4	2	3	4	5	5	1	4	2	3	4	4	4	3	4	3	3	3	3	4	4	3	5	3	4	5	3	4

R4	4	4	4	4	3	2	2	4	4	2	4	4	4	3	4	3	3	3	3	3	3	4	2	3	2	3	2	3	3	4	2	3	3	3	2
R5	4	3	2	3	4	4	3	4	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4	4	4	4	4	4	4	4	4	4
R9	3	3	3	3	4	4	4	3	3	3	3	3	3	3	4	3	3	3	4	4	3	4	2	2	3	2	2	4	3	2	2	2	4	3	3
R10	5	5	5	3	4	2	4	3	2	2	1	3	4	2	5	4	4	4	3	5	5	5	2	3	4	2	2	3	4	4	3	3	2	5	4
R13	4	5	4	4	5	4	4	5	3	3	4	4	4	3	4	4	5	4	4	3	4	4	4	4	4	5	5	5	5	5	5	5	4	4	5
R14	5	3	4	3	3	3	3	3	2	2	4	3	3	3	3	4	4	4	3	3	3	3	4	4	3	3	3	3	3	3	3	4	3	4	3
R19	3	3	4	4	3	4	4	3	4	4	4	4	3	5	4	4	4	5	4	3	3	4	5	5	3	3	2	5	5	4	4	4	4	4	5
R20	1	2	4	5	5	2	3	4	2	4	5	5	5	4	3	3	4	4	5	3	2	2	2	2	3	3	3	4	2	2	3	2	2	2	3
R25	5	4	5	5	4	5	3	4	3	3	4	5	5	4	4	4	4	4	4	4	4	4	3	5	3	4	4	4	4	4	4	4	4	4	4
R26	3	4	4	4	3	4	3	4	4	4	4	4	4	4	4	4	3	3	4	4	3	3	3	3	3	3	4	4	3	3	3	3	4	3	3
R28	5	4	5	5	4	3	3	4	4	5	4	5	5	4	5	4	4	4	4	4	3	5	3	4	4	4	5	3	3	4	5	5	4	4	4
R30	2	4	5	4	4	4	4	4	4	4	4	4	4	4	5	5	5	4	4	4	4	5	4	5	4	4	4	4	4	5	4	4	4	4	4
R31	4	2	2	4	5	3	4	4	4	3	2	4	4	5	4	3	3	3	4	3	3	3	2	4	3	4	4	4	3	3	4	4	3	4	4
R1	4	4	5	4	5	3	4	2	3	4	2	5	4	5	3	2	4	4	5	3	2	2	2	3	2	2	2	2	3	3	2	4	4	4	3
R7	2	2	3	4	4	4	3	3	2	3	4	1	2	2	4	4	4	4	3	4	4	4	3	4	4	3	4	4	4	4	4	4	4	4	4
R11	5	4	3	3	2	2	3	3	3	4	2	5	4	3	3	2	4	4	2	2	1	2	1	2	3	2	2	4	2	2	1	2	3	2	1
R12	3	3	3	3	3	3	3	3	3	3	3	4	4	4	3	3	3	3	5	3	3	3	3	3	2	2	3	4	3	3	3	3	3	3	3
R17	5	3	5	4	5	5	5	3	4	5	5	5	5	3	5	4	5	4	3	3	3	4	2	3	4	4	4	3	4	5	3	3	4	3	4
R24	4	5	4	4	4	4	3	4	3	5	2	3	4	4	5	4	4	3	5	3	3	2	2	2	3	3	3	4	4	3	3	3	4	4	3

R15	2	4	4	4	4	2	4	4	2	4	4	2	4	3	4	4	5	4	4	4	2	2	1	2	2	2	2	2	2	2	2	2	4	4	3
R16	2	4	4	3	3	3	4	5	3	4	4	5	5	4	5	5	5	4	4	4	4	5	2	2	4	4	5	5	5	5	4	4	4	4	5
R18	3	3	4	3	4	4	4	2	3	3	4	4	4	4	5	2	2	3	3	3	3	4	2	3	3	3	4	3	3	3	3	4	3	3	3
R22	4	5	2	4	2	4	2	2	4	2	3	4	2	2	2	2	4	4	2	2	5	5	4	4	4	4	4	3	4	4	4	2	5	4	3
R23	4	4	5	5	5	5	4	4	3	4	4	4	4	4	5	4	5	4	4	4	4	4	3	3	3	3	3	3	3	3	2	3	3	3	3
R29	4	4	4	4	3	3	4	4	4	4	2	2	2	4	4	2	3	4	3	3	4	2	2	4	5	5	2	2	4	4	2	3	3	3	2
R33	4	1	1	1	1	1	3	3	1	1	1	5	1	4	4	3	4	4	4	4	3	3	4	4	4	4	3	3	2	3	4	3	2	4	4
R34	3	4	3	3	3	5	5	5	5	5	5	5	5	5	5	5	5	4	4	5	4	5	3	3	3	4	5	3	3	3	3	3	5	3	4	3
R8	4	5	5	3	2	2	4	4	2	4	5	2	2	3	3	3	3	3	4	3	3	3	2	3	3	3	3	4	3	3	3	3	3	3	3

