DELAY IN INFRASTRUCTURE PROJECT

SITI NURFARAHIN BINTI SAMSUDIN

B. ENG (HONS.) CIVIL ENGINEERING

UNIVERSITI MALAYSIA PAHANG

UNIVERSITI MALAYSIA PAHANG

DECLARATION OF THESIS AND COPYRIGHT

Author's Full Name : **SITI NURFARAHIN BINTI SAMSUDIN**

Date of Birth : **1 APRIL 1993**

Title : DELAY IN INFRASTRUCTURE PROJECT

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)

930401-11-5150
New IC/Passport Number
Date:

(Supervisor's Signature)

MR. MOHAMMAD SYAMSUL HAIRI BIN SAAD
Name of Supervisor
Date:

Universiti Malaysia PAHANG
Engineering • Technology • Creativity

SUPERVISOR'S DECLARATION

I/We* hereby declare that I/We* have checked this thesis/project* and in my/our* opinion, this thesis/project* is adequate in terms of scope and quality for the award of the Bachelor Degree of Civil Engineering

(Supervisor's Signature)

Full Name : MR. MOHAMMAD SYAMSYUL HAIRI BIN SAAD

Position : LECTURER FKASA, UMP

Date : 14 JANUARY 2019

Universiti Malaysia PAHANG
Engineering • Technology • Creativity

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 : SITI NURFARAHIN BINTI SAMSUDIN

ID Number : AA15277

Date : 14 JANUARY 2019

DELAY IN INFRASTRUCTURE PROJECT

SITI NURFARAHIN BINTI SAMSUDIN

Thesis submitted in fulfillment of the requirements
for the award of the
Bachelor Degree in Civil Engineering

Faculty of Civil Engineering and Earth Resources

UNIVERSITI MALAYSIA PAHANG

DEC 2018

ACKNOWLEDGEMENT

I would like to express my sincere appreciation to my supervisor Mr. Mohammad Syamsyul Hairi Bin Md. Saad for the guidance, assistance, criticism, and suggestions on this study. To those who had contributed assistance and advice in this study, either directly or indirectly, yet their names are not cited here, they deserve my greatest gratitude. Millions thanks to all. Last but not least, I would like to thank my family members and my friends, who had given a lot of encouragement and motivation to complete this study.

ABSTRACT

Delays can be defined as the late completion of work compared to the planned schedule or contract schedule. It will effect due to the construction such as time overrun and cost overrun. But the delay can be minimizing if the cause was identified. The objective of this study was to identify the main causes, the effects, and methods of minimizing infrastructure project delays. This study was carried out based on the literature review and a questionnaire survey. A total of six groups were contributed to the main cause of construction delays, six factors that effects delays and six methods of minimizing infrastructure project delays were identified based on literature review. A questionnaire survey was distributed to the randomly respondent in Malaysia. The target respondent of question is management team include site supervisor, assistant engineer, engineer civil, consultants and contractors. The top three most important factors that contributed to the main causes of delays were improper planning and poor site management, low productivity of labors and equipment, and delay in preparing and approving document by the consultant during construction.

ABSTRAK

Kelewatan boleh didefinasikan sebagai kelewatan atau penangguhan kerja-kerja yang telah dijadualkan dalam kontrak yang memberi kesan kepada pembinanaan seperti melebihi kos dan masa pembinaan. Namun, ia dapat dikurangkan jika punca kelewatan dapat dikenalpasti. Objektif yang terlibat dalam kajian adalah untuk mengenal pasti punca-punca utama, kesan, dan kaedah-kaedah meminimumkan kelewatan dalam infrastruktur projek. Kaedah literatur dan soal selidik kaji selidik dipilih untuk mendapatkan data. Berdasarkan kajian literature, terdapat enam jenis kumpulan yang menjadi penyebab utama kelewatan pembinaan, enam faktor kesan kelewatan dan enam kaedah bagi mengurangi kelewatan telah dikenalpasti. Tinjauan soal selidik telah diedarkan kepada responden secara rawak di Malaysia yang terdiri daripada kumpulan pengurusan seperti penyelia tapak, pembantu jurutera, jurutera awam, perunding dan kontraktor. Antara faktor paling penting yang menyumbang kepada punca utama kelewatan ialah perancangan yang tidak menyeluruh dan pengurusan tapak yang lemah, kebolehkerjaan rendah dari segi tenaga kerja dan peralatan dan kelewatan perunding dalam menyediakan dan meluluskan dokumen semasa pembinaan.

TABLE OF CONTENT

CHAPTER 5 CONCLUSIONS AND RECOMMENDATION

LIST OF TABLE

LIST OF FIGURE

CHAPTER 1

INTRODUCTION

1.1 Introduction

The infrastructure industry is one of the major sectors that provide important thing for the development of an economy in Malaysia. Successful project are consider when its will completed on time, within the budget that given, with the great quality of construction, following the specifications and will be safe to user. Besides, it will are determined by functionality, profitability to contractors and absence of claims after the finished of the project. Nowadays, in Malaysia has a lot of projects experience extensive delays and thereby exceed initial time and cost estimates. The delays are classified or categorized into four basic ways which is critical or non-critical delays, excusable or non-excusable delays, concurrent delay and compensable or non-compensable delays (El-Saadi (1998).

The delay of construction occurs when a project that was agreed and scheduled can't achieve the target within the contract period. This problem is usually due to the delays of project start-up times, delays in payments from owners, budgeted expenses, failure to meet customer requirements, and others. This not only affect corporate finance ability, but also damage in company reputation and influence that social and development of the nation economy. According to Abdullah et al. (2010), project team should acquire a deep understanding of the factors that would affect projects in order to help projects to be completed on time.

Based on Kaza, Ulibeyli, and Tuncbilekli (2012), delay under construction can cause some changes in a project like late completion, lost productivity, acceleration, add cost and termination of the contract. Time the issues fulfil or delay continuously for many years. Delay in the project means that what not completion from the project in a certain period as sanctioned in the contract. Time fulfil is a common problem in many infrastructure projects, that show many parties. Infrastructure delay usually has a misunderstanding between contractor, subcontractor and owner or clients. According to the JCT form, under clause 25, details relevant events which are beyond the control of the contractor. If the occurrence of any of those contingencies occur so as to cause the works to take the longer to complete then, because those contingencies are not at the contractor's risk, that much more time must be added to the contract period.

According to Joint Contracts Tribunal (JCT) 1980 the contractor must to identify any cause of delay or likely delay to progress and requires the contractor to estimate the effect on the date for completion for each delay event and to provide all the necessary particulars demonstrating how such an effect has been calculated. For example, an extension of time (EOT) assessment techniques should be used to demonstrate any such delay to the date for completion. .The important is to recognize that it is only delayed to the progress of the works that the contractor has to notify about the effect of the project on the date of completion.

In addition, weather or ground conditions may impair the infrastructure of the delay because if a place is raining, it will cause the work progress will stop and the ground conditions may change after raining. From New Straits Times, 22 January 2018 MIC chairman Datuk R. Goonasekaran says that, "Due to the red soil in the area, each time it rains, the contractor has to stop earthworks and this resulted in some setbacks in the progress".

According to Mehdi Riazi, Salman Riazi & Lamari Fiona (2013), delays in construction projects have become a major obstacle in the last decade and is an even more serious issue in developing countries and based on them in Malaysia, delay is one of the most significant problems with major concerns are given to public sector projects as it has a direct relationship with the public. This could endanger the safety of the public when a project

delay over a long period of time is particularly a delay in road or bridge project as it may become the accident in the future.

1.2 Problem Statement

Delays in a construction project can be such a problem and a very serious issue for the parties involved such as client, consultants, and contractors. There are many adverse effects that can occur as the results of the delays. To reduce this problem from occurring, site management should be made carefully. Since, Malaysia develops to industrial direction, infrastructure industry's role enhancing to the large. When the project is delayed, the client or customer will have the effect like the road or bridge cannot be used but they had to postpone their initial planning too and the cost of overruns also will be increased. This issue is a main of problem in the infrastructure industry not only in Malaysia but the phenomena is a global problem for construction industry worldwide.

In the study of Yusof, Mohammad, and Mat Derus (2010), the main conclusions of the research are that delays due to nominated sub-contractor or supplier are the most significant causes of excusable delays. Meanwhile delay due to architect instruction, delay in late information given by architecture and delay also due to failure of employer to provide access to site are the most significant of excusable compensable delays in the building projects.

Elina (2008) studied the project construction delay which is focus in Johor Bahru about the reasons and impact of construction delays. Although our research are in the same state, but my research would be more concentrate on Malaysia in infrastructure project. Sambasivan and Yau conducted a survey on the causes and effects of delays in Malaysian Construction Industry, which was focus on the reasons and impact to the project delays in all Malaysia. In a study by Alhomidan (2015), a survey of contractors' viewpoint was conducted to investigate the top causes of cost overrun at the infrastructure projects in Saudi Arabia. A list of 41 factors of cost overrun causes was considered. Among these factors, it was concluded that according to opinions of the responding contractors the top causes of cost

overrun in infrastructure projects in Saudi Arabia are internal administrative problems, delay of payments, poor communication between construction parties and delays in decision-making.

The effect of delay in construction cause result in a clash, time overrun, damage on the reputation, decreasing in the growth of construction industry. The construction is a risky industry with plenty unpredictability due to both of external and internal factors which is influence the work progress. There is part delay source which can cause construction project is failed to be delivered on time. In order to improve the construction delays in Malaysia, Sambasivan and Yau studied the causes and effects of delays in Malaysian Construction Industry. Furthermore, Kang studied causes, effect, and methods of minimizing delay in construction projects. By referring to the all statement above, it is important to conduct a study on delays in infrastructure project to find out the key main cause for the delay, the effect of delays and what methods will be used to minimize deferment in the infrastructure. If we can prevent the cause of delay, it will be a big help to the construction of our industry. Contractor contractors and project managers can manage their projects in the future.

1.3 Objective of Study

The aim and objective of this case study is to analysis the delay in infrastructure project. To achieve the aim of this study, the following objectives have been set as:

i. To identify the main cause of delay in infrastructure project.
ii. To study the effect of delay in infrastructure project.
iii. To identify the method for minimizing infrastructure project delay.

1.4 Scope of Study

The scope of this study will be focusing on the delay in an infrastructure project in Malaysia in road and bridge sector. This study is needed to evaluate the level of respondent understanding by questionnaire survey. The questionnaire will be distributed to the management team include site supervisor, assistant engineer, engineer civil, consultants and contractors are selected randomly as the respondent. For this study, data is carried out through a questionnaire. This study focused on to identify the main cause of delay in infrastructure project, the effect of delay in infrastructure project and the method for minimizing infrastructure project delay.

1.5 Significant of Study

The findings from this research will create awareness on the construction of the sector by providing information on the source of the usual delays or experience of the construction of the company. It will also contribute to the solution to overcoming the source of delay that occurs on infrastructure industry. Hence, raising awareness and knowledge of contractors and team projects to solve the delay problem in Malaysia.

In addition, this research can explain the risks or delays of resources by categories that may occur at any party in the construction of the project as well as the outside environment. Hence, the findings of this research can provide guidance to the construction of companies in Terengganu district to manage their projects and help them provide limited resources to the risk of resource delays that can affect and bring damage to the project.

Other than that, the reason why it is needed to solve this problem is to identify the method for minimizing infrastructure project delay. The persons that get benefit when this problem solve was all side especially the local authorities because of the proper strategies for reducing the delay in the project so they do not need to worry about the extension of time of the project.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The purpose of literature review was to study the theoretical background about the Delay in Infrastructure Project through the journals, books, internet and articles. The study was related to the aim and objectives of this study. This chapter discuss on the definition of delay, types of delay, cause of delay, effect of delay, methods of minimizing construction delays, extension of time (EOT), liquidated damages and types of infrastructure (road and bridge),

2.2 Types of Delay

According to Ravisankar K.L. et. al (2014), delays are considered critical, excusable, non-excusable, and concurrent delays, which are responsible for the delay are between the owner or the consultant, the contractor as well as the third party fault Excusable delays can be categories as compensable delays which caused by the owner and non-compensable which cause by the third part. The type of delays are been categorized as critical delays, excusable delays, and concurrent delays. Meanwhile, excusable delays can be classified as compensable delays and non-compensable delays.

2.2.1 Critical Delay

In the construction schedule, they will have a lot of activities that are independent and depend on each other, which is called path critical. If critical activities are not well run, this will lead to critical delays which will lead to further periods in the project). Ravisankar K.L. et. al. (2014) indicates that critical delays have an impact on the date of occurrence and project completion date. The critical path is the longest path along the project or network schedule. It has no sagging or floating; therefore all critical path activities must be completed as scheduled. The date of completion project will begin if critical activities are delayed. The activities that impacted the completion date of the project will depends on the contractor's schedule and schedule and contract requirements for sequential and phasing. Delays in critical paths should be emphasized as it requires time extension to reach the completion date of the project.

2.2.2 Excusable Delays

Excusable delay is beyond the control of contractor and without any parties fault or negligence. The contractor will not terminate if the delay is excusable. Other than that, Ravisankar K.L. et. al (2014) defines that delays occur due to unpredictable events that are not controlled by contractors and subcontractors as a excusable delay. The following event will be considered as an excusable delays that are general by labor strikes, fires, flood, owner-requested changes, error and omissions in the plans and specification, unusual climate and lack of action by government bodies such as building inspection.

2.2.2.1 Compensable delays

According to Fugar and Agyakwah-Baah (2010), they are state that the compensable delay are caused by the owner or the owner's agents. An example of this type of delay would be the late release of drawings from the owner's architect. An excusable compensable delay usually leads to a schedule extension and exposes the owner to financial damages claimed

by the contractor (Soon, 2010). In this case, the contractor incurs additional indirect costs for extended field office and home office overhead and unabsorbed home office overhead.

2.2.2.2 Non-Compensable delays

Fugar and Agyakwah-Baah (2010), they mention that the non-compensable delays are caused by third parties or incidents beyond the control of either the owner or the contractor and are not attributable to any of the parties. Examples typically include acts of God, unusual weather, strikes, fires, acts of government in its sovereign capacity, etc. In this case, the contractor is normally entitled to a time extension but no compensation for delay damages (Soon, 2010).

2.2.3 Concurrent Delays

Concurrent delays is brings effect on the other activity and cause the project completion time has to be recalculated. Based on research by Ravisankar K.L. et. al. (2014), there is the ways to identify the classification of concurrent delays that affect the entitlement of a contractor to have an addition compensation for time extension or the responsibility to the liquidated damages through the contract language. Liquidated damages occur when one party fails to fulfil the obligations contract and compensation has been collected by injured party. Firstly, if excusable and non-excusable delays occur concurrently, the contractor will accept the extension of time. If there is the excusable delay with compensation occur concurrently with excusable without compensation delays, the contractor is given extension time but does not dissolve the contract. Last but not least, if two excusable with compensation delay occur concurrently in the project, both times extension and the liquated damages are entitled to the contractor.

