DELAY IN DESIGN PHASE IN MALAYSIA CONSTRUCTION: THE CAUSE AND THE FACTOR TO REDUCE THE DELAY

NOOR SYAZWANI MOHD RIZHUAN

B. ENG(HONS.) CIVIL ENGINEERING

UNIVERSITI MALAYSIA PAHANG

UNIVERSITI MALAYSIA PAHANG

DECLARATION OF THESIS AND COPYRIGHT

Author's Full Name : NOOR SYAZWANI BINTI MOHD RIZHUAN

Date of Birth : 31 OCTOBER 2019

Title : DELAY IN DESIGN PHASE IN MALAYSIA CONSTRUCTION: THE CAUSE AND THE FACTOR TO REDUCE THE DELAY

Academic Session : 2015/ 2016

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)

____
New IC/Passport Number
Date:

____
Name of Supervisor
Date:

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 : NOOR SYAZWANI BINTI MOHD RIZHUAN

ID Number : AA15231

Date : 29 MAY 2019

DELAY IN DESIGN HASE IN MALAYSIA CONSTRUCTION: THE CAUSE AND THE FACTOR TO REDUCE THE DELAY

NOOR SYAZWANI MOHD RIZHUAN

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

Faculty of Civil Engineering & Earth Resources
UNIVERSITI MALAYSIA PAHANG

MAY 2019

ACKNOWLEDGEMENTS

I would like to express my gratitude and thank you to Sir Zahrizan bin Zakaria, my supervisor of this project, for the valuable guidance and advice. Her willingness to motivate and tolerate my mistakes and wrong doings has contributed tremendously to my project. Besides, I would like to thank you to respondents from industry during this entire project development.

Besides that, I would like to thank the authority of Universiti Malaysia Pahang (UMP) for providing me good environment and facilities to complete this project. Finally, with honourable gratitude goes to my family and friends for their understandings and supports towards me in completing this project. Without the help of the particular mentioned above, I would face many difficulties and step back while doing this project. Thank you.

ABSTRAK

Kelewatan pembinaan adalah sesuatu yang menghalang keupayaan pihak berkuasa tertentu untuk mengekalkan jadual. Kelewatan nyata pada semua fasa projek, di mana mereka mungkin memulakan walaupun dalam fasa reka bentuk. Kelewatan dalam perancangan dan reka bentuk fasa untuk projek pembinaan secara literal adalah dalam keadaan kritikal. Walaupun kebanyakan kajian menumpukan perhatian kepada mencari sebab atau menyelesaikan masalah penangguhan dalam fasa pembinaan, beberapa kajian telah menganalisis masalah penangguhan dalam fasa perancangan dan reka bentuk. Oleh itu, kajian ini bertujuan untuk mengkaji secara mendalam mengenai fasa reka bentuk, sebab-sebab mereka, dan kemungkinan strategi untuk mengurangkan kelewatan dalam fasa perancangan dan reka bentuk. Sementara itu, soal selidik dalam talian juga diedarkan kepada perunding swasta untuk mendapatkan visi yang lebih jelas tentang masalah ini. Kaedah analisis indeks kepentingan relatif (RII) telah diterima pakai untuk menimbulkan sebab-sebab keterlambatan dari segi keparahan mereka seperti yang dirasakan oleh responden. Perubahan dalam keperluan pelanggan, takrifan skop yang lemah dan miskomunikasi adalah antara penyebab utama kelewatan dalam perancangan dan reka bentuk fasa. Aspek komunikasi boleh menjadi strategi utama utama untuk menyelesaikan beberapa sebab utama penangguhan, dalam usaha untuk mengurangkan kelewatan dalam fasa perancangan dan reka bentuk, serta dalam fasa pembinaan.

ABSTRACT

Construction delay is anything that impedes the ability of a certain obliged party to maintain a schedule. Delays manifest during all project phases, where they might initiate even in the design phase. Delays in the planning and design phases for construction projects were literally in a critical state. While most studies focus on finding causes or resolving delay problems in the construction phase, few studies had analyzed delay problems in the planning and design phases. Hence, this research aims to study in-depth about design phase, their causes, and the possible strategies to reduce delays in the planning and design phases. Meanwhile, an online questionnaire was also distributed to private consultants in order to get a clearer vision of this problem. Relative importance index (RII) analysis methods were adopted to rank delay causes in terms of their severity as perceived by the respondents. Changes in clients' requirements, poor scope definition and miscommunication were among the most critical causes of delay in the planning and design phases. The communication aspect could have been the principal key strategy to resolve some major delay causes, in the effort to mitigate delays in the planning and design phases, as well as in the construction phase.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

RII	Relative Importance Index

CHAPTER 1

INTRODUCTION

1.1 Introduction

Construction is a major industry that contribute for a nation's development. However, it is not easy to survive in this though industry. Construction companies must always be alert to ensure the quality of their work is at a good level. This is because they have to compete with dozens of other companies in the same field to get a good construction project. To achieve a satisfactory level of construction work, the company needs to do every job based on the established work phases. There are a few phases involved in a construction in order to ensure that the construction are carried out well. The phases involved in a construction project includes design, pre-construction, procurement, construction, commissioning, owner- occupancy and project closeout. Construction project management is traditionally separated into several independent and contiguous phases, e.g. planning, design, construction, commissioning, etc, and they are implemented respectively with almost no communication or interaction between participants in each phase (Gransberg and Ellicott 1997).

Design is a first stage of a construction project and it signals the beginning of the bidding process after it is completed. The owner chooses a contractor based on a completed designs for a design-bid-build contracts. In this stage, the feasibility of the design is first assessed by the architect or engineer based on the regulations and codes of the building, as well as the building's size, the number of rooms and the amount of space needed. After assessed all the information, the architect or engineer will creates schematic designs that includes the type of equipment used and materials needed plus their cost. Delay occurred in the first phase will obviously affect all the phases afterwards.

Architectural design is a complex and open process. Design process starts from the abstract stage to solve a design problem until it reaches the design solution in the form of design product. Designing activities is a repetitive problem solving process (Demirkan 1998). Watanabe (1994) describes designing process as a process to full-fill human needs through new idea produced. According to French (1998), architecture design is a response to human special needs which is refuge and comfort. Lawson (2007), states that architectural design is a process where an architect produced a space, place and building which has a big amount of effects on the quality of human life. Most architects agreed with Sanders (1996) whom stated that architectural design is a repetitive process where the process scheme can be recognized, valued, repeated, explored and repaired until the best solution is achieved. Decision making activities in architectural design process happens at sketching stage, schematic design stage and final design stage. At the details stage, design process is focused on producing drawings activity and planned building construction activity.

1.2 Background of Study

Delay in construction could be defined as the time overrun, happening at a later completion date than planned or expected, specified in the contract or beyond the date of the agreement between the parties for the delivery of the project. (A. Assaf & Al-Hejji, 2006). According to Assaf and Al-Hejji, seventy percent of construction projects experienced time overrun and the average time overrun was between 10% and 30% of the original duration.

Many researchers and practitioners have studied the cause of delay in construction projects. Most of the studies only conducted on the cause of delay occurred during construction phase. However, we need to realize the fact that a construction project have a long process that should be considered. This process starts with the design phase. Many overlooked this first phase. Any small changes that need to be done in this phase will affect the project timeline that will cause the project to delay.

A design change is defined as any change in the design or construction of a project after the contract is awarded and signed. Such changes are related not only to matters in accordance with the provision of the contract but also changes to the work conditions (Burati et al., 1992). As stated in New Straits Times 21st Oct 2015 by Minderjeet Kaur, "The project of constructing KLIA2 that began since 2009 had several delay due to the design changes and extensive earthworks". Malaysia Airports has to date forked out RM76.5 million repair works at KLIA2 since the airport opened last year May.

1.3 Problem Statement

Design changes in a construction can give a huge impact in construction project performance. One of them is that they can cause the delay in the project completion time and cost overrun. Delays in construction industries are often means a lot which define the whole project and put various types of hurdles on the way of completion even with the schedule and plan work. It is acknowledged as successful as our projects rapped on our target and schedule time, as accordance with the specifications, in estimated budget and client satisfaction. The most important problems in the construction project is delays. Generally we experience different types of delays occur in construction project and the same magnitude. As delays occur in construction such situation should be minimize with a team work and plan with contractor, consultant, and client jointly or severally contribute to the non-completion of the project within the original or the stipulated or agreed contract period. Here construction projects are affected by different types of delays and reason are experienced with step by step reason to be solved with very stone and effective efforts. (Uddin, Ahmad, & Danish, 2017)

One of the project that experienced delay in construction is KLIA2. In this case, Malaysia Airports Holdings Bhd (MAHB) expects to finalise by December discussions with the joint venture between UEM Construction Sdn Bhd and Bina Puri Holdings Bhd to determine the quantum of the liquidated and ascertained damages (LAD) charged to the joint venture for the delay in completing the KLIA2 terminal building in Sepang. MAHB managing director Datuk Badlisham Ghazali said MAHB said this during a press conference at the Global Airport Development Asia 2015 conference in Kuala Lumpur. MAHB has been reported to have said previously that the total LAD incurred by the UEM-Bina Puri JV was RM60mil. However, the contractors appealed against the LAD, saying that there were many last-minute requests and additional changes by the clients. (Poo, 2015).

Thus, this study is attempted to highlight the cause of delay in design phase and investigate the factor that can reduce delay in design phase in construction project. However, most studies focused mainly on identifying delay causes in the construction phase, rarely emphasizing on the planning and design phases. McManus et al., 1996, who evaluated delay causes in architectural construction projects, concluded that many delays manifest during all project phases and primarily occur during the construction phase; however delays that start in the design phase include inadequate schedule control by architects, inability of owners to review design in a timely manner, late incorporation of emerging technologies into a design, and ineffective coordination and/or inclusion of project user groups. Basu 2005 identified factors at the start of a project that almost certainly lead to project delays and provided insight into the reasons for the delay and their impact on schedule.

1.4 Objectives

There are three main objectives obtained from the problem statement above:

1) To study in-depth about design phase
2) To identify the cause of delay in design phase in construction project
3) To analyse the factor that can reduce the delay in design phase in construction project.

1.5 Scope of Study

Related to the objectives obtained, the study focused on the delay in design phase in a construction project. The study applied review on the factor that can reduce the delay in design phase in construction project. The questionnaire will be distributed to selected construction and consultant company to analyse the cause of delay in design phase. Peninsular Malaysia was selected as the study site.

1.6 Methodology

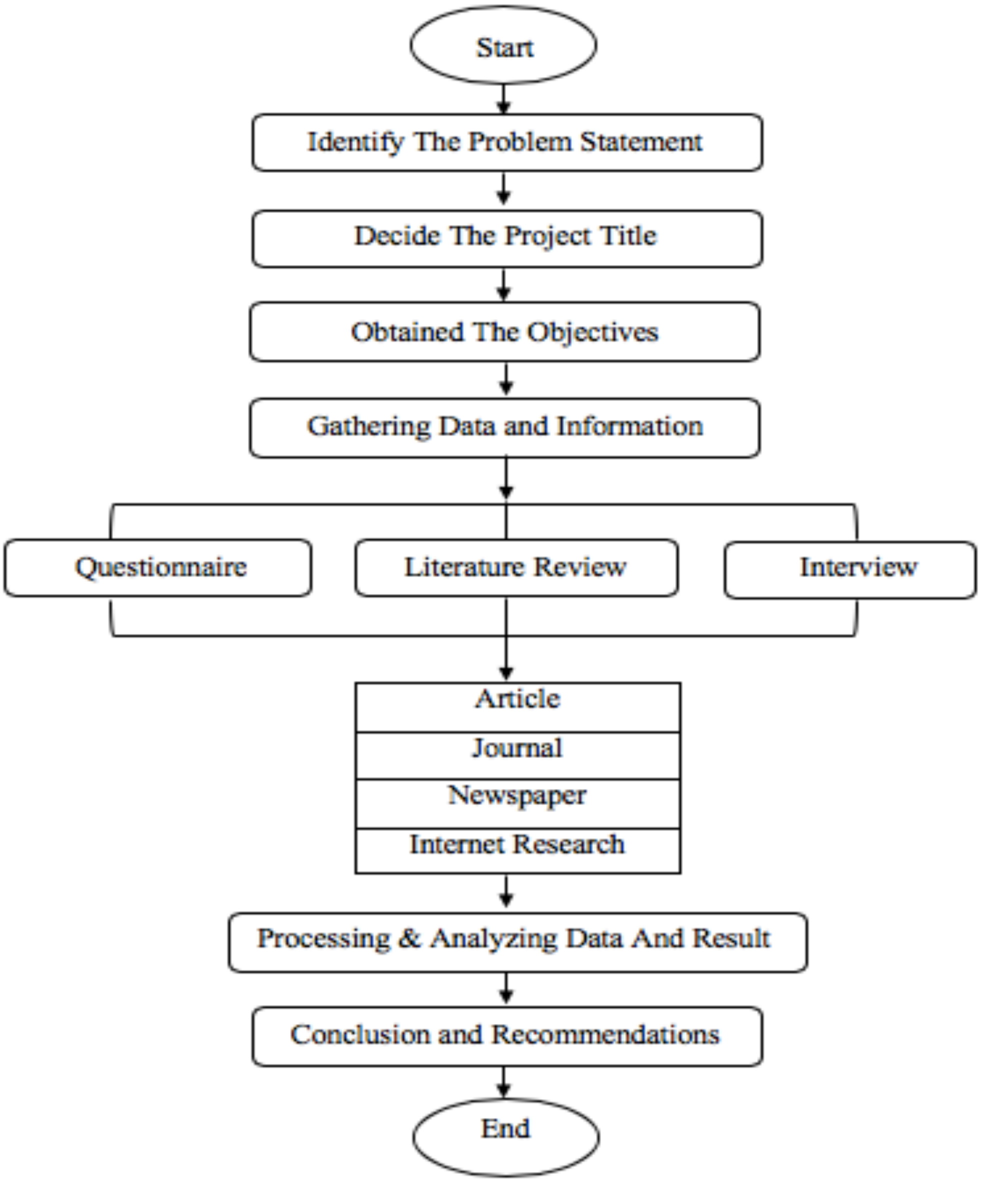

Figure 1.1 : Flowchart of Methodology

1.7 Significant of Study

It is important to know in-depth about the design phase in a construction project. The purpose of the study is to identify what is the cause of delay in design phase in construction project and what is the factor that can reduce the delay in design phase in construction project.