APPENDIX-F: Statistical data of Section C

Material Identification Phase

Code	Possible Root causes	Mean
A8	Not determining what and when materials needed	3.00
A5	Nonstandard specification	3.21
A6	Incomplete/ ineffective meeting	3.32
A4	Lack of conformance to requirements	3.59
A7	Difference between plans and specification	3.59
A1	Undefined scope	3.62
A3	Incomplete drawings	3.74
A2	Lack of communication	3.76

Vendor Selection Phase

Code	Possible Root causes	Mean
B1	Uncontrollable bid list	3.35
B2	Incomplete proposal	3.41
B3	Time spent in investigating non-qualified suppliers	3.91

Procurement Phase

Code	Possible Root causes	Mean
C11	Storage of materials	2.62
C12	Theft	3.21
C9	Vague stated requirements	3.24
C13	Damage of material	3.32
C8	Unrealistic delivery date	3.47
C4	Late deliveries	3.50
C10	Re handling of material	3.50
C2	Availability of quality	3.65
C6	Poor communication	3.76
C5	Late or incorrect submittals	3.79
C7	Lack of conformance to requirements	3.84
C1	Availability of material	3.85
C3	Matching price to competitors price	4.00

Construction Phase

Code	Possible Root causes	Mean
D6	Storage of material	3.12
D2	Incorrect sizes delivered	3.29
D1	Incorrect type of material delivery	3.32
D10	Poor communication	3.38
D4	Keeping track of material	3.41
D7	Loss of material	3.41
D3	Incorrect quantity delivered	3.50
D9	No supplier quality assurance	3.50
D5	Re-handling of material	3.56
D8	Damage of material	3.56

APPENDIX-G: Ranking of root causes of ineffective Material Management

Section C

Possible root causes		Mean Score	Rank
C3	**Matching price to competitors price**	**4.00**	**1**
B3	**Time spent in investigating non-qualified suppliers**	**3.91**	**2**
C1	**Availability of material**	**3.85**	**3**
C7	Lack of conformance to requirements	3.84	4
C5	Late or incorrect submittals	3.79	5
A2	Lack of communication	3.76	6
C6	Poor communication	3.76	6
A3	Incomplete drawings	3.74	7
C2	Availability of quality	3.65	8
A1	Undefined scope	3.62	9
A4	Lack of conformance to requirements	3.59	10
A7	Difference between plans and specification	3.59	10
D5	Re-handling of material	3.56	11
D8	Damage of material	3.56	11
C4	Late deliveries	3.50	12
C10	Re handling of material	3.50	12
D3	Incorrect quantity delivered	3.50	12
D9	No supplier quality assurance	3.50	12
C8	Unrealistic delivery date	3.47	13
B2	Incomplete proposal	3.41	14
D4	Keeping track of material	3.41	14
D7	Loss of material	3.41	14
D10	Poor communication	3.38	15
B1	Uncontrollable bid list	3.35	16
A6	Incomplete/ ineffective meeting	3.32	17
C13	Damage of material	3.32	17
D1	Incorrect type of material delivery	3.32	17
D2	Incorrect sizes delivered	3.29	18
C9	Vague stated requirements	3.24	19
A5	Nonstandard specification	3.21	20
C12	Theft	3.21	20
D6	Storage of material	3.12	21
A8	Not determining what and when materials needed	3.00	22
C11	**Storage of materials**	**2.62**	**23**