2.3 Cause of Delay

Infrastructure delay is considered to be one of the most recurring problems in the construction industry and it has an adverse effect on project success in terms of cost, time, quality, and safety. There are several factors that cause delay in construction. Delay may be caused by clients, users, consultants, designers, owners, contractors and suppliers. Ibrahim Mahamid, et al worked on finding out the causes of delay in road construction projects and their severity according to contractors and consultants through a questionnaire survey. Cost, time, and quality have proven their importance as the prime measures for project success.

According to Ahmed, et al delays on construction project is a universal phenomenon. They are usually accompanied by cost overruns. Delay has a negative effect on clients, contractors, and consultants in terms of growth in adversarial relationships, mistrust, litigation, arbitration, and cash-flow problems. A project may be regarded as a successful endeavour until it satisfies the cost, time, and quality limitations applied to it. However, it is not uncommon to see a construction project failing to achieve its goal within the specified cost, time, and quality.

The causes of delays where categorized into eight related groups namely:

1) Client related factors: finance and payments of completed work, owner interference, slow decision making and unrealistic contract duration imposed by owners.
2) Contractor related factors: delays caused by subcontractor, site management, improper construction methods, improper planning and errors during construction, and inadequate contractor experience.
3) Consultant related factors: contract management, preparation and approval of drawings, quality assurance and waiting time for approval of test and inspection.
4) Material related factors: quality of material and shortage in material.
5) Labor and equipment related factors: labor supply, labor productivity and equipment availability and failure.
6) Contract related factors: change orders and mistakes or discrepancies in contract document.

7) Contract relationship related factors: major disputes and negotiations, inappropriate overall organizational structure linking to the project and lack of communication between the parties.
8) External factors: weather condition, regulatory changes, problem with neighbours and unforeseen site condition

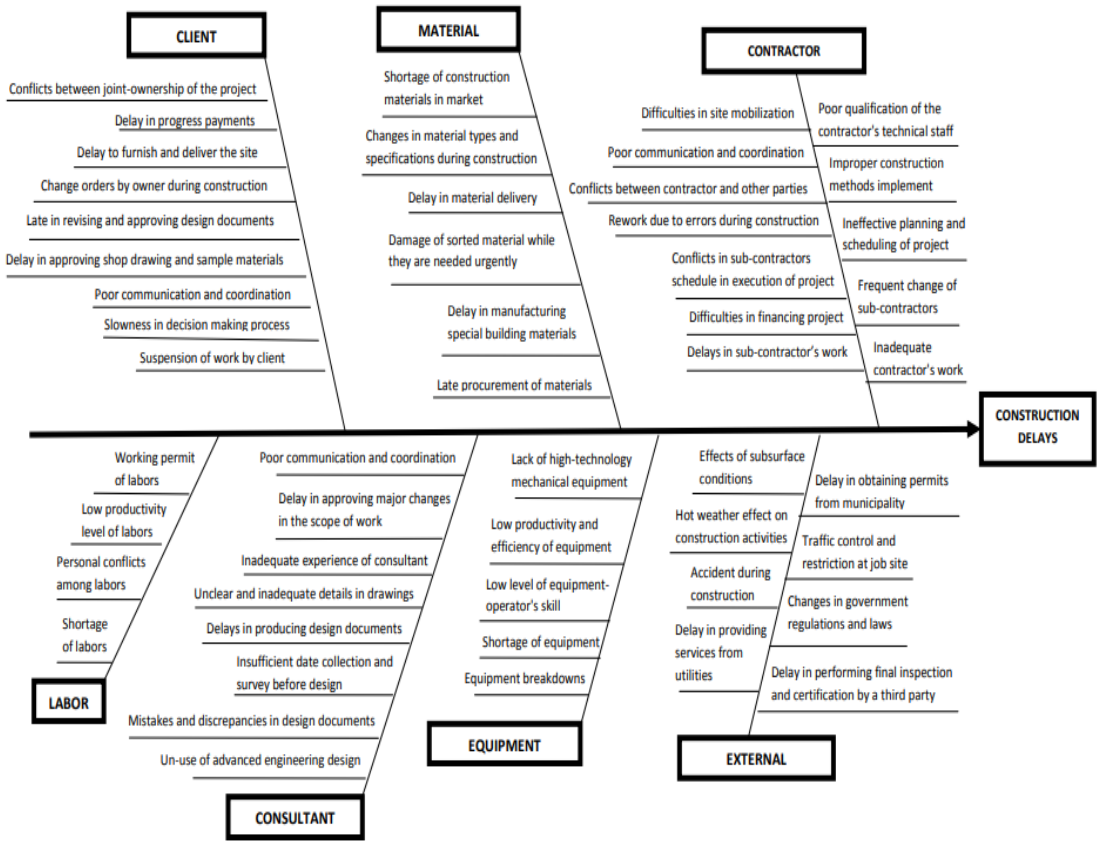

Figure 2.3.1: Factors That Contributed To the Causes of Delays

Murali Sambasivan, et al studied the delay factors and their impact on project completion in Malaysian construction industry. The study identified ten most important causes of delay from a list of 28 different causes. Ten most important causes of delay were:

1) Contractor's improper planning.
2) Contractor's poor site management.
3) Inadequate contractor experience.
4) Inadequate client's finance and payments for completed work.

5) Problems with subcontractors.
6) Shortage in material.
7) Labour supply
8) Equipment availability and failure.
9) Lack of communication between parties.
10) Mistakes during the construction stage

Assaf, et al identified 56 main causes of delay in Saudi large building construction projects and their relative importance. A survey of contractors, owners, and architects/engineers was conducted on the causes of delay factors in large building projects in Saudi Arabia. The survey showed that all three groups generally agree on the ranking of individual delay factors. The factors were categorized into nine major groups and were ranked. The nine groups were material, manpower, equipment, financing, changes, government relations, scheduling and controlling, environment, and contractual relationships. Based on the contractors surveyed, the most important delay factors were:

1) Preparation and approval of shop drawings.
2) Delays in contractor's progress.
3) Payment by owners.
4) Design changes.

Chan and Kumaraswamy conducted a research on potential delay factors in Hong Kong construction projects as seen by clients, contractor and consultants. Five principal factors are identified: poor risk management and supervision, unforeseen site conditions, slow decision making, client-initiated variations, and work variations.

Frimpong, Oluwoye, and Crawford conduct a survey to identify the significant factors contributing to delay and cost overruns in Ghana groundwater construction projects. They are monthly payment difficulties from agencies, poor contractor management, material procurement, poor technical performances, and escalation of material prices.

Sambasivan and Soon identified ten most important causes of delay in construction projects. They are contractor's improper planning, contractor's poor site management, inadequate contractor experience, inadequate client's finance and payments for completed work, problems with subcontractors, shortage in material, labor supply, equipment availability and failure, lack of communication between parties, and mistakes during the construction stage. A similar study in Malaysia by Alaghbari, Kadir, Salim, and Ernawati indicated that clients, contractors and consultants agreed that financial problems were the main factors and coordination problems were the second most an important factor causing a delay in construction projects in Malaysia.

Long, Ogunlana, Quang, and Lam studied the problems on large construction projects Vietnam. They grouped the problems in 5 major factors: incompetent designers/contractors; poor estimation and change management; social and technological issues; site related issues; and improper techniques and tools.

Wijekoon and Attanayake (2012) examined cost overrun on road construction projects in Sri Lanka. They noted factors influencing cost overruns in road projects through a literature survey. Further, they used a questionnaire survey to identify significant factors influencing cost overruns in road projects. According to them, the critical factors were delays in making payment, delays in utility relocation, and design changes during the construction phase, cost escalation, and land acquisition-related issues.

Choudhry, Nasir and Gabriel (2012) explored time delays and cost overruns in highway projects in Pakistan through a questionnaire survey. They collected responses from 25 contractors, 21 consultants, and 10 clients. They ranked a total of 30 time delays and 28 cost overrun factors using the relative importance index (RII). They revealed that scope changes and additional work, inappropriate government policies and priorities, improper planning, price escalations on essential construction materials, and land acquisition were major factors for time delays and cost overruns. According to them, the most important causes were delay in making payments to contractors, the conditions under force majeure, financial difficulties faced by clients, and land acquisition and settlement.

Patil et al. (2013) examined the causes of delay in Indian transportation infrastructure projects extensively. Based on the literature review, they prepared a questionnaire with 64 possible causes. After analysis of data, they concluded that the problem of delays in transportation infrastructure projects was frequent and notable. According to them, the five most important causes of construction delays in transportation infrastructure projects were land acquisition, environmental impact of the project, financial closure and change of orders by the client, poor site management, and poor supervision of contractors.

Dutta and Dutta (2015) investigated the causes of time delays and cost overruns in transportation sector projects in Bangladesh and identified project size, organisational failures, and economic factors as the main causes.

Singh (2009) investigated the various issues related to time delays and cost overruns in publicly-funded infrastructure projects in India. He analysed a dataset of 894 projects from 17 infrastructure sectors. He revealed that the contractual and the institutional failures were the primary causes of time delays and cost overruns.

Table 2.3.1: Summaries of Previous Studies of the Causes of Delay.

Researchers	Country	Major cause of delay
Murali Sambasivan	Malaysia	- Contractor's improper planning and poor site management. - Inadequate contractor experience. - Inadequate client's finance and payments for completed work. - Problems with subcontractors. - Shortage in material. - Labour supply. - Equipment availability and failure. - Lack of communication between parties. - Mistakes during the construction stage

Assaf	Arab Saudi	- Preparation and approval of shop drawings. - Delays in contractor's progress. - Payment by owners. - Design changes.
Chan and Kumaraswamy	Hong Kong	- Poor risk management and supervision. - Unforeseen site conditions. - Slow decision making. - Client-initiated variations. - Work variations.
Frimpong, Oluwoye, and Crawford	Ghana	- Difficulties monthly payment from agencies. - Poor contractor management, material procurement. - Poor technical performances. - Escalation of material prices.
Alaghbari, Kadir, Salim, and Ernawati	Malaysia	- Indicated that clients, contractors and consultants agreed that financial problems.
Mezher and Tawil	Lebanon	- The perspective of owners, contractors and architectural/engineering firms. - Financial issues.
Wijekoon and Attanayake	Sri Lanka	- Delays in making payment. - Delays in utility relocation. - Design changes during the construction phase, cost escalation, and land acquisition-related issues.
Choudhry, Nasir and Gabriel	Pakistan	- Delay in making payments to contractors. - The conditions under force majeure. - Financial difficulties faced by clients. - Land acquisition and settlement.

Patil	Indian	- Land acquisition. - Environmental impact of the project/ - Financial closure and change of orders by the client. - Poor site management. - Poor supervision of contractors.
Dutta and Dutta	Bangladesh	- Project size. - Organisational failures. - Economic.
Singh	India	- Contractual and the institutional failures

2.4 Effect of Delay

The study by Kikwasi, (2012) also revealed that disruption and delays in construction project create the following consequences; negative social impact, misunderstanding causing dispute, time overrun, resources wasting in relation to equipment as well as labour, and work going beyond budget. Most construction contract deals with delays in construction projects and disruption through making provisions inside a contract that a contractor ought to make submission of claims for time extension and cost recovery after proper notification that events met are expected to or are resulting in delays to completion (Hamzah et al., 2011 and Briamah, 2009) cost budgeted as well as specified quality outcome in other unanticipated negative effect and failure to achieve the beset time. Mostly, in times where projects are being delayed, projects are one or the other protracted or the time accelerated and thus, invites extra cost (Fawzy et al., 2012 and McGraw et al., 2009).

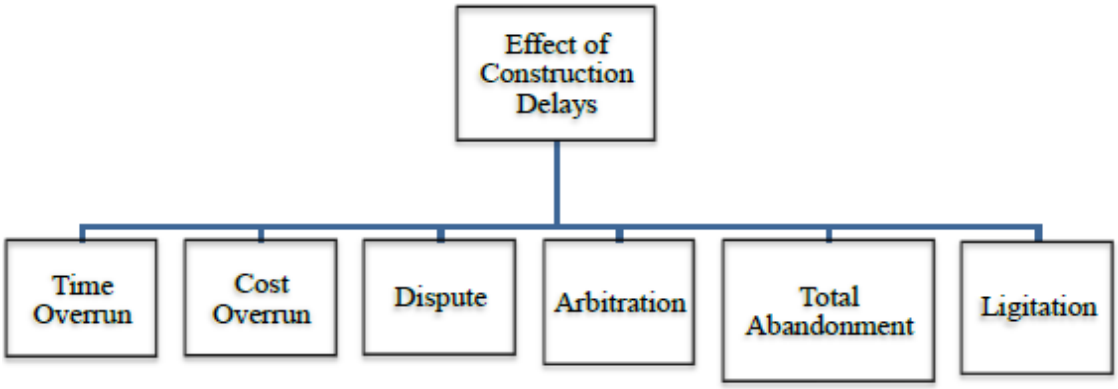

Figure 2.4.1: Effects of Construction Delays

2.4.1 Time Overrun

According to Ameh, John O. and Osegbo E.E. (2011), the time overrun is defined as an extension of time in addition to the agreed estimated and actual completion date. Time overrun affect the project clients projects, contractors and all construction project participants. The contractor will have to spend for extra workers to reach the completion date or pay the penalty and lose one profitable contract.

Besides, according to Taher E.F. and Pandey R.K. (2013), time overrun in the phase of construction activity will also lead to cost overrun in the overall construction project. Aziz and Remon F. (2013) also prove that time is one of the major risks of resource delays in industrial construction. Memon A.H. (2014) states that elapsed time is a major problem that needs to be regulated as it is a key indicator of the success project.

Other than that, Azlan, Smith, Pitt, and Chan (2010) state that it is common issues with project time overrun faced in Klang Valley. The study focus on contractor perception about project time overrun. Seven factors that contribute to delay were identified through literature review, namely contractors financial difficulties, construction mistakes and defective work, labour shortage, coordination problems, shortage of tools and equipment, material shortage and poor site management. Of those factors, the three most important

factors were found to be labour shortage, contractors‟ financial difficulties and construction mistakes and defective works.

2.4.2 Cost Overrun

According to Salunkhe A.A. and Patil R.S. (2014), cost overrun can be defined as the exceeding of estimated budget for the project which bring a huge effect to the delayed construction project in Ghana. He also found that the common reason which leads to project cost overruns include under estimation of project cost, unrealistic project design, project task exceeds the assigned duration and changing of project scope. Besides, Singh (2009), state that cost overrun is the excess of the actual cost that was planned or budgeted for the project from the conception phase to the construction and finishing phase. It can be referred to sometimes as cost escalation, cost increase or budget overruns. It can also be explained as the difference between the actual cost of the project and the initial cost budgeted.

By referring to Indhu and Ajai (2014), a common risk to the project is a failure to start work on time. Very long delays can be caused by variations, legal or planning difficulties, shortage of information, lack of funds or other resources, and other reasons which may lead to a delay of the site possession. Delay caused by contractors attributes most often is classified into five main items which are the failure to evaluate the site or design, a management problem, inadequate resources, poor workmanship, and subcontractor failures. Other causes of delay are attributed to improper management of materials and loaded by lack of an explicit and detailed model of the project materials management process and due to lack of management where less attention is paid to resources allocation.