This research will give contribution to any parties involved in a construction project since they will know the cause and the factor to reduce delay in design phase in a construction. This study can be used as a reference for further improvement in related research in the future.

Early steps to prevent project delay can be taken as the main cause of the delay in design is identified. This can be a guidance to provide a good quality performance for the parties involved in the project. Hopefully, this research will help the construction industries to improve the performance of project management in construction industries in Malaysia.

1.8 Layout of Thesis

In order to make this report more systematic and more organized for the reader to read the research, it is organized into five chapters. General description of every chapters in this report are given as below:

1) Chapter 1 is basically the introduction of the project which discuss about the background of the study, problem statement, objectives, scopes and significance of the study.
2) Chapter 2 describes about the literature review of the study which contains the information about the study of the project in general. Is shall discuss on the road maintenance management, types of defects and factors that contribute to road failure, and type of repair method use to overcome the defects.
3) Chapter 3 shall describe on the methodology of the project. This chapter will discuss the overall approach of the study. It will cover the approached method to be used.
4) Chapter 4 will describe on data analysis and results of the project. This chapter will discuss and analyze the result of the data obtain. It must achieve the objective of this research.
5) Chapter 5 concludes the study which shows that the project has been achieved the objectives of the project.

1.9 Expected Outcome

This research is expected to give the following outcomes:

1) The cause of delay in design phase in construction project.
2) The factor that can reduce the delay in design phase in construction project.

CHAPTER 2

LITERATURE REVIEW

2.1 Planning and Design Phase

A plan is a set of actions for achieving something in the future, especially a set of actions that has been considered carefully and in detail (Longman, 2003). It indicates the significance of working towards an objective and distinguishing how that objective will be accomplished. There are more extensive viewpoints or definitions be considered in what constitutes planning, for example:

1) Planning is the determination and communication of an intended course of action incorporating detailed methods showing time, place and the resources required (CIOB, 2011).
2) Planning is the creative and demanding mental activity of working out what has to be done, how and when, by whom and with what, i.e. doing the job in the mind (Neale and Neale, 1989).
3) Planning is a decision making process performed in advance of action which endeavours to design a desired future and effective ways of bringing it about (Ackoff, 1970).

In the early stages of the design phase, such as preparation, brief, concept design etc., processes are creative, iterative and innovative. These are processes which many solutions, thoughts and ideas are shared between stakeholders. These processes need to be open and to enable the best solution to arrive (Hansen & Olsson, 2011). The process has an iterative form (Kalsaas & Sacks, 2011) and each iteration will hopefully contribute to the end value of a project.

The main purpose in a design phase is the exchange of information and the transformation of information to ideas and solutions to be presented to others. This exchange process is difficult to plan and follow up, and equally difficult to foresee interdependencies that each exchange might have. Azlan-Shah and Cheong-Peng (2013) argue that "coordination needs to be performed by a designer". The design phase includes the actual planning and design of a project.

Planning and design phases offer the greatest potential for influencing the performance of a project. An all-around managed project will give esteem and basically meet client prerequisites all through its lifetime and will likewise advantage the earth, society and the economy. Appropriate execution in planning and design can convey these advantages and avoid pointless expenses and delays. Mawdesley et al. (1997) had also stressed that all parties to the project can benefit from planning. The benefits for the client and designer include (Mawdesley et al., 1997):

1) Established deadline dates for the release of information on the project.
2) The ability to forecast resource requirements and resource costs.
3) The ability to forecast the expenditure and payment schedules.
4) The ability to forecast the staffing levels.
5) The ability to provide information to the public and other third-parties.
6) Improved co-ordination of the work of the project team.
7) Co-ordination of the project with work on other projects within the client's or architect's portfolio.

2.2 Delays in Construction Projects

Public construction projects are for the most part capital in nature. Capital projects constitute an essential fixing in the improvement procedure of groups, countries and areas everywhere throughout the world. However before such projects can achieve the set goals for which they were conceived, they need to be successfully delivered (Amade et al., 2015). In the design phase, there is also a deadline to convey the final design reports. The out-sourced, lead consultant should authoritatively convey the design reports and different prerequisites in time.

The actual time of project completion frequently exceeds the planned time, commonly known as a delay or overrun (Gonzalez et al., 2014). Some definitions for delay are to make something happen later than expected or to cause something to be performed later than planned or not to act in a timely manner (Mahdavinejad and Molaee, 2011). Anything that hinders the capacity of a certain obliged party to keep up a schedule means a construction delay is happening, for example, delay in design phase by designers or delay in construction phase by contractors. Marzouk and El-Rasas (2014) acknowledged that a construction delay means a time overrun either beyond the contract date or beyond the date that the parties have agreed upon for the delivery of the project.

Delay in planning and design phases is not a separate subject from a delay in construction phases. Each phase has its own deadline in an effort to achieve the set goals and objectives. Nevertheless where contractors are the ones to deliver products in the construction phase, designers or consultants are the ones who are supposed to deliver products (design reports) in the design phase. Yau and Yang (2012) referred to this fact, that most projects have delays in the design stage, which subsequently prompts project delays. It would appear that types of delay in the planning and design phases are identical to delay in the construction phases, but with lesser potential causes and concurrent delay is unlikely to be established.

2.3 Causes of Delays in Design Phases

McManus et al. (1996), who investigated delay causes in architectural construction projects, concluded that many delays manifest during all project phases and primarily occur during the construction phase; however there are also many delays that start in the design phase. Basu (2005) also identified factors at the start of a project that would almost certainly lead to project delays and provided insight into the reasons for the delays and their impact on schedules. Then, Abdullah and Koskela (2008) concluded that the primary delay causes appear to cluster around management issues and the project environment. Gonzalez et al. (2014) brought an argument to the conclusion which requires further research to address current management practices and negative delay impacts. Inspired to carry out a related research, they proposed that non- compliance in the planning phase was the most important cause of delay.

There are limited researches concerning delay causes in the planning and design phases conducted in recent years as pointed out earlier. In particular, Yang and Wei (2010) at the early stage of their research managed to determine 15 and 20 causes of delays in the planning and design phases respectively. Later, Yau and Yang (2012) identified the schedule delay factors in the design of turnkey projects in power distribution substation projects in Taiwan. In the research, 27 delay factors identified in the design stage. These causes of delay by Yau and Yang (2012) were listed together with the findings by Yang and Wei (2010) in Table 1 for broader perspective of delay causes in the planning and design phases.

Table 2.1 : Causes of Delay in the Planning and Design Phases

Causes of Delay in Planning and Design Phases	Source
Planning Phase • Improper basic planning. • Changes in client's requirement. • Complicated administration process of client. • Insufficient or ill-integrated basic project data. • Unfinished client-furnished item. • Slow land expropriation due to resistance from occupants. • Unreasonable contract duration. • Poor scope definition. • Project complexity. • Unreasonable or unpractical initial plan. • Inadequate planning and schedule. • Improper selection of subsequent consultants. • Change orders by client. • Incomplete or delayed document delivery by client. • Regulations changes • Over-subjective explanation of regulations by government officer • Public resistance or political intervention.	•Yang and Wei (2010) •Yau and Yang (2012)

Table 2.2 : Causes of Delay in the Planning and Design Phases

Causes of Delay in Planning and Design Phases	Source
Design phase • Changes in client's requirement. • Inadequate integration on project interfaces. • Changes orders by deficiency design. • Unrealistic design duration imposed. • Liability ambiguity due to improper contract clauses. • Conflicts between contract clauses. • Incomplete design drawings and specifications. • Change orders by code change. • Disagreement on design specifications. • Improper or wrong cost estimation. • Slow decision making by designers. • Insufficient training of designers. • Poor communication and coordination between designers/ project user group. • Inadequate experience of designers. • Lack of database for estimation. • Wrong or improper design. • Client's financial problems. • Unclear authority among designers. • Slow information delivery between designers. • Inadequate schedule control. • Inability of owner to review design in a timely manner. • Late incorporation of emerging technologies into a design. • Unforeseeable site conditions (e.g., existing underground conduits). • Delay due to other construction projects.	• Yang and Wei (2010) • Yau and Yang (2012)

2.4 Factors Reducing Delay in Design Phases

A construction project is commonly acknowledged as successful when it is completed on time, within budget, and in accordance with specifications and to the stakeholders' satisfaction (Nguyen et al., 2004). Adnan et al. (2014) stated that critical success factors are a crucial few factors or variables that a manager should pay more attention to in order to achieve the stated goals.

Ibironke et al. (2013) and Mahamid et al. (2012) provided concise thoughts on strategies and opportunities in mitigating or minimizing delay in the planning and design phases as in Table 3. Prior research by Yau and Yang (2012), also suggested some strategies which provide alternatives for preventing delays specifically for turnkey projects, but applicable for any construction projects. The proposed strategies were based on the perspectives of the owner and designer as exploratory recommendations to deal with similar circumstances. Their recommendations were:

a) For Client

- An open public hearing should be held which acts as a bridge connecting the project team and project stakeholders.

- A site tour of completed projects is a good alternative to resolving doubts of the public and the politicians.

- Selection of a qualified contractor or consultant for smooth project execution, which is attained through a transparent prequalification mechanism during the procurement process.

b) For Designer

- The designer needs to complete the site layout, preliminary drawings, and regulation checks as early as possible before applying for necessary permits or licenses, thus preferably completing the design work thoroughly to avoid foreseeable pitfalls in planning and design.

- The designer might need to request client support if the outcome of the review by government agencies is in conflict with the original planning and design principles issued by the client.

- A designer can assist in investigating the possibility of public resistance or political intervention.

- A designer should definitely take the position of a professional in designing a project, specifically by providing an error-free design and should be able to provide a thorough project description if required.

Design issues in most construction projects could be the results of inadequate on-site investigation, design and specifications inaccuracy, incomplete drawings, lack of details, design changes, and so on. Achieving error free design entails good communication with the entire design team and integrating a design process that is properly planned, giving enough time for corrections, extensive investigation and reviews (Ambituuni, 2011).

Table 2.3 : Factor Minimizing Delay in the Planning and Design Phases

Factor Minimizing Delay in Planning and Design Phases	Source
• Allow sufficient time for proper planning, design, information, documentation, and tender submission. • Allocation of sufficient time and money at the design phase. • Check for resources and capabilities before awarding the contract to the lowest bidder. • Detailed and comprehensive site investigation should be done at the design phase. • Multidisciplinary/ competent project team. • Better communication and coordination with other parties.	• Mahamid et al. (2012) • Ibironke et al. (2013)

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter aim to describe the process of conducting this study in detail. The details are cover the research design, research instrument, research setting, data collection and data analysis. The raw data will be collected by using the online questionnaire and the questionnaire is design according to the research objectives. Furthermore, the link of the online questionnaire will be sent to respondents through email. Then, the raw data will be analyzed using statistical method. Further discussion will be carried on in below chapters. Below is the flow chart, refer to Figure 3.1.

