CAUSES AND EFFECTS OF DELAY IN COMPLETION OF GOVERNMENT FUNDED BUILDING CONSTRUCTION PROJECTS IN SRI LANKA

WITH SPECIAL REFERENCE TO THE PROJECTS BASED IN WESTERN PROVINCE

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Thesis/Dissertation submitted in partial fulfillment of the requirements for the degree Master of Business Administration in Project Management

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Declaration

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The above candidate has carried out research for the thesis of the Masters of Business Administration in Project Management under my supervision.

Name of the supervisor: Dr. Lesly Ekanayake

Signature of the supervisor: Date: /06/2017

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I also like to thank all those whose support was rendered to me in this regard.

I want to thank my family for burning oil along with me as I sat at my desk researching on numerous variables.

Abstract

The main purpose of this study is to identify the causes of delay in completion of government funded building construction projects in Sri Lanka; with special reference to the projects based in the Western province as well as to highlight its impact on the construction industry and to round up by forwarding recommendations for minimization of such delays. A questionnaire survey was carried out among the engineers representing consultants and contractors engaged in building construction projects of government funded projects in western province of Sri Lanka to identify the delays and their effects.

The delay in completion of government funded building construction projects could be due to various reasons and those reasons will change from region to region. For this research, a questionnaire was used with 25 delay causes and the responses were ranked according to relative importance index. At the completion of the research nineteen causes were identified which have more effect on the delay. Those 25 delay causes were grouped in to four called client related delays, consultant related delays, contractor related delays and other delays and were used in finding which party had higher impact on project delay. The ten effects were listed in the questionnaire that can occur as a result of delay in building construction projects and ranked them according to their importance level.

Having identified the causes having a high effect for the delays, the areas that are to be improved/concentrated can be identified and that will help overcome the problem for delays. According to the analyzed data, shortage of skill labor is the cause with the most impact and delay in providing necessary drawings and delay in delivery of required material to the site has become the second and third position respectively. Also it was found that delays occurring from the contractor's side have higher impact on project delay. Increasing in the final cost of the project is the main effect which results from the delay in completion of government funded building construction projects.

The guidelines laid down in chapter 5 will help the government of Sri Lanka and it requires more attention to be paid on the problem of shortage of skill laborers in construction industry. The contractor should take more attention on contractor related delay causes which have higher effect to delay in completion of government funded building construction projects relative to other three factors.

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CHAPTER 01: INTRODUCTION

1.1. Background

Construction industry is an important segment of development for any country. Development of infrastructure, development of physical entities is itself a representation of where a particular country stands in her economic growth. There is a diversity of persona with relevant to the handling of the construction project as it can be varied to governmental organizations and non-governmental organizations.

When considering the impact the construction industry has on a country's economy it's vital for the projects to be completed on time as many other attributes depends on the completed entity. Delay in completion can lead to various issues in both macro and micro level that will impact the country's economy as the last pearl in the thread.

Sri Lanka mainly saw a huge boom in the construction industry between the time periods from 2010 to 2015. Infrastructure as well as life style needs were accommodated during that time. According to Central Bank, construction in Sri Lanka has been a reason for the boom the country’s GDP in the year ending 2015 and this clearly illustrates the important role that is played by construction industry towards a healthy economy.

Although construction plays a main role, the success or the failure of that particular role depends mainly on the construction schedule and whether that schedule is met. Delays in the construction schedule negatively impact both owners and contractors as it has a sequential order of occurrence. Owners of property are burdened by delays due to the additional costs by not being able to use or occupy their property for its intended purpose. Since construction is a multiparty stakeholder pit, delays has a negative impact on construction contractors by driving up the costs of construction resulting from having to pay for a workforce and/or equipment that sits idly by as the delay continues. In addition, contractors may incur increases in the price of construction materials and fuel during the delay, resulting in increased overhead costs and general conditions. Given the severe monetary impact construction delays may have on both owners and contractors, it has become the primary source of disputes, claims, and litigation.

1.2. Types of delays: A Categorization

1.2.1 Inevitable delays and non-inevitable delays

As with most construction projects, the construction contract usually determines whether a construction delay is excusable or not. Typically, excusable (inevitable) delays are the ones that result from events that are beyond the contractor's control. Examples of these types of delays include sudden severe weather conditions, unanticipated site conditions, design errors, human resource issues (labor disputes), and change orders from owner. Depending on the terms of the contract, when these types of delays occur, the contract completion time is often extended without compensation to the owner.