Financial problem of the contractor is the most important cause. Inefficient site management is certainly another key factors affecting time performance of most construction projects in India. This is perhaps due to a lack of formal training among the site professionals who usually develop their supervisory skills by experience. The finding support by RII where material shortage was one of the key factors affecting time delay and result also show that

slow decision from the owner is the reason the overall delay by referring to Doloi, Sawhney, Iyer, & Rentala, 2012.

2.4.3 Dispute

Disputes are one of the main factors which prevent the successful completion of the construction project. Thus, it is important to be aware of the causes of disputes in order to complete the construction project at the desired time, budget and quality.

The main factor contributed to dispute and delays in construction project by clients when they take longer time than stipulated in the contract to certify the claim. According to Yee and Abdul Rahman (2010), delay in certification by parties involved may also lead to late payment. The parties involved may delay in approving the application for payment claim due to certain reasons which may arise because of his own or other parties fault, for example, claims of the design and construction administration services. The obligation of the design professional to issue payment certificates, for instance, has long been a tedious and dreaded task and therefore often creates numerous liability problems. Although the only real purpose of issuing payment certificates is to inform the owner or lender that the contractor is entitled to payment, these certificates are often used by potential claimants as a basis for many types of legal actions. This obviously leads to late payments in the construction project.

Susila (2012) found in a construction project, on the one hand, the contractor's attention is in the completion of the project in accordance with the specified schedule and attempt to make financial gain, while on the other hand, the owner needs excellent facilities at economical prices. The purpose of each party seems contradictory in achieving their goals, such circumstances could lead to conflict. The causes of the conflict can be caused by the owner, consultants, contractors, contracts and specifications, human resources, and project conditions.

2.4.4 Arbitration

Arbitration is the process where the settlement of dispute occurs between two parties, one party is government body (Client) and another is a private party (Contractor, supplier, service provider) and third person is arbitrator or arbitral tribunal. Arbitral award is final and binding upon the parties.

2.4.5 Total Abandonment

According to Alusegun (2011), project abandonment can be referred to as stopping or terminating ongoing projects due to the many difficulties and constraints or problems faced during the phases the life cycle of the project in such a way that it became impossible to continue at that time. Many construction and non-construction projects have been abandoned in various their life cycle stages cause many losses to stakeholders. To the owner or clients loses in terms of capital and other resources including time. To contractors and consultants, they are losing in terms of time and waste of expertise. Normally most of projects are abandoned due to too long delays. The contractors, consultant or owner can abandon the project.

In addition, Yap (2013) states that in 2000 there were about 54 abandoned housing projects in the country with an estimated value of RM7.5 billion. Project abandoned is often caused by inadequate planning, inadequate funding, and inflation, late payment of political factors, inefficient management, incorrect inadequate budgeting, design and control over and above all disputes between stakeholders.

Project abandonment often results from inadequate planning, inadequate finance, inflation, delayed payments political factors, incompetent management, wrong estimates, design and inadequate cost control and above all dispute amongst stake holders.

2.4.6 Litigation

Litigation can be defined as an action taken to court to enforce certain rights. Charles et. al states that the ligation is considered to be the third most important delay effect on industrial construction. This will happen when the client refuses to accept a surprise or accepts the risk without receiving due compensation and the litigation of action will be taken. According to Sambasivan M. and Soon Y.W. (2007), there are several parties involved in litigation using the project as the most appropriate alternative to resolving the dispute. Results from Aibinu A.A. and Jagboro G.O (2002), litigation is placed sixth in the position of risk of delay in project construction

2.5 Type of Infrastructure

Infrastructure is the fundamental facilities and systems serving a country, city, or other area including the services and facilities necessary for its economy to function. Infrastructure is composed of public and private physical improvements such as roads, bridges, tunnels, water supply, sewers, electrical grids, telecommunications (including Internet connectivity and broadband speeds). In general, it has also been defined as "the physical components of interrelated systems providing commodities and services essential to enable, sustain, or enhance societal living conditions."

2.5.1 Types of Road

The road is a thoroughfare, route, or way on land between two places that have been paved or otherwise improved to allow travel by foot or some form of conveyance, including a motor vehicle, cart, bicycle, or horse. There are four main road categories in Malaysia which are Expressway, Federal Road, State Road and Local Road. First, expressways called access-controlled high-speed routes, are all dual carriageways, which have two or three lanes on each side. The maximum speed limit is 110 Km/h, but this limit is further reduced to 90 Km/h in mountainous areas and near urban centers. Secondly, federal roads or primary roads,

which have one or two lanes and expand to four lanes in places with heavier traffic, are funded by and fall under the jurisdiction of the Federal Government of Malaysia. The maximum speed limit on federal roads is 90 Km/h. third, State roads, or secondary roads which have one lane, are mostly found on the outskirts of cities, in older sections of cities, and in rural areas. The speed limit is 60 to 90 Km/h, which is indicated on road signs. Lastly is roads maintained by local authorities are categorised in this typical way three letters followed by a number. The first of the three letter code is taken from the state road codes and the rest of the letters may be the initials of a city's names.

2.5.2 Types of Bridge

A bridge is a structure built to span physical obstacles without closing the way underneath such as a body of water, valley, or road, for the purpose of providing passage over the obstacle. There are many different designs that each serve a particular purpose and apply to different situations. Designs of bridges vary depending on the function of the bridge, the nature of terrain where the bridge is constructed and anchored, the material used to make it, and the funds available to build it. There are seven main bridge categories which are beam bridge, truss bridge, cantilever bridge, arch bridge, tied arch bridge, suspension bridge and cable-stayed bridge. Beam bridges also known as stringer bridges, are the simplest structural forms for bridge spans supported by an abutment or pier at each end. No moments are transferred throughout the support, hence their structural type is known as simply supported. Next, a truss bridge is a bridge whose load-bearing superstructure is composed of a truss, a structure of connected elements usually forming triangular units. A cantilever bridge is a bridge built using cantilevers, structures that project horizontally into space, supported on only one end. An arch bridge is a bridge with abutments at each end shaped as a curved arch. Arch bridges work by transferring the weight of the bridge and its loads partially into a horizontal thrust restrained by the abutments at either side. A tied-arch bridge is an arch-bridge in which the outward-directed horizontal forces of the arch (es) are borne as tension by a chord tying both arch ends, rather than by the ground or the bridge foundations. A suspension bridge is a type of bridge in which the deck (the load-bearing portion) is hung

below suspension cables on vertical suspenders. The first modern examples of this type of bridge were built in the early 1800s. A cables-stayed bridge has one or more towers from cables support the bridge deck.

2.6 Methods of Minimizing Construction Delays

When a construction delay occurs, there is no question that the Owner suffers financially. But the extent to which an Owner can recover its loss of income from the Contractor, and more importantly minimize the risk that such delays will occur, depends largely on how the construction contract was drawn up.

Sadi A. Assaf, et al also recommended the following points in order to minimize and control delays in construction projects.

Owners should give special attention to the following factors:

1) Pay progress payment to the contractor on time because it impairs the contractor's ability to finance the work.
2) Minimize change orders during construction to avoid delays.
3) Avoid delay in reviewing and approving of design documents than the anticipated.
4) Check for resources and capabilities, before awarding the contract to the lowest bidder.

Contractors should consider the following factors:

1) Enough number of labors should be assigned and be motivated to improve productivity.
2) Contractor should manage his financial resources and plan cash flow by utilizing progress payment.
3) Administrative and technical staff should be assigned as soon as project is awarded to make arrangements to achieve completion within specified time with the required quality, and estimated cost.

Consultants should look to the following points:

1) Reviewing and approving design documents.
2) Consultants should be flexible in evaluating contractor's works.

Architects/design engineers should focus on the following points:

1) Producing design documents on time.
2) Mistakes and discrepancies in design documents have to be taken care off.

2.7 Extension of Time (EOT)

Hamid and Torrance (2006) identified extension of time (EOT) as an excusable delay that occurs when the contractor is delayed by occurrences beyond his control. The Government of Malaysia P.W.D. Form 203A (Rev. 10/83) form of contract is widely used in public sector construction projects (Government of Malaysia, 1983). It provides 11 clauses whereby the contractor is eligible for an extension of time. Data related to extension of time were:

1) Extension of time (EOT) due to clause 43a, force majeure.
2) EOT due to clause 43b, exceptionally inclement weather.
3) EOT due to clause 43c, direction given by Superintending Officer (SO) consequential upon disputes with neighboring owner.
4) EOT due to clause 43d, loss or damage occasioned by allowable contingencies;
5) EOT due to clause 43e, Superintending Officer's instructions.
6) EOT due to clause 43f, contractor not having received in due time necessary instructions, drawings, levels or instructions in regard to the nomination of subcontractors and/or suppliers.
7) EOT due to clause 43 g, delays in giving possession of site.
8) EOT due to clause 43 h, any action due to local combination of workmen strike, or lockout affecting any of the trades employed upon the works.

9) Extension of time due to clause 43i, delay on the part of artists, tradesmen or others engaged by Government in executing work not forming part of the contract.
10) EOT due to clause 43j, contractor's inability, for reasons beyond his control, which he could not reasonably have foreseen at the date of closing tenders.
11) EOT due to clause 43k, delays on the part of nominated suppliers.

2.8 Liquidated Damages

According to Twyford (2007), in the construction contracts liquidated damages clauses are usually inserted to encourage compliance with time provisions, in particular, completion of the work and payment on time. In regard to completion of the work, a typical clause will provide that if the work is not completed by the extended date for completion, liquidated damages, at the daily rate provided by the schedule, shall become due and payable. A similar provision is made for overdue payments under the contract.

Liquidated damages clauses have the virtue of informing both parties to a contract in advance what the damages payable for an identified breach will be at the time of entering the contract. This can be equal advantage to the party who must pay the damages as it is to the party receiving the damages. The upper limit of the damages payable is fixed and a party can take this into account in the initial negotiations. It is not uncommon for a contractor who knows he or she cannot complete within the required time to add the liquidated damages equivalent of the time overrun to the tendered price.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

Methodology consists of several procedures or methods which can be a guideline while doing this study. The stage of the method is arranged in sequence to ensure the good quality of the study and the objectives of the study can be achieved. Besides, the methodology is important to ensure that the progression of the study will be done right on time and avoid careless during the process.

Based on Figure, the step is initiated with discussion field selection and meeting supervisor. In this step the title identification and choosing suitable title involved. Then, it followed by the objective determination and problem identifying. The problem is identified based on the current issues for the selected topic. As the problem is determined, the objective of the study is defined. The objective of the study is defined to achieve the determined goals. The scope of study is a method to specify the limit of the study.

The next step is getting the information for the literature review. It can be a reference in order to develop a questionnaire and interview question. In addition, the purpose of literature review is to gain more understanding for this topic. The literature review is based on other resources such as journals, books, previous thesis, proceeding papers, internet and newspapers.

The other step will be the data collection and data analysis. Then, get the information from site survey, interview and questionnaire form. The data will be collected through distributing the questionnaire and conducting the interviews with the respondents involved. Then the data will be analyzed by using the software such as Microsoft Excel.

As the result obtained, the summary and conclusion will be suggested to improve the performance of the study. The recommendation is also step in this step for those who have an interest in order to continue this case study in future.

3.2 Literature Review

The literature review was done through internet, construction management books, and engineering journals. By referring to the previous literature, the information from the main causes of infrastructure project delays, effects of infrastructure project delays, and the method to minimizing of infrastructure project delay would be used to develop the questionnaire survey in order to collect data from the targeted respondent.

3.3 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. Shuttleworth27 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".

3.4 Research Setting

The research is conducts in the Malaysia.

3.5 Population and Sample

The population of respondents for the questionnaire is the site supervisor, assistant engineer, engineer civil, consultants and contractors involved in construction project in Malaysia. The sampling method is probability samplings, the randomly sampling method is chooses because it has the advantage of no bias in sampling, all the subjects in the population have an equal chance to be selected as a respondents.

3.6 Data Collection

Data which is obtained from the questionnaires will be used to analyse with an appropriate method which may result in the successful of the research. Data collection from the different type of questionnaire would be analyzed and answered to the objective of the study.

3.7 Questionnaire Design

A questionnaire survey was designed based on the objectives of the study, which are causes of infrastructure project delays, effects of infrastructure project delays and the method minimizing of infrastructure project delays. A questionnaire survey was developed to get the opinion and understanding from the experienced respondents regarding to the construction delays problem. The questionnaires are all classified into 4 sections:

a) SECTION A : Respondent and Organization Background
b) SECTION B : Perspective of Delay in Infrastructure Project
c) SECTION C : Causes and Effects of Infrastructure Project Delays
d) SECTION D : Method of Minimizing Infrastructure Project Delays

3.7.1 Section A: Respondent and Organization Background

In this section, we are trying to obtain the respondents' information. The questionnaire includes:

- ✓ The respondent organization
- ✓ The experience of the respondent in the infrastructure project

3.7.2 Section B: Perspective of Delay in Infrastructure Project

This section is designed to knowing the perspective of delay in infrastructure project from the respondent. The questionnaire includes:

- ✓ Delay in infrastructure project
- ✓ The main cause and effect of the delay in infrastructure project
- ✓ The method to minimizing the delay in infrastructure project

3.7.3 Section C: Causes and Effects of Infrastructure Delays

For this section, there is a separate by two (2) parts for the respondent to complete. Part 1 is about the major cause of delay and the second is about the effect of delay in infrastructure project**.**

Part 1:The Major Cause of Delay

This section is designed to evaluate the factor that contributes to the main causes of infrastructure delays from the previous literature review. There are in total of six (6) groups of causes for delay in infrastructure project:

a) Client
b) Contractor
c) Consultant

d) Materials
e) Labor and Equipment
f) External factors

The questionnaire is mainly based on Likert's scale of 5 ordinal measures from 1 to 5 according to level of contributing.

(5) = Strongly Agree
(4) = Agree
(3) = Moderate
(2) = Disagree
(1) = Strongly Disagree

Part 2:Effect of Infrastructure Delays

For this section, respondents should evaluate the effects of infrastructure delays based on their working experience and their own judgment. There are consists of 6 impacts of infrastructure delays, i.e. time overrun, cost overrun, dispute, arbitration, litigation, total abandonment. The questionnaire is mainly based on Likert's scale of 5 ordinal measures from 1 to 5 according to level of contributing.

(5) = Strongly Agree
(4) = Agree
(3) = Moderate
(2) = Disagree
(1) = Strongly Disagree

3.7.4 Section D: Method of Minimizing Infrastructure Delays

This section is to identify the effective methods of minimizing infrastructure delays. There are some of methods are identified for this questionnaire used. The questionnaire is mainly based on Likert's scale of 5 ordinal measures from 1 to 5 according to level of contributing.

(5) = Strongly Agree
(4) = Agree
(3) = Moderate
(2) = Disagree
(1) = Strongly Disagree

3.8 Data Analysis

Data analysis is very important step to get the result of the study. By this analysis, the conclusion of the project can be made to determine either the objective of study is achieved or not. In this study analysis, all the result data from table are analysed using frequency analysis and average index. For this study the type of data analysis is using SPSS. The data from Likert scale study and Frequency Analysis will be analyse using SPSS. The summary of the study then presented with the conclusion of the study.