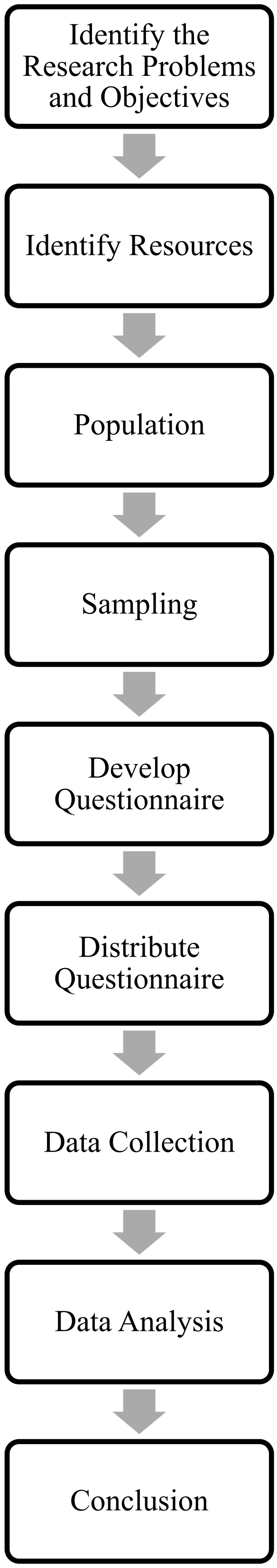

Figure 3.1 : Research flow chart

3.2 Research Instrument

Since this study is generally an opinion based study, therefore a questionnaire is uses as a research instrument to collect opinion from the respondents. Shuttlewort (2008) states :

Questionnaires are an effective way of quantifying data from a sample group, and testing emotions or preferences. This method is very cheap and easy, where budget is a problem, and gives an element of scale to opinion and emotion. These figures are arbitrary, but at least give a directional method of measuring intensity.

3.3 Data Collection

There are two type of data collection to be used in this research which are:

3.3.1 Primary Data

Primary data is a data collected by a researcher from first-hand sources. The primary data collection will be in the forms of questionnaire and industrial visit.

3.3.1.1 Questionnaire

Types of question in this questionnaire are closed questionnaire and it is consists of three parts. Form of this questionnaire is positively and negatively worded questionnaire, by using positively and negatively worded question, respondents will most likely to stay involving answering the question and remain alert while answering the question. This questionnaire consists of three parts. Part I comprised of demographical data, aims to gather general demography profile of the respondents. Part II determined the cause of delay in design phase in construction project. Part III determined the factor to reduce the delay in design phase in construction project. Responses are measured by five- point Likert scale from 1= “strongly disagree” to 5 = “strongly agree”.

Questionnaire Part I

Part I is to obtain and understanding more about the company respondent profile and their working experience.

- The respondent profile, included names, gender and years of experience.

Questionnaire Part II

Part II is to obtain the level of agreement on causes of delay in design phase. The questionnaire designed for this part is measured by using a five-point Likert Scale(Vagias, 2006), which consists of (1) Strongly disagree, (2) Disagree, (3) Neither disagree nor agree, (4) Agree, (5) Strongly agree. Respondent should scale the one answer in the Likert scale. All categories are rated by using a Likert scale, because it is easy to measure. Table 3.1 is showed the level of agreement by Likert scale as following:

Table 3.1 : Likert Scale for the Level of Agreement(Vagias, 2006)

Category	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
Rating	1	2	3	4	5

Questionnaire Part III

In Part III, based on the causes of delay in design phase, respondents were scale the level of factor to reduce delay in design phase. The questionnaire in this section is measured by Liker scale of five ordinal measure from one (1) to five (5) according to the level of affect; (1) No affect, (2) Minor affect, (3) Moderate affect, (4) Major affect, and (5) Full affect (Vagias, 2006). All categories were rated by using a Likert scale. Each level of effect scale was represented in the Table 3.2 as following:

Table 3.2 : Likert Scale for the Effect of Cost Overrun Factors on Project Delay during Each Stage of the Project Life Cycle

Category	**No effect**	**Minor effect**	**Moderate effect**	**Major effect**	**Full effect**
Rating	1	2	3	4	5

3.3.2 Relative Importance Index

The Relative Importance Index (RI) is computes as in equation 3.1 below :

$$I = \frac{\Sigma Wi\ Xi}{\Sigma xi} \qquad (3.1)$$

Where :

I = response category index

Wi = the weight assigned to ith response = 1, 2, 3, 4, 5, respectively.

Xi = frequency of the ith response given as percentage of the total responses for each factors.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

There is an important issue that need to be highlighted in construction project which is the delay of the construction especially in design phase. It is very crucial to get the result of the causes of delay in design phases and the factor that can reduce the delay in design phase to overcome the highlighted problem. This research is to study in depth about design phase and identify the causes of delay in design phase and to analyze the factor that can reduce the delay in design phase in construction project.. This chapter analyses the data collected throughout the questionnaire survey.

The method adopted in this research for analyzing the questionnaire survey were by using Relative Importance Index (RII) method. The set of questionnaires was hand out in Peninsular Malaysia focused on consultant company only. By the distribution of 50 sets of questionnaires, 33 completed questionnaires were return back.

4.2 Data Collection

The survey questionnaires were distributed to the consultant company involved in design phase in Peninsular Malaysia in order to identify the causes of construction delay in design phase and factor to reduce the construction delays in design phase. The questionnaire was completed by respondents which are in different position, they are directors, project managers, site managers, engineers and designers. According to Table 4.1 and Figure 4.1, there are total of 33 respondents, 17 males and 16 females. These mean 52% feed backs from males and 48% feed backs from females.

Table 4.1: Gender of respondents

Gender	Number of respondents	Percentage,%
Male	17	52
Female	16	48
Total	33	100

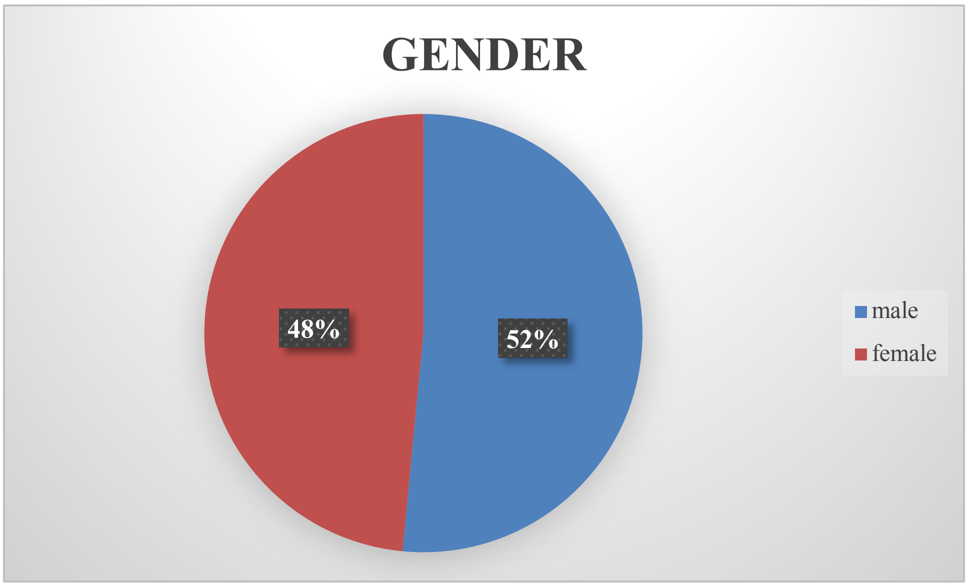

Figure 4.1 : Gender of respondents

According to Table 4.2 and Figure 4.2, there are total of 33 respondents, 18 have less than 5 years of working experience, 12 have working experience between 5 to 9 years and 3 have more than 10 years of working experience.

Table 4.2: Working experience of respondents

Work experience	Number of respondents	Percentage,%
$<$ 5 years	18	55
5 $<$ years $<$ 9	12	36
$>$ 10 years	3	9
Total	33	100

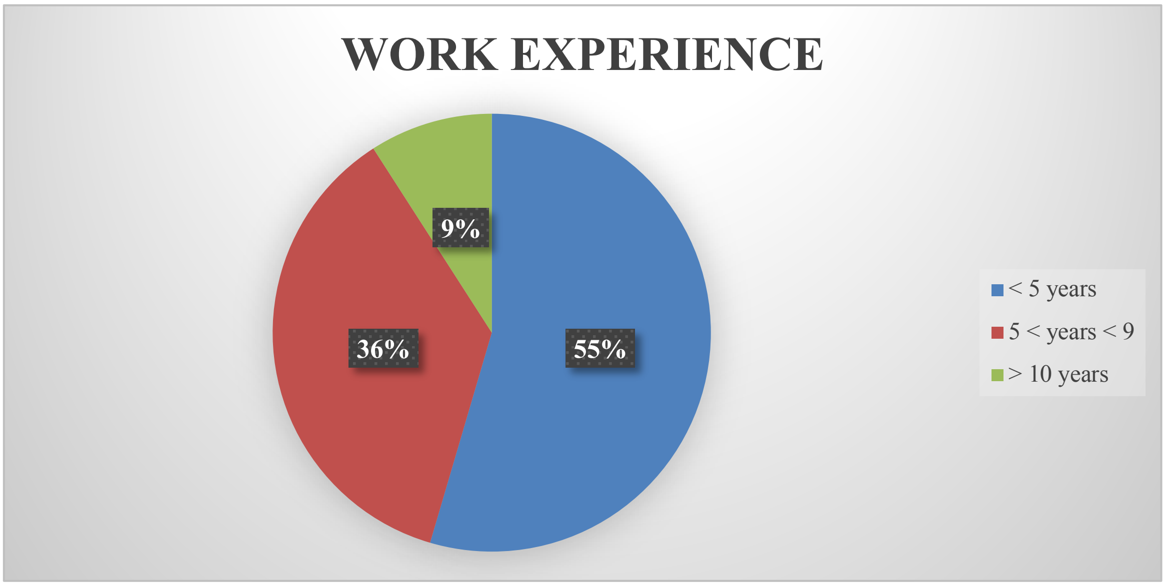

Figure 4.2 : Working experience of respondents

4.3 Analysis of Results

The purpose of analyzing result is to identify the cause of delay in design phase in construction project and analyse the factor that can reduce the delay in design phase in construction project in Malaysia by using relative importance index. With this, the ranking of the causes contribute to construction delay and the factor to reduce construction delays can be easily establish according to the respondents.

4.3.1 The Cause Of Delay In Design Phase In Construction Project

The causes of construction delays have been identified in literature review state and grouped into seven major groups. The causes in each group were analyzed and ranked by using relative important index. Below are the discussions on the factors cause construction delays for each group.

4.3.1.1 Lack of Information

Table 4.3 shows the ranked causes of lack of information based on relative importance index. According to Table 4.3 and Figure 4.3, in overall, insufficient or ill-integrated basic project data was ranked first, unforeseeable site conditions (e.g., existing underground conduits) was ranked second and project complexity was ranked third. Integrated project management is very important so Insufficient or ill-integrated basic project data cannot be happening since

Integrated project management is the solution to haphazard management techniques and instinctive managerial actions. By understanding, sharing and codifying processes and knowledge across the entire organization, integrated project management brings a much-needed robustness to your project management approach. With an integrated approach to project management, a project charter can be built, the project scope can be sketched out and the project plan can be mapped. the project is closely monitored and its performance is measured against an established baseline. There are a fixed process for dealing with stakeholders and their requests. The parties involved will get a broad understanding of each project and its requirements by implementing this method. It also helps them share knowledge and processes across projects, making for a healthier organization.

Unforeseeable site conditions (e.g., existing underground conduits) also contribute more towards delays since site condition risk is not static. All too often, during the course of construction, contractors encounter subsurface conditions that differ from those set out in information provided by its employer or anticipated in their bids, or come across unforeseeable or undetected site conditions in the field. Such discoveries can cause schedule delays, cost increases and dangerous working, invalidate design assumptions and ultimately pave the way to litigation. One size does not fit all and the site condition risk is unique for each and every project. In the context of site risks, there is no substitute for signing a clear contract which, where possible, identifies such risks, and particularises precisely what the parties should do if they eventuate.

The deficiency of project complexity framework due to lack of knowledge about their effect on the project process and hence project outcomes. Efficient complexity measures should be elaborated and clearly explained at the local level which may lead to a better vision of project complexity influence on project outcomes and consequently the better project performance in Malaysia. The successful management of projects depends on the appropriate actions taken according to certain critical characteristics of the projects. The authors propose that the project complexity should be understood in terms of interdependencies and diversity. The consequence to project complexity is integration by direction, control and communication. The concept of project complexity, therefore deserves further consideration and extensive research in future. The complexity has to be managed effectively in order to achieve greater levels of project performance.