APPENDIX-H: Interview transcript

Respondent	Tell me more about the material management process you follow? Please explain the reason why you are not following some processes?
R35	We get materials from shops like STO, Sonee Hardware, Nalahiya (local supplier shops), no storage we buy when we need and store inside the site itself. There are people always living around the site so never experienced anyone stealing from the site. Sometimes difficult to get large quantities like tiles so we wait for next shipment and sometime we need to wait months and if the owner ok we just replace with another tile
R40	I talk with shopkeeper we buy material and we check the availability and we buy when we need it for the site, This week they say they have maybe 1000 pcs available and we go to buy they say now some other people come and buy them and now out of stock, cannot buy bulk because no place to store so we buy portion by portion. Sometimes if material not available from one shop we go for other shops and if cannot get from anywhere we wait.
R37	Material from different shop the price is more or less the same the problem is when we go to buy they say the stock is now coming, and when we go again they say some problem with the shipment just wait for another month, and so on they keep on telling these stories. It is not possible to get same material from one shop but many material you can get most from STO. Sometimes we do not get the exact material or specs that the client or architect want so this also a problem. At some projects especially interior things we just tell the client to buy on his own
R36	There are some usual shops we get our materials so we have good links with them, but still there are times we face the difficulty of getting the material we want especially the quantity. We do residential houses so the materials we use are very similar, so most material are available from shops.
R38	We take very small project as we have just few staff, material buying and delivering to site very difficult as roads are congested and narrow. If we have to take the materials to another island we need to find a boat to carry them and it is a long process. If the sea is rough it is too risky as we lose the material we lose lot of money. So the boats are also not so big so in one round we may not be able to take all the materials to the island. So need to take many rides to take all the material
R39	We buy material for the project according to the BoQ, we don't have our own supplier we just get them from the shops in Male'.
R3	There are some materials that are easy to get and there are others that are difficult, projects I have worked do not have their own warehouse so need to buy materials close to the time that is needed. Most of the time we have a schedule but not very strict as it is usually residential houses. No strict contracts so projects get delay is very common. Sometimes it is because of difficulty of getting the permission from government offices and so on.
R6	In Male' City if you want to rent a warehouse it is very expensive and we get only 1 project per year and the value also not high, it is not worth to rent a place to keep the material, so we just buy material from the local shop and keep it in the site. Never experience theft.

R21	Previous time there are only few supplier shops, but are they are reliable. Now there are many shops but the quality we do not know. Some shops bring very poor quality material we cannot test them and later when problem happen client ask us to cover damage. This is very sad but it is happening the supplier shop do not give warranty for most items, because no other option available we buy from them as we want to finish the project soon.
R27	We do not have our own warehouse we just buy material when needed for the construction site. Sometime we do not have money to buy because delay in payment. Once we get money and try to get material most of the time the material quantity is not available. May be colour or spec not matching, this problem we face a lot.
R32	Material we get easily from the local supplier shops, now not like before we can call and order online, which is very convenient We can check prices and compare online. The shops deliver the material we need to the site to the time we need but this is only applicable for Male' city if we need to take the material to another island that is very difficult.
R2	Prepare the BoM and we bring material as per the BoM, we have specific suppliers for different materials. Communication is very important as we need to bring the materials to according to a certain schedule. We don't have our own warehouse usually material are stored in the supplier's warehouse.
R4	For the construction materials we depend very much on the hired suppliers of a project. We keep them very close to us, because if they are not doing a good job in bringing the materials then this can have a big effect on the project schedule. And the more the schedule drag the more money we spend. So we choose the supplier very wisely, we usually have regular suppliers, as we know them well. But if they are not available sometimes we need to hire new suppliers and they sometime do not turn out too well
R5	Our projects have specific suppliers, they are responsible to deliver materials when it is needed. Schedule is given beforehand, so they follow it. Most of the suppliers are very good, but the problem is the shipment issues. There connection with the other country supplier sometimes have problem. To bring the materials from abroad is a very long procedure, sometimes there are too many forms to fill out and permissions to take and this takes up a lot of time and also high transaction cost
R9	In a recent project I have worked I faced communication problem with the supplier, even though the specification of the material was written the supplier was careless and brought in a wrong order. The supplier took the responsibility and he ordered another shipment of the correct spec of material but it took a long time to deliver it. Due to this problem our project delayed and the client got furious and we actually lost some projects we could have gained if we were able to finish that project on time. The cost of that project even escalated due to the delay.
R10	Now to build any place the materials we need we get it from India, Sri Lanka and other countries. So we now have good supplier contacts from those places and we use a local logistic company to bring those materials to us. It's true, we do not have our own warehouse, but this is not a problem. The logistic company we use give the service of storing the materials and also keep track of the stock. It is ok to pay a little high for these logistic companies because the service they are providing is very valuable for us.
R13	Some companies still do not operate with a central supply store or warehouse like us. Needs to bring per stage basis to avoid storage space short comings.
R14	To bring imported construction material is a challenge. There is too many steps that it needs to go through before reaching the construction site. We want to buy all the materials at once but so sad no place to store them and one supplier cannot provide it too. So material come phase by phase and we always need to update schedule and keep the suppliers informed of the latest schedule. But sometimes miscommunication happens too we are always learning from our previous projects.