3.8.1 Software Statistical Package for Social Sciences (SPSS)

SPSS software contains variety of data analysis method that can applied by easily. The application available in SPSS software is a method of descriptive statistical analysis, analysis of general linear model, analysis manageable and so on. But for the purpose of this study, I just use only the method of statistical analysis. Frequency and descriptive analysis method. Basically, this method showed the percentage of times and frequency of each

variables and descriptive statistics mean getting the multiple numbers that can be used for describing the distribution of the set of data.

3.8.2 Likert Scale

A Likert Scale measures the extent to which a person agrees or disagrees with the question. The most common scale is 1 to 5. In each question, a statement is presented in which a respondent must answer in a multiple choice type format.

The advantageous side of the Likert Scale is that is a most universal method for survey collection, therefore the method is easily understood. The responses are easily quantifiable and subjective. Likert surveys are also quick, efficient and inexpensive methods for data collection.

Likert scale primarily used in questionnaires to obtain participants preferences or degree of agreement with a statement or set of statements. Respondents asked to indicate their level of agreement with a given statement by way of an ordinal scale. (Bengal, 2012).

The study uses the Likert Scale because of it suitable to achieve the first objective which is to find the main cause, effect, and method of minimizing delay in infrastructure. The respondent can choose anyone scale from 1 until 5 to answer the questions.

3.8.3 Average Index Analysis

To measure the data that obtained from the respondent, the frequency of data will be analyzed by using the average index. The formula of getting Average Index will be used in section C and section D the result that is obtained from targeted respondents from Likert Scale. Average Index is average or sum of the values that divided by a number of observations. Mean is the one acceptable measure of central tendency for interval data thus the Average Index of each factor is used to rank in order to produce the most influential factor.

All of the answers need to be sum up and divided with the numbers of questions. The Average Index is calculated on the formula by Assef et al (1996) as follow:

$$Average\ Index = \frac{\sum ai \times Xi}{\sum Xi}$$

Where,

ai is a constant expressing weight given to i

Xi is the variable that expressing the frequency of respondent

Table 3.8.3 below showed the Average Index and the Rating Scale uses the method by Assef et al (1996) as follow:

Category	**Average Index**	**Rating Scale**
Most Frequent	5.00 - 4.01	1
Frequent	4.00 - 3.01	2
Fair	3.00 - 2.01	3
Less frequent	2.00 - 1.01	4
Least frequent	1.00 - 0.00	5

3.9 RESEARCH METHODOLOGY

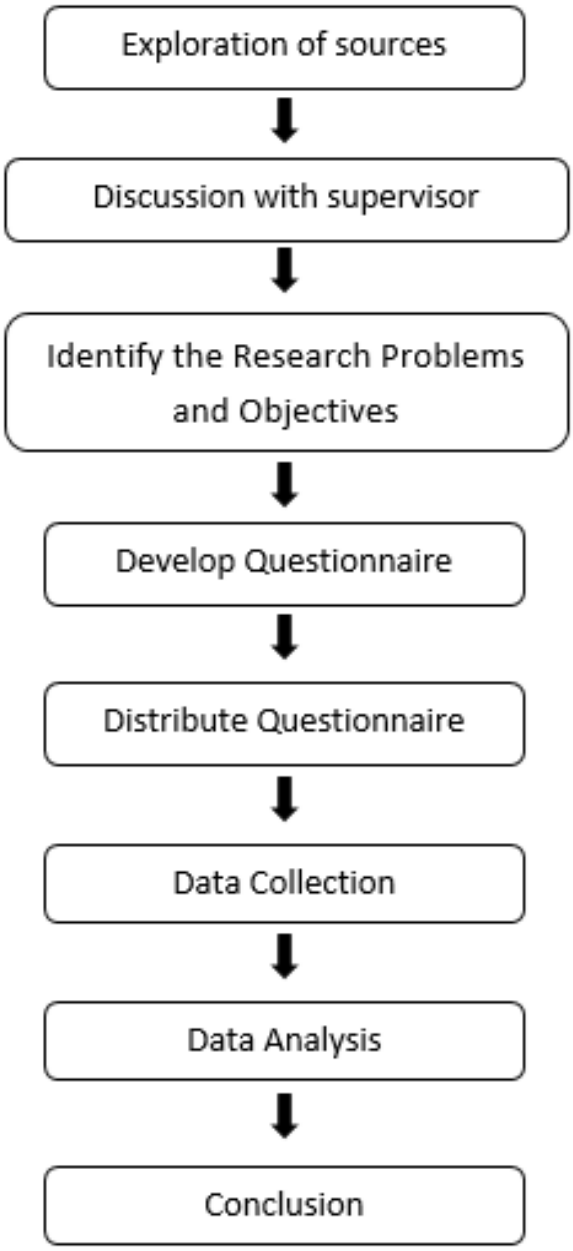

Figure 3.7.1: A Flow Chart of Research Methodology

CHAPTER 4

ANALYSIS AND DISCUSSION

4.1 Introduction

This chapter will discuss the finding from the respondent to the questionnaires. The results are presented using the Statistical Package for Social Science (SPSS) analysis. The questionnaire of this study is to find the main cause, effect, and method of minimizing the delay in infrastructure project and to rank the issue. The average index from SPSS is used to rank the factors in order to produce the most influenced factor.

4.2 Questionnaire Distribution

There are in total of seventy sets of survey questionnaire was distributed to the targeted respondent in order to identify the most important factors that cause delays, the common effect of delays, and methods of minimizing construction delays. The survey questionnaires were distributed to the government and private who are taking part in the infrastructure site in Malaysia. The questionnaire was completed by the management team include site supervisor, assistant engineer, engineer civil, consultants and contractors are selected randomly as the respondent.

4.3 Demographic Respondent's Profile

This section is about the result of the demographics of respondents. Demographic it is significant of respondent background. For this research, have six (6) items were asked in demographics which are gender, age, company sector, the location of the company, duration of the company in construction and experience in the infrastructure project. Demographic analysis is carried out through descriptive statistic based on 100 respondents. The frequencies and percentages for each item will be present.

4.3.1 Gender of Respondent

Based on the table and figure below, it was found that the majority gender of respondents in this survey is 55% women to compare with men only 45%. This survey to find out the percentage number of genders were answering the questionnaire.

Table 4.3.1: Gender of Respondent

		Frequency	**Percent (%)**
Valid	Male	45	45
	Female	55	55
	Total	**100**	**100**

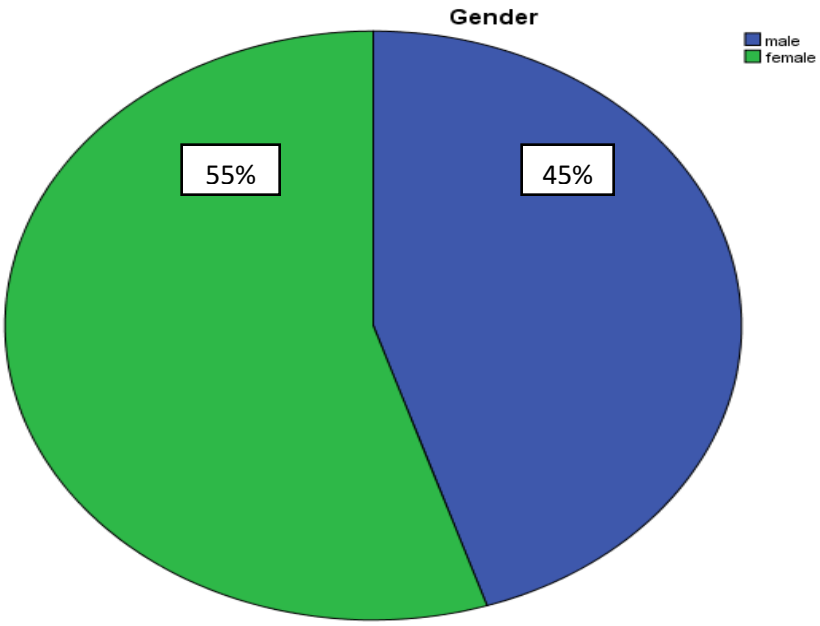

Figure 4.3.1: Percentage of Respondent

4.3.2 Age of Respondent

Based on the table and figure below, it is found that the age of majority of respondents in the survey is less than 30 years old is 75%, while for the age of 30-40 years is 21% and lastly for the 40-50 years old is 4%. This study is to percentage determine the age level that filled the questionnaire.

Table 4.3.2: Age of Respondent

		Frequency	Percent (%)
Valid	Less Than 30 Year	75	75
	30-40 Years	21	21
	41-50 Years	4	4
	Total	**100**	**100**

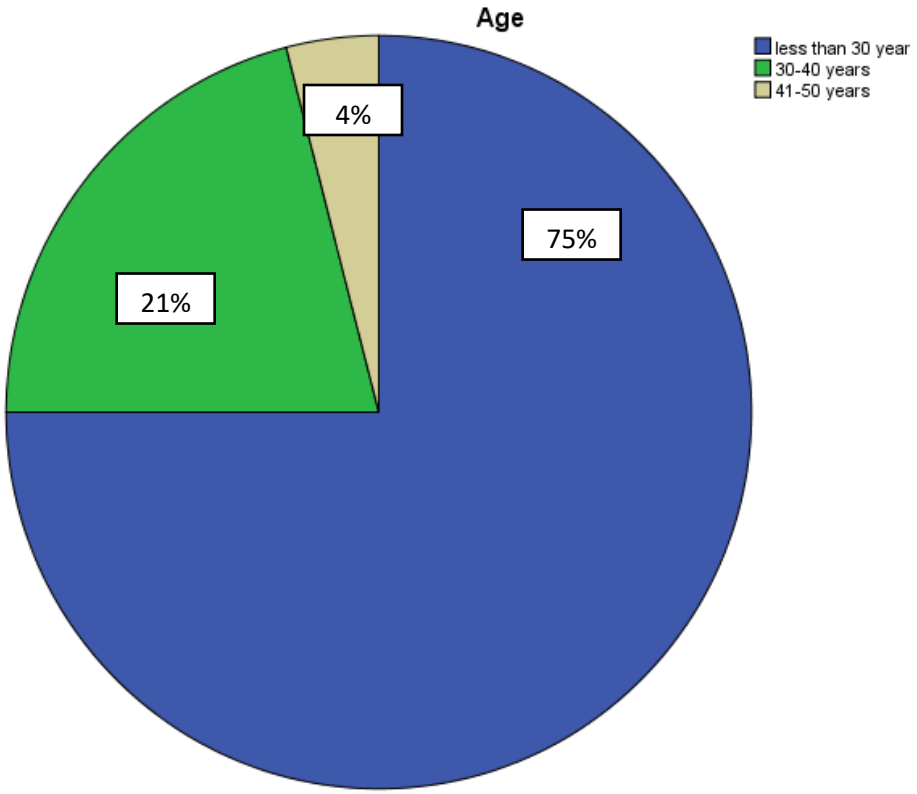

Figure 4.3.2: Age of Respondent

4.3.3 Company Sector of Respondent

Based on the table and figure below, it is found that the majority of respondent sector companies in the survey are from the private sector which is 81% more than some from government sector of 19% only. This study is to determine percentage the sector of companies that have filled the questionnaire.

Table 4.3.3: Company Sector of Respondent

		Frequency	Percent (%)
Valid	Government	19	19
	Private	81	81
	Total	**100**	**100**

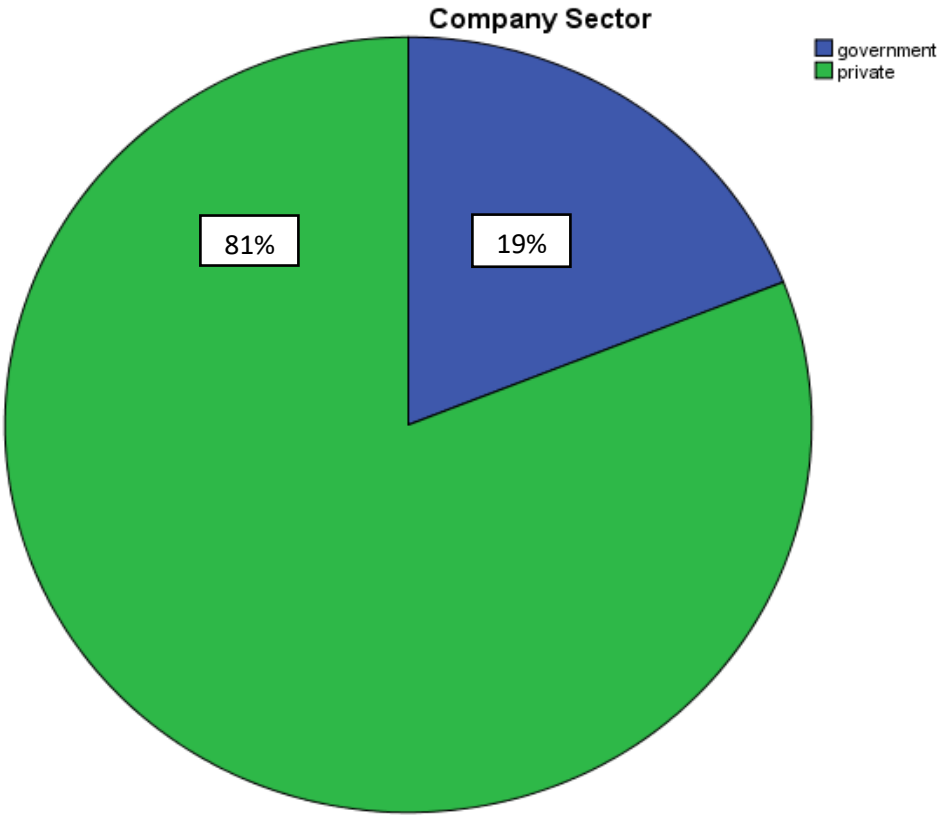

Figure 4.3.3: Company Sector of Respondent

4.3.4 Location Company of Respondent

Based on the table and figure below, it is found that the majority of respondents' locations in the survey are from central (e.g. Kuala Lumpur, Selangor, Putrajaya, Cyberjaya and Negeri Sembilan) is 33%. The second is from east cost (e.g. Kelantan, Terengganu and Pahang) which is 27%. Then, followed by the Southern section (e.g. Johor and Melaka) by 19%. In fourth place is from North (e.g. Perlis, Kedah, Pulau Penang, and Perak) which is 18%. Lastly, from East Malaysia (e.g. Sabah, Sarawak, Labuan) by 3%. This study is to determine percentage the location of the company that filled the questionnaire.

