# BEST PRACTICES TO PREVENT OUT OF SEQUENCE CONSTRUCTION ACTIVITIES

NURUL IZATI BINTI SHAHIDAN

B. ENG (HONS.) CIVIL ENGINEERING

UNIVERSITI MALAYSIA PAHANG

**UNIVERSITI MALAYSIA PAHANG**

**DECLARATION OF THESIS AND COPYRIGHT**

Author's Full Name : NURUL IZATI BINTI SHAHIDAN

Date of Birth : 23 OCTOBER 1996

Title : BEST PRACTICES TO PREVENT OUT OF SEQUENCE CONSTRUCTION ACTIVITIES

Academic Session : 2018/2019

I declare that this thesis is classified as:

| | | |
|---|---|---|
| ☐ | CONFIDENTIAL | (Contains confidential information under the Official Secret Act 1997)* |
| ☐ | RESTRICTED | (Contains restricted information as specified by the organization where research was done)* |
| ☑ | OPEN ACCESS | I agree that my thesis to be published as online open access (Full Text) |

I acknowledge that Universiti Malaysia Pahang reserves the following rights:

1. The Thesis is the Property of Universiti Malaysia Pahang
2. The Library of Universiti Malaysia Pahang has the right to make copies of the thesis for the purpose of research only.
3. The Library has the right to make copies of the thesis for academic exchange.

Certified by:

| | |
|---|---|
| _____ | _____ |
| (Student's Signature) | (Supervisor's Signature) |
| _____ | _____ |
| 961023-02-5212 | Dr. Abdul Rahimi Bin Abdul Rahman |
| Date: 30 MAY 2019 | Date: 30 MAY 2019 |

NOTE : * If the thesis is CONFIDENTIAL or RESTRICTED, please attach a thesis declaration letter.

## STUDENT'S DECLARATION

I hereby declare that the work in this thesis 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 Universiti Malaysia Pahang or any other institutions.

_____

(Student's Signature)

Full Name : NURUL IZATI BINTI SHAHIDAN

ID Number : AA15116

Date : 30 May 2019

# BEST PRACTICES TO PREVENT OUT OF SEQUENCE CONSTRUCTION ACTIVITIES

NURUL IZATI BINTI SHAHIDAN

Thesis submitted in fulfillment of the requirements
for the award of the
B.Eng (Hons.) Civil Engineering

Faculty of Civil Engineering and Earth Resources

UNIVERSITI MALAYSIA PAHANG

MAY 2019

## ACKNOWLEDGEMENTS

Alhamdulillah, praise to Allah the Almighty and peace be upon our Prophet Muhamad s.a.w. With the will and bless from Allah s.w.t, also with the strength He bestowed upon me I am able to finish my Final Year Project.

In the development of this dissertation, it seems that an infinite number of people have provided immeasurable amount of guidance, assistance and idea. While my gratitude goes to all of those that has assisted me, I could only mention a few of many benefactor here. Immense thanks to my supervisor Dr. Abdul Rahimi Bin Abdul Rahman for his sincere guidance and endless support in whatever he could for me to complete my Final Year Project. I could never thanks enough for all of his support throughout my journey in completing this project.

I am deeply indebted to all of the interviewers which had significantly contributes to the success of this project, those who contribute their time and idea to provide the data needed for this research. I submit my heartiest gratitude to all the interviewers involve.

I am tremendously thankful for my parents; Shahidan Bin Abdullah and Siti Latifah Binti Ahmad also my whole family and my love ones Muhamad Amier Hamzah for their endless support through ups and down while I am completing this research and my bachelor degree. I could never ask for anything more than a supporting circle in my life and for that I am forever grateful.

Last but not least, my thanks goes to the administration, faculty and university's staff for their assistance either directly or indirectly. My sincere thanks goes to my course mate and friends for their knowledge and information sharing in completing this research.

## ABSTRAK

Kelewatan dalam industri pembinaan bukan sesuatu yang terasing lagi. Masalah dan cabaran umum dalam projek pembinan adalah  kelewatan pelaksanaan dan operasi. Salah satu punca kelewatan pembinaan adalah aktiviti pembinaan yang tidak mengikut urutan. Oleh itu, kajian ini dijalankan untuk mengenal pasti amalan yang sesuai untuk mengelakkan kerja yang tidak mengikut urutan di dalam projek pembinaan. Kaedah penyelidikan yang digunakan dalam kajian ini adalah wawancara individu dengan pengamal industri dari industri pembinaan. Penemuan kajian ini menunjukkan bahawa amalan yang paling ditonjolkan untuk menghalang aktiviti pembinaan yang tidak mengikut urutan terletak di pengurusan atasan dan pengurusan bawahan yang terlibat di dalam projek pembinaan itu sendiri.

## ABSTRACT

Delays in the construction industry are not something alienated anymore. The common problems and challenges in construction project are delay in implementation and operation. One of the causes of construction delays are out of sequence construction activities. Therefore, this study is conducted to identify the feasible practices to prevent out of sequence in construction projects. The research method that is being used in this study is individual interviews with industry practitioners from the construction industry. The findings of this study have shown that the most highlighted practices to prevent out of sequence construction activities lie upon the upper management and lower management that involves in the construction project itself.

## TABLE OF CONTENT

## LIST OF TABLES

## LIST OF FIGURES

## LIST OF ABBREVIATIONS

| | |
|---|---|
| CIDB | Construction Industry Development Board |
| OOS | Out of sequence |

# CHAPTER 1

# INTRODUCTION

## 1.1 Introduction

The construction industry is a distinct sector of the economy which makes its direct contribution to economic growth like all the other sectors such as manufacturing, agriculture, tourism, entertainment, and services. It also provides the basis where the other sectors can grow, by constructing the physical facilities required for the production and distribution of goods also services. Therefore, it is clear that the industry or construction activities affect nearly every aspect of the economy and undoubtedly vital for its continual growth.

However, failure in the construction industry is inevitable. Delays are one of the biggest problems of the construction process in developing countries, as cause a negative effect on the projects (Pourrostam et al, 2012). Many research has been done in analyzing the cause and effect of delay in construction project but in this study, the scope of focus will be decreased and highlighted to the issues that contribute to construction delay which is out of sequence construction activities. The improvement of delay factor not only limited to technical factors but also factors in the project management perspective both from the aspects of processes involve and the influence of human attitudes, mentality, skills, and behavior (Hamzah et al, 2011). Therefore the prevention to the out of sequence construction activities will be analyzed in this study to cater to the issues.

Scheduling in project management is a process of listing a project's milestones, activities, and deliverables with project start and finish dates. It is a very important process because it helps the engineers and project management team to complete the project within the allocated time and budget. Meanwhile, out of sequence construction

activities is generally any activity that is in progress or has completed before its predecessor. It is a condition in which the originally planned, and probably most efficient and logical work sequence is interrupted and changed (Ibbs et al., 2017). It also a quiet familiar terms to project scheduler, project manager and project management team that involves scheduling work task at the initial of any construction project.

## 1.2 Problem Statement

The construction industry is a vast and wide industry, therefore it is common when something mass operating to have huge chances of issues to come on the surface. Plus, it involves many individuals, hierarchy and type of work where each has its response and mannerism. To set everything in place, the project management team will set up a standardized working method and project schedule. Construction management decisions are made based on schedules that are developed during the early planning stage of projects, yet many possible scenarios should be considered during construction (Daniel et al., 2009).

Changes on the original standard may lead to contractor or worker to skip a scheduled task plan to progress the work and move on with the schedule by continuing work efforts rather than suspending the task on the scheduled activity or demobilizing until the delay induced by the change is rectify. Out of sequence work during construction is a major cause of productivity losses, cost and schedule overruns, and quality decline, either directly or indirectly (Abotaleb, 2018). The next things that are influenced are project success and project productivity. For example, out-of-sequence performance can decrease productivity as a result of additional time expended on the task moving back and forth to it and also indirectly due to transporting employees, retraining employees, reorienting workers to the tasks skipped over, and completing or and correcting deficient work (Ibbs, 2017).

## 1.3 Research Objective

Generally, this research aims to find ways to solve issues regarding construction failure and will be focusing on practices to prevent out of sequence construction activities. Besides, this research will also study on the factors that are believe to be a challenge to implement the practices that could avoid out of sequence from happening.

Specifically, in response to the stated issues, this research intends to achieve the following objectives:

i. To identify the best practices to prevent out of sequence in construction activities.

ii. To study the challenges in implementing the practices

## 1.4 Research Question

In an effort to understand the technique or strategy to avoid out of sequence from occurring in the construction industry, few relevant and specific questions are being formed to address the research objective. The research questions that were used in this research are as follows:

i. What are the best practices to prevent out of sequence construction activities?

ii. What are the challenges to implement the practices?

## 1.5 Scope of the Study

The main focus of this research is to solve the occurring problem in the construction industry regarding ways to prevent out of sequence construction activities. This research also aims to identify the challenges arise in implementing the practices. To facilitate this research, the scope of this study is being narrowed down and will be focusing on the contractor from grade 5 and above listed in the Construction Industry Development Board (CIDB). The targeted population for this study is the Project Manager, Assistant Project Manager, Senior Project Manager, and the Scheduling and Planning Team of a construction company.