R19	We make good contracts with suppliers they are responsible to bring the materials on time. If they fail to do so they need to pay us. Yes we experience delay and also cost overrun due to material problems but there are other problems also causing these delays and cost problems. Especially we use those expatriate workers who do not understand what we say and if there is nobody to supervise them the work they do most of the time we need to redo it. And to do the work again we need material that have not been scheduled earlier, similar these type of problems we face. We do not have too many staff usually we multitask and it is impossible to keep someone always at the site to supervise them.
R20	Local supplier shops are not reliable and we do big projects and enough quantities are not available from those shops, so we always get special suppliers for our projects. They are very good they provide us with the materials we need. Most suppliers we hire are regular suppliers, we have worked together in many projects. So we both understand each other very well, but you also know right big projects can cause high cost overrun with little delay too. We do not own any warehouse we just use the warehouse of the suppliers.
R25	Having no storage is no problem now, as the trend is to outsource everything to the supplier. He is responsible to take care of it we don't care how he do it once he is able to deliver the materials we need on the right time the correct quantity and quality we are happy. Material problem is common as they are not available from here they are coming from different countries so we also understand that the supplier also face complications.
R26	Materials are not cheap, we buy material blindly from suppliers, and this is because in Maldives we do not have ways to test the material so we just hope that they are going to be ok. But if the material we buy we need to change then we are in deep trouble as they are not available locally so we need to bring a new batch from abroad. It is expensive and it will take time. we need to make sure we get good loyal suppliers who do not cheat with us
R28	Yes we do not have a warehouse we buy them phase by phase and we have specific suppliers for different materials. As usually aggregate we bring from India and wood usually from Malaysia or Thailand. It depends on the material we need for the project, we try to find the best supplier to bring these materials.
R30	Few suppliers in Maldives it's a challenge even if we know that some suppliers are not good also as there is no other supplier available at that time we again go to suppliers who we have blacklisted earlier. We just micromanage them to make sure that they do not make us suffer this time
R31	We have regular clients so we want to keep a good image so can't take the risk of depending on local supplier shops so we find good suppliers especially for the project. We find the best value price and hire them. They take care of the storage of the material and delivering the materials to the site. We do not worry about it.
R1	The company I work have latest technology to keep track of material, so we rarely have problems regarding material management. So far so good. We usually hire the best suppliers in town. Our company have our own warehouse and there is a different department in our company who looks after all these stock.
R7	The projects I was involved we don't go to local shops to buy we buy in bulk through different suppliers and store them in the company's warehouse. Mostly 2-3 projects will be carried out together so we try to use the materials between the ongoing projects. We have good trained staff and good infrastructure to have a good material management system
R11	I work for a very big company where they have their own shipping departments, so the material needed for the scheduled projects are always brought in beforehand and are stored in the company's warehouse.

R12	My company owns a warehouse but still we are having difficulty to manage the materials because we have few skilled staff. So we work under staff so many things go not very much in order and sometimes this cause delay in some projects. Stock is not kept updated and when projects need the material it not well informed beforehand, so there is problems in carrying out material management processes in my company
R17	Unavailability of construction material is a common problems so we try to mitigate it by improving the SOP of bringing in materials for project. Always material need must be informed before at least two weeks ahead to the main office so that the material that is needed can be provided within the following procedures. We have our own warehouse but the management of stock keeping needs improvement, maybe need to utilize good IT software to keep the stock intact.
R24	I think having a company warehouse have saved our projects many time, as things usually do not go according to schedule. Keeping the construction material safe and sound saves us money.
R15	Have a warehouse, now we going on to second thoughts about our warehouse as it is too costly and we are not fully utilizing it, but so far it is helpful to have the warehouse as we have a space to store the material.
R16	We do not have a process written on a paper to manage the construction material with time now there is certain process we follow when a project goes on like when a material is needed from the site we call the stock officer and ask to send the material from our warehouse to the site location. Likewise we select different suppliers for different projects.
R18	Construction material we buy in bulk as we can get good discounts from the suppliers, as we have our own storage we keep the needed materials for all the projects that are carried out by our company in the storage. There is a store keeper that person keep track of the materials in the stock.
R22	Construction materials are not the same, some it is difficult to store in our small warehouses while there are some material that is very fragile and expensive that it is not safe to just to keep in the open in the site. We try to separate and select the items that need to be in the site and what materials that need to be stored and locked in our warehouse. So material in the warehouse will be send to the site when they are officially requested by the project manager or site supervisor.
R23	Projects material specification is determined by the consultant but the supplier is hired by us. So sometimes there is confliction between the consultant and us as we always try to use the material that we have in our warehouse as we do not want to waste them. It is very difficult to convince the consultant to change specs of material that is one of the problem we are facing.
R29	Too many projects going on hand in hand can be very chaotic especially when very similar construction material is required for all the projects. warehouse categorization of the materials are not project wise but material type wise so sometimes there is mix up
R33	Our company warehouse is always well equipped with the material needed by the ongoing projects. No problems with construction materials in the recent projects
R34	Have our own warehouse to store the project construction material. Have people trained to make material management good.
R8	I work for a very big company we have our own material supplier departments, so the material needed for the scheduled projects are always brought in ahead of the projects and it is not one project at a time that goes on so. All the materials of all the projects are stored in the main warehouse