Table 4.3.4: Location Company of Respondent

		Frequency	Percent (%)
Valid	Southern (e.g. Johor and Melaka)	19	19
	Central (e.g. Kuala Lumpur, Selangor, Putrajaya, Cyberjaya and Negeri Sembilan)	33	33
	East Cost (e.g. Kelantan, Terengganu and Pahang)	27	27
	North (e.g. Perlis, Kedah, Pulau Penang, and Perak)	18	18
	East Malaysia (e.g. Sabah, Sarawak, Labuan)	3	3
	Total	**100**	**100**

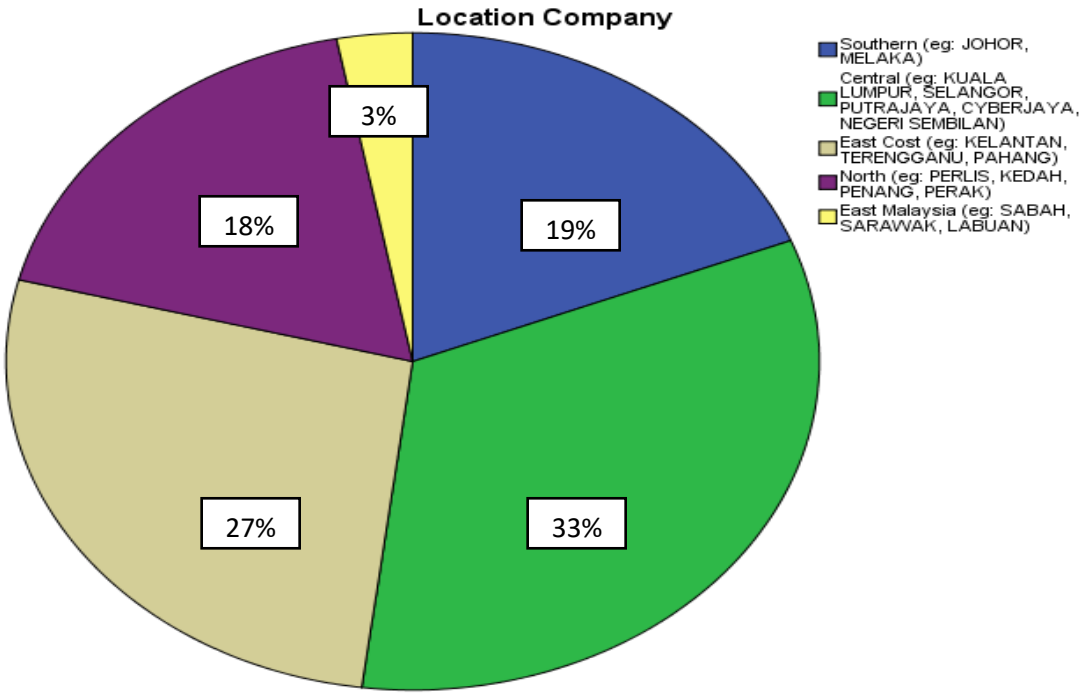

Figure 4.3.4: Location Company of Respondent

4.3.5 Duration Company in Construction of Respondent

Based on the table and table below, it is found that the Duration Company in Construction respondents in the highest survey is below 5 years, which is 51%. Then, followed by a 5-10 year construction period of 29%. The last is over 15 years, which is 20%. This study is to determine the percentage of time the company under construction is completing the questionnaire.

Table 4.3.5: Duration Company in Construction of Respondent

		Frequency	Percent (%)
Valid	Less than 5 years	51	51
	5-10 years	29	29
	More than 15 years	20	20
	Total	**100**	**100**

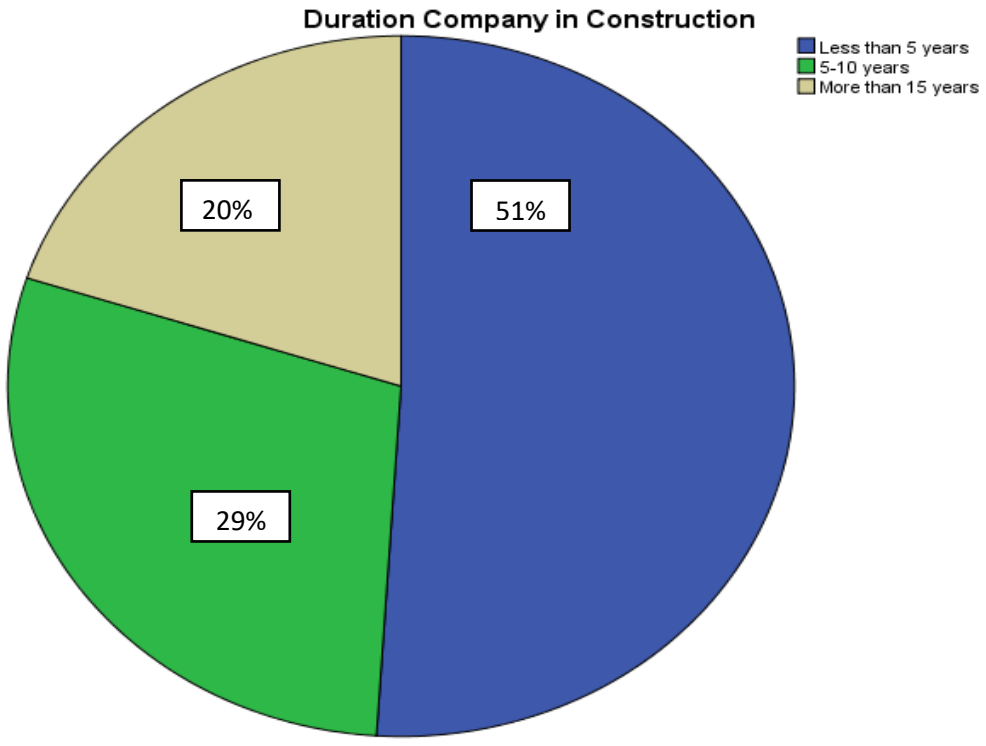

Figure 4.3.5: Duration Company in Construction of Respondent

4.3.6 Experience in Infrastructure Project of Respondent

Based on the table below, it is found that the Experience in Infrastructure Project in Construction Respondents in the highest survey is below 5 years which is 63%. Second, within 5-10 years of 31%. Lastly over a period of over 15 years of 6%. This study is to determine the percentage of respondents who have the Experience in Infrastructure Project that filled the questionnaire.

Table 4.3.6: Experience in Infrastructure Project of Respondent

		Frequency	Percent (%)
Valid	Less than 5 years	63	63
	5-10 years	31	31
	More than 15 years	6	6
	Total	**100**	**100**

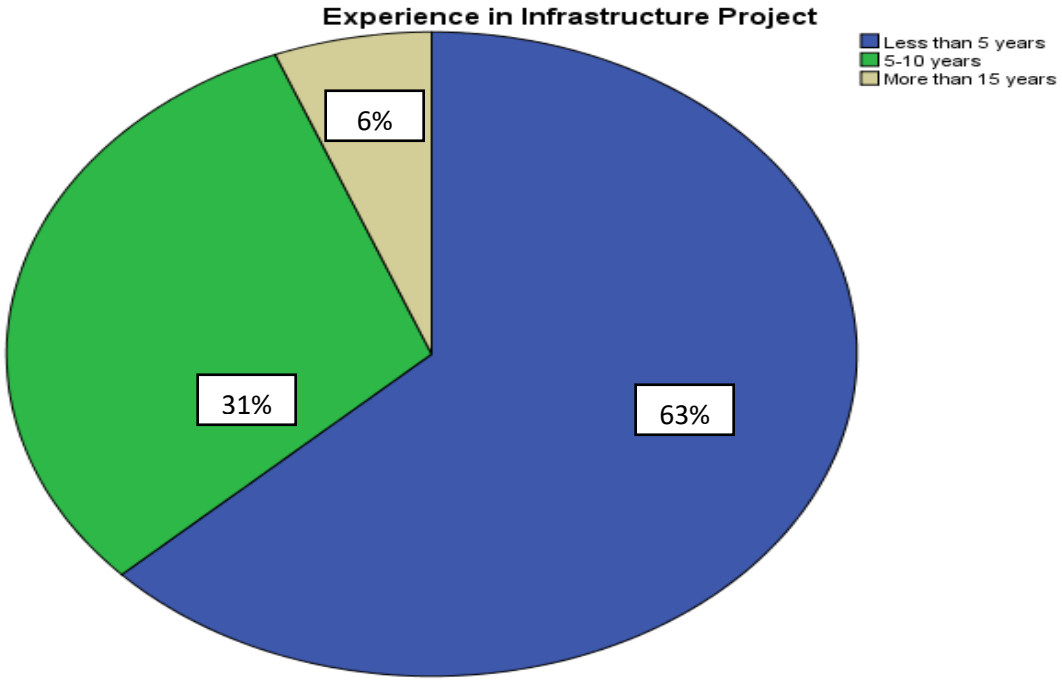

Figure 4.3.6: Experience in Infrastructure Project of Respondent

4.4 Perspective of Delay in Infrastructure Project of Respondent

This section is about the result of delayed perspectives in respondent infrastructure projects. For this survey, there are four (4) things that need to be answered by the respondents is knowledge about delay, major cause of delay, affect delay and method to minimizing delay. This analysis is to get the frequency and percentage for each item to be present.

4.4.1 Knowledge about Delay

The tables and figure below show about the knowledge of respondents about delay. The majority said that 47% had knowledge in the medium range. While, as many as 33% said they have high knowledge in delay and 13% said they had very high knowledge about delay issues. Lastly, only 7% state they have low knowledge in delay.

Table 4.4.1: Knowledge about Delay

		Frequency	Percent (%)
Valid	Very Low	0	0
	Low	7	7
	Medium	47	47
	High	33	33
	Very high	13	13
	Total	**100**	**100**

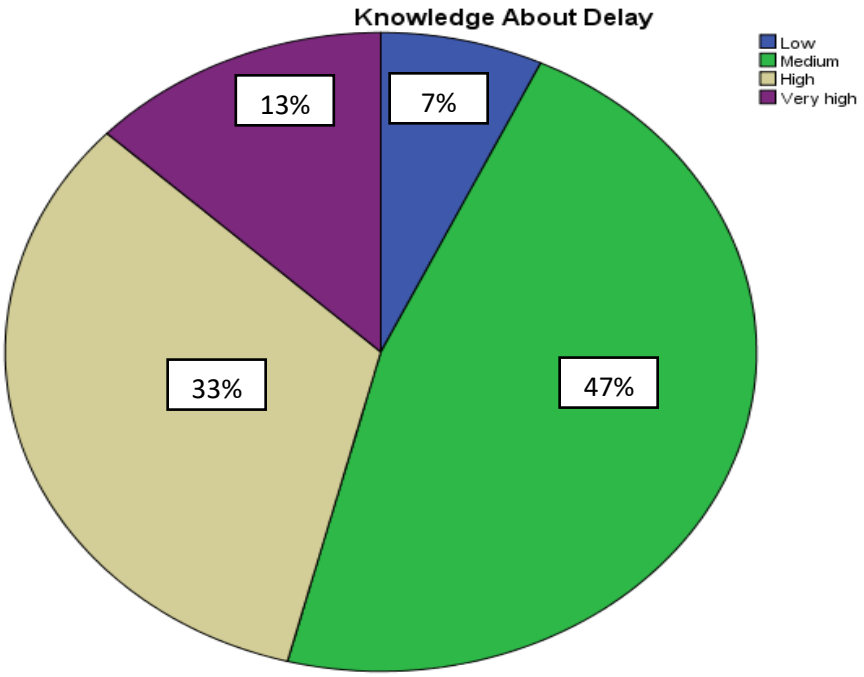

Figure 4.4.1: Knowledge about Delay

4.4.2 State Main Cause of Delay

The tables and figures below show the percentage of respondents who can state the main cause of delay. The majority show that 91% can state YES for the real cause of delay while the remaining 9% states NO to tell the cause of delay.

Table 4.4.2: State Main Cause of Delay

		Frequency	Percent (%)
Valid	Yes	91	91
	No	9	9
	Total	**100**	**100**

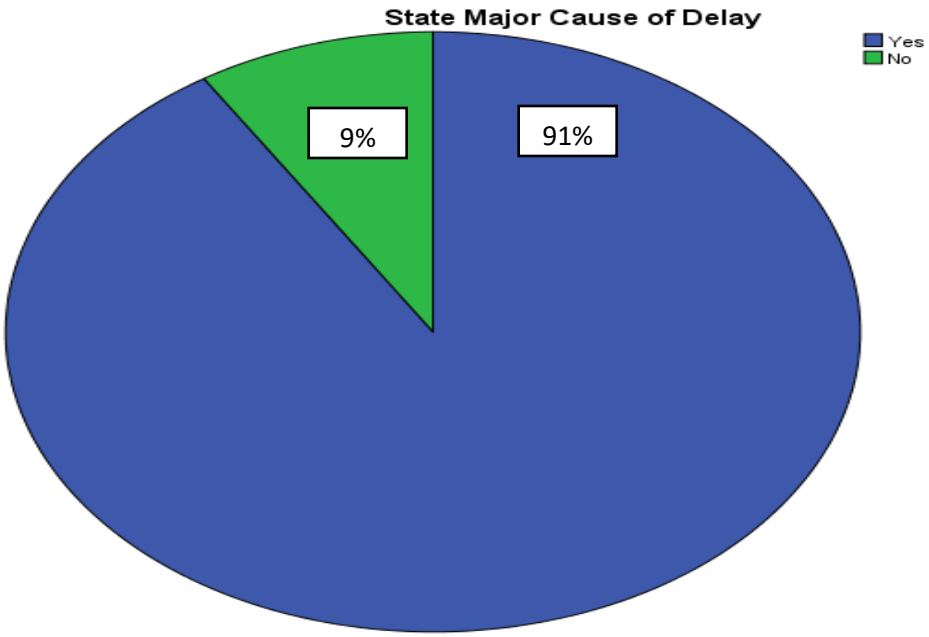

Figure 4.4.2: State Main Cause of Delay

4.4.3 Agree Delay Affect Construction

The tables and figures below show the percentage of respondents who agree to delay affecting the construction. As much as 48% states strongly agree and 46% agree it brings affect to construction. While, 3% in neutral range and 3% stated strongly disagree that the delay for the effect on construction.