Project Manager is a person who has the most responsibility on the successful initiation of the project planning, design, execution, monitoring and controlling of a particular project. Besides that, we choose the project scheduling and planning team in view to the fact that the involvement of the project team is likely to play a crucial role and responsibilities in the implementation and execution of a project. This is because the project team's participation, motivation, capabilities, consistency, and adaptability

help promote the effectiveness of the team and are found to be the main contributor to project success (Ashley et al., 1987).

## 1.6 Significance of the Study

This study aims to determine the best practices and the practices that can help to prevent out of sequence construction activities. By preventing the incident, the project can be run smoothly and it can also reduce the chances of construction failure. Besides, this study also will analyze the challenges that are likely to occur while implementing the practices. Particularly, by knowing what are the challenges that are expected to happen, the project management team will have a better preparation to face the challenges and can be ready with a solution in facing the problems.

Any construction project will have an allocation time or time frame to be completed. A vast majority of project scheduling efforts assume complete information about the scheduling problem to be solved when the pre-computed baseline schedule is executed. In reality, however, project activities are subject to considerable uncertainty, which generally leads to numerous schedule disruptions (Herroelen et al., 2004). Therefore, this research will help the project management team to be prepared with the practices to accommodate the issues.

## 1.7 Operational Definition

### 1.7.1 Construction

Construction can be defined as a complex industry, volatile one and responsive, for the temporary relationship it is so essence according to one-off projects (Smith et al., 2004). It starts with the planning, design, and financing; and continues until the project is built and ready to use. It is a high-risk activity that must be managed from the procurement stage, through the design process until the end of the construction stage and the handover of the project.

### 1.7.2 Construction Activity

It is a small essential piece of a job that serves as a means to differentiate various components of a project.

### 1.7.3 Scheduling

Scheduling is the process of arranging, controlling and optimizing work and workloads in a production process or manufacturing process. It is used to allocate plant and machinery resources, plan human resources, plan production processes and purchase materials.

### 1.7.4 Out of Sequence

Any activity that is in progress or has been completed, before its predecessor. It is a condition in which the originally planned, and probably most efficient and logical, work sequence is interrupted and changed (Ibbs et al., 2017).

## 1.8 Conclusion

The main goal for any construction project is to be completed on the designated time frame and to fulfill the client requirement while providing to their satisfaction with the least resistance. The entire project management and the executioners of the project no matter the upper management or the lower management must give their all and their best to ensure the project success in achieving. The expected results from this study are to come out with the best and most effective practices to prevent out of sequence construction activities that may lead to project delay and further to project failure. The second expected result from this study is to know the challenges that may occur while implementing the practices.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Introduction

In the previous chapter, the key term, problem statement and also the objective of this study have been clearly stated and discussed. The research question, and the main importance of this study also has been highlighted.

To start any research, it is essential to begin with the literature review in order to gain a better understanding of the theories regarding the topic. A study on the literature review can be seen as the answer to the problem statement and support to the research by comprehending the results of the study. This chapter will be focusing on defining the construction project and the out of sequence construction activities.

The purpose of this research is to provide a review of the research that has been done regarding the topic of studies. The review will be detailed in an effort to help the present research to be properly tailored to add to the present body of literature as well as to justify the scope and direction of the present research effort.

## 2.2 Construction Project

Generally, the construction project is made of a series of activities or related tasks that are being carried out in order until the completion of the project. The construction project team is the one who will support the organizational goals as far as the owner of the facilities is concerned. Therefore, the owner of the facilities is continually re-shaping the way they design and organize their work practices, which in turn directly affects the performance of their physical facilities (Whelton, 2004). Meanwhile, construction work is accomplished by contractors who vary widely in terms of size and specialty (Sears et al., 2015).

## 2.3 Out of Sequence Construction Activities

Out of sequence (OOS) work during construction is a major cause of productivity losses, cost and schedule overruns, and quality decline, either directly or indirectly (Abotaleb et al., 2018). Looking at the complexity of the construction project, the impact of OOS could be linear where we could see it or non-linear. It is a condition where the original plan work program or work sequencing that could be the most effective work plan is interrupted and change. Meanwhile, change is unenviable in such circumstances. The need to keep on the work progress requires a change to be made to prevent delays in construction workflow until the change is resolved.

An OOS work involves demobilization, mobilization, and remobilization among the activities. Work performed in this manner is typically less productive due to the higher percentage of demobilization and remobilization time (labor hours) expended per productive time worked on the task (Ibbs et al., 2017). OOS events lead the contract work to be divided into a smaller interval of work construction than planned; therefore losses arise from the time lost on associating the unplanned demobilization and remobilization.

The American Association of Cost Engineers (ACCE, 2004) has listed out of sequence work as one of the common causes of lost productivity and gave an example that crews moving around a site haphazardly might negatively affect efficiency. Long (2005) also listed out of sequence work as one of the site environment changes that the contractor should record. He suggested comparing as-planned and as-built schedules to understand which activities were performed out of sequence. But comparing the activity can only compare the timing and duration of a change and does not fully present the side of the labor worker clearly where they might have to frequently change the from each activity that is being out from its original sequence.

The previous studies have tried to developed approaches on quantifying the impact of out of sequence but none has tried to find the best and most effective way to prevent it from occurring. Although the effect of out of sequence work has been recognized by many people in the industry, a consistent and efficient way to demonstrate skips and out of sequence work is still needed (McLeish, 1981). Classic schedule delay analysis in which the planned and as-built schedules are compared is the

most informative when a contractor is completely stopped from performing all work from one date to another date, meaning that the planned workflow is delayed, not altered or disrupted (Ibbs et al., 2017).

## 2.4 Conclusion

The impact of the out of sequence construction activities has been developed and quantified by the previous study but none of it has come out with the best practices to prevent out of sequence activities. The impact and the activities that lead to OOS has been specified by the previous study and how OOS could lead to delay in construction activities, scheduling and time frame, also in worse cases scenario is construction project failure. The out of sequence is vital events that need to be prevented no matter in small projects or big project, the impact of this event can be happening linearly or nonlinear by the construction project team.

# CHAPTER 3

# METHODOLOGY

## 3.1 Introduction

This chapter explains the research methodology in order to achieve the goals and objectives of the research. A research methodology is a path to finding the answer to the research questions. This chapter is separated in a few sections consisting in detail the participant involved in this study, how the study was conducted, methods of data collection, and how the data is analyzed. The aspects of this study are based on a literature review of construction delay but emphasizing on the best practices to prevent out of sequence construction activities which contribute to construction productivity. The interview is used as the method for data collection to study the best practices used to prevent out of sequence construction activities for Construction Company in Malaysia. The overall objective of this chapter is to describe the stage in the research methodology used in completing this study.

## 3.2 Research Population

Before any research can be started the target population where the data will be drawn upon must be defined and identified based on the suitability of the research study. A research population or target population is usually a large collection of objects or individuals that is the central focus of scientific query. The research benefit is likely will serve the research population itself. However, due to the excessive size of the population the researcher is often impossible to perform their research on every individual or object involves because it is expensive and time-consuming which is why they need to be centralized or focus on. A research population is also known as distinct and well-defined individuals or objects known with a similar characteristic or attribute.

All the individuals or objects in a certain population generally will have the same varying mannerism and traits.

The target population for this study has been selected based on the review and research upon the roles and responsibilities of each individual involves with the research topics. In selecting the target population, the roles and responsibilities of the individuals are being analyzed to highlights the best individuals which have the highest impact to the research study and the individuals who are able to make changes or have the sovereignty of making changes that will improve the future. The most common sample size were 20 and 30 (Mason, 2010). The data collection will be conducted until it reaches 20 individuals or when the data seem to be saturated. Saturated data is when collections of data keep showing a repetitive pattern or seem to have similar data over and over again.

The targeted population for this study is as followed:

1) Project Manager

2) Assistant Project Manager

3) Senior Project Manager

4) Planning and Scheduling Team

Project Manager (PM) has a standing role or act as the backbone in determining the success ability of a project. He/she will carry the overall responsibilities for the successful planning, execution, control, monitoring and closure of a project.

### 3.3 Data Collection

The data collection method used in this study is as stated before which is in the form of an individual interview. The interview is performed on the targeted population that has already been specified. The main reason as to why this approach is being used is because there is not enough research has been done on this topic in the current literature review.

The interview is performed as an open discussion to get the qualitative data from the targeted population experience itself of what they see as the best practices to

prevent out-of-sequence construction activities. The interviewees are provided with two main open-ended questions and are followed with side questions to get a better understanding of the approaches that they suggested. The two main open-ended questions are:

i. What are the best practices to prevent out of sequence construction activities?

ii. What are the challenges in implementing the practices?