Table 4.3 : Results of causes in lack of information

NO	CATEGORY	RATE					RII	PERCENT-AGE	RANK
		1	2	3	4	5			
1	Insufficient or ill-integrated basic project data.	0	0	7	17	9	0.812	20.775	1
2	Poor scope definition.	1	2	8	15	7	0.752	19.225	4
3	Project complexity.	0	2	7	14	10	0.794	20.31	3
4	Lack of database for estimation.	0	3	9	15	6	0.745	19.07	5
5	Unforeseeable site conditions (e.g., existing underground conduits).	0	2	6	14	11	0.806	20.62	2

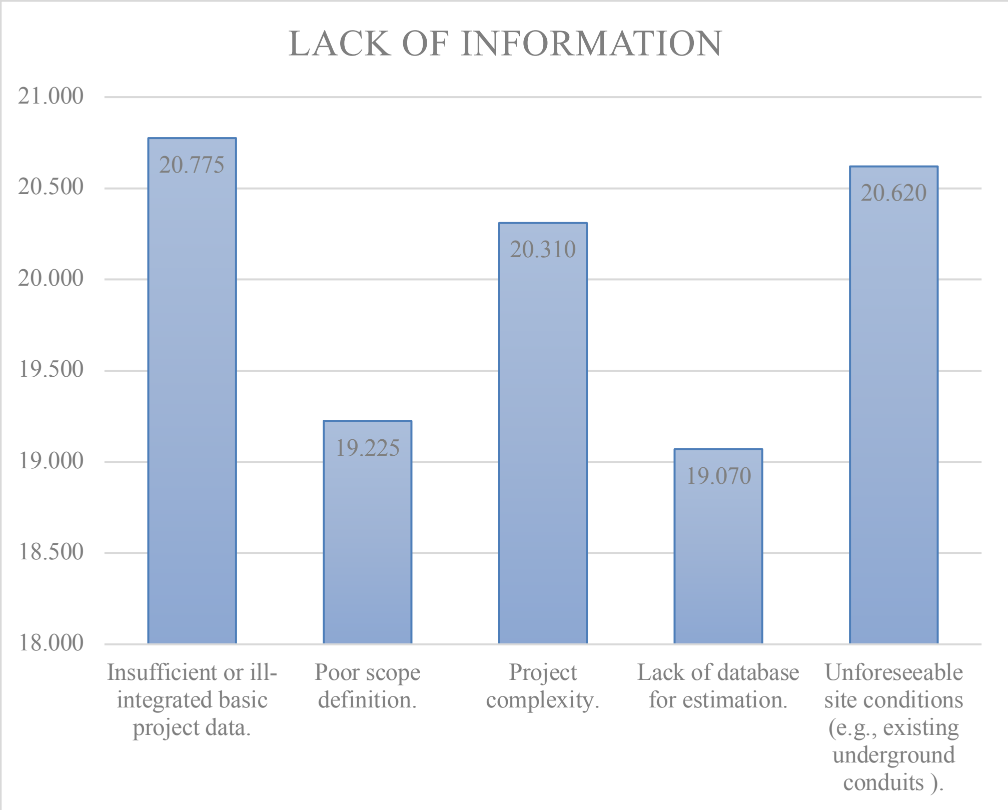

Figure 4.3 : Results of causes in lack of information

4.3.1.2 Poor Design Management

According to Table 4.4 and Figure 4.4, in overall, changes in client's requirement is ranked first while improper basic panning is ranked second and unfinished client-furnished item ranked third. Changes in client's requirements are part of the design process as it is impossible to completely identify all the requirements during the early phases of the design process. Changes in client's requirement during the design process are informal (lack a standard procedure) and frequently changes in client's requirement are carried out without updating the specification. Design engineers are found to update the specification at the end of the design process. Any modification (change) on an initial specification is always carried out upon client approval. Thus changes in client's requirement that does not modify an initial specification is considering as a normal activity during the design process. In a collaboration project, both internal and external stakeholders are actively involved in initiating changes during the design process.

It is important to have a proper basic planning of a project. The planning phase is when the project plans are documented, the project deliverables and requirements are defined, and the project schedule is created. It involves creating a set of plans to help guide the team involved through the implementation and closure phases of the project. The plans created during this phase will help the team to manage time, cost, quality, changes, risk, and related issues. The planning phase refines the project's objectives, which were gathered during the initiation phase. It includes planning the steps necessary to meet those objectives by further identifying the specific activities and resources required to com-plete the project. Now that these objectives have been recognized, the team involved must be clearly articulated, detailing an in-depth scrutiny of each recognized objective. With such scrutiny, the understanding of the objective may change. Often the very act of trying to describe something precisely gives them a better understanding of what they are looking at. This articulation serves as the basis for the development of requirements. What this means is that after an objective has been clearly articulated, they can describe it in concrete (measurable) terms and identify what they have to do to achieve it. Obviously, if they do a poor job of articulating the objective, their requirements will be misdirected and the resulting project will not represent the true need. Client will often begin describing their objectives in qualitative language. The project manager must work with the client to provide quantifiable definitions to those qualitative terms. These quantifiable criteria include schedule, cost, and quality measures. In the case of project objectives, these elements are used as measurements to determine project satisfaction and successful completion. Subjective evaluations are replaced by actual numeric attributes.

Client-furnished item presents unique planning and scheduling challenges. The idea is that another party to the contract procures / orders and supplies equipment, material (even services, such as utilities or scaffolding) to the contractor. The notion is that the contractor receives the equipment, goods or services and then erects, installs or otherwise uses these items. The motivation for this type of arrangement can be one or more of several seemingly logical concepts. Equipment with long lead times for fabrication and delivery may be ordered in advance of placing a contract for the equipment erection or installation. Another motivation relates to cost savings. Some believe ordering equipment and commodities (bulk materials) can be done by a general contractor or client (owner, developer, employer) and thereby save a mark-up by a subcontractor. In these cases, an interface is created between the ordering/procurement entity and the execution (engineering, erection, installation, fabrication, etc.) entity. The creation of this interface becomes the issue.

The obvious challenge here is to plan and manage around the interface with the supplying (or contract specified) party. These interfaces serve to amplify any issues (delivery, quality, design) that emerge. Large field erected and/or integrated equipment is a common example. Done for reasons related to long lead time delivery, these pieces of equipment tend to be on or near the project's execution critical path. Ordered by a client, expediting (monitoring and assessing progress) can be a challenge that some clients are not equipped to address. Accurate forecasting of fabrication and delivery is essential for erection contractor planning and scheduling. As issues arise, some clients are not equipped to detect these variations to plan (assuming there is a plan). Further, some react by obscuring variations with the expectations that other unrelated issues will result in delays that will mitigate or negate the impact of the equipment variation.

Table 4.4 : Results of causes in poor design management

NO	CATEGORY	RATE					RII	PERCENT-AGE	RANK
		1	2	3	4	5			
1	Improper basic planning.	1	2	8	11	11	0.776	14.884	2
2	Complicated administration process of client.	1	4	8	12	8	0.733	14.07	4
3	Unfinished client-furnished item.	2	0	10	15	6	0.739	14.186	3
4	Incomplete or delayed document delivery by client.	1	3	9	13	7	0.733	14.07	4
5	Changes in client's requirement.	1	2	8	10	12	0.782	15	1
6	Improper or wrong cost estimation.	3	4	5	12	9	0.721	13.837	7
7	Wrong or improper design.	3	1	8	14	7	0.727	13.953	6

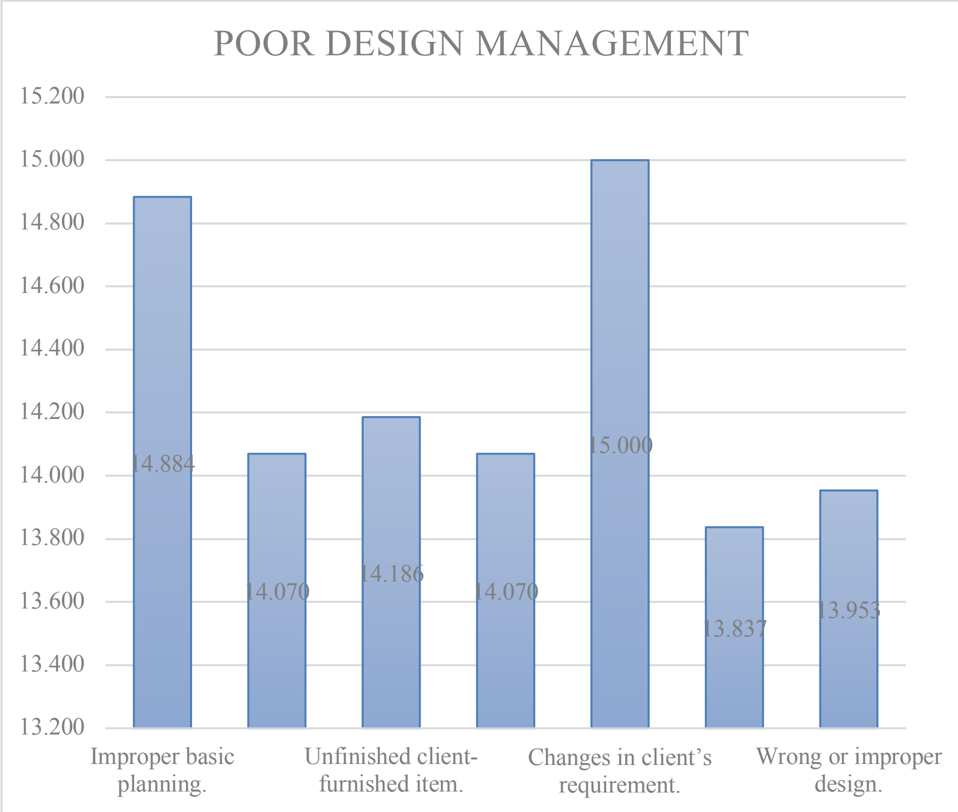

Figure 4.4 : Results of causes in poor design management

4.3.1.3 Schedule and Detail Design

According to Table 4.5 and Figure 4.5, in overall, changes in client's requirement is ranked first while changes orders by deficiency design is ranked second. Both incomplete design drawings and specifications and client's financial problems is ranked third. Client requirements, usually presented to designers in the form of a brief, provide an initial focus for interactions between client and designers. As design work commences, conceptual solutions are produced and communicated to the client (via drawings, images, etc.). In briefing work, communication occurs not just from person to person but also from project resource to person: interactions between humans, drawings and images also being legitimate instances of communication. Official codes of practice for construction project management [CIB (Chartered Institute of Building), 2010] highlight effective communication as important whilst often underplaying the significance of interpretative processes in acts of communication. Whereas "meaning" and "understanding" may be mentioned in such texts, they are critically important for any communicative act to be effective, and these concepts are dependent upon shared signs.

A design deficiency is a flaw or problem in either the drawings or specifications that require correction in order for the project to be bid, built and function as intended. Design deficiency can occur due to the design professional's (or A/E's) failure to produce a complete, accurate, and well-coordinated set of design and construction documents. Design defects typically come in the form of either errors or omissions. An error is an element in a design that does not serve the intended function of either the project or a component of the project while an omission is an element not included in the design documents, but was necessary in order for the project to be built and function as intended.

The detailed design for the project may not be complete during the early stages of the project, (i.e., invitation to bid and project award). In some cases, such as in fast-track construction, this incomplete engineering is by design as the design-build contractor will be responsible for providing the detailed engineering for the project. However, in many cases, in an effort to accelerate the work and allow the contractor to begin construction, the engineer provides early drawing revisions that may not have been approved for construction. This can lead to changes in the field as new and updated engineering drawings become available. In many cases, drawings that have already been approved for construction can be impacted as further drawings are completed that impact the original approved for construction drawings. The timing of these changes and subsequent impacts is often determined more by the timing of the changes than the nature of the changes themselves. Early design changes may only require that other engineering drawings be completed; however, as the construction begins and continues, updates to the engineering and design can have significant impact on the cost and schedule. Often, late revisions and updates to the design require rework to construction work that has already been completed, which can be much more damaging to the project cost and schedule than simply revising drawings.

Client's financial problem will lead to payment failures. Late payment is defined as failure of a paymaster to pay within the period of honouring of certificates as provided in the contract. A delayed payment by a client who is involved in the process of payment claim may have an influence on the supply chain of payment in whole. Any problems in payment at the higher end of the hierarchy will lead to a serious knock-on cash flow problem down the chain of contracts.