Table 4.4.3: Agree Delay Affect Construction

		Frequency	Percent (%)
Valid	Strongly disagree	3	3
	Disagree	0	0
	Neutral	3	3
	Agree	46	46
	Strongly agree	48	48
	Total	**100**	**100**

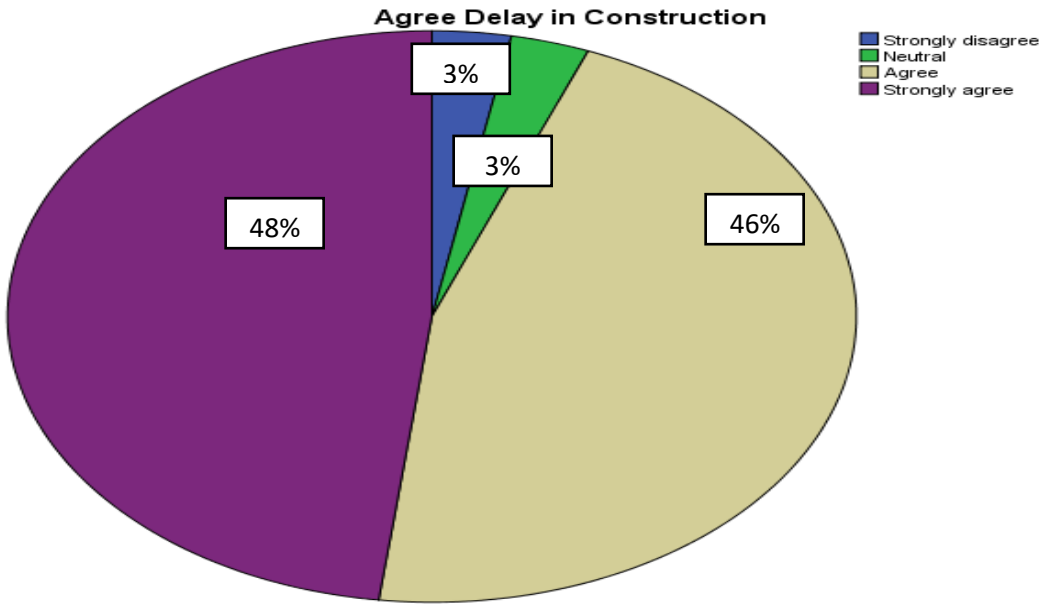

Figure 4.4.3: Agree Delay Affect Construction

4.4.4 Method Minimizing Delay

The tables and figures below show the percentage of respondents who can declare a method that can minimizing the delay whereby 84% states YES and the remaining 16% states NO to state method for reducing delay.

Table 4.4.4: Method Minimizing Delay

		Frequency	Percent (%)
Valid	Yes	84	84
	No	16	16
	Total	**100**	**100**

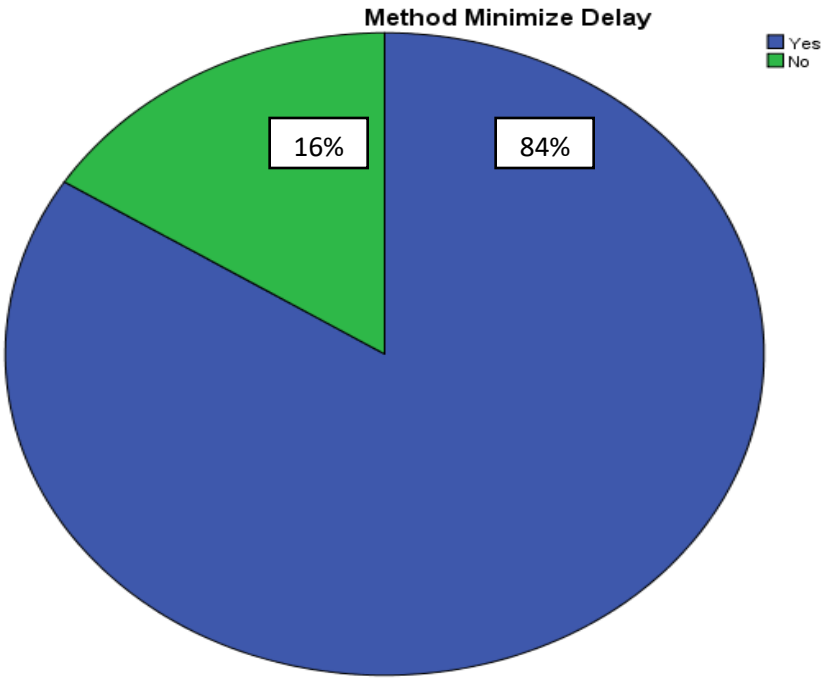

Figure 4.4.4: Method Minimizing Delay

4.5 Descriptive analysis: Causes and Effects of Infrastructure Delays

For this section, there is a separate by two (2) parts for the respondent to complete. Part one is about the major cause of delay and the second is about the effect of delay in infrastructure project**.**

4.5.1 The Major Cause of Delay

The first objective of study related to causes of delays from one hundred sets of the questionnaire has been identified and grouped into seven major groups. These factors were ranked in each group based on the Relative Importance Index (RI) from the viewpoint of contractor and consultant. The following is a brief description of these factors in each group.

4.5.1.1 Factors of Client-Related Delays

Table 4.5.1.1 shows the results of the survey analysis of factors of client related delays. Factors to causes of delays were ranked based on the relative important index the group of the respondent. Referring to Table 4.5.1.1 and Figure 4.5.1.1, change orders and additional work by the client during construction was contributed the most for client-related delays. Besides that, delay in making payment of completed work from client to the contractor was ranked second in overall while slowness in the decision-making process to be submitted to the contractor ranked third.

Table 4.5.1.1: Factors of Client-Related Delays

FACTOR	AVERAGE INDEX	RANK
Change orders and additional work by the client during construction.	4.17	1
Delay in making payment of completed work from client to the contractor.	4.16	2
Slowness in the decision-making process to be submitted to the contractor.	4.13	3

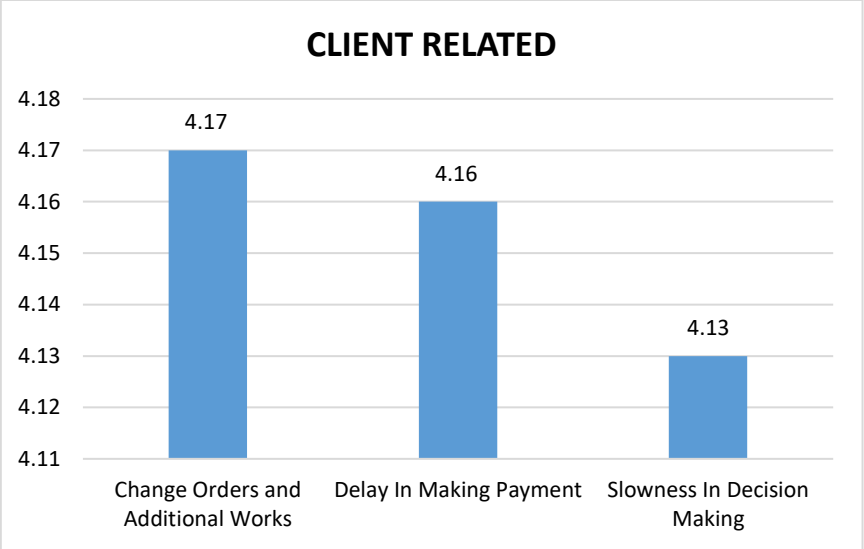

Figure 4.5.1.1: Factors of Client-Related Delays

4.5.1.2 Factors of Contractor-Related Delays

Table 4.5.1.2 shows the results of the survey analysis of factors of contractor-related delays. Factors to causes of delays were ranked based on the relative important index the group of the respondent. Referring to Table 4.5.1.2 and Figure 4.5.1.2 contractor's improper planning and poor site management was contributed the most for contractor-related delays. Besides that, the conflict between the contractor and other parties during construction was ranked second in overall while inadequate contractor experience before starting the project ranked third. The last rank is the offense made by the contractor during the construction stage.

Table 4.5.1.2: Factors of Contractor-Related Delays

FACTOR	AVERAGE INDEX	RANK
Contractor's improper planning and poor site management.	4.35	1
The conflict between the contractor and other parties during construction.	4.18	2
Inadequate contractor experience before starting the project.	4.13	3
The offense made by the contractor during the construction stage.	3.96	4

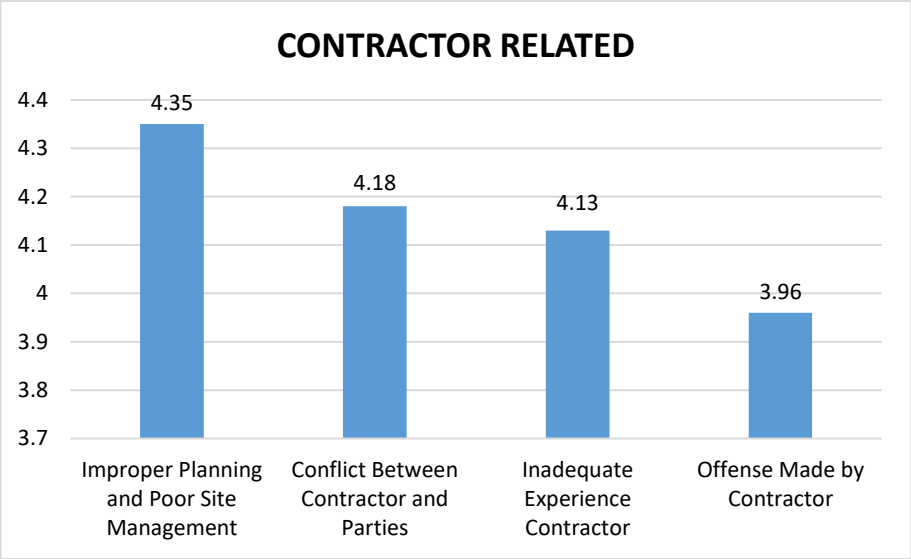

Figure 4.5.1.2: Factors of Contractor-Related Delays

4.5.1.3 Factors of Consultant-Related Delays

Table 4.5.1.3 shows the results of the survey analysis of factors of contractor-related delays. Factors to causes of delays were ranked based on the relative important index the group of the respondent. Referring to Table 4.5.1.3 and Figure 4.5.1.3 delay in preparing and approving major changes in the scope of work.was contributed the most for consultant-related delays. Besides that, waiting time for approval of test and inspection was ranked second in overall while inadequate experience of consultant ranked third.

Table 4.5.1.3: Factors of Consultant-Related Delay

FACTOR	AVERAGE INDEX	RANK
Delay in preparing and approving major changes in the scope of work.	4.19	1
Waiting time for approval of test and inspection.	4.02	2
Inadequate experience of consultant.	3.98	3

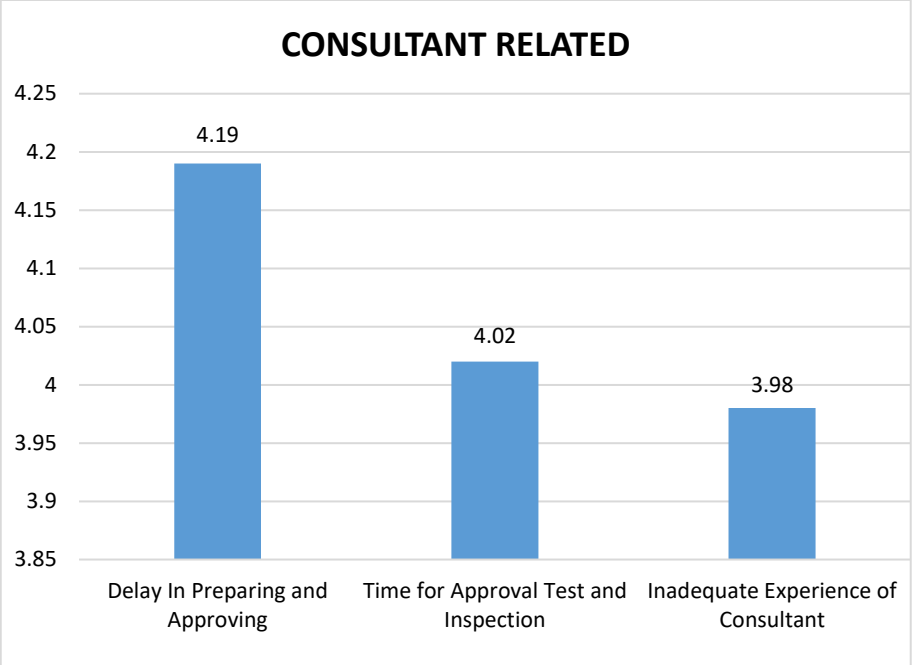

Figure 4.5.1.3: Factors of Consultant-Related Delay

4.5.1.4 Factors of Material-Related Delays

Table 4.5.1.4 shows the results of the survey analysis of factors of contractor-related delays. Factors to causes of delays were ranked based on the relative important index the group of the respondent. Referring to Table 4.5.1.4 and Figure 4.5.1.4 shortage of construction materials in the market was contributed the most for material-related delays. Besides that, quality of construction material was ranked second in overall while escalation of material prices during construction.ranked third.

Table 4.5.1.4: Factors of Material-Related Delay

FACTOR	AVERAGE INDEX	RANK
Shortage of construction materials in the market.	4.00	1
Quality of construction material.	3.99	2
Escalation of material prices during construction.	3.93	3

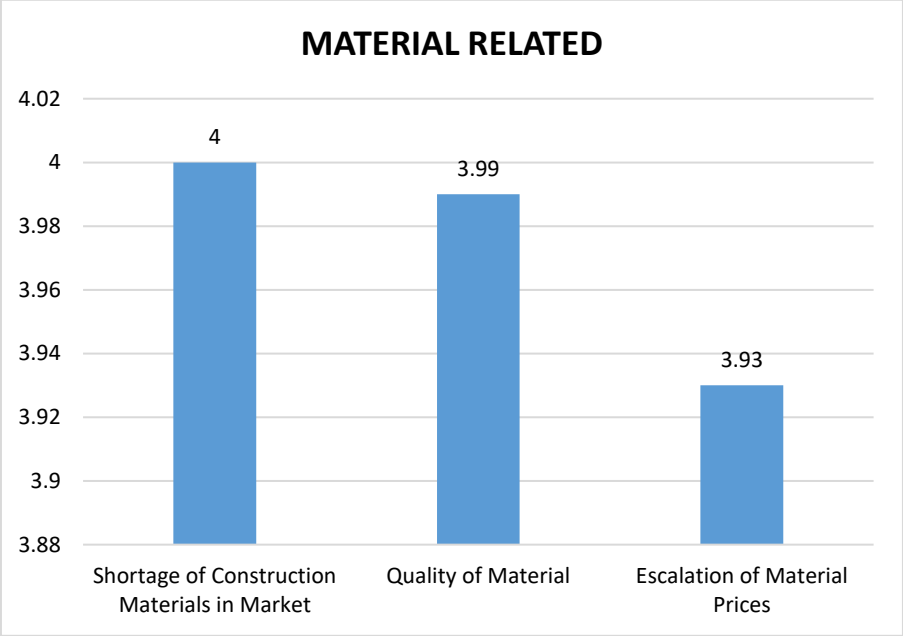

Figure 4.5.1.4: Factors of Material-Related Delay

4.5.1.5 Factors of Labor and Equipment-Related Delays

Table 4.5.1.5 shows the results of the survey analysis of factors of contractor-related delays. Factors to causes of delays were ranked based on the relative important index the group of the respondent. Referring to Table 4.5.1.5 and Figure 4.5.1.5 low productivity level of labors and equipment was contributed the most for labor and equipment-related delays. Besides that, labor and equipment shortage during construction was ranked second in overall while equipment availability and failure ranked third.