The interview takes approximately about 60 minutes to give the interviewees enough time to explain or discuss the answer to the question given and to strengthen their answer with their personal experience handling the project management team. Before the start of the interview, the introduction and objective of the study are being set forth to give the interviewees a general idea about this topic and to set them on the right track of the discussion. Next, the follow-up question is introduces to get in-depth with the discussion and to prevent from any misunderstood on their response. After the interview, the summary of the discussion is being made to get a brief confirmation on the interview data and are being sent to the interviewees to prevent any misinterpretation. By doing this step, they can check on the information that they have supply and any misapprehend or misinterpretation of data can be avoided.

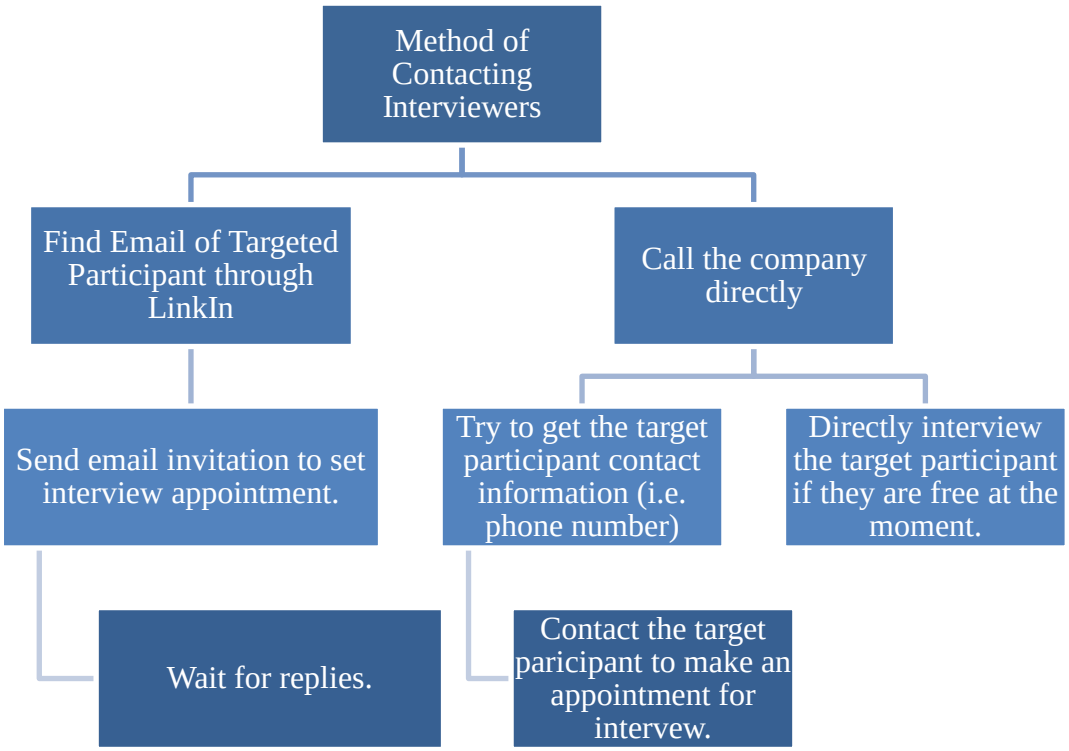



Figure 3.1 Method of contacting the interviewers

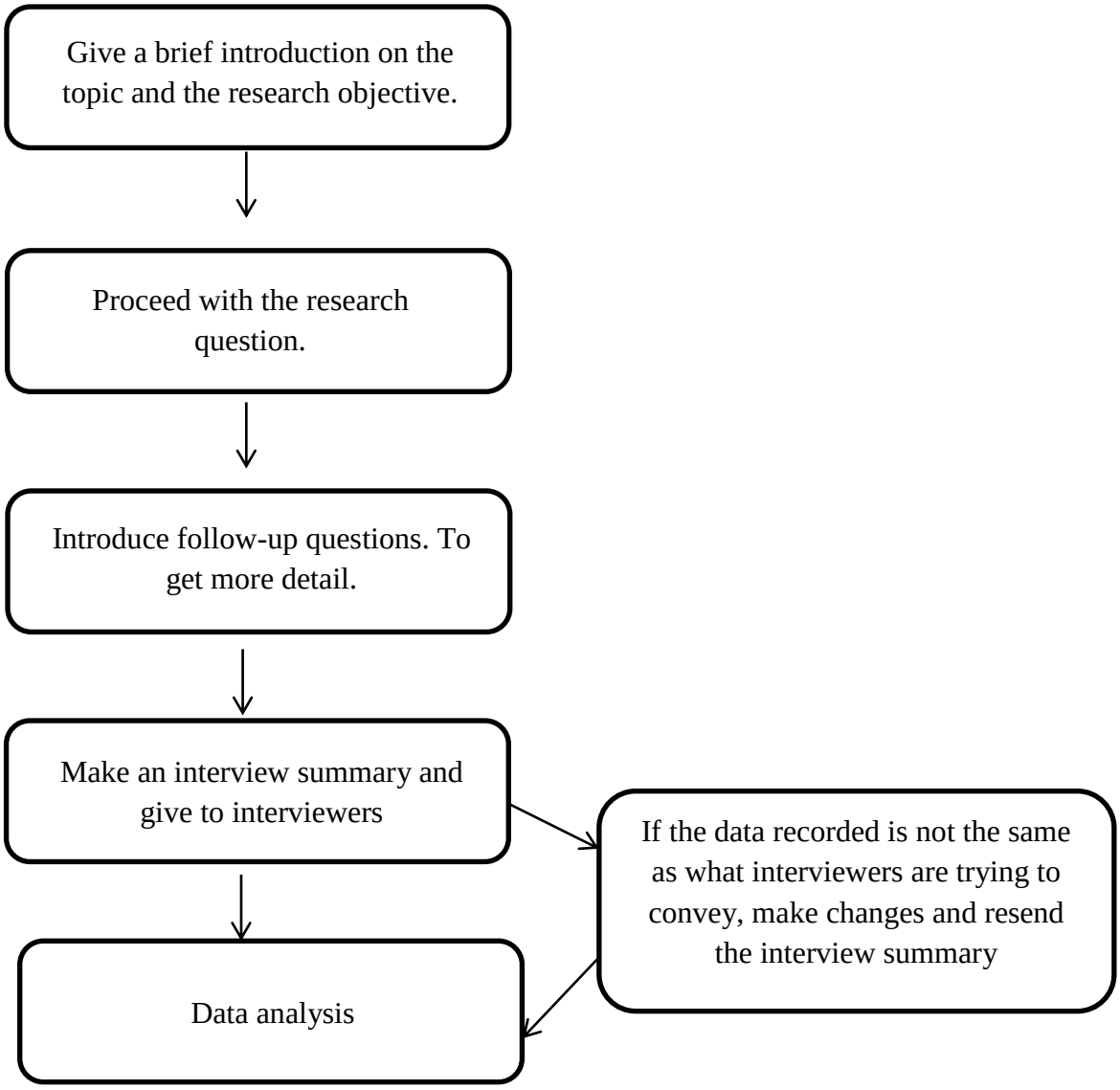



Figure 3.2 Interview session flowchart

### 3.4 Data Analysis

The method used to analyze the data from the interview is thematic analysis. This type of analysis is generally used in qualitative research and focuses on examining and coming up with a theme within the data that we get. Coding is the primary or an initial process for developing the theme within the raw data by identifying the important information in the data and encoding it prior to interpretation. The interpretation of these codes can include comparing theme frequencies, identifying theme co-occurrence, and graphically displaying the relationship between different themes (Guest et al.,

2012). Thematic analysis is considered very useful to most researchers as the method in capturing the intricacies of meaning within a set of data.

## 3.5 Conclusion

The best practices used in preventing out-of-sequence construction activities are the main target of this research. The project manager, senior project manager, assistant project manager, and the project scheduling and planning team are identified as the ideal participant to collect the desired data in answering the research question. The method used in collecting the data are being explained in this chapter which is using interview session and the data are being analyzed using the thematic analysis. Overall, this chapter explains the research design process to collect the data, the procedure carried out and how the results and findings are being drawn and understood.

# CHAPTER 4

# RESULTS AND DISCUSSION

## 4.1 Introduction

This chapter presents the qualitative findings of this research. The main purpose of this research is to identify the best practices to prevent out-of-sequence construction activities and to study the challenges in implementing the practices. This chapter will present the data collection from a series of interview sessions and the analysis of data using a thematic analysis.

From the objective of this study, we wanted to come out with the best and effective practices that can prevent out-of-sequence that can lead to many issues such as productivity losses, cost, schedule overruns and quality decline. Therefore, a total of 15 individuals who played a part as stated in the target participant which is project manager, senior project manager, assistant project manager and project planning and scheduling team has been interviewed to collect the data for this study.

The data and statements gathered from the interview are assembled and the discussion is drafted through writings, chart and tables. The data will be presented in a good arrangement manner to ensure the information is conveyed as what it should be. Therefore, the detailed data breakdown, summarized information and final conclusion is compiled in this chapter.