Table 4.5 : Results of causes in schedule and detail design

NO	CATEGORY	RATE					RII	PERCENT-AGE	RANK
		1	2	3	4	5			
1	Changes in client's requirement.	2	0	8	13	10	0.776	20.285	1
2	Improper selection of subsequent consultants.	1	3	8	12	9	0.752	19.651	4
3	Changes orders by deficiency design.	1	3	6	13	10	0.77	20.127	2
4	Incomplete design drawings and specifications.	1	2	8	13	9	0.764	19.968	3
5	Client's financial problems.	1	3	9	8	12	0.764	19.968	3

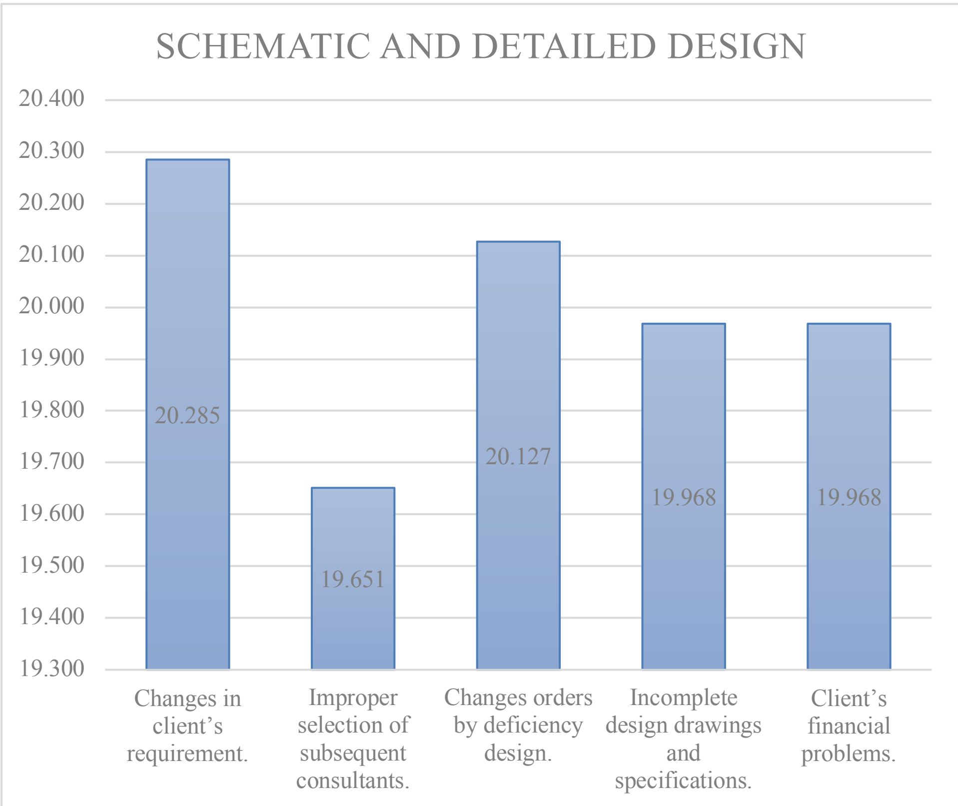

Figure 4.5 : Results of causes in schematic and detail design

4.3.1.4 Inability of Effectively Managing and Preparing Contract

According to Table 4.6 and Figure 4.6, in overall, regulations changes is ranked first while conflicts between contract clauses in raked second and the changes orders by code change is ranked third. It is common in commercial contracts to include a provision that any changes made to a contract are ineffective unless made in writing and signed by or on behalf of both parties. This is known as a variation clause, and is intended to prevent informal or inadvertent oral variations. However, common law allows for a written contract to be changed by subsequent mutual agreement from both parties, whether oral or written. This can make the position complicated. Similarly, changes in the relevant law can affect the way work is performed under a contract. Contractors will generally be obliged to complete the work in accordance with local building regulations and other laws. If the law changes during the term of a construction project, this can have cost implications for the contractors.

It is almost inevitable that during the course of construction there will be a dispute concerning the interpretation of inconsistencies and ambiguities in the contract, plans, conditions and/or specifications. Basically, an ambiguous provision is a clause which can reasonably be read in more than one way. Conflicting provisions exist where the provisions cannot both be complied with coincidently. Although a well-drafted contract will include/set forth the precedence of interpretation, if the contract does not include a clause that aids in the interpretation of disputes concerning the contract terms, the parties may be able to turn to the interpretation rules that have been by enacted by the Legislature.

Change orders must adhere to the appropriate building codes, just like any other construction, and they take legal precedence over construction industry custom or trade practices. Also, they only apply to lump sum contracts, not cost-plus or time and materials (T&M) contracts (unless there is a guaranteed maximum written in). Change orders are not the same as change directives or construction changes.

Table 4.6 : Results of causes in inability of effectively managing and preparing contract

NO	CATEGORY	RATE					RII	PERCENT-AGE	RANK
		1	2	3	4	5			
1	Regulations changes	1	2	8	14	8	0.758	25.934	1
2	Liability ambiguity due to improper contract clauses.	1	2	14	10	6	0.709	24.274	4
3	Conflicts between contract clauses.	1	3	9	13	7	0.733	25.104	2
4	Change orders by code change.	1	5	8	11	8	0.721	24.689	3

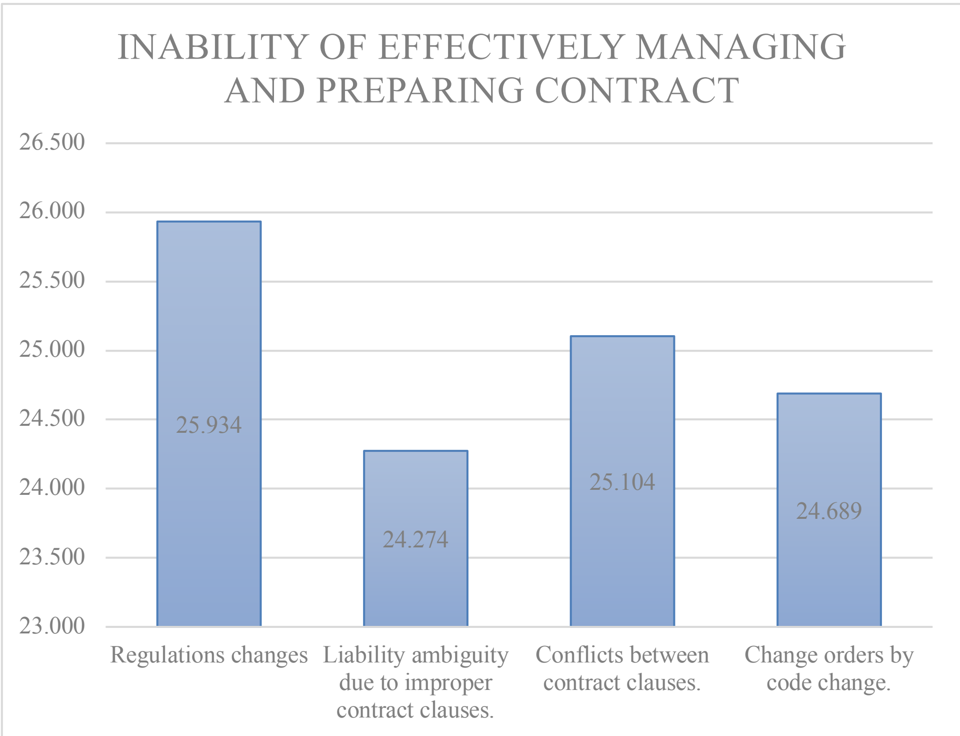

Figure 4.6 : Results of causes in inability of effectively managing and preparing contract

4.3.1.5 Lack of Communication

According to Table 4.7 and Figure 4.7, in overall, poor communication and coordination between designers/ project user group is ranked first. Both slow land expropriation due to resistance from occupants and slow information delivery between designers is ranked second. Then, the disagreement on design specification is ranked third.

Communication skills are essential to produce effective communication however if the speaker lacks of these skills then poor communication may result. Interpersonal skills which include communication skills play an important role for the success of a project. Parties involve in construction possess different communication skills which also depends on their qualification and cultural background. These differences cause concurrent misunderstanding in the delivery stage. `

Table 4.7 : Results of causes in lack of communication

NO	CATEGORY	RATE					RII	PERCENT-AGE	RANK
		1	2	3	4	5			
1	Slow land expropriation due to resistance from occupants.	2	0	8	12	11	0.782	13.522	2
2	Over-subjective explanation of regulations by government officer	2	0	8	16	7	0.758	13.103	4
3	Public resistance or political intervention.	1	2	9	13	8	0.752	12.998	5
4	Disagreement on design specifications.	0	4	7	13	9	0.764	13.208	3
5	Poor communication and coordination between designers/ project user group	0	35	5	12	13	1.2	20.755	1
6	Unclear authority among designers.	0	3	10	13	7	0.745	12.893	7
7	Slow information delivery between designers.	0	2	7	16	8	0.782	13.522	2

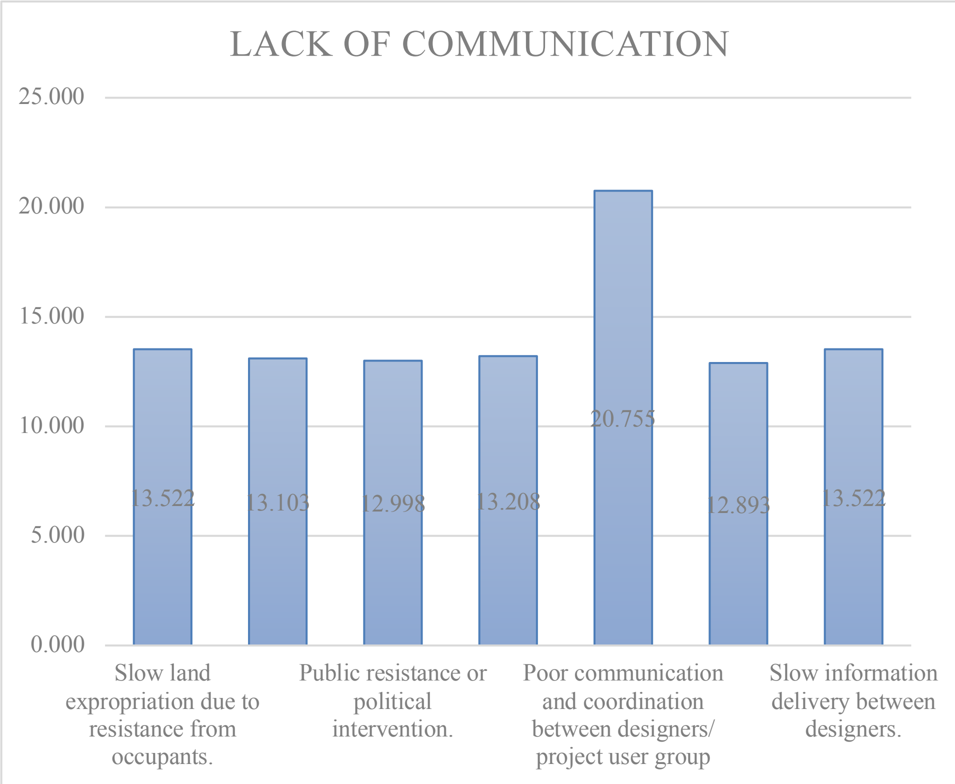

Figure 4.7 : Results of causes in lack of communication

4.3.1.6 Unrealistic Scheduling

According to Table 4.9 and Figure 4.9, in overall, both unrealistic design duration imposed and inadequate planning and schedule is ranked first. Then both inadequate schedule control and inability of owner to review design in a timely manner is ranked second. The estimate activity duration's process is to estimate how much time each activity will take. It is completed after defining and sequencing the activities and the type and quantity of resources for each activity are identified. Who should play a role in estimating these durations? Ideally, the estimators should be those who will be doing the work. However, the estimators are more often project team members who are more familiar with the work that needs to be done. The three methods used for estimating include analogous estimating, parametric estimating, three-point estimating or reserve analysis. Estimation activity needs to be completed by individuals who are doing the work. A project manager plays a key role during the process of estimation.

A project manager must create a schedule management plan and it is observed that in real-world scenarios most of the project managers miss on this important aspect. A schedule management plan should include the methodology used to create the schedule. The project manager should also describe the use of scheduling software. He should identify the measurement guidelines i.e. should he measure the process progress in hours, days, weeks, months or quarters. The schedule management plan should also include the duration of each activity and the efforts required for those activities. All of this should establish the project baseline. This baseline is to be used to monitor and control the project during various phases.

The project manager should also include a plan to mitigate any variances observed in the schedule. Change Control Procedure should be in place to manage schedule changes. Reporting requirements should also be established. As described earlier, the measures of performance need to be planned in advance and then captured and reported. Schedule management plan is a part of the project management plan and can be formal or informal. It expedites the schedule estimation process by providing guidelines on how estimates should be stated. During the monitor and control phase, the deviation from the schedule baseline can be analysed and acted upon. Reporting of the project is also determined by the schedule management plan.