Table 4.5.1.5: Factors of Labor and Equipment-Related Delay

FACTOR	AVERAGE INDEX	RANK
Low productivity level of labors and equipment.	4.21	1
Labor and equipment shortage during construction.	4.16	2
Equipment availability and failure.	4.10	3

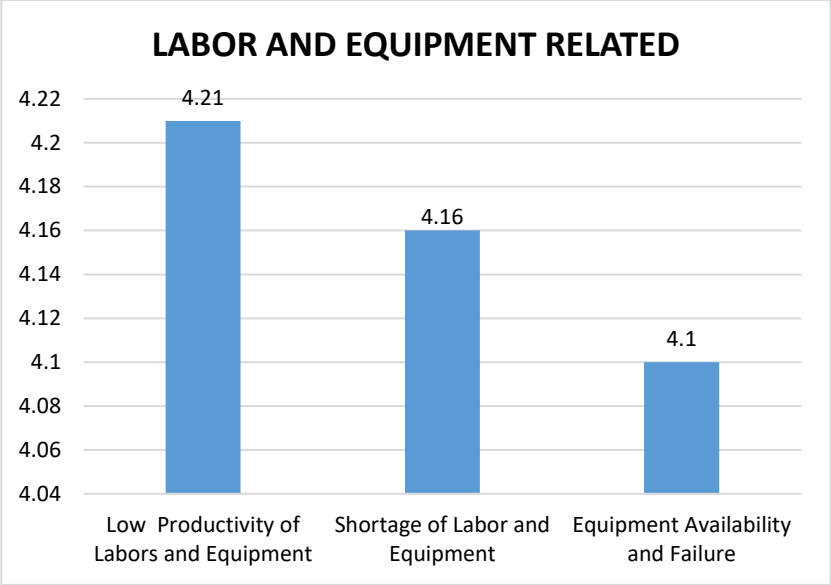

Figure 4.5.1.5: Factors of Labor and Equipment-Related Delay

4.5.1.6 Factors of External Factor-Related Delays

Table 4.5.1.6 shows the results of the survey analysis of factors of contractor-related delays. Factors to causes of delays were ranked based on the relative important index the group of the respondent. Referring to Table 4.5.1.6 and Figure 4.5.1.6 effects of subsurface and ground conditions (e.g. soil, high water table, etc.) was contributed the most for external factor-related delays. Besides that, weather effect on construction progress (e.g. rain, temperature, wind, cloud, etc.) was ranked second in overall while poor economic condition (e.g. currency, inflation, etc.) ranked third. The last rank delay in providing services from utilities (e.g. water, electricity, telephone, etc.).

Table 4.5.1.6: Factors of External Factor-Related Delays

FACTOR	AVERAGE INDEX	RANK
Effects of subsurface and ground conditions (e.g. soil, high water table, etc.).	4.16	1
Weather effect on construction progress (e.g. rain, temperature, wind, cloud, etc.).	4.10	2
Poor economic condition (e.g. currency, inflation, etc.)	4.01	3
Delay in providing services from utilities (e.g. water, electricity, telephone, etc.).	3.91	4

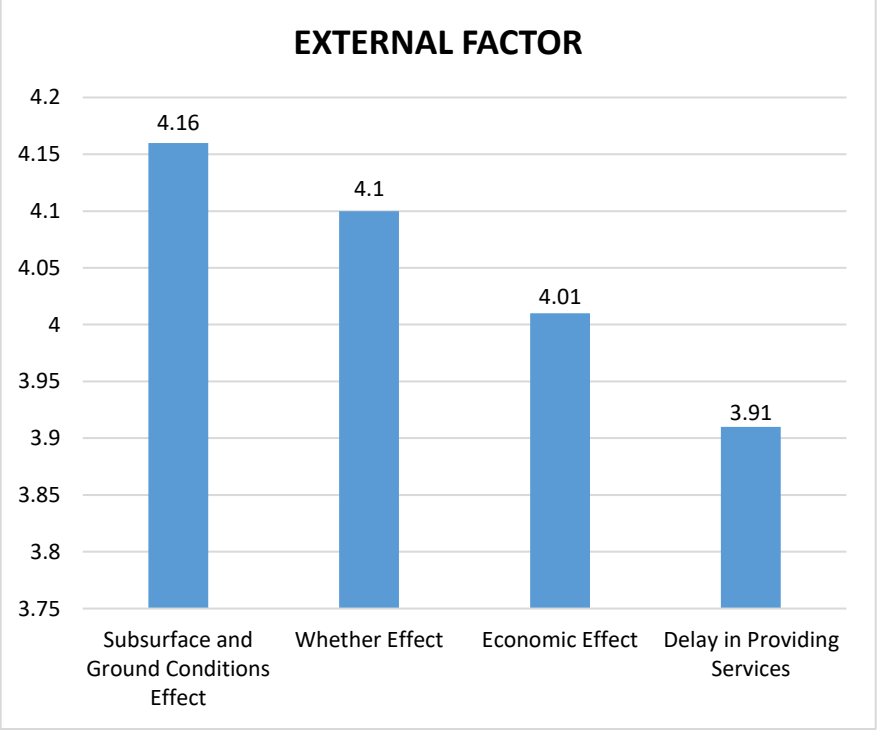

Figure 4.5.1.6: Factors of External Factor-Related Delays

Table 4.5.1.7: Summaries of Main Cause of Delay in Infrastructure Project

FACTOR	AVERAGE INDEX	RANK
CLIENT RELATED		
1. Change orders and additional work by the client during construction.	4.17	1
2. Delay in making payment of completed work from client to the contractor.	4.16	2
3. Slowness in the decision-making process to be submitted to the contractor.	4.13	3
CONTRACTOR RELATED		
1. Contractor's improper planning and poor site management.	4.35	1
2. The conflict between the contractor and other parties during construction.	4.18	2
3. Inadequate contractor experience before starting the project.	4.13	3
4. The offense made by the contractor during the construction stage.	3.96	4
CONSULTANT RELATED		
1. Delay in preparing and approving major changes in the scope of work.	4.19	1
2. Waiting time for approval of test and inspection.	4.02	2
3. Inadequate experience of consultant.	3.98	3

MATERIAL RELATED		
1. Shortage of construction materials in the market.	4.00	1
2. Quality of construction material.	3.99	2
3. .Escalation of material prices during construction.	3.93	3
LABOR AND EQUIPMENT RELATED		
1. Low productivity level of labors and equipment.	4.21	1
2. Labor and equipment shortage during construction.	4.16	2
3. Equipment availability and failure.	4.10	3
EXTERNAL FACTOR		
1. Effects of subsurface and ground conditions (e.g. soil, high water table, etc.).	4.16	1
2. Weather effect on construction progress (e.g. rain, temperature, wind, cloud, etc.).	4.10	2
3. Poor economic condition (e.g. currency, inflation)	4.01	3
4. Delay in providing services from utilities (e.g. water, electricity, telephone, etc.).	3.91	4

Table 4.5.1.8: The Rank of Main Cause Related of Delay in Infrastructure Project

FACTOR	AVERAGE INDEX	RANK
Contractor Related	4.16	1
Labor And Equipment Related	4.16	1
Client Related	4.15	2
Consultant Related	4.06	3
External Factor	4.05	4
Material Related	3.97	5

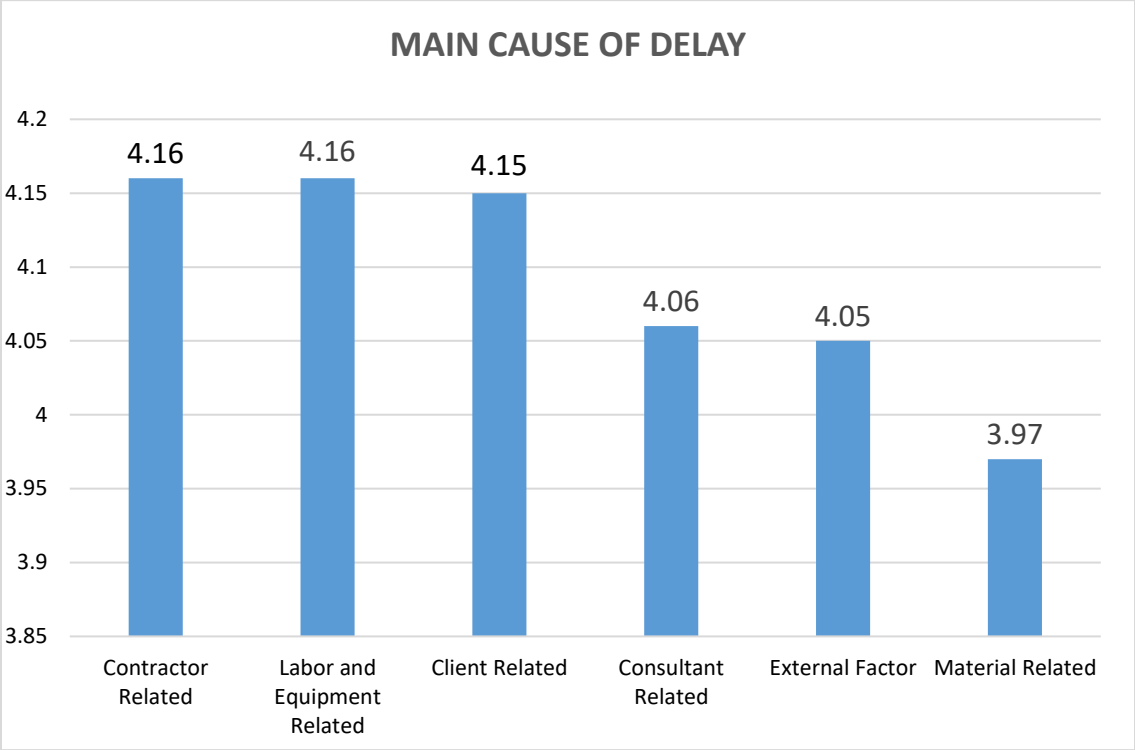

Figure 4.5.1.7: The Main Cause of Delay in Infrastructure Project

4.5.2 Effect of Infrastructure Delays

The questionnaire surveyed on the effects of delays in infrastructure project from the viewpoint of team management was analyze as shown in Table 4.5.2. In order to identify the effect of delays in construction project, there are factors that effects delays were identified and ranked based on the Average Indexes.

Referring to Table 4.5.2 and Figure 4.5.2, shows time overrun and cost overrun were the two most common effects of delays in infrastructure project from the view of point of respondent.

Table 4.5.2: The Effect of Delay in Infrastructure Project

EFFECT	AVERAGE INDEX	RANK
Time Overrun	3.85	1
Cost Overrun	3.83	2
Dispute	3.69	3
Litigation	3.67	4
Arbitration	3.66	5
Total Abandonment	3.45	6

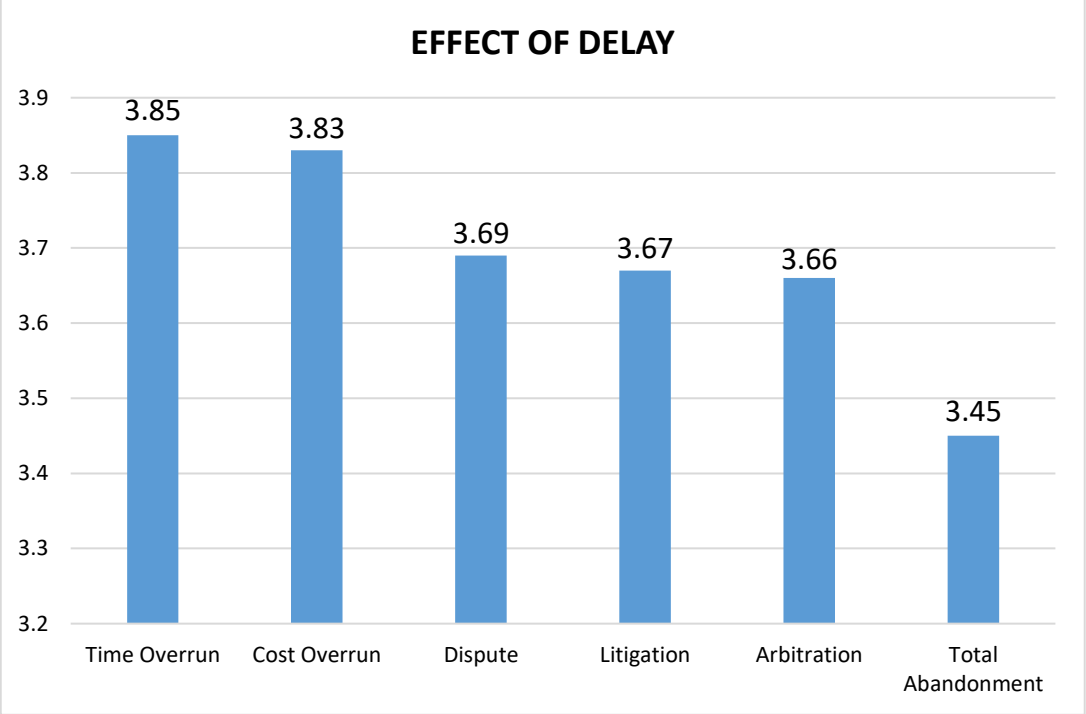

Figure 4.5.2: The Effect of Delay in Infrastructure Project

4.6 Methods of Minimizing Delays in Infrastructure Project

Table 4.6 and Figure 4.6 below shows that the results of methods of minimizing delays in infrastructure project from the viewpoint of respondent was selected. These methods were ranked based on average indexes of methods identified by the team management.

The results of research revealed that effective strategic planning from consultant and contractor for reducing delay issue in construction in the first rank. The second is the client should follow payment progress to the contractor on time because it impairs the contractor's ability to finance the work and contractor should manage his financial resources and plan cash flow by utilizing progress payment. then, it follows by contractors should ensure a sufficient number of employees to improve productivity at the site, consultants should be flexible in evaluating contractor's works and lastly, the client should minimize any change orders during construction to avoid delays made the top five effective for overall ranked by respondent.