## 4.2 Interview Analysis

The data collections are gathered through the interview session with the defined target participant. All the targeted interviewees are contacted starting from October 2018 to March 2019. An appointment with the relative interviewees is being set up beforehand to give the interviewees time to prepare for the interview sessions and also

to fit into the time and date that works best for the interviewees. The interview sessions are divided into two conditions, the first one is a face to face interview and the second one is an interview session through a phone call. The approximate duration for each interview session is around one hour. 15 interviewees from different construction companies have agreed to have interview sessions in order to obtain their views in the practices that can prevent out-of-sequence construction activities and the challenges in implementing the practices. All interviewees who participate in this interview are from construction companies registered under grade 5 and above in CIDB's registration. Table 4.1 shows the summary of the participation of interviewees in this data collection.

Table 4.1 Summary of the participation of respondents in interview

| **Interviewees** | **Quantity** | **Percentage (%)** |
|---|---|---|
| Grade 7 | 7 | 47 |
| Grade 6 | 5 | 33 |
| Grade 5 | 3 | 20 |
| Total | 15 | 100 |

Based on the table illustrate above, most interviewees are from the construction company that is awarded with grade 7 which represents about 47% of the data collected, followed by interviewees from construction company grade 6 which is 33% and grade 5 which is 20%.

Table 4.2 CIDB contractor grade and tender capacity

| **Grade** | **Tender Capacity (RM)** | **Paid-up Capital (RM)** |
|---|---|---|
| G7 | No Limit | 750,000 |
| G6 | Not exceeding 10 million | 500,000 |
| G5 | Not exceeding 5 million | 250,000 |
| G4 | Not exceeding 3 million | 150,000 |
| G3 | Not exceeding 1 million | 50,000 |
| G2 | Not exceeding 500,000 | 25,000 |
| G1 | Not exceeding 200,000 | 5,000 |

Source: Azman et al., (2012).

Table 4.2 has shown the tender capacity and paid up capital for each grade of contractor awarded by CIDB. For a contractor that has been awarded by grade 7, there is no limitation of tender capacity being restricted on them which means they are able to do project costs more than 10 million Ringgit Malaysia, in other words they can manage mega projects. Meanwhile, for contractor grade 6 they have limitations to an only tender contract that is not exceeding 10 million Ringgit and for contractor grade 5 the restriction that is imposed on them are to only accept tender contract value that is not exceeding 5 million Ringgit Malaysia. Therefore, to be emphasized, the interviewers that are involved in these studies have experienced in managing project value of 5 million Ringgit Malaysia and above, and are likely to have many experiences handling a big project.

Table 4.3 Interviewers Gender

| Gender | Number of Interviewers | Percentage (%) |
|---|---|---|
| Male | 14 | 93 |
| Female | 1 | 7 |
| Total | 15 | 100 |

The total number of interviewers who participate in this study is 15 people. Out of those 15 people, there is only 1 female and the other 14 people are male. As stated in Table 4.3, 93% out of the total participant who involves in this study is the male population which signifies that the male population is the dominant who working in this construction industry and this sector of work as the project manager.

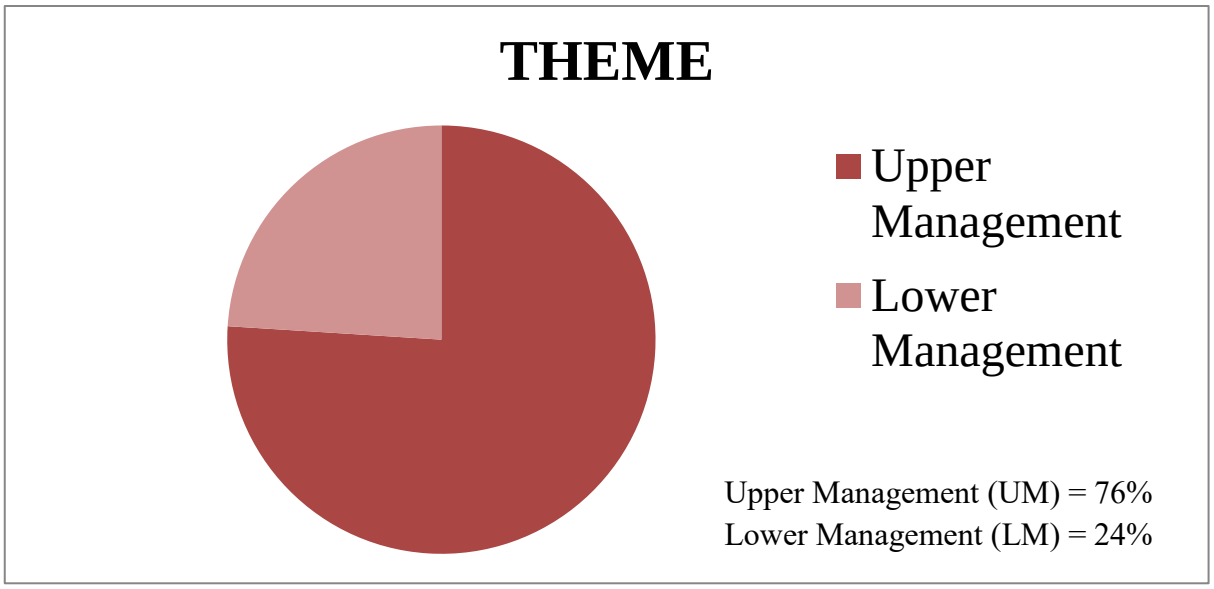
## 4.3 Thematic Analysis

The thematic analysis has been performed on the raw data collection to get the patterns within the data. The interpretations of data analysis will be in coding reliability which segregates into the same patterns and classified into a theme. For some thematic analysis proponents, themes are patterns of shared meaning across data items, underpinned by a central concept, that are important to the understanding of a phenomenon and are associated with a specific research question (Dally et al., 1997). For the data analysis of this study will be separated into two sections which are Section A for the first research question, and Section B for the second research question.

### 4.3.1 Section A

In this section, the first research question will be analysed to get the best practices to prevent out of sequence construction activities to answer the first objective of this research. There are two themes that have been developed from the data collection, the upper management and the lower management.

Figure 4.1 Pie chart representing subtheme for the first research question




Brief statistic:

Total response Σn = 68

Response on UM, n1 = 52

Response on LM, n2 = 16

UM%=$\frac{52}{68}$ x 100 = 76%

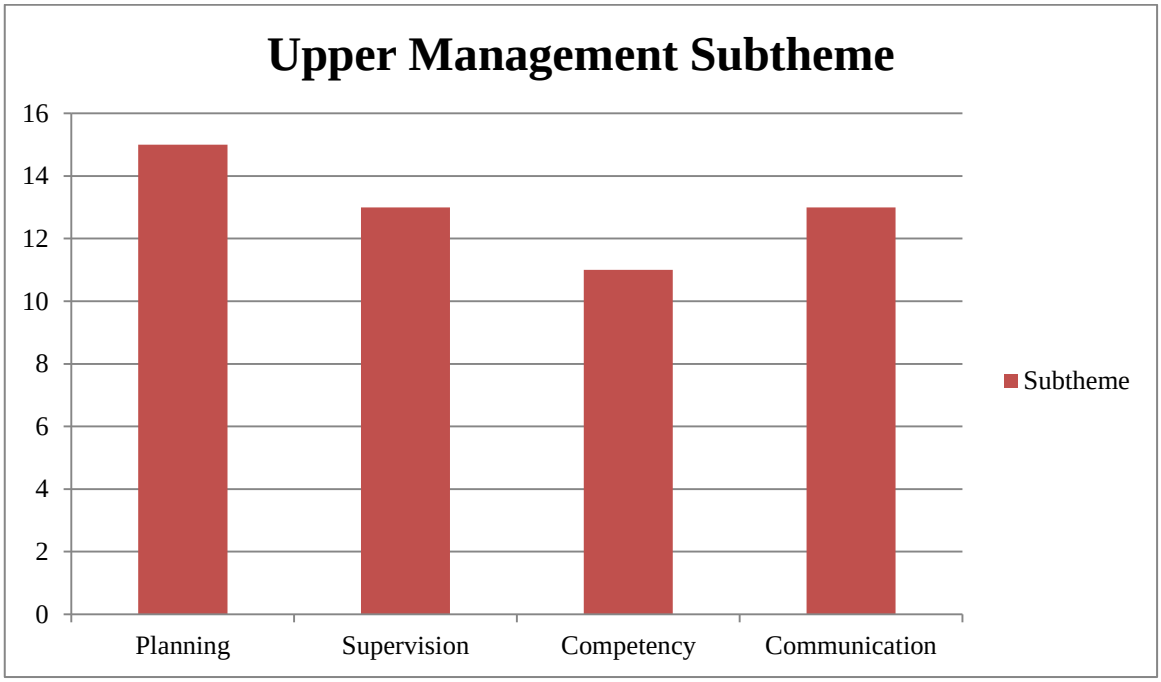
LM%= $\frac{16}{68}$ x 100 = 24%

#### 4.3.1.1 Upper Management

Upper management role in preventing out-of-sequence construction activities from happening in a construction project has encompassed over 76% statistically, of the total data collected upon the first research question. From the numbers, it is shown that this theme carries a major effect on the research objective if the practices are properly

implemented. Referring to Figure 4.1, the total response that is obtained for the first research question is 68, and the responses that are classified into the upper management subtheme are 52. Furthermore, there are four subthemes has been developed under this theme, which is the planning, supervision, communication and competency.