Conversely, stoppable delays are delays caused by events that are within the control of the contractor. Examples of these types of delays include: delays caused by anticipated weather conditions, improper scheduling by the contractor, inadequate human workforce, poor supervision, and delays associated with the repairs of the contractor's defective work. Depending on the specific terms of the construction contract, these delays are often times compensable to the owner by the payment of either liquidated damages or actual damages by the contractor.

1.2.2. Compensable Delays

In a delay situation, the "affected party" may be compensated for the delays by the payment of money, the addition of time to complete the project or both.

In the case of inevitable delays, a contractor may be provisioned by the owner by the allowance of additional time to complete the project. The additional time to complete the project often results in the payment of additional money to the contractor to cover its additional costs and overhead incurred as a result of having to be on a project for a longer period of time.

In the case of inexcusable delays, the owner may be compensated by the payment of actual damages incurred as a result of the delays. If, as is often the case, actual damages are difficult (if not impossible) to calculate, many construction contracts include a liquidated damages provision. A typical liquidated damages provision

allows the owner to be paid a certain sum for each day a project is delayed after the agreed upon project completion date.

1.2.3. Concurrent Delays

Concurrent delays occur when both parties bear some of the responsibility for the construction delays or when there are multiple delays that occur during the same time period. Here, because both parties are at fault, in most instances neither party is entitled to monetary compensation. In those circumstances, however, most courts will add time for the completion of the project.

1.3. Problem Statement

As discussed above timely delivering of construction projects is essential to keep the balance of monetary aspects that affect the long term and the short term efficiency and growth. With delays in place, the efficiency is degraded in the short term whereas in the long term the overall economic stability is affected. Thus it's important to identify the causes of delays and also to identify the impact such delays have on all the attributes.

When considering government projects most of the projects run over their time period. It is wasting time and resources which can be used for another task. Due to the delay, both the client and contractor will have to pay or use more funds than the expected in form of rentals, salaries, liquidize damages and so on. Delay in government funded projects has a direct impact to the economic growth as the government funding occurs as per a schedule for a monetary year. If a certain project is delayed, then the overrun of funds will directly affect the financial year which it's pulled from.

The delay can be occurring due to vast number of reasons but mostly these are problems in the construction schedule where thread start from the planning stage as it's sequential. If one event of the thread is delayed for whichever the reason then the rest of the schedule is affected. It's very important to identify the root causes and make necessary measures to reconsider and rectify from the root itself.

Because this is very important problem globally, many literatures are available. The prime reasons for delay in government funded building construction projects are mainly local. Therefore the available literature cannot be localized to another country. Few studies have been done in Sri Lanka relevant to delay in completion of construction projects in general but rarely has been narrowed down to government funded projects. Since government funded projects has a direct liability towards the country's monetary management, it's the right time to conduct a study and find the offenders of the story.

1.4. Objectives of Research

To identify the causes for delay in completion of Government Funded Building Construction Projects in Sri Lanka

To identify the effects of delay in completion of Government Funded Building Construction Projects in Sri Lanka

To find remedies for delay in completion of Government Funded Building Construction Projects in Sri Lanka

1.5. Method of Study

In this study, it is designed to obtain views from representatives of consulting firms and construction firms with regard to causes and effects of delays in completion of building construction projects that are funded by the government.

The population of the study comprises of representatives (engineers) of consulting firms and construction firms that are involved with government funded building construction projects. The sample size is 60 and will be comprising of engineers. The sample will be selected from the population using random sample technique with the sample frame of engineers who work in government funded building construction projects less than 1000 million rupees.

Among the available methods in collecting data mainly two methods will be adopted, these are literature review and questionnaires which comprises two sections for causes and effects respectively. Literature will be reviewed to establish what others have documented on the subject matter. Useful information will be collected from

seminar and workshop papers, journal papers and internet sources. Questionnaires will be used to gather information for the study.

1.6. Scope and Limitations

This research is mainly based on the government funded building construction projects which are less than Rs: 1000 million and the delay is considered from awarding to completion of a project. Therefore findings of the research should be used only for the projects within the mentioned threshold.

Questioners were distributed through hand, e-mail and face book. Most responses were received for questioners which were distributed by hand. The data were collected from engineers who are working in government funded building projects based on western province. Therefore results of this study were most suitable to projects available in western province as it's clustered around it.

1.7. Organization of report

Chapter 1 looks at the introduction to the background, the problem statement, the problem question, the objective, the significance of the study and the limitations.