Table 4.8 : Results of causes in unrealistic scheduling

NO	CATEGORY	RATE					RII	PERCENT-AGE	RANK
		1	2	3	4	5			
1	Unreasonable contract duration.	1	5	7	10	10	0.739	14.072	3
2	Unreasonable or unpractical initial plan.	0	4	10	11	8	0.739	14.072	3
3	Unrealistic design duration imposed.	0	2	8	15	8	0.776	14.764	1
4	Inadequate schedule control.	0	3	11	11	8	0.745	14.187	2
5	Inability of owner to review design in a timely manner.	0	4	9	12	8	0.745	14.187	2
6	Delay due to other construction projects.	1	4	6	16	6	0.733	13.956	4
7	Inadequate planning and schedule.	0	3	9	10	11	0.776	14.764	1

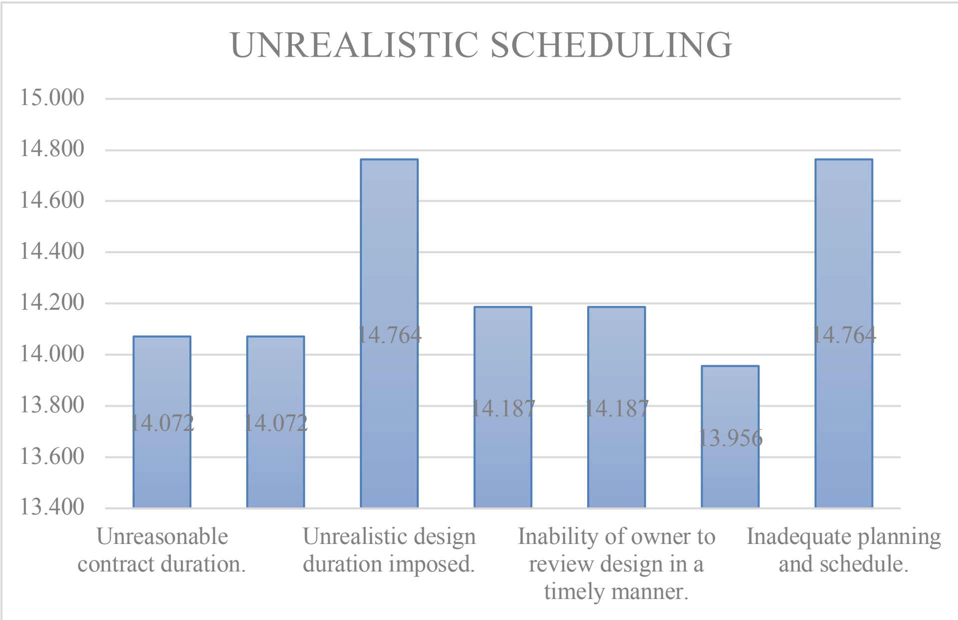

Figure 4.8 : Results of causes in unrealistic scheduling

4.3.1.7 Lack of Skilled Designers

According to Table 4.9 and Figure 4.9, in overall, inadequate integration on project interfaces is ranked first. Both inadequate experience of designers and late incorporation on emerging technologies into a design is ranked second. The project interface covers design/manufacturing and/or design/construction. This is the most difficult project interface to manage, precisely because the differentiation across it is so big. Characterized by an amazing conjunction of dimensions, the design/production interface is differentiated between systems having various technologies and often between different organizations or organizational units. It is an information interface, often with time and territory differences, and it is oftert vague and ill-defined. Especially important in determining the difficulty of managing this interface is the complexity of the design relative to the project’s size and speed of completion. Where the design is complex, organizational problems should be minimized; otherwise the interface may become too complex to manage. A more useful generalization of this rule is that if there must be technological, timing, geographical, or organizational complexity at an interface, make sure it is only one of these at a time. Do not complicate matters by having organizational complexity for example, contractual complexity or responsibility uncertainty at the same time as technical complexity. Thus, at the design/production interface: identify it well; assess schedule and organization integration requirements; and set up clear and effective integrating mechanisms for coordinating and controlling progress across the interface.

Designers will need to understand the implications of science and technology for people. Design should provide the connective tissue between people and technology. The seamless integration of a technology into our lives is almost always an act of great design, coupled with smart engineering; it's the "why" that makes the "what" meaningful. It is through this humane expression of technology that the designer ensures a product or service is not just a functional experience, but one that is also worthwhile. We must consider the outputs of these technologies - what people need and want.

Table 4.9 : Results of causes in lack of skilled designers

NO	CATEGORY	RATE					RII	PERCENT-AGE	RANK
		1	2	3	4	5			
1	Slow decision making by designers.	2	3	11	8	9	0.715	19.732	3
2	Insufficient training of designers.	1	3	12	10	7	0.715	19.732	3
3	Inadequate experience of designers.	0	3	14	9	7	0.721	19.9	2
4	Inadequate integration on project interfaces.	0	0	15	11	7	0.752	20.736	1
5	Late incorporation of emerging technologies into a design.	1	5	8	11	8	0.721	19.9	2

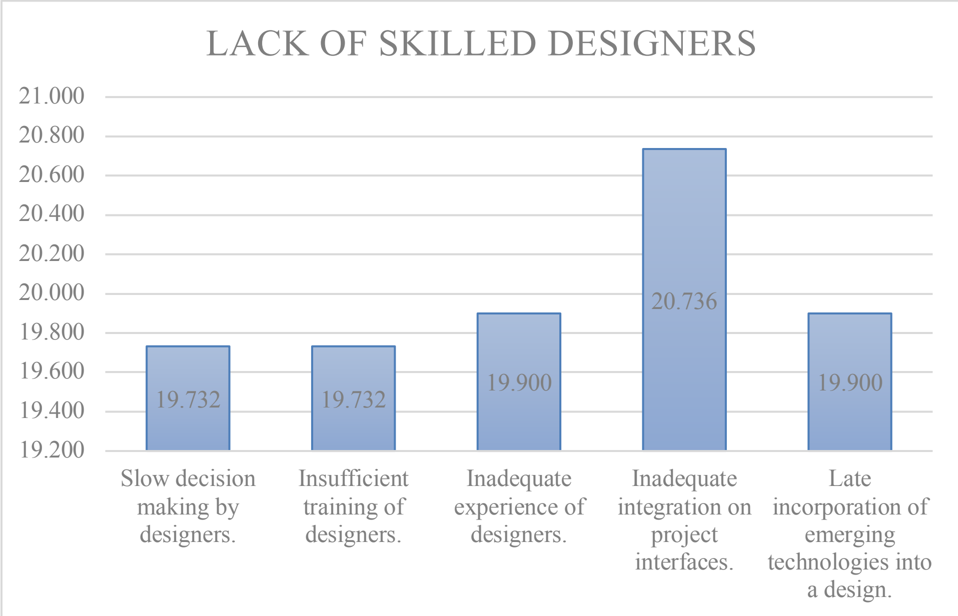

Figure 4.9 : Results of causes in lack of skilled designers

4.3.1.8 Ranking Of All Factors That Causes Delay

Table 4.10 : Results of all factors that causes delay

NO	CATEGORY	RATE					RII	PERCENT-AGE	RANK	OVERALL RANK
		1	2	3	4	5				
1	Insufficient or ill-integrated basic project data.	0	0	7	17	9	0.812	20.775	1	5
2	Poor scope definition.	1	2	8	15	7	0.752	19.225	4	19
3	Project complexity.	0	2	7	14	10	0.794	20.31	3	9
4	Lack of database for estimation.	0	3	9	15	6	0.745	19.07	5	20
5	Unforeseeable site conditions (e.g., existing underground conduits).	0	2	6	14	11	0.806	20.62	2	8
6	Improper basic planning.	1	2	8	11	11	0.776	14.884	2	22
7	Complicated administration	1	4	8	12	8	0.733	14.07	4	30

	process of client.									
8	Unfinished client-furnished item.	2	0	10	15	6	0.739	14.186	3	27
9	Incomplete or delayed document delivery by client.	1	3	9	13	7	0.733	14.07	4	30
10	Changes in client's requirement.	1	2	8	10	12	0.782	15	1	21
11	Improper or wrong cost estimation.	3	4	5	12	9	0.721	13.837	7	34
12	Wrong or improper design.	3	1	8	14	7	0.727	13.953	6	33
13	Changes in client's requirement.	2	0	8	13	10	0.776	20.285	1	10
14	Improper selection of subsequent consultants.	1	3	8	12	9	0.752	19.651	5	18
16	Changes orders by deficiency design.	1	3	6	13	10	0.77	20.127	2	11
17	Incomplete design drawings and specifications.	1	2	8	13	9	0.764	19.968	3	12
18	Client's financial problems.	1	3	9	8	12	0.764	19.968	3	12
19	Regulations changes	1	2	8	14	8	0.758	25.934	1	1
20	Liability ambiguity due to improper contract clauses.	1	2	14	10	6	0.709	24.274	4	4
21	Conflicts between contract clauses.	1	3	9	13	7	0.733	25.104	2	2

22	Change orders by code change.	1	5	8	11	8	0.721	24.689	3	3
23	Slow land expropriation due to resistance from occupants.	2	0	8	12	11	0.782	13.522	2	35
24	Over-subjective explanation of regulations by government officer	2	0	8	16	7	0.758	13.103	5	38
25	Public resistance or political intervention.	1	2	9	13	8	0.752	12.998	6	39
26	Disagreement on design specifications.	0	4	7	13	9	0.764	13.208	4	37
27	Poor communication and coordination between designers/ project user group	0	35	5	12	13	1.2	20.755	1	6
28	Unclear authority among designers.	0	3	10	13	7	0.745	12.893	7	40
29	Slow information delivery between designers.	0	2	7	16	8	0.782	13.522	2	35
30	Unreasonable contract duration.	1	5	7	10	10	0.739	14.072	5	28
31	Unreasonable or unpractical initial plan.	0	4	10	11	8	0.739	14.072	5	28
32	Unrealistic design duration imposed.	0	2	8	15	8	0.776	14.764	1	23
33	Inadequate schedule control.	0	3	11	11	8	0.745	14.187	3	25

34	Inability of owner to review design in a timely manner.	0	4	9	12	8	0.745	14.187	3	25
35	Delay due to other construction projects.	1	4	6	16	6	0.733	13.956	7	32
36	Inadequate planning and schedule.	0	3	9	10	11	0.776	14.764	1	23
37	Slow decision making by designers.	2	3	11	8	9	0.715	19.732	4	16
38	Insufficient training of designers.	1	3	12	10	7	0.715	19.732	4	16
39	Inadequate experience of designers.	0	3	14	9	7	0.721	19.9	2	14
40	Inadequate integration on project interfaces.	0	0	15	11	7	0.752	20.736	1	7
41	Late incorporation of emerging technologies into a design.	1	5	8	11	8	0.721	19.9	2	14

4.3.2 Factor That Can Reduce The Delay In Design Phase In Construction Project

The factors that can reduce delay in design phase in construction project have been analyzed for the questionnaires that have been distributed and grouped into three major groups. The factors in each group were analyzed and ranked by using relative important index. Below are the discussions on the factors that can reduce delay in design phase for each group.

4.3.2.1 Improving Communication

According to Table 4.11 and Figure 4.11, in overall, better communication and coordination with other parties is ranked first while scope investigation with clients in order to fully understand their requirement and finalize the outcome of the projects is ranked second. The multidisciplinary/ competent project team is ranked third.

Table 4.11 : Results of factors to reduce delay by improving communication

NO	CATEGORY	RATE					RII	PERCENT-AGE	RANK
		1	2	3	4	5			
1	A client is obliged to provide complete project data to planners or designers.	2	0	5	11	15	0.824	19.318	5
2	Multidisciplinary/ competent project team.	0	0	6	12	15	0.855	20.028	3
3	Better communication and coordination with other parties.	0	0	4	12	17	0.879	20.597	1
4	Competent and capable client representatives.	0	0	8	10	15	0.842	19.744	4
5	Scope Investigation with clients in order to fully understand their requirement and finalize the outcome of the projects.	0	0	6	10	17	0.867	20.312	2

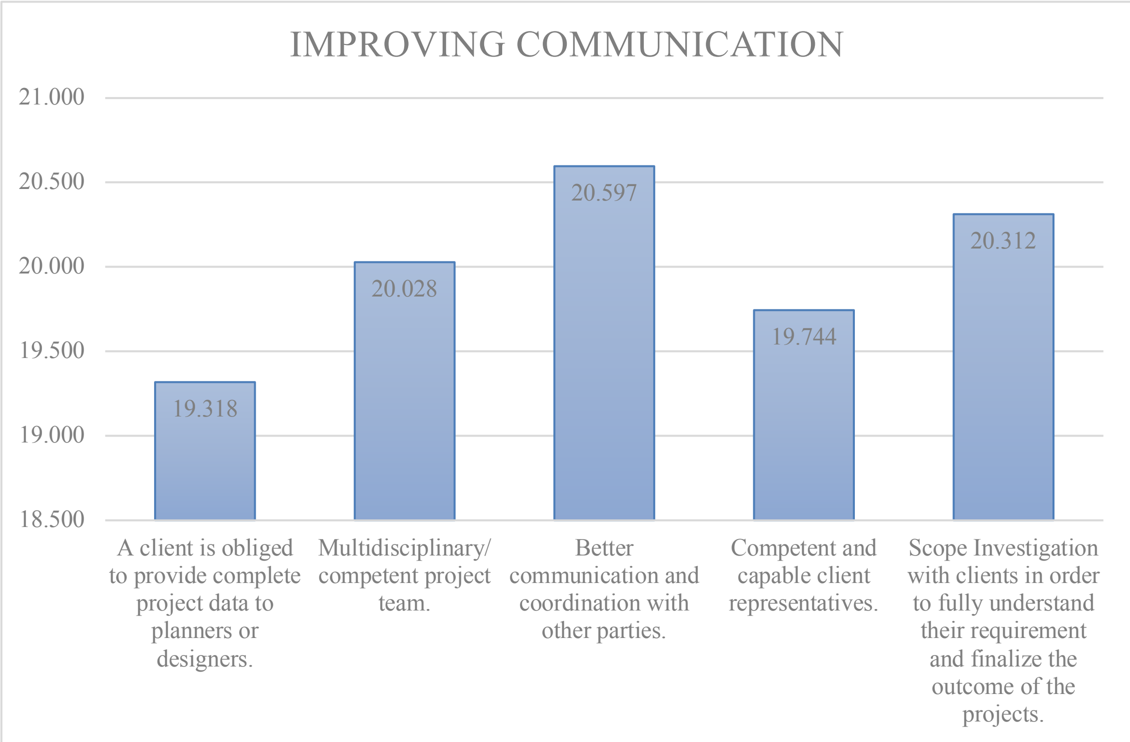

Figure 4.10 : Results of factors to reduce delay by improving communication

4.3.2.2 Improving Designer's Skill

According to Table 4.12 and Figure 4.12, in overall, the allocation of sufficient time and money at the design phase is ranked first. Both designer need to complete the site layout, preliminary drawings, and regulation checks as early as possible before applying for necessary permits or licenses, thus preferably complete the design work thoroughly to avoid foreseeable pitfalls in planning and design and value engineering might help in reviewing the design and get into the best solution on certain issues from the outset is ranked second.