Figure 4.2 Subtheme developed under the Upper Management Theme




***Planning***

As illustrated in Figure 4.2, this particular subtheme has the most response given by the interviewees and is ranked the highest among the other subtheme. The interviewees have stated that on the planning stage, the individuals in charge of planning the project sequence should make a proper sequencing of activities and what he/she thinks is the best or most effective planning based on his experience in handling such a project. If he/she is not well experienced in handling such a project it is best to refer to someone who does, and addresses the advice given based on its suitability on the project.

Generally, a project manager goal is to bring a project to completion on time, within the budget cost and to meet the planned performance or end product goals (Rumane et al., 2017). Therefore, it is crucial for the project manager to prepare a solid plan and make sure the execution of work is according to the plan all the way to

success. Although there are some that claim that too much planning can curtail the creativity of the project team, there is no argument that at least a minimum level of planning is required and the lack of planning will probably guarantee failure (Dov et al., 2003).

On the planning stage of a project, the contract tender must be studied through fully and every requirement and the client's needs must be understood. Every data sheet (if given) by the client must be revised and project design must be made according to the data sheet given and the document is given. All the required documentation must be prepared before the execution of the project to prevent misconceptions of the project design. Usually, the client requirement will be stated during the pre-tendering process, therefore the contractor who wants to take part in the project are obligated to fulfil the entire requirement by the clients. Also, on this stage the client will certify the entire documents that are required to be submitted by the constructors. The prequalification stage is generally preferred by clients to minimize the risks and failures (Mohamed et al., 2010). It also will enhance the performance levels of selected contractors (Palaneeswaran et al., 2001).

Besides that, a work programme should be prepared before the execution of the work and also, the planning and scheduling should be done properly to avoid issues on out of sequence construction activities. An effective work plan should be done considering the client requirement, design and also the site condition. Generally, a client is well-informed and clear about what he needs, but sometimes what he thinks he wants and what he really needs may actually be different (Chitkara, 1998). In addition, the work programme to be made must also be taking into account the deadline of the project and the work timeline, each work process to accomplish the end product and the allocation of the workforce needed adequately. On top of that, set a good standard operation procedure for everyone to follow in order to maintain the quality of work product or the end product.

Furthermore, all the execution of work must follow the work programme that has been made. If change is required, the executioners of work must refer to the Project Manager first before taking any action. Then, the root problem must be identified and the improvement of the work programme must be made to avoid the same problem from re-occurring. Next, to avoid the risk of complications, a recovering plan must be

prepared in case the original work programme does not work for a quick back up to avoid delay on the timeframe.

During the planning stage, the purchasing of material must be done correspondingly without leaving any single component behind, the person in charge with the Bill of Material (BOM), Material Procurement Summary List (MPSL) and ordering must check through fully before placing the order. The material delivery date also must align with the construction work schedule, not too early but must arrive before the execution of the work schedule. Placing the material at the site for too long can cause issues with the material being damaged, vandalise or even loss and sometimes there is not enough space at the site to put the material. On the other hand, the cost allocated for the project must be used wisely and accordingly. The material used must be as per agreed in the contract by both client and contractor or the one that has the same quality and value.

***Supervision***

The next subtheme developed is the supervision, as shown in Figure 4.2 this subtheme has gotten the second highest response from the interviewers along with one more subtheme which is communication. Usually, in a construction project, there will be individuals in-charge specifies in supervising the project which called the supervisor. The construction supervisor plays a huge role in determining the profitability of the construction work that a construction firm performs, and as the management person closest to the workface, that is, to where the work is actually performed by a skilled construction craft workers, the supervisor continually makes decisions and takes actions that directly affect the cost of the work, as well as the duration of the project and the quality and the safety of the work (Rounds et al., 2010).

Site supervision is very crucial to make sure all the work done follows the original work plan; drawings, installation or construction must be done according to the method of statement (MOS), and follow the design requirement. Therefore, during the construction period, proper supervision should be made regularly not only to maintain the work flow but also to make sure the work progress is as planned. The MOS is a safe system of work that already details the way a work task or process is to be completed. It outlines the hazards involved and includes a step by step guide on how to do the job

safely. So by following the MOS, the sequence of the work programme can be more manageable and any issues can be disregard.

While doing the supervision, it is best for the supervisor to always refer to the drawing or other related documents to avoid misconstruction and to ensure the work done is according to planned sequencing. If there are any issues on the work progress, the executioners must refer to the designated people who are able to make the decision rather than just preceding the work. At the same time, the supervisor must ensure the work progress followed the time frame and work timeline. Additionally, the material placement on site also should be supervised to prevent any loss of material. Vandalism and stealing of material that were placed on site is not an uncommon issue, therefore by having material insurance the safety of material can be preserve.

***Communication***

The construction project is typically characterized by high uncertainty, complexity and inter-organizational task interdependence, which makes communication ever more important (Badir et al., 2012). For a smooth flow of construction project, communication is very crucial not only to deliver information but also it could create a healthy working environment. By having good communication the information can be liberated easily and at the same time reduce misinterpretation or misapprehended of information among the project team, client and project executioners. In a country like Malaysia where the construction worker come from many countries and speak the various language, it can be hard for the worker to communicate and sometimes the information was not able to be passed down clearly. Ling et al (2009) have stated that supervisors should be trained to understand and speak different languages, and multi-lingual ability could be considered as one of the selection criteria for safety manager or supervisor.

During the construction phase, by conducting a regular weekly or monthly site meeting, the progress work of the contractor can be tracked or followed. Not only that, any issues happened at the site can be discussed in the meeting and can solve together for a more effective solution. Then, put a target for each week or month to make sure the task is being accomplished according to the work plan. Other than that, send a request for information immediately when big issues arise to get the solution and must

make sure the RFI is channelled to the right person to get quick feedback thus can avoid out of sequence construction activities from happening. Last but not least, communication with the client and the entire project community is also important to maintain a good relationship and courtesy for a positive image. Communication provides project teams with efficient coordination to complete their tasks and reduce the risks for conflicts (Kennedy et al., 2011 and Knight, 2010).

***Competency***

Specifically, the manager's leadership role is of great importance in motivating people and creating an effective working environment in order for the project team to meet greater challenges in today's global economy (Anantatmula, 2010). The competency of a project manager can be a measure of the success ability of a project. Therefore, one of the best way to determine the project success and to prevent out of sequence construction activities are by letting the project to be handled by a competent project manager. The competence of project managers is clearly a vital factor in the success of projects, yet it remains a quality that is difficult to quantify (Crawford, 2000). The results from the interview sessions have stated that a competent project manager and experienced usually will know how to tackle problems effectively and maintain smooth progress of work.

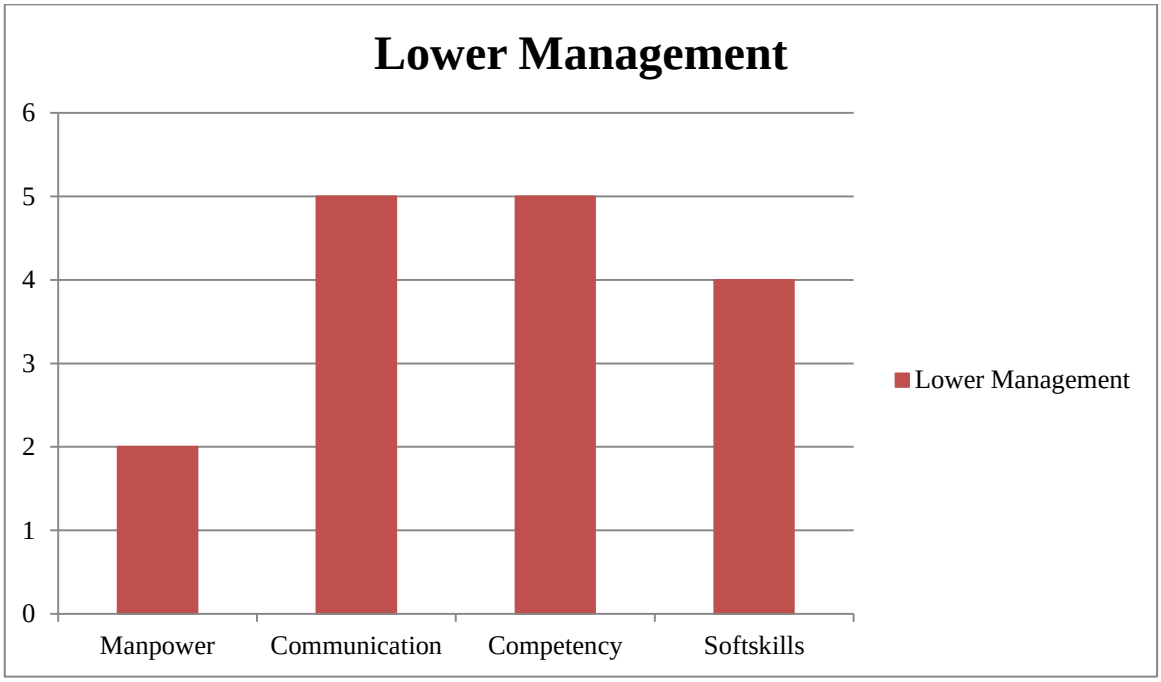
Next, a competent project manager also knows how to manage the manpower resources and knows which task requires more worker to do and which requires less. The allocation of the manpower to execute the construction activities are being placed accordingly. If the work needs continuous construction or fabrication, the allocation of the workforce can be put in a shift or extend working hours appropriately. Also, the project manager, project engineer, or project supervisor must be strict on maintaining the work programme; schedule and work progress to make sure out of sequence activities can be avoided. A competent project manager must also make the payment to their workers on time according to the work progress.