Chapter 2 looks at the secondary literature collected from books, articles, magazines, web pages, and student past studies.

Chapter 3 addresses the methodology. The methodology starts off with the introduction. Then identify the delay causes, selection of sample, data collection methods and the way of data analysis is discussed.

Chapter 4 considers the analysis of data collected using a questionnaire

Chapter 5 includes recommendations and conclusions on findings

CHAPTER 02: LITERATURE REVIEW

2.1. Introduction

According to the usage of buildings it can be classified in to four categories as follows.

01. Residential

02. Commercial

03. Institutional

04. Industrial/others

Most of the government funded buildings are within the commercial and institutional category. The sizes of those buildings are usually within two to ten stories and cost is mostly less than RS: 1,000.00 million and consultancy work is usually done by government institutions.

There are at least three most important parties involved with any government construction project. Namely they are as follows;

01. Client:-The organization or individual that is procuring the building development and usually referred as employer

02. Consultant: - This sector consist of professionals who are typically appointed by the client to perform expert task on a project

03. Contractor: - A person or firm that undertakes a contract to provide materials or laborers to perform a service or to do a job.

2.2 Definition of delay

Any project which is over running it's scheduled contract period can be defined as project delay. According to the study of Assaf and Al-Hejji (2006) construction delay is defined as "the time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project.

"Leishman (1993) defined delay as an "act or event which extends required time to

perform or complete work of the contract manifests itself as additional days of work".

Ubaid (1991) define delay as an event that causes extended time to complete all or part of a project whereas Kazie (1987) defined as the time overrun, either beyond the date for completion specified by the contract or beyond the extended contract period where an extension of time has been granted.

Bromilow (1974) defined delay as "Act or event that extends the time required to perform a task under a contract. It usually shows up as additional days of work or as delayed start of an activity."

2.3 Types of Construction Delays

Alkaas, Mazeroll and Harris (1996) gave five categorizations: excusable delays, excusable compensable delays, excusable non compensable delays, non-excusable delays, concurrent delays.

2.3.1 Critical and Non-Critical

In simple words Critical delays are those which cause delay to the project completion date while Non critical delays not necessarily affect the project completion date but affects progress. In all the projects delays are considered at the project completion date. Delays can be combination of small and bigger delays that occurred during the span of the whole project. Therefore critical delays are taken more into consideration than noncritical delays.

2.3.2. Excusable Delays

Excusable delays occurs due to events which are outside the control of contractor like heavy rains, storms, strikes, fire, client suggested changes, differing site conditions, change of government policy or their intervention, stakeholder intervention etc.

Alkass.et al (1996) says that when there are excusable delays, contractor is entitled to time extension in case date of completion is extended. Such delays can also affect non critical activities which must be considered with more detailed analysis or adjustment of float time.

Excusable delays can be further classified in compensable and non-compensable delays.

2.3.3. Excusable Compensable Delays

As the name itself suggests excusable compensable delays are those in which contractor is entitled for extra payment (compensation) i.e. monetary compensation and time extension as well. The decision that a delay is compensable or non-compensable is taken as per the contract between client and contractor. Natural disasters or reasons which are out of control are not considered. Example of such delay could be that client doesn't allow access to site even after notice to proceed is given; other such delays which are due to client are compensable.

2.3.4. Excusable Non-Compensable Delays

Such delays are where both contractor and client are not responsible for delay. Under such circumstances only time extensions are granted and no monetary compensation is provided. These are usually out of the control of both the client and contractor.

2.3.5. Non-Excusable Delays

As the name suggests these delays are such that no excuse can be given for them. They arise due to carelessness or actions and inactions of contractors and subcontractors. For such delays no time extensions and monetary compensation is given to contractor if it has affected whole duration of project. In such cases client is liable to get liquidated damages. Example of such delay could be constructing something wrong which is not given in drawings, not completing work on time, improper resource allocation etc.

2.3.6. Concurrent Delays

This is the most complex categorization of delay as it consists of two or more kind of delays regardless of their type which occurs at same time or overlaps some duration together. It is necessary to find out what type has caused overall delay in project completion. Therefore different factors like time of occurrence of delay, duration of delay, impact of them, float ownership etc. have to be considered carefully.

Alkass (1996) said that; Concurrent delays which contains two or more excusable delays results in time extension. When compensable and non-excusable delays are

concurrent a time extension can be given or delay can be distributed between client and contractor.