Table 4.12 : Results of factors to reduce delay by improving designer's skills

NO	CATEGORY	RATE					RII	PERCENT-AGE	RANK
		1	2	3	4	5			
1	Allow sufficient time for proper planning, design, information, documentation, and tender submission.	0	2	5	14	12	0.818	19.737	5
2	Allocation of sufficient time and money at the design phase.	0	0	7	12	14	0.842	20.322	1
3	Designer need to complete the site layout, preliminary drawings, and regulation checks as early as possible before applying for necessary permits or licenses, thus preferably complete the design work thoroughly to avoid foreseeable pitfalls in planning and design.	0	2	6	10	15	0.83	20.029	2
4	Government to conduct continuous training programs.	0	2	5	13	13	0.824	19.883	4
5	Value Engineering might help in reviewing the design and get into the best solution on certain issues from the outset.	0	0	7	14	12	0.83	20.029	2

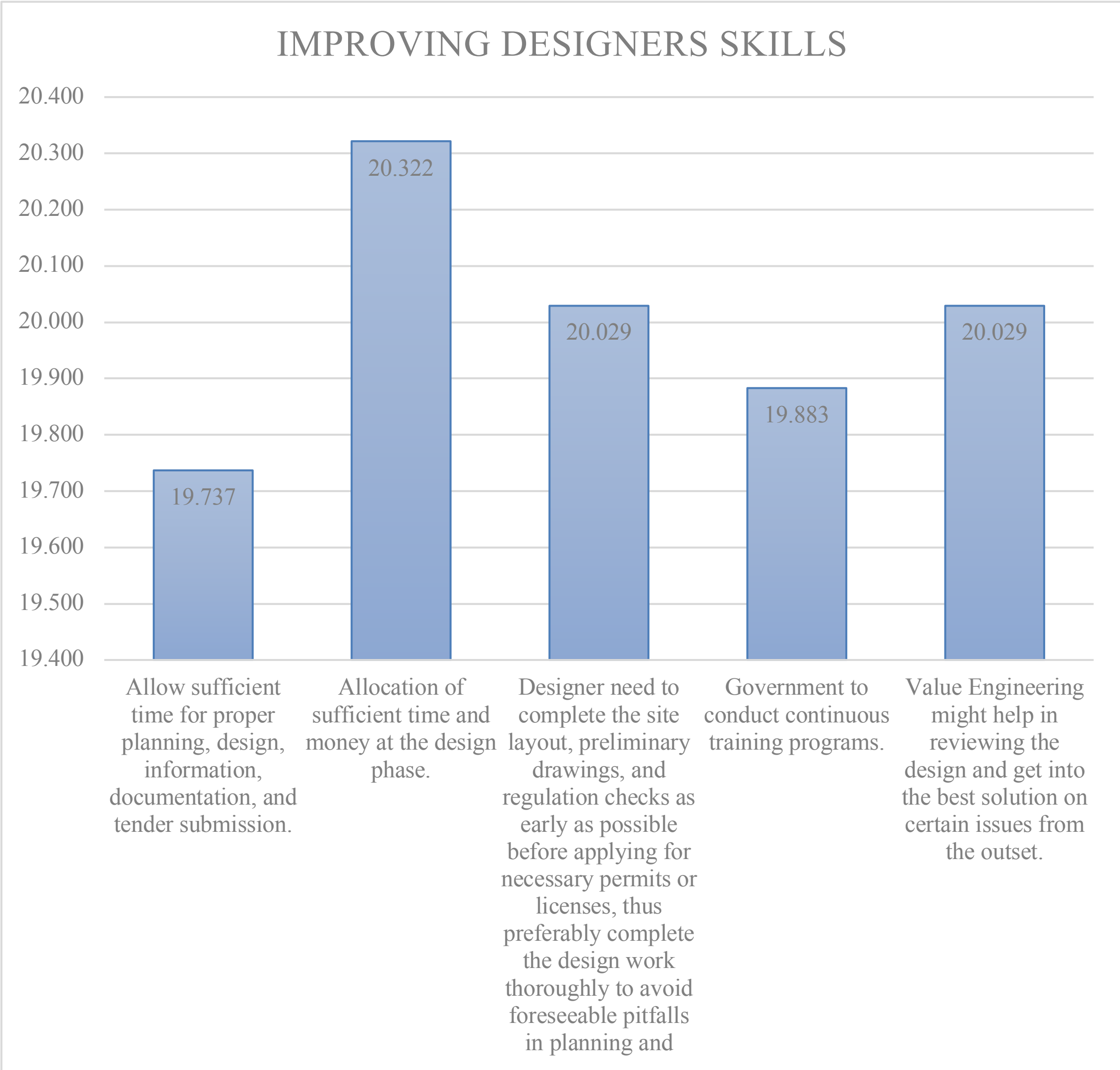

Figure 4.11 : Results of factors to reduce delay by improving designer's skills

4.3.2.3 Lack of Skilled Designers

According to Table 4.13 and Figure 4.13, in overall, comprehensive project communication plan needs to be in place, implemented and monitored is ranked first while detailed and comprehensive site investigation should be done at the design phase is ranked second and designer might need to request client support if the outcome of the review by government agencies is in conflict with the original planning and design principles issued by the client is ranked third.

Table 4.13 : Results of factors to reduce delay by improving management

NO	CATEGORY	RATE					RII	PERCENT-AGE	RANK
		1	2	3	4	5			
1	Detailed and comprehensive site investigation should be done at the design phase.	0	0	6	12	15	0.855	20.705	2
2	Government to modify and improve the related regulations and laws.	0	1	13	12	7	0.752	18.209	5
3	Awarding bids to the right/ experienced consultant.	0	2	6	12	13	0.818	19.824	4
4	Designer might need to request client support if the outcome of the review by government agencies is in conflict with the original planning and design principles issued by the client.	0	0	6	16	11	0.83	20.117	3
5	Comprehensive project communication plan needs to be in place, implemented and monitored.	0	0	5	11	17	0.873	21.145	1

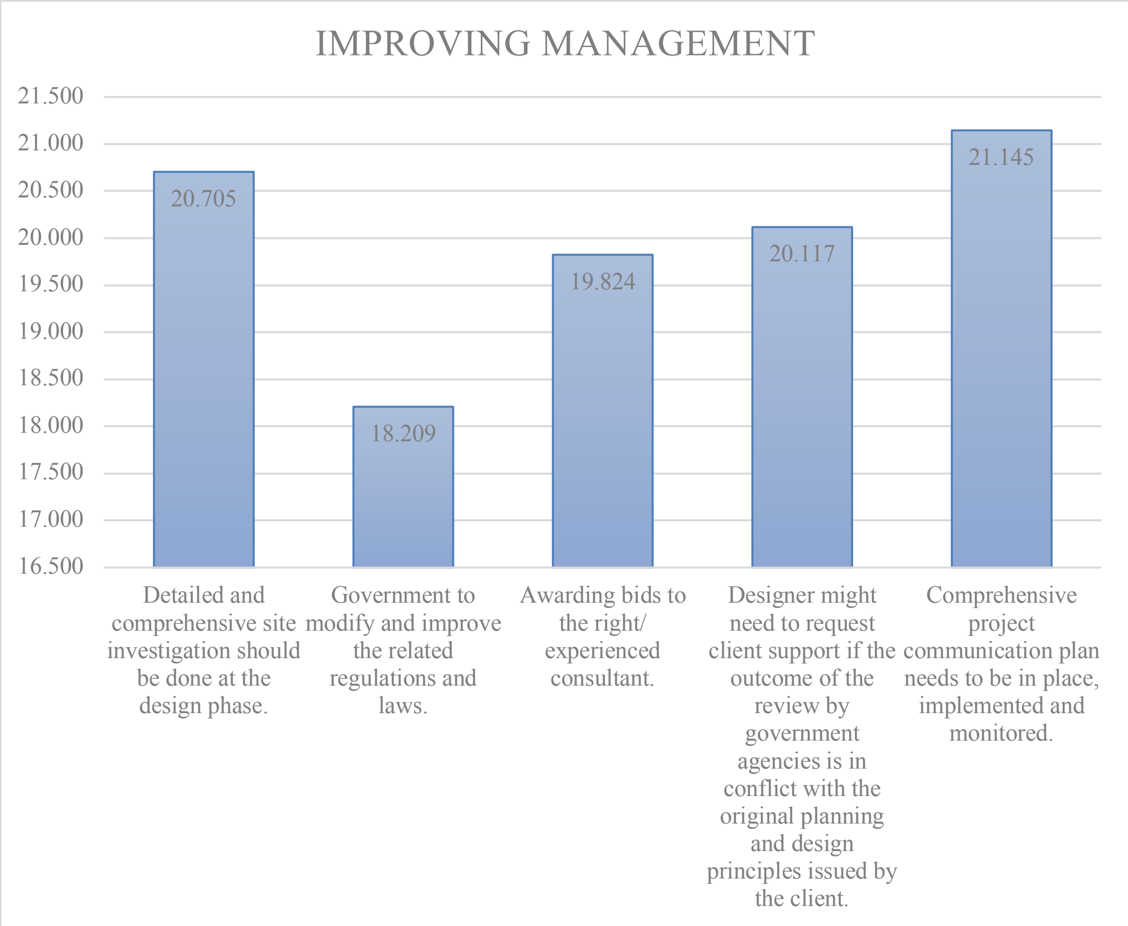

Figure 4.12 : Results of factors to reduce delay by improving management

4.3.2.4 Ranking Of All Factors That Can Reduce Delay

Table 4.14 : Results of all factors that can reduce delay

NO	CATEGORY	RATE					RII	PERCENT-AGE	RANK	OVERALL RANK
		1	2	3	4	5				
1	A client is obliged to provide complete project data to planners or designers.	2	0	5	11	15	0.824	19.318	5	14
2	Multidisciplinary/ competent project team.	0	0	6	12	15	0.855	20.028	3	9

3	Better communication and coordination with other parties.	0	0	4	12	17	0.879	20.597	1	3
4	Competent and capable client representatives.	0	0	8	10	15	0.842	19.744	4	12
5	Scope Investigation with clients in order to fully understand their requirement and finalize the outcome of the projects.	0	0	6	10	17	0.867	20.312	2	5
6	Allow sufficient time for proper planning, design, information, documentation, and tender submission.	0	2	5	14	12	0.818	19.737	5	13
7	Allocation of sufficient time and money at the design phase.	0	0	7	12	14	0.842	20.322	1	4

8	Designer need to complete the site layout, preliminary drawings, and regulation checks as early as possible before applying for necessary permits or licenses, thus preferably complete the design work thoroughly to avoid foreseeable pitfalls in planning and design.	0	2	6	10	15	0.83	20.029	2	7
9	Government to conduct continuous training programs.	0	2	5	13	13	0.824	19.883	4	10
10	Value Engineering might help in reviewing the design and get into the best solution on certain issues from the outset.	0	0	7	14	12	0.83	20.029	2	7
11	Detailed and comprehensive site investigation should be done at the design phase.	0	0	6	12	15	0.855	20.705	2	2

12	Government to modify and improve the related regulations and laws.	0	1	13	12	7	0.752	18.209	5	15
13	Awarding bids to the right/ experienced consultant.	0	2	6	12	13	0.818	19.824	4	11
14	Designer might need to request client support if the outcome of the review by government agencies is in conflict with the original planning and design principles issued by the client.	0	0	6	16	11	0.83	20.117	3	6
15	Comprehensive project communication plan needs to be in place, implemented and monitored.	0	0	5	11	17	0.873	21.145	1	1

4.4 Summary

In conclusion, top five causes of delays are regulations changes, conflicts between contract clauses, change orders by code change, liability ambiguity due to improper contract clauses and insufficient or ill-integrated basic project data. While the top five methods to prevent construction delays are comprehensive project communication plan needs to be in place, implemented and monitored, detailed and comprehensive site investigation should be done at the design phase, better communication and coordination with other parties, allocation of sufficient time and money at the design phase and scope investigation with clients in order to fully understand their requirement and finalize the outcome of the projects.