#### 4.3.1.2 Lower Management

The lower management role in preventing out of sequence from happening takes about 24% of the overall data collection on the first research question. As shown in Figure 4.1, the total response obtained on this second theme is 16. Moreover, there are

four subthemes classified under this particular theme which is manpower, communication, competency, and soft skill.

Figure 4.3 Subtheme developed under the Lower Management Theme




***Manpower***

Construction is a labour intensive as well as craft-based activity and the behaviour of people has a direct impact on the performance of construction projects (Lill, 2008). Manpower is generally a group of people who are assigned with the task to be completed or available for work. From the findings of the data collection, the interviewer has stated that the allocation of manpower can prevent the out of sequence of construction activities from happening. Either to put the worker in a shift or adjust their working hours is based on the requirement of the task. Next, by having enough manpower the risk of out of sequence from happening can be prevented. On the other hand, stabilizing the workforce also may result in an increase in employment duration and job continuity (Florez et al., 2013).

***Communication***

Communication is not only important among the upper management but it is vital in the lower management as well. The communication between the contractor, general worker and site engineer is very crucial to ensure the execution of work is as it

should be. As stated before, any work done on the site must follow the actual or original plan that is already being established before the execution. Importantly, if there are any issues regarding the work plan, the worker needs to reach out and get confirmation with the person in charge first to be clear before any actions are taken.

***Competency***

Undeniably, some works need a skilled worker to do it so that it could produce a quality end product and according to the allocation of time. Some complex tasks might require an incompetent worker more time to accomplish it. Meanwhile, a competent worker can make the work a lot easier and also avoid any delay, plus the competent worker can benefit from on-time task completion or even earlier finish. Competent workers usually know how to read plans and drawings and experience in handling the construction task.

***Soft Skill***

An honest worker also contributes to the success or smooth work progress and prevention of out of sequence activities. When the worker is honest in doing their job, the outcome of the work itself will be satisfying and will be done properly according to the requirement. To have an honest worker is really an advantage because it will affect the work done and the overall outcome of the project in the long term. Honesty and moral value is not something that we can control but it can be nourished among the worker and project team.

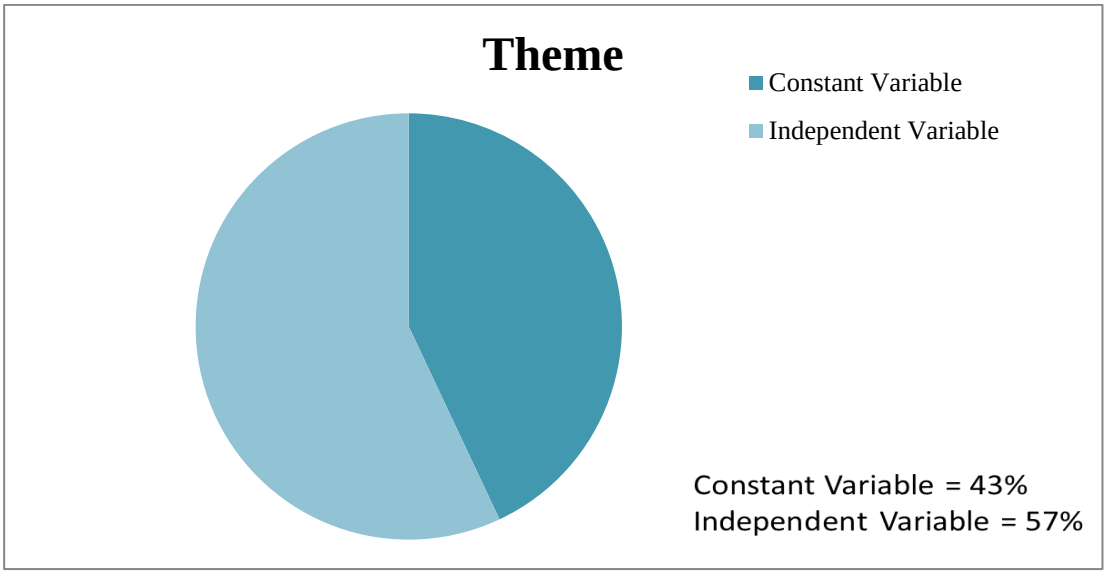
Table 4.4 Interview response based on the subtheme for Section A

| **Individual** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Upper Management | | | | | | | | | | | | | | | |
| Supervision | | ✔ | ✔ | ✔ | ✔ | ✔ | | | ✔ | | ✔ | | ✔ | ✔ | ✔ |
| Competency | ✔ | ✔ | | ✔ | | ✔ | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ | ✔ | |
| Communication | ✔ | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ |
| Planning | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Lower Management | | | | | | | | | | | | | | | |
| Manpower | | | | | | | ✔ | | ✔ | | | | | | |
| Communication | | | | | ✔ | | ✔ | | ✔ | ✔ | | | | | ✔ |
| Competency | | ✔ | ✔ | | | | | ✔ | | | ✔ | | | | ✔ |
| Soft skills | ✔ | | | ✔ | | ✔ | | | | | | ✔ | | | |

### 4.3.2 Section B

In this section, the second research question will be analysed to outline the challenges in implementing the practices to answer the second objective of the research. There are two main themes developed which are a constant variable that represent something that is unavoidable and the independent variable which represents something that has the potential to be resolved. Under the constant variable theme, two subthemes have been developed which are nature condition and project community. Meanwhile, under the independent variable theme there are also two subthemes that are internal and external.

Figure 4.4 Pie chart representing subtheme for the second research question




Brief statistic:

Total response Σn = 40

Response on CV, n1 = 17

Response on IV, n2 = 23

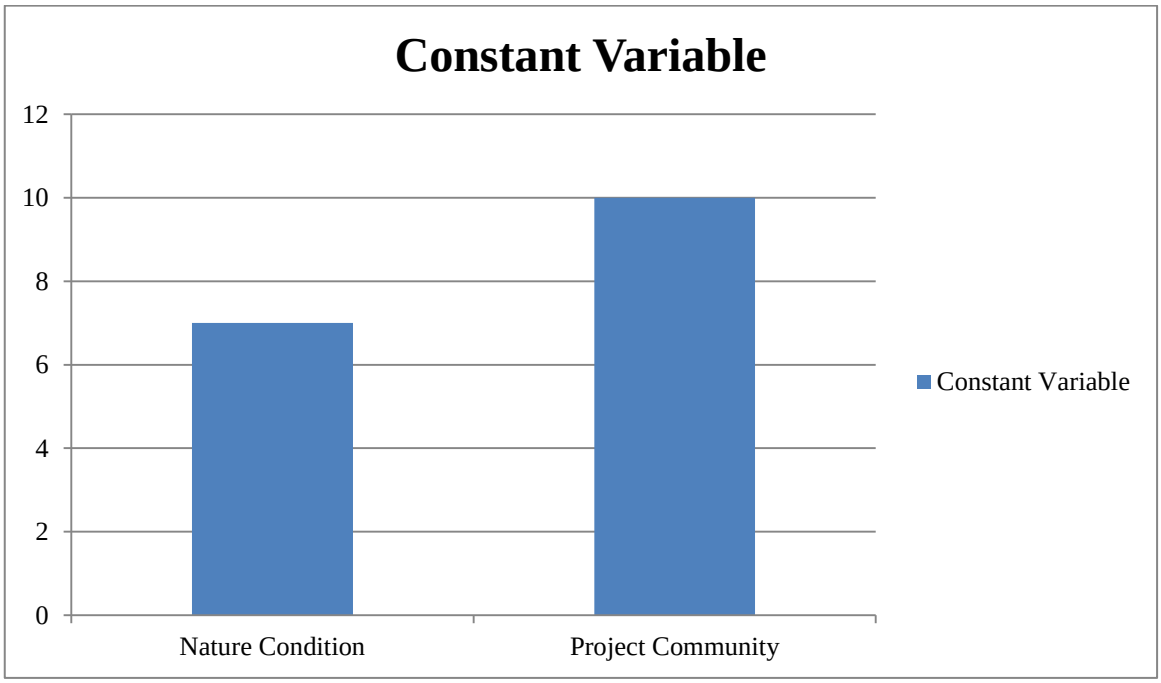
CV% = $\frac{17}{40}$ x 100 = 43%

IV%= $\frac{23}{40}$ x 100 = 57%

#### 4.3.2.1 Constant Variable

The challenges that are classified as a constant variable in implementing the practices encompass over 43% of the data gathered during the interview sessions. From the statistical value illustrated in Figure 4.4, the total response from the interviewers regarding the second research question is 40 and the response that is grouped into the constant variable is 17 which is 43% from the overall data. Under the constant variable theme there are two subthemes developed which is nature condition and the project community.