2.4 Delay causes

Many researches in different countries has done research to find delay causes and has identified most affected causes on delaying the projects.

Al-Momani (2000) found that the main causes of delay in construction of public projects in Jordan were related to designer and user changes, weather, site conditions, late deliveries, economic conditions and increase in quantities. Odeh and Battaineh (2002) showed that owner interference, inadequate contractor experience, financing and payments, labor productivity, slow decision making, improper planning, and sub-contractors are among the top ten most important factors casing delay in Jordan.

Assaf and Al-Hejji (2006) identified Seventy three causes of delay in construction projects in Saudi Arabia. The delay between 10 percent to 30 percent of planned duration. The most common cause of delay was change order‘‘. Sambasivan and Soon (2007) identified 10 most important causes of delay as: (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) labor supply, (8) equipment availability and failure, (9) lack of communication between parties, and (10) mistakes during the construction stage.

Furthermore Alnuaimi and Mohammed (2013) has identified causes of delay in Completion of Construction Projects in Oman which are namely as follows

Alnuaimi and Mohammed (2013) find out five major factors affecting to project delay.1. Design related delay: a. possible change in initial design. b. Complexity of the project. 2. Construction related delay: a. Variations and claims. b. Change of scope of project 3. Financial/ economic- related delay: a. financial ability of the owner b. Not enough funds 4. Management/ Administrative- related delay: a. Unavailability of suitable management team. b. Unspecialized subcontractors. c. Lack of project management. d. Lack of experience of the consultant e. Lack of

experience of the contractor 5. Regulations and code- related key delays: a) new legal instructions or rules

Countries like Malaysia where economic development has ramped up considerably has done various studies on to find causes of delay in their respective environment where reasons are varying and this depicts that the causes of delay vary according to the environment the project is being run (Murali and Yau (2006)).

Mansfield (1994) identified 16 major factors that caused delays and cost overruns in Nigeria. A questionnaire survey was carried out with contractors, consultants and client organizations in Nigeria. They presented that the causes of delay and cost overruns in Nigerian construction projects were attributed to finance and payment arrangements, poor contract management, shortages in materials, inaccurate estimation, and overall price fluctuations.

Assaf (1995) identified 56 main causes of delay in Saudi large building construction projects and their relative importance. Based on the contractors surveyed the most important delay factors were: preparation and approval of shop drawings, delays in contractor's progress, payment by owners and design changes. From the view of the architects and engineers the cash problems during construction, the relationship between subcontractors and the slow decision making process of the owner were the main causes of delay. However, the owners agreed that the design errors, labor shortages and inadequate labor skills were important delay factors.

Ogunlana and Promkuntong (1996) conducted a study on construction delays in Thailand. They found that the problems faced by the construction industry in developing economies like Thailand could be: (a) shortages or inadequacies in industry infrastructure (mainly supply of resources); (b) caused by clients and consultants and (c) caused by contractor's incompetence/inadequacies. They recommended that there should be concerted effort by economy managers and construction industry associations to provide the necessary infrastructure for efficient project management.

Chan and Kumaraswamy (1997) conducted a survey to determine and evaluate the relative importance of the significant factors causing delays in Hong Kong

construction projects. They analyzed and ranked main reasons for delays and classified them into two groups: (a) the role of the parties in the local construction industry (i.e. whether client, consultants or contractors) and (b) the type of projects. Results indicated that five major causes of delays were: poor site management and supervision, unforeseen ground conditions, low speed of decision making involving all project teams, client initiated variations and necessary variations of works.

Odeyinka and Yusif (1997) have addressed the causes of delays in building projects in Nigeria. They classified the causes of delay as project participants and extraneous factors. Client-related delays included variation in orders, slow decision-making and cash flow problems.

Sambasivan and Soon (2007) the related delays identified by this were: financial difficulties, material management problems, planning and scheduling problems, inadequate site inspection, equipment management problems and shortage of manpower. Extraneous causes of delay identified were: inclement weather, acts of nature, labor disputes and strikes.

Al-Momani (2000) carried out a quantitative analysis on construction delays in Jordan. The result of his study indicated that the main causes of delay in construction of public projects were related to designers, user changes, weather, site conditions, late deliveries, economic conditions and increase in quantity.

Similarly, Odeh and Battaineh (2002) also conducted a survey aimed at identifying the most important causes of delays in construction projects with traditional type of contracts from the viewpoint of construction contractors and consultants. Results of the survey indicated that contractors and consultants agreed that owner interference, inadequate contractor experience, financing and payments, labor productivity, slow decision making, improper planning, and subcontractors were among the top ten most important factors.