Table 4.6: Methods of Minimizing Delays in Infrastructure Project

METHOD	AVERAGE INDEX	RANK
Effective strategic planning from consultant and contractor for reducing delay issue in construction.	4.68	1
The client should follow payment progress to the contractor on time because it impairs the contractor's ability to finance the work.	4.39	2
Contractor should manage his financial resources and plan cash flow by utilizing progress payment.	4.39	2
Contractors should ensure a sufficient number of employees to improve productivity at site	4.33	3
Consultants should be flexible in evaluating contractor's works.	4.14	4
The client should minimize any change orders during construction to avoid delays.	4.04	5

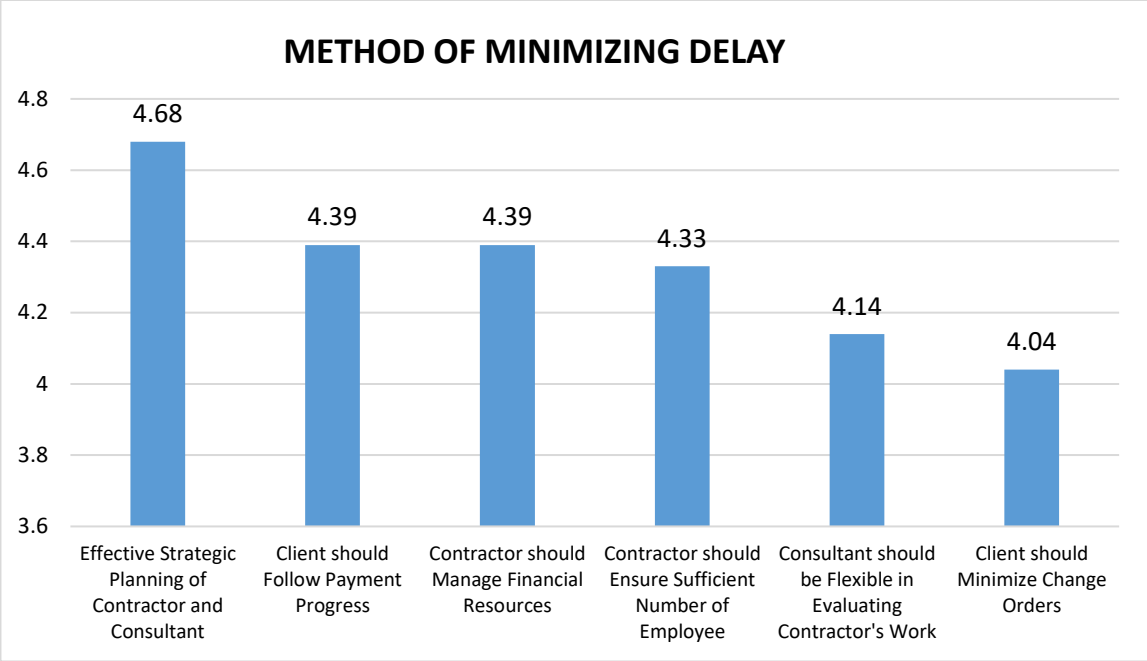

Figure 4.6: Methods of Minimizing Delays in Infrastructure Project

4.7 Summary

The major delays groups were identified and ranked, which group of contractor-related and labor and equipment-related delays is the top main groups that contribute to the causes of delays in infrastructure projects. The top five most important factors that contributed to the causes of delays are factors contractor's improper planning and poor site management, low productivity level of labors and equipment, delay in preparing and approving major changes in the scope of work, the conflict between the contractor and other parties during construction and change orders and additional work by the client during construction. The effects of delays have been identified which time overrun and cost overrun were the most common effects of delays on infrastructure projects. To minimize delays in construction project, effective strategic planning from consultant and contractor for reducing delay issue in construction, the client should follow payment progress to the contractor on time because it impairs the contractor's ability to finance the work and contractor should manage his financial resources and plan cash flow by utilizing progress payment are the top three recommended methods to minimizing the infrastructure delays.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATION

5.1 Introduction

This chapter discusses the conclusion and recommendation of the research to support the findings of the study. The discussion of this research included demographic information about the sample and the result from descriptive.

5.2 Conclusions

There are three objectives of this study which have been achieved. The first objective was to identify the major causes of delays, to study the effects of delays, and to identify the methods of minimizing delays in infrastructure projects.

5.2.1 Finding 1: To identify the main cause of delay in infrastructure project.

The first objective of the study has been successfully identified. A total of twenty factors that cause delays were identified. Some of these factors were the top ten most important factors that contributed to the causes of delays include the factors of contractor's improper planning and poor site management, low productivity level of labors and equipment, delay in preparing and approving major changes in the scope of work, the conflict between the contractor and other parties during construction, change orders and additional work by the client during construction, delay in making payment of completed work from

client to the contractor, labor and equipment shortage during construction, effects of subsurface and ground conditions (e.g. soil, high water table, etc.), inadequate contractor experience before starting the project and slowness in the decision-making process to be submitted to the contractor. The factors were grouped into six groups of causes of delays. Group of contractor-related delays was ranked the most significant groups that cause delays, followed by group of labor and equipment-related delays, client-related delays, consultant-related delays, material-related delays and external factor-related delays.

5.2.2 Finding 2: To study the effect of delay in infrastructure project.

The second objective of this research was to study the common effects of delays in infrastructure projects. This objective has been success fully achieved. There are six factors that affect delays in an infrastructure project which includes with time overrun, cost overrun, dispute, litigation, arbitration and total abandonment. The results of analysis shown time overrun and cost overrun were two most common effects of delays in an infrastructure project.

5.2.3 Finding 3: To identify the method for minimizing infrastructure project delay.

The third objective of this study was to identify the effective methods of minimizing delays in infrastructure project has been successfully achieved. The most effective methods of minimizing delays includes effective strategic planning from consultant and contractor for reducing delay issue in construction, the client should follow payment progress to the contractor on time because it impairs the contractor's ability to finance the work, contractor should manage his financial resources and plan cash flow by utilizing progress payment, contractors should ensure a sufficient number of employees to improve productivity at site, consultants should be flexible in evaluating contractor's works and the client should minimize any change orders during construction to avoid delays.

5.3 Recommendation

From this study, some recommendations are given as follows:

1) An infrastructure delay occurs mostly during the construction phase. This is mostly caused by the poor labor's skill, supervisor not able to coordinate the project very well and also low quality of material used in the construction projects. Therefore, the contractor needs to give awareness of these three factors stated above in order to minimize the construction delays' problems.

2) Low technical and managerial skills of contractors are the problems faced by contractors which might cause construction delays. Therefore, contractors should organize some training programs for their workers in order to update their knowledge and improve their management skill.

3) Due to the dynamic nature of project environments, it is inevitable that conflicts among the project team will arise. All project participants should recognize that conflict is inevitable and actually can be beneficial if resolved in an appropriate manner. Therefore, conflict management is a need to produce a good working environment.

REFERENCES

Aibinu, A. A. and Jagboro, G.O. “The Effects of Construction Delays on Project Delivery in Nigerian Construction Industry. International Journal of Project Management”. (2002)

Azlan, S., Smith, a, Pitt, M., & Chan, H. “Contractors Perception of Factors Contributing To Project Delay: Case Studies of Commercial Projects in Klang Valley, Malaysia”. (2010 (Aibinu, 2002))

Doloi, H., Sawhney, A., Iyer, K. C., & Rentala, “Analysing factors affecting delays in Indian Construction Projects”. *International Journal of Project Management*. (2012)

Dutta, A. and Dutta, P. “Causes of time and cost overruns in transportation sector projects in Bangladesh” in *International Journal of Economics and Management Studies,* 2(4): 15–17. (2015)

Fugar, F.D.K and Agyakwa- Baah A.B. “Delays in Building Construction Projects in Ghana”. (2010)

Indhu, B., & Ajai, P. Study. “Delay Management in a Construction Project - A Case Study”. (2014)

Kang Sik Wei “Causes, Effects and Methods of Minimizing Delays in Construction Projects”. (2010)

Kazaz, A., Ulubeyli, S. & Tuncbilekli, N. A. “Causes of delays in construction projects in Turkey. Journal of Civil Engineering and Management”. (2012)

Kikwasi, G.J. “Causes and Effects of Delays and Disruptions in Construction Projects in Tanzania”, Australasian Journal of Construction Economics and Building, conference series, (pp. 1, (2) 52-59,). Ardhi University, Tanzania (2012)

M. A. Yusof, N. Mohammad, and Z. Mat Derus, “Excusable and Compensable Delays in the Construction of Building Project - A Study in the States of Selangor and Wilayah Persekutuan Kuala Lumpur, Malaysia,” *Journal-The Institution of Engineer.* (2010)

Mehdi Riazi, Salman Riazi & Lamari Fiona. “Public Sector Project Delay: The Malaysian Perspective and the Way Forward”. (2013)

Ram Singh, “Delays and Cost Overruns in Infrastructure Projects: An Enquiry into Extents, Causes and Remedies”. (2009)

Ravisankar, Dr.S AnanadKumar, V Krishnamoorthy. “Study on the Quantification of Delay Factors in Construction Industry K L” *International Journal of Emerging Technology and Advanced Engineering* (2014)

Roger Gibson, “Construction Delays Extension Of Time And Prolongation Claims” . 20: 151-156. (2008)

Saleh Al Hadi Tumi, Abdelnaser Omran, and Abdul Hamid Kadir Oakir, "Causes of delay in large construction industry in Libya," in *The International Conference on Economics and Administration*, 14-15. (November 2009)

Sambasivan, M. and Yau W.S. “Causes and Effects of Delays in Malaysian Construction Industry. International Journal of Project Management”. (2007)

Soon, T.K. “Dispute resolution in relation to delay of construction projects. MSc diss. Universiti Teknologi Malaysia”. (2010).

Susila, H. “Causes of Conflict in the Implementation of Project Construction”, *Journal of Engineering and Architecture, Faculty of Engineering, University of Surakarta Tunas Development*, 11(15). (2012)

Wijekoon, S.B. and Attanayake, A.M.C.T.K. “Study on the Cost Overrun in Road Construction Projects in Sri Lanka”. (2013)

Yap Eng Hoe, “Causes Of Abandoned Construction Projects In Malaysia”. (2013)

APPENDIX A
QUESTIONAIRE SAMPLE

DELAY IN INFRASTRUCTURE PROJECT IN MALAYSIA (ROAD & BRIDGE)

Assalamualaikum and Good Morning,

Respected Dato / Datin / Sir / Madam / Mr / Ms,

My name is Siti Nurfarahin Binti Samsudin, currently pursuing Degree at Faculty of Civil Engineeering, Universiti Malaysia Pahang (UMP), I am conducting a research under the supervision of Mr. Syamsyul Hairi Bin Md. Saad as a partial requirement for my Degree. Your company is selected as one of the significant respondents for this study and your input is highly appreciated to represent your company. For your kind information, the purpose of this questionnaire is to identify the major cause and the effect of delay and to study on the method for minimizing delay in Infrastructure Project.

Your honest opinion is requested. We can assure you whatever information gathered will be treated with utmost confidentially and used strictly for academic purpose only. This questionnaire consists of four (4) sections to be answered according to the given instruction. It will take you about 10 minutes to complete this survey form.
I am greatly appreciated the help of your company and yourself in furthering this research endeavor. If you have any enquirers, please do not hesitate to contact me. Thank you very much for your kind cooperation.

I would like to invite you to fill out the form: Delay In Infrastructure Project (ROAD & BRIDGE)

Siti Nurfarahin Binti Samsudin
Degree Candidate
Civil Engineering
Faculty of Civil Engineering & Earth Resources
sitisamsudin@rocketmail.com
+60109670507

Mr Syamsyul Hairi Bin Md. Saad
Faculty of Civil Engineering & Earth Resources
msyamsyulhairi@ump.edu.my
+60199844388

* Required

SECTION A - Respondent and Organization Background

The primary objective of this section is to get to know the background of the researched company
Please tick the most appropriate response box.

1. **1. Gender** *
   Mark only one oval.
   - ◯ Male
   - ◯ Female

2. **2. Age** *
   Mark only one oval.
   - ◯ Less than 30 year
   - ◯ 30-40 years
   - ◯ 41-50 years
   - ◯ More than 50 years

3. **3. Company Sector** *
Mark only one oval.

- Government
- Private

4. **4. Where is your company located?** *
Mark only one oval.

- North (eg: PERLIS, KEDAH, PENANG, PERAK)
- Central (eg: KUALA LUMPUR, SELANGOR, PUTRAJAYA, CYBERJAYA, NEGERI SEMBILAN)
- Southern (eg: JOHOR, MELAKA)
- East Cost (eg: KELANTAN, TERENGGANU, PAHANG)
- East Malaysia (eg: SABAH, SARAWAK, LABUAN)

5. **5. How long has your company been in the construction?** *
Mark only one oval.

- Less than 5 years
- 5-10 years
- 11-15 years
- More than 15 years

6. **6. Experience in infrastructure project** *
Mark only one oval.

- Less than 5 year
- 5-10 years
- More than 10 years

SECTION B - Perspective of Delay in Infrastructure Project

7. **1. How well is your knowledge about "DELAY" ?** *
Mark only one oval.

- Very low
- Low
- Medium
- High
- Very high

8. **2. Can you state the major cause of the "DELAY" in construction ?** *
Mark only one oval.

- Yes
- No

9. **3. Do you agree that the "DELAY" can affect the construction?** *
Mark only one oval.

- ◯ Strongly disagree
- ◯ Disagree
- ◯ Neutral
- ◯ Agree
- ◯ Strongly agree

10. **4. Do you know the effective method for minimizing construction "DELAY"?** *
Mark only one oval.

- ◯ Yes
- ◯ No

SECTION C - The Major Cause and Effect of Delay in Infrastructure Project

PART 1 - The Major Cause of Delay

Please indicate in your degree of agreement or disagreement in each statement by tick/circle for each question based on 5-point Likert scale
(1= strongly disagree , 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)

i. Client Related

11. **1. Delay in making payment of completed work from client to the contractor** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

12. **2. Slowness in the decision-making process to be submitted to the contractor** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

13. **3. Change orders and additional work by the client during construction** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

ii. Contractor Related

14. **1. Contractor's improper planning and poor site management** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

15. **2. Inadequate contractor experience before starting the project** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

16. **3. The conflict between the contractor and other parties during construction** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

17. **4. The offense made by the contractor during the construction stage** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

iii. Consultant Related

18. **1. Delay in preparing and approving major changes in the scope of work** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

19. **2. Waiting time for approval of test and inspection** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

20. **3. Inadequate experience of consultant** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

iv. Material Related

21. **1. Shortage of construction materials in the market** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

22. **2. Escalation of material prices during construction** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

23. **3. Quality of construction material** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

v. Labor and Equipment Related

24. **1. Labor and equipment shortage during construction** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

25. **2. Low productivity level of labors and equipment**
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

26. **3. Equipment availability and failure** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

vi. External Factor

27. **1. Effects of subsurface and ground conditions (e.g. soil, high water table, etc.)** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

28. **2. Weather effect on construction progress (e.g. rain, temperature, wind, cloud, etc.)** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

29. **3. Delay in providing services from utilities (e,g s water, electricity, telephone, etc.)** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

30. **4. Poor economic condition (e.g. currency, inflation, etc.)** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

PART 2 - The Effect of Delay

31. **1. Our company has Time Overrun for infastructure project** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

32. **2. Our company has Cost Overrun for infastructure project** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

33. **3. Our company has Dispute for infastructure project** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

34. **4. Our company has Arbitration for infastructure project** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

35. **5. Our company has Litigation for infastructure project** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

36. **6. Our company has Total abandonment for infastructure project** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

SECTION D - The Method for Minimizing Infrastructure

Please indicate in your degree of agreement or disagreement in each statement by tick/circle for each question based on 5-point Likert scale
(1= never , 2 = seldom, 3 = sometimes, 4 = mostly, 5 = always)

37. **1. The client should follow payment progress to the contractor on time because it impairs the contractor's ability to finance the work.** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

38. **2. The client should minimize any change orders during construction to avoid delays.** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

39. **3. Contractor should manage his financial resources and plan cash flow by utilizing progress payment.** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

40. **4. Contractors should ensure a sufficient number of employees to improve productivity at site** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

41. **5. Consultants should be flexible in evaluating contractor's works.** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

42. **6. Effective strategic planning from consultant and contractor for reducing delay issue in construction** *
Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