Figure 4.5 Subtheme developed under the Constant Variable Theme




***Nature Condition***

There are two challenges that specify under the nature condition subtheme which is the weather condition and the site condition. Weather condition is not something that we can control. For example, if there is a sudden downpour, some small structures can be protected with canvas or any material but the big structure is impossible to be protected. Another example is when there is strong wind or typhoon, those inevitable conditions require some work need to be re-do to ensure the quality of the work and structure involved. Rework will affect the progress and out of sequence will happen inevitably.

The second challenge is the site condition. The existing standard work programme and the MOS are not applicable to the site conditions are issues that could contribute to out of sequence. The regular work progress might have to be re-sequencing, re-do or even re-design.

***Project Community***

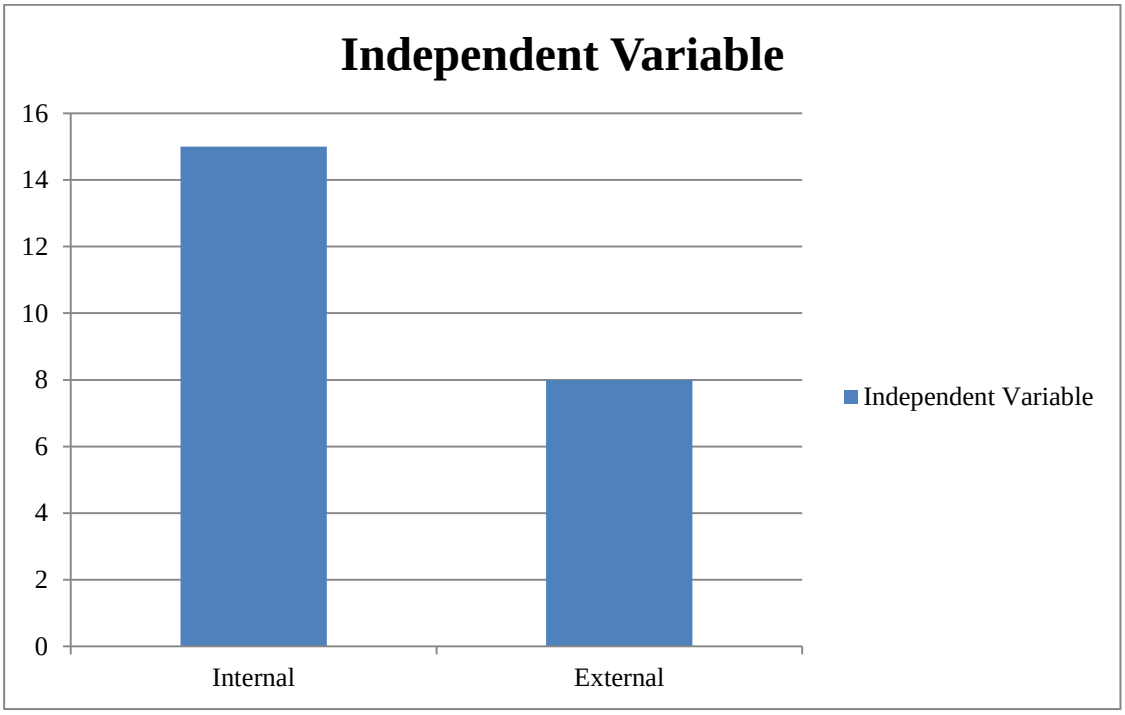
There are two challenges specified under the project community subtheme which is the client requirement in changes in design and the time constraint for the project team to accomplish the end product. The request from the client cannot be declined therefore it will become a challenge when a new design is proposed by the client after the execution of the construction and rework have to be done. Li et al (2011) have stated that rework in construction development projects can significantly degrade project cost and schedule performance.

There are times when out of sequence activities cannot be avoided; if one task is redundant we have to proceed with another task to deal with the time constraint and to avoid form delay in the work progress and completion of the project.

#### 4.3.2.2 Independent Variable

Referring to Figure 4.4, the challenges specifies as the independent variable comprises about 57% of the overall data. There are 23 responses on this theme which classifies into two subthemes of internal and external factors.

Figure 4.6 Subtheme developed under the Independent Variable Theme




***Internal***

There are approximately 15 responses gathered under this subtheme as illustrated in Figure 4.6. One of the responses given by the interviewers is the challenge in communication. People are an organization's most valuable asset and this is especially true in relatively low-tech labour intensive industries such as construction, but again people also represent the most difficult resources for organizations to manage (Osabiya et al,. 2015). Construction project community usually involves a lot of people from different background and nationality, issues on language barrier is not an uncommon issue in the construction project. Next, when the communications between the project team are low it is challenging to convey the information around. Other than that, the worker or subcontractor does not listen to the order given. In this case, the official memo should be issued to speed up the impacts of the complaints. Another response regarding these issues is that the complaints regarding any issues occur on site

are not being channelled to the right person who has the authority to make the decision. This leads to a delay in work progress because some work cannot proceed without completing its predecessor. Therefore, the re-sequencing of work might be needed to continue the work progress and avoid delay in overall projects.

The next challenges are the competency of the project manager and the competency of the overall project community determines the flow of the project. Muller et al (2010) have stated that the project manager training and development should focus not only on technical development should focus not only on technical and management skills, but also on the development of leadership and competencies. The interviewer has stated that it is hard to get a skilful and experienced project manager to implement the best practices. The competency of workers is also classified as challenges to maintain the work progress, because an incompetent worker will drag the time in completing the execution of works. Some workers don't have the appropriate knowledge in executing the task given.

Moreover, there are also challenges when the supervisor needs to supervise a wide area of the site. It is quite difficult to maintain strict supervision when working on a wide area of project site especially when there is more than one task that is operating at the same time. Increasing the number of supervisors somehow will lead to increasing in cost to pay the supervisor which seems impractical according to some company. Also, the manpower resources also seem to be a challenge, to complete the task on time workers might need to work for an extra hour to maintain the progress of work according to the timeline.

Furthermore, worker behaviour is a challenge for the supervisor and project manager to deal with. The worker sometimes had problem with doing the task according to the order of the project manager or supervisor, chances are because working at a construction site involves with heavy work all the time and they are not just physically exhausted but also mentally exhausted when the work is too heavy for them to handle. In this particular issue, they tend to become lazy or skip on the work procedure when they are tired. Another issue on the worker behaviour is they do not listen to their superior and sometimes they even fight against their superior because they think that they are more experience in handling the work especially when their superior is younger than them and they have more experience in handling those

particular jobs. This issue lead to disrespect due to the age gap, old worker have less respect on young superior because they think they are more competent about the work since they have more experience than the engineer or manager may have.

***External***

The external challenges contribute to out of sequence of construction activities are delay in material deliveries which lead to shorter time to complete the project. Also, when the cost of material went up to the contractor either need to find another supplier that offers the same price with the same quality or need to recalculate the cost for the project.

The next challenges are short in machinery own by the company. Therefore the company needs to borrow from other company or rent it, if the usage of the machinery are not too often then the needs to spend money to buy it would be unnecessary considering the cost for some machinery is very high. Then, to hire an expert to execute the work also need some additional cost but the quality of the construction work need to be preserved.

Table 4.5 Interview response based on the subtheme for Section B

| **Individual** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Constant Variable | | | | | | | | | | | | | | | |
| Nature Condition | | ✔ | | | ✔ | | ✔ | ✔ | ✔ | | ✔ | | | | ✔ |
| Project Community | ✔ | | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ | ✔ | | | ✔ | | ✔ |
| Independent Variable | | | | | | | | | | | | | | | |
| Internal | ✔ | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| External | | ✔ | | ✔ | ✔ | ✔ | ✔ | | ✔ | | ✔ | | | ✔ | |

## 4.4 Conclusion

Based on the results of this research, it can be concluded that the best practices to prevent out of sequence befall on the upper management role and also lower management role. Everyone involves in the project execution must together be responsible to ensure the project flow goes smoothly and out of sequence can be prevented. Next, the challenges in implementing the practices are also being specified.

From the results that are being drawn from the interview data collection has stated that the majority of the challenges lie under the independent variable theme. It can be concluded that those challenges can be solved if the practices are being implemented properly and everyone inside the project team is doing their best to prevent out of sequence from occurring.