Frimpong (2003) conducted a survey to identify and evaluate the relative importance of significant factors contributing to delay and cost overruns in Ghana groundwater construction projects. A questionnaire with 26 factors was carefully designed from preliminary investigations conducted in groundwater drilling projects between 1970

and 1999 in Ghana. The questionnaire was directed towards three groups in both public and private organizations: owners of the groundwater projects, consulting offices, and contractors working in the groundwater works. The questionnaire was distributed to a random sample of 55 owners, 40 contractors and 30 consultants. The result of the study revealed the main causes of delay and cost overruns in construction of groundwater projects: monthly payment difficulties from agencies; poor contractor management; material procurement; poor technical performance; and escalation of material prices.

Assaf and Al-Hejji (2006) conducted a survey on time performance of large construction projects in Saudi Arabia. The survey had 73 different causes of delay. He studied the importance of various causes from the viewpoint of contractors, consultants, and owners. The most common cause of delay identified by all the parties was ‘‘change order’’. He also found that about 70% of the projects experienced time overruns.

2.5 Studies on effects of delay

Aibinu and Jagboro (2002) studied and evaluated the effects of construction delays on project delivery in Nigerian construction industry. They found that the six effects of construction delay were:

Time overrun

Cost overrun

Dispute

Arbitration

Litigation

Total abandonment

The questionnaires were sent to three groups of construction practitioners: quantity surveyors, architects and engineers, and contractors.

Manavazhia and Adhikarib (2002) conducted a survey to investigate material and equipment procurement delays in highway projects in Nepal. Delay in the delivery of

materials and equipment to construction sites is often a contributory cause to cost overruns in construction projects in developing countries. An assessment of the causes of the delays and the magnitude of their impact on project costs were also made. The survey method was used in conducting this research involving 22 highway projects. The main causes of material and equipment procurement delays were found to be (in rank order) organizational weaknesses, suppliers' defaults, governmental regulations and transportation delays. However, the actual impact of these delays on project costs was found to be on average, only about 0.5% of the total budgeted cost of the projects. Among materials, delays in the supply of aggregates and equipment were found to occur most frequently.

Chan and Kumaraswamy (2002) explored strategies of compressing construction durations of various types of building projects on the basis of the lessons learned from Hong Kong based surveys and other research findings. The literature from different countries on the factors affecting construction durations, reasons for project delays and existing statistical models for duration forecasts were reviewed. A regression-based model developed from Hong Kong public housing construction project data was used for predicting the durations of the primary work packages in the building process and the overall completion period. And finally, a survey was conducted by the researchers to explore the construction time performance of projects in three building sub-sectors (i.e. public housing, public non-residential and private sector). Based on the factors identified as significant from the above research, specific technological and managerial strategies for reducing construction periods in particular building sub-sectors were formulated in order to improve the construction time performance of Hong Kong building projects.

Terry Williams (2003) studied the standard methods currently available for assessing extension of time delays on major projects, and issues around such assessment. He used network causal mapping and system dynamics approach to study the impact of delays on a project. Based on the above studies, it can be inferred that the earlier studies concentrated on either the causes or the effects. However, some studies have alluded to the probable link between the causes and effects of delays without a systematic analysis.

Manavizha and Adhikarib (2002) linked the material-related causes to the probable cost overruns in construction projects in Nepal.

Assaf and Al-Hejji (2006) linked the contractor-related and labor-related causes to the probable time overruns in construction projects in Saudi Arabia. Odeh and Battaineh (2002) linked the contract-linked causes to the probable disputes occurring in construction projects in Jordan.

Chan and Kumaraswamy (1997) linked the consultant-related and client-related causes to the probable time overruns in construction projects in Hong Kong. Mansfield et al. (1994) and Frimpong et al. (2003) linked the client-related, Sambasivan and Soon (2007) consultant-related and material-related factors to the probable cost and time overruns.

CHAPTER 03: METHODOLOGY

3.1 Introduction

For the purpose of collecting data, as the survey method a questionnaire will be used and it will be circulated among a sample of 60. The sample comprises of engineers who are working in consultancy and construction firms related to government funded building construction projects in western province. The sample was selected using random sample technique that is based on a sample frame of the engineers who are representing construction and consultancy firms in government funded building construction projects less than 1000 million rupees. The sample consists of 50% of engineers from consultants and balance 50% is representing the contractor. The questionnaire is set with the use of a Likert scale. The data that are collected is tabulated and discussed further in chapter 4.