CHAPTER 5

CONCLUSION

5.1 Introduction

Chapter five concludes on the data collected from questionnaire survey which was analysed and discussed in chapter four.

5.2 Conclusion

The main objectives in this research have been achieved by identified the causes of the cause of delay in design phase in construction project and methods to the factor that can reduce the delay in design phase in construction project in Malaysia.

5.2.1 Major Causes of Delays in Design Phase

A total of 41 causes of delays was identified, the top ten causes that contribute to construction delays are insufficient or ill-integrated basic project data, project complexity, unforeseeable site conditions (e.g., existing underground conduits), changes in client's requirement, regulations changes, liability ambiguity due to improper contract clauses, conflicts between contract clauses, change orders by code change, poor communication and coordination between designers/ project user group, inadequate integration on project interfaces. All the 41 causes of delays were grouped into seven groups, lack of information, poor design management, schedule and detail design, inability of effectively managing and preparing contract, lack of communication, unrealistic scheduling and lack of skilled designers. The first objective of this research achieved.

5.2.2 Methods to Reduce Delay in Design Phase

A total of 15 methods to prevent construction delays were identified, the top ten effective methods to reduce delay in design phase are Multidisciplinary/ competent project team, Better communication and coordination with other parties, scope investigation with clients in order to fully understand their requirement and finalize the outcome of the projects, allocation of sufficient time and money at the design phase, designer need to complete the site layout, preliminary drawings, and regulation checks as early as possible before applying for necessary permits or licenses, thus preferably complete the design work thoroughly to avoid foreseeable pitfalls in planning and design, government to conduct continuous training programs, value engineering might help in reviewing the design and get into the best solution on certain issues from the outset, detailed and comprehensive site investigation should be done at the design phase, designer might need to request client support if the outcome of the review by government agencies is in conflict with the original planning and design principles issued by the client and comprehensive project communication plan needs to be in place, implemented and monitored.

REFERENCES

Demirkan, H. 1998. Integration of Reasoning Systems In Architectural Modeling Activities. *Automation in Construction.* 7 (2-3). pp. 229-236.

Watanabe, S. (1994). Knowledge Intergration for Architectural Design. Automation In Construction, 3. 149-156

French, H. (1998). Architecture : A Crash Course. New York: Watson-Guptill Publications.

Lawson, Brian. 2007. CAD and Creativity: Does the Computer Really Help? *ISAST,* Vol. 35, No. 3, pp. 327-331.

Sanders, K. (1996). The digital architect : a common sense ; guide to using computer technology in design practice. 1st ed. New York : John Wiley & Sons. Inc

Longman, Pearson Education Limited. *Dictionary of Contemporary English.* Edinburgh Gate, Harlow. 2003

CIOB (2011). *Guide to Good Practice in the Management of Time in Complex Projects.* Oxford, UK: Wiley-Blackwell.

Neale, R., and Neale, D. E. (1989). *Construction Planning.* London: Thomas Telford.

Ackoff, R. (1970). A Concept of Corporate Planning. *Long Range Planning*. 3(1), 2–8.

Mawdesley, M., Askew, W. and O'Reilly, M. (1997). *Planning and Controlling Construction Projects.* Harlow, UK: Addison Wesley Longman and the Chartered Institute of Building.

Amade, B., Ubani, E. C., Omajeh, E. O. M. and Njoku, U. A. P. (2015). Critical Success Factors for Public Sector Construction Project Delivery: A Case of Owerri, Imo State. *International Journal of Research in Management, Science & Technology*. Vol. 3 No. 1, 11–21.

Mahdavinejad, M. and Molaee, M. (2011). The result of delayed projects on publics' satisfaction in Tehran. *2nd International Conference on Construction and Project Management IPEDR*. 16–18 September. Singapore.

Marzouk, M. M., and El-Rasas, T. I. (2014). Analyzing delay causes in Egyptian construction projects. *Journal of Advanced Research*. 5, 49–55.

Yau, N. J. and Yang, J. B. (2012). Factors Causing Design Schedule Delays in Turnkey Projects in Taiwan: An Empirical Study of Power Distribution Substation Projects. *Project Management Journal.* Vol. 43 No. 3, 50–61.

Yang, J. B. and Wei, P. R. (2010). Causes of Delay in the Planning and Design Phases for Construction Projects. *Journal of Architectural Engineering*. 16 (2), 80–83.

McManus, T. C., Tishman, D. R. and Turnbaugh, L. R. (1996). Remedies for delays in architectural construction. *Cost Engineering.* 38 (9), 33–40.

Basu, A. (2005). Is your schedule late at the starting gate? *AACE International Transaction*. Morgantown, Washington, D.C., Paper No. PS.07, 1–8.

Abdullah, A., and Koskela, L. (2008). What Can Be Learned From Studies of Delay on Construction? *Proc., 16th Annual Conf. of Int.* Group for Lean Construction, Manchester, UK.

Nguyen, L. D., Ogunlana, S. O. and Lan, D. T. X. (2004). A study on project success factors in large construction projects in Vietnam. *Engineering, Construction and Architectural Management.* 11 (6), 404–413.

Ibironke, O. T., Oladinrin, T. O., Adeniyi, O. and Eboreime, I. V. (2013). Analysis of Non-Excusable
Delay Factors Influencing Contractors' Performance in Lagos State, Nigeria.
Journal of Construction in Developing Countries. 18 (1), 53–72.

Ambituuni, A. (2011). *Causes of Project Delay and Cost Overrun, and Mitigation Approach*. MSc Project Management. The Robert Gordon University, Scotland

Shuttleworth, M. (2008). How to choose between different research methods. *Experiment Resources*. Available at: http://www.experiment-resources. com/different-research-methods.html [Accessed February 1, 2011].

Shuttleworth, M. (b2008). Case Study Research Design. *Experiment Resources*. Available at: http://www.experiment-resources.com/case-study- research-design.html [Accessed February 1, 2011].

Vagias, W.M. (2006) Likert-Type Scale Response Anchors. Clemson International Institute for Tourism & Research Development, Department of Parks, Recreation and Tourism Management. Clemson University, Clemson.

Halim, A. H. A., & Zin, R. M. (2016). Causes of Delay in the Planning and Design Phases forPublic Works Department Construction Projects. *Malaysian Journal of Civil Engineering*, *28*(3).

APPENDIX A
SAMPLE OF QUESTIONNAIRE

THE CAUSES OF DELAY AND THE FACTOR THAT CAN REDUCE THE DELAY IN THE DESIGN PHASE IN MALAYSIA CONSTRUCTION

* Required

Background of respondent

1. **i. Gender** *
Mark only one oval.

   - Female
   - Male

2. **ii. Work experience** *
Mark only one oval.

   - < 5 years
   - 5 < years < 9
   - > 10 years

Section B: Causes of project delay in design phase

Objective of the study: To identify the causes of delay in design phase construction project

Based on the scale below, please choose the causes of delay in design phase construction project that you think related.

Which of the following related factors stated below that contribute to causes of delay in design phase in Malaysia construction project?

1) Lack of information

3. **i. Insufficient or ill-integrated basic project data.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	○	○	○	○	○	strongly agree

4. **ii. Poor scope definition.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	⬭	⬭	⬭	⬭	⬭	strongly agree

5. **iii. Project complexity.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	⬭	⬭	⬭	⬭	⬭	strongly agree

6. **iv. Lack of database for estimation.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	⬭	⬭	⬭	⬭	⬭	strongly agree

7. **v. Unforeseeable site conditions (e.g., existing underground conduits).** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	⬭	⬭	⬭	⬭	⬭	strongly agree

2) Poor design management

8. **i. Improper basic planning.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	⬭	⬭	⬭	⬭	⬭	strongly agree

9. **ii. Complicated administration process of client.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	⬭	⬭	⬭	⬭	⬭	strongly agree

10. **iii. Unfinished client-furnished item.** *

Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

11. **iv. Incomplete or delayed document delivery by client.** *

Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

12. **v. Changes in client's requirement.** *

Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

13. **vi. Improper or wrong cost estimation.** *

Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

14. **vii. Wrong or improper design.** *

Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

3) Schematic and detail design

15. **i. Changes in client's requirement.** *

Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

16. **ii. Improper selection of subsequent consultants.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

17. **iii. Change orders by client.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

18. **iv. Changes orders by deficiency design.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

19. **v. Incomplete design drawings and specifications.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

20. **vi. Client's financial problems.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

4) Inability of effectively managing and preparing contract

21. **i. Regulations changes** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

22. **ii. Liability ambiguity due to improper contract clauses.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

23. **iii. Conflicts between contract clauses.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

24. **iv. Change orders by code change.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

5) Lack of communication

25. **i. Slow land expropriation due to resistance from occupants.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

26. **ii. Over-subjective explaination of regulations by government officer** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

27. **iii. Public resistance or political intervention.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

28. **iv. Disagreement on design specifications.** *

Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

29. **v. Poor communication and coordination between designers/ project user group** *

Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

30. **vi. Unclear authority among designers.** *

Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

31. **vii. Slow information delivery between designers.** *

Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

6) Unrealistic scheduling

32. **i. Unreasonable contract duration.** *

Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

33. **ii. Unreasonable or unpractical initial plan.** *

Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

34. **iii. Unrealistic design duration imposed.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

35. **iv. Inadequate schedule control.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

36. **v. Inability of owner to review design in a timely manner.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

37. **vi. Delay due to other construction projects.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

38. **vii. Inadequate planning and schedule.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

7) Lack of skilled designers

39. **i. Slow decision making by designers.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

40. **ii. Insufficient training of designers.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

41. **iii. Inadequate experience of designers.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

42. **iv. Inadequate integration on project interfaces.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

43. **v. Late incorporation of emerging technologies into a design.** *
Mark only one oval.

	1	2	3	4	5	
strongly disagree	◯	◯	◯	◯	◯	strongly agree

Section C: Factor That Can Reduce Delay

Objective of the study: To analyse the factor that can reduce the delay in design phase in construction project.

Based on the scale below, please choose the scale that describe the factor that can reduce the delay in design phase in construction project.

Question: What is the strategies to minimize delays in design phase?

1) Improving communication

44. **i. A client is obliged to provide complete project data to planners or designers.** *
Mark only one oval.

	1	2	3	4	5	
no effect	◯	◯	◯	◯	◯	full effect

45. **ii. Multidisciplinary/ competent project team.** *

Mark only one oval.

	1	2	3	4	5	
no effect	◯	◯	◯	◯	◯	full effect

46. **iii. Better communication and coordination with other parties.** *

Mark only one oval.

	1	2	3	4	5	
no effect	◯	◯	◯	◯	◯	full effect

47. **iv. Competent and capable client representatives.** *

Mark only one oval.

	1	2	3	4	5	
no effect	◯	◯	◯	◯	◯	full effect

48. **v. Scope Investigation with clients in order to fully understand their requirement and finalize the outcome of the projects.** *

Mark only one oval.

	1	2	3	4	5	
no effect	◯	◯	◯	◯	◯	full effect

2) Improving designer's skill

49. **i. Allow sufficient time for proper planning, design, information, documentation, and tender submission.** *

Mark only one oval.

	1	2	3	4	5	
no effect	◯	◯	◯	◯	◯	full effect

50. **ii. Allocation of sufficient time and money at the design phase.** *

Mark only one oval.

	1	2	3	4	5	
no effect	◯	◯	◯	◯	◯	full effect

51. **iii. Designer need to complete the site layout, preliminary drawings, and regulation checks as early as possible before applying for necessary permits or licenses, thus preferably complete the design work thoroughly to avoid foreseeable pitfalls in planning and design.** *
Mark only one oval.

	1	2	3	4	5	
no effect	⬭	⬭	⬭	⬭	⬭	full effect

52. **iv. Government to conduct continuous training programs.** *
Mark only one oval.

	1	2	3	4	5	
no effect	⬭	⬭	⬭	⬭	⬭	full effect

53. **v. Value Engineering might help in reviewing the design and get into the best solution on certain issues from the outset.** *
Mark only one oval.

	1	2	3	4	5	
no effect	⬭	⬭	⬭	⬭	⬭	full effect

3) Improving management

54. **i. Detailed and comprehensive site investigation should be done at the design phase.** *
Mark only one oval.

	1	2	3	4	5	
no effect	⬭	⬭	⬭	⬭	⬭	full effect

55. **ii. Government to modify and improve the related regulations and laws.** *
Mark only one oval.

	1	2	3	4	5	
no effect	⬭	⬭	⬭	⬭	⬭	full effect

56. **iii. Awarding bids to the right/ experienced consultant.** *

Mark only one oval.

	1	2	3	4	5	
no effect	◯	◯	◯	◯	◯	full effect

57. **iv. Designer might need to request client support if the outcome of the review by government agencies is in conflict with the original planning and design principles issued by the client.** *

Mark only one oval.

	1	2	3	4	5	
no effect	◯	◯	◯	◯	◯	full effect

58. **v. Comprehensive project communication plan needs to be in place, implemented and monitored.** *

Mark only one oval.

	1	2	3	4	5	
no effect	◯	◯	◯	◯	◯	full effect