# CHAPTER 5

# CONCLUSION

## 5.1 Introduction

The purpose of this study was first to determine the best practices to prevent out of sequence construction activities. Apart from that, the second objective was to study the challenges in implementing the practices. Hence, the construction project executioners will be prepared to face a whole construction timeline with the practices to avoid out of sequence activities from occurring through their way to success. Besides, the research summarization will be address in this chapter along with the recommendation.

## 5.2 Research Summarization

Based on the data analysis done in Chapter 4 of these studies, the first objective of the research can be summarized into two themes which are the upper management role and the lower management role. Under the upper management role, four subthemes are being categorized which is the planning, supervision, competency, and communication. The practices in each of this subtheme that is said as the best practices in preventing out of sequence are being specified and explained under Chapter 4. The planning subtheme as illustrated in Figure 4.2 gets the highest response from the interviewer and it can be said that to prevent out of sequence from occurring we must start as early as the planning of the project. Next, the second highest responses gotten from the interview are supervision and communication. Lastly, are the competencies of upper management in executing the construction project.

Furthermore, for the second theme on the first research question is the lower management role. There are also four subthemes categorize under this theme which is

the communication, competency, manpower and soft skill of the lower management. Communication and competency of the lower management role show the same response got from the interviewers. Meanwhile, the second highest response received is the soft skills followed by the manpower subtheme. Therefore, it can be concluded that the lower management should practice more communication skills and improve their competency in executing the work to prevent out of sequence from occurring.

Moreover, for the second research question, there are two main themes which are the constant variable that represents on the challenges that are hard to be change or control and the independent variable which represent the challenges that are potentially to change or solve if the implementation of the practices is being done properly. Under the first theme which is the constant variable comprises 43% from overall data in the second research objective, and the second theme which is the independent variable takes about 57% from the overall data. There are two subthemes developed under the first theme which is the natural condition and the project community. Figure 4.5 shows that the project community has a greater contribution to challenges in implementing the practices rather than the natural condition. On the other hand, for the second theme, there are also two subthemes being developed which are the internal and external challenges in implementing the best practices. Among the two subthemes, referring to Figure 4.6 we can see clearly that the internal factor contributes more on the challenges to prevent out of sequence from happening.

## 5.3 Limitation

In completing this research, some limitations can be improved for further studies on this topic. During the research, some potential limitations of this research based on terms, literature review and data collection are expected. The first limitation of this study was the literature review, where there are not many studies on this topic has been done. Therefore, there is not much literature review focusing on this study.

Besides that, there are challenges in making an appointment with the project manager and the target population. Most of the project manager and project team have a time constraint to have an appointment for the interview session because they need to use their working time to do the interview and most of them refuse to be interviewed during the weekend. The first approaches to reach the target participant is through email

but literally, none of them are responding to the email send and only agreed to be interview if they were called directly through the company contacts.

## 5.4 Recommendation

There are some recommendations for future research in this area of study. Future researchers are suggested to study a more variety of respondents to get their perspective on what are the best practices to prevent out of sequence construction activities. Also, the CIDB Grade of the selection of contractors also can be expanded and not only focusing on Grade 7 until Grade 5.

On the other hand, the future researcher could use various methods of data collection and data analysis. For example, they could use a questionnaire by using the data gathered from this research.

## 5.5 Conclusion

As a conclusion, out of sequence may be one of the resistance in construction project management in achieving the desired end product but after this study is conducted the implementation of the best practices are hopefully could benefit the construction industry on how to prevent out of sequence from occurring. The challenges in implementing the practices are also being study; therefore the construction projects executioners could be prepared beforehand on the possible scenario happening during the execution of the projects. From the data gathered, the theme will help project executioners on visualizing which patterns of practices can prevent out of sequence of construction activities from occurring and better prepared before starting or making the involvement of in any construction projects.

## REFERENCES


AACE (American Association of Cost Engineers). (2004). “Estimating lost labor productivity in construction claims.” AACE International Recommended Practice No. 25R-03, Morgantown, WV.

Abotaleb, I.S. and El-adaway, I.H., 2018. First Attempt Toward a Holistic Understanding of the Interdependent Rippled Impacts Associated with Out-of-Sequence Work in Construction Projects: System Dynamics Modeling Approach. *Journal of Construction Engineering and Management*, *144*(9), p.04018084.

Anantatmula, V.S., 2010. Project manager leadership role in improving project performance. *Engineering Management Journal*, *22*(1), pp.13-22.

Ashley, D.B., Lurie, C.S. and Jaselskis, E.J., 1987. Determinants of construction project success. Project Management Institute.

Azman, M.N.A., Ahamad, M.S.S. and Hilmi, N.D., 2012, October. The perspective view of Malaysian industrialized building system (IBS) under IBS precast manufacturing. In *The 4th International Engineering Conference-Towards engineering of 21st century*

Badir, Y.F., Büchel, B. and Tucci, C.L., 2012. A conceptual framework of the impact of NPD project team and leader empowerment on communication and performance: An alliance case context. *International Journal of Project Management*, *30*(8), pp.914-926.

Castro-Lacouture, D., Süer, G.A., Gonzalez-Joaqui, J. and Yates, J.K., 2009. Construction project scheduling with time, cost, and material restrictions using fuzzy mathematical models and critical path method. *Journal of Construction Engineering and Management*, *135*(10), pp.1096-1104.

Crawford, L., 2000, June. Profiling the competent project manager. In *Proceedings of PMI Research Conference* (pp. 3-15). Newton Square, PA: Project Management Institute.

Daly, Kellehear, & Gliksman (1997). *The public health researcher: A methodological approach*. Melbourne, Australia: Oxford University Press. pp. 611–618.

Dvir, D., Raz, T. and Shenhar, A.J., 2003. An empirical analysis of the relationship between project planning and project success. *International journal of project management*, *21*(2), pp.89-95.

Florez, L., Castro-Lacouture, D. and Medaglia, A.L., 2013. Sustainable workforce scheduling in construction program management. *Journal of the Operational Research Society*, *64*(8), pp.1169-1181.

Guest, G., MacQueen, K.M. and Namey, E.E., 2012. Introduction to applied thematic analysis. *Applied thematic analysis*, *3*, p.20.

Hamzah, N., Khoiry, M.A., Arshad, I., Tawil, N.M. and Ani, A.C., 2011. Cause of construction delay-Theoretical framework. *Procedia Engineering*, *20*, pp.490-495.

Herroelen, W. and Leus, R., 2004. The construction of stable project baseline schedules. *European Journal of Operational Research*, *156*(3), pp.550-565.

Ibbs, W., Berry, M. and Sun, X., 2017. Visualizing Skipped and Out-of-Sequence Work. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, *9*(4), p.05017006.

K K Chitkara, 1998. Construction Project Management

Li, Y. and Taylor, T.R., 2011, July. The impact of design rework on construction project performance. In *The 29th International Conference of the System Dynamics Society* (pp. 25-35).

Lill, I., 2008, June. Sustainable management of construction labour. In *25th International Symposium on Automation and Robotic in Construction, June* (pp. 26-29).

Ling, F.Y.Y., Liu, M. and Woo, Y.C., 2009. Construction fatalities in Singapore. *International Journal of Project Management*, *27*(7), pp.717-726.

Long, R. J. (2005). Cumulative impact claims, Long International, Littleton, CO.

Mason, M., 2010, August. Sample size and saturation in PhD studies using qualitative interviews. In *Forum qualitative Sozialforschung/Forum: qualitative social research* (Vol. 11, No. 3).

McLeish, D.C.A.(1981).“Manhours and interruptions in traditional house building.” Build. Environ., 16(1), 59–67.

Mohemad, R., Hamdan, A.R., Othman, Z.A. and Noor, N.M.M., 2010. Decision support systems (dss) in construction tendering processes. *arXiv preprint arXiv:1004.3260*.

Müller, R. and Turner, R., 2010. Leadership competency profiles of successful project managers. *International Journal of project management*, *28*(5), pp.437-448.

Osabiya, B.J., 2015. The effect of employees motivation on organizational performance. *Journal of Public Administration and Policy Research*, *7*(4), pp.62-75.

Palaneeswaran, E., Kumaraswamy, M.M. and Zhang, X.Q., 2001. Reforging construction supply chains:: a source selection perspective. *European Journal of Purchasing & Supply Management*, *7*(3), pp.165-178.

Pourrostam, T. and Ismail, A., 2012. Causes and effects of delay in Iranian construction projects. *International Journal of Engineering and Technology*, *4*(5), p.598.

Rounds, J.L. and Segner, R.O., 2010. *Construction supervision*. John Wiley & Sons.

Rumane, A.R., 2017. *Quality management in construction projects*. CRC Press

Sears, S.K., Sears, G.A., Clough, R.H., Rounds, J.L. and Segner, R.O., 2015. *Construction project management*. John Wiley & Sons.

Smith, J., O'Keeffe, N., Georgiou, J., and Love, P.E., 2004. Procurement of construction facilities: a case study of design management within a design and construct organisation. *Facilities*, *22*(1/2), pp.26-34.

Whelton, M. (2004). The Development of Purpose in the Project Definition Phase of Construction Projects - Implications for Project Management.