3.2 Identify of delay causes and effects

Both the experience being in the construction sector and the knowledge obtained from literature review were helpful to formulate the questionnaire to be effective in finding causes and effects of delay in government funded building construction projects in western province of the country.

3.3. Population and sample size

The population of the study comprises of representatives (engineers) of consulting and construction firms that are involved with government funded building projects. The sample size is 60. Sampling technique used is random sample technique that utilizes the sample frame of engineers in government funded building construction projects in western province which are less than 1000 million rupees.

3.4. Data collection techniques

Among the available methods in collecting data mainly two methods have been adopted, which are literature review and questionnaires which comprises two sections for causes and effects respectively. Literature is reviewed to establish what others have documented on the subject matter. Useful information is collected from seminar and workshop papers, journal papers and internet sources. A questionnaire is used to gather information for the study.

A questionnaire was developed in order to assess the perceptions of different parties involved in the construction process in Sri Lanka's construction sector using the evaluation of frequency in occurrence and importance of the identified causes. The questionnaire is divided into three sections. In first section, information and background of the respondents is requested. Second section consists of most frequent and important causes of construction delay. Third part consists of most important and frequent effects of construction delay. The questionnaire is distributed only among the engineers who are representing consultants and contractors relevant to government funded building construction projects less than 1 billion rupees. Any questionnaire that is not filled correctly is rejected.

3.5. Data analysis

Data is analyzed by calculating frequencies and Relative Importance Index (RII). The Relative Importance Index (RII) is calculated as following:

Equation (1): $RII = \frac{\sum W}{A \times N}$

W = weight given to each factor by respondents

A = highest weight

N = total number of respondents.

For the purpose of this study A=5 and N=60.

Relative Importance Indices (RII) comparison table is used to rank the results by taking the average scores into consideration and the RII is as mentioned in table 1.

Table 3-1: Relative Importance Index (RII) Table

Average Score	R(II)	Ranking
4.0 to 5.0	0.80 to 1.00	High (H)
3.0 to 4.0	0.60 to 0.80	Medium (M)
1.0 to 3.0	0.20 to 0.60	Low (L)

Source: Chileshe, Haupt and Fester (2007)

Relative importance index is calculated for consultants view; contractor view and general view (contractor and consultants) separately and rank the causes and effects accordingly.

Then Spearman rank correlation coefficient is used to find the strength of ranking between consultants and contractors and identify the most important causes which have higher effect on delay in completion of projects.

Equation (2):

$$\rho = 1 - \frac{6\sum d_i^2}{n(n^2-1)}$$

ρ= Spearman rank correlation coefficient;

d_i = Difference in ranking between the contractors and the consultants;

n = the number of variables.

The questions in the second part of the questionnaire have been divided in to four groups called contractor related delays, consultant related delays, client related delays and other delays. The data collected from questioner surveys is analyzed using Statistical Package for the Social Science (SPSS) software and the correlation between delay in building construction projects and delay reasons of each group are obtained. Then each group will be ranked with their importance in delaying the building construction projects and to find out whose causes are mostly affecting to the delay in completion of government funded building construction projects.

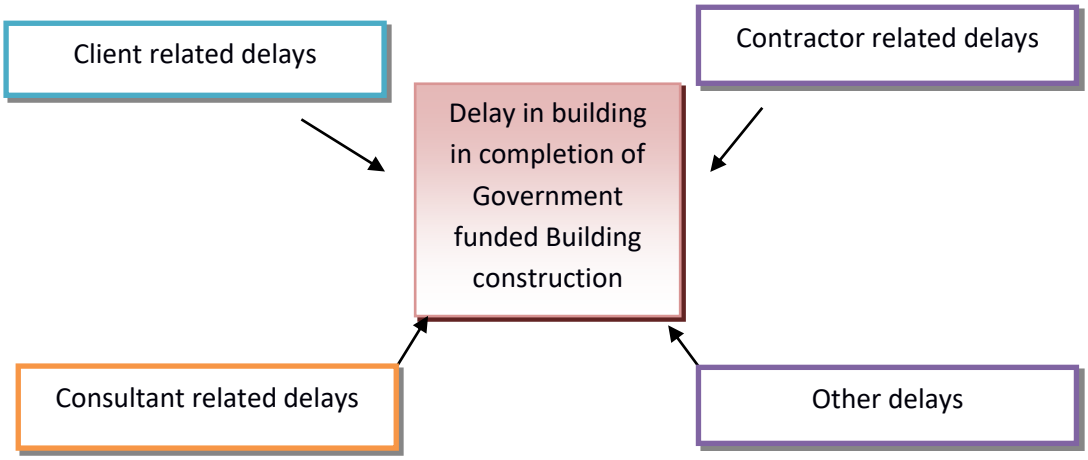

Figure 3-1: Type of delays affecting governmental construction projects

CHAPTER 4: DATA ANALYSIS

4.1 Introduction

This chapter illustrates the analysis of data that were collected using the questionnaires. The Likert scale questionnaire consists of 25 delay causes and 10 delay effects. As mentioned in the previous chapter, data is collected from engineers who are representing contractors and consultants related to government funded building construction projects in western province. 72 questionnaires were distributed among the sample. Among that 72 questionnaires 37 were distributed to contractors and balance 35 distributed to consultants. Only 30 contractors and 33 consultants responded to the questionnaire. Due to sample size is 60, 30 questionnaires from contractors and 30 from consultants were selected by removing randomly three questionnaires from consultants. The relevant experience of the selected sample is shown in figure 4.1. The analysis is done to solve the problem stated as the objective of the thesis. The findings presented in this chapter demonstrate the potential for merging theory and practice.

In this the causes of delay and effects were analyzed according to consultant, contractor and general (contractor + consultant) perspectives. The analyzed data were tabulated and are discussed separately.

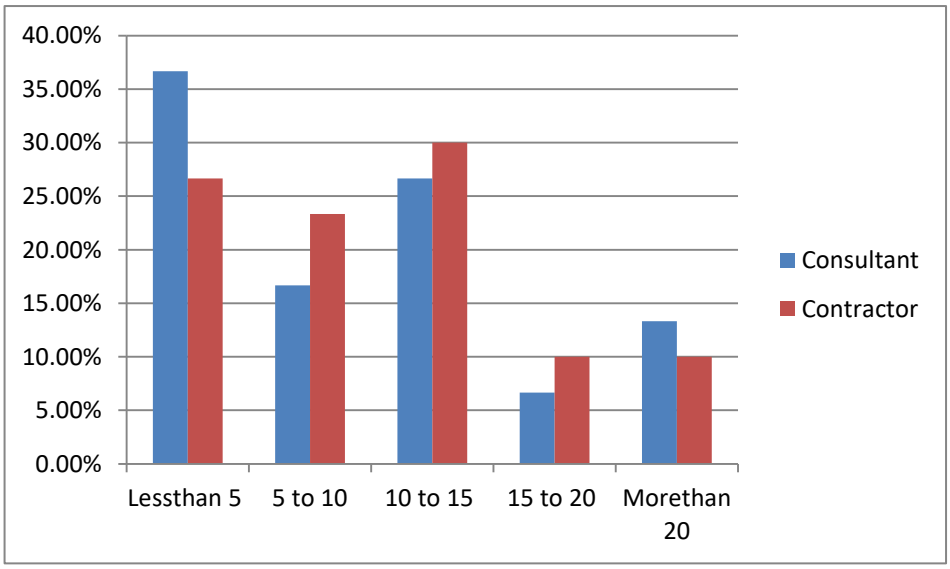

Figure 4-1: Experiences of the selected sample

4.2 Analysis of Delay Causes

4.2.1 Consultant's perspective

Table 4-1: Rank of causes according to consultant's responses

	Description	1	2	3	4	5	RII	Rank
CLIENT RELATED DELAYS								
1	Client's financial problems		3	9	14	4	0.73	6.5
2	Delay in contractor's interim payments by client	1	4	12	8	5	0.68	10.5
3	Changes to the scope during construction		9	11	8	2	0.62	16
4	Slow decision making		6	9	13	2	0.67	12
5	Delay in handing over the site	1	6	9	14		0.64	13.5
6	Delay due to ceremonial function(ex. foundation stone laying)	4	7	15	4		0.53	21
CONSULTANT RELATED DELAYS								
1	Delay in providing necessary drawings		1	12	12	5	0.74	4
2	Lack of experience of the consultant	5	12	8	4	1	0.49	24
3	Delay in providing necessary approvals & instructions	2	8	13	4	3	0.59	18
4	Mistakes & discrepancies involving to design drawings and BOQ		9	11	8	2	0.62	16
5	Attitude of consultant persons	2	15	9	2	2	0.51	23
6	Delay in approving contractor's payments	5	15	7	3		0.45	25
CONTRACTOR RELATED DELAYS								
1	Financial difficulties of contactor		1	11	16	2	0.73	6.5
2	Skill and experience of laborers		6	9	9	6	0.70	9
3	Delay in delivery of required materials to the site		2	7	19	2	0.74	4
4	Qualification of the contractor's technical staff allocated to the project		2	4	17	7	0.79	1
5	Unavailability of required equipment and machineries		4	10	12	4	0.71	8
6	Problems with subcontractor	1	4	7	18		0.68	10.5
7	Attitude of contractor's persons	1		11	13	5	0.74	4
8	Mistakes during construction	1	9	13	6	1	0.58	19
OTHER DELAYS								
1	Shortage of material	4	11	8	7		0.52	22
2	Bad weather conditions		9	10	10	1	0.62	16
3	Problems with neighbors and site conditions	3	7	13	7		0.56	20
4	Obstacles from government (regulations, elections, government changes, etc…)		8	10	10	2	0.64	13.5
5	Shortage of skill laborers		3	7	15	5	0.75	2

The table 4.1 shows consultant's responds for the questionnaire. Their responds were ranked by calculating Relative importance index.

Table 4-2: Importance of delay causes with respect to consultant's perspective

Description	RII	Rank	Delay Reason
Qualification of the contractor's technical staff allocated to the project	0.79	1	contractor
Shortage of skill laborers	0.75	2	other
Delay in providing necessary drawings	0.74	4	consultant
Delay in delivery of required materials to the site	0.74	4	contractor
Attitude of contractor's persons	0.74	4	contractor
Client's financial problems	0.73	6.5	client
Financial difficulties of contactor	0.73	6.5	contractor
Unavailability of required equipment and machineries	0.71	8	contractor
Skill and experience of laborers	0.70	9	contractor
Delay in contractor's interim payments by client	0.68	10.5	client
Problems with subcontractor	0.68	10.5	contractor
Slow decision making	0.67	12	client
Delay in handing over the site	0.64	13.5	client
Obstacles from government (regulations, elections, government changes, etc…)	0.64	13.5	other
Changes to the scope during construction	0.62	16	client
Mistakes & discrepancies involving to design drawings and BOQ	0.62	16	consultant
Bad weather conditions	0.62	16	other
Delay in providing necessary approvals & instructions	0.59	18	consultant
Mistakes during construction	0.58	19	contractor
Problems with neighbors and site conditions	0.56	20	other
Delay due to ceremonial function(ex. foundation stone laying)	0.53	21	client
Shortage of material	0.52	22	other
Attitude of consultant persons	0.51	23	consultant
Lack of experience of the consultant	0.49	24	consultant
Delay in approving contractor's payments	0.45	25	consultant

According to the consultant's perspective, the first seventeen delay causes in table 4.2 have medium impacts for project delay and balance have less impact.

4.2.2 Contractor's perspective

Table 4-3: Rank of causes according to contractor's responses

	Description	1	2	3	4	5	RII	Rank
CLIENT RELATED DELAYS								
1	Client's financial problems		2	7	13	8	0.78	7.5
2	Delay in contractor's interim payments by client		5	4	13	8	0.76	9.5
3	Changes to the scope during construction			7	10	13	0.84	2
4	Slow decision making		4	3	15	8	0.78	7.5
5	Delay in handing over the site	2	4	8	12	4	0.68	16
6	Delay due to ceremonial functions	3	8	8	11		0.58	24.5
CONSULTANT RELATED DELAYS								
7	Delay in providing necessary drawings		2	4	16	8	0.80	4
8	Lack of experience of the consultant		5	16	9		0.63	23
9	Delay in providing necessary approvals & instructions		2	5	15	8	0.79	5
10	Mistakes & discrepancies involving to design drawings and BOQ			11	14	5	0.76	9.5
11	Attitude of consultant persons		9	9	9	3	0.64	21
12	Delay in approving contractor's payments		5	12	11	2	0.67	17
CONTRACTOR RELATED DELAYS								
13	Financial difficulties of contactor			15	9	6	0.74	13
14	Skill and experience of laborers	1	3	7	13	6	0.73	14
15	Delay in delivery of required materials to the site		3	7	9	11	0.79	6
16	Qualification of the contractor's technical staff allocated to the project	2	5	8	13	2	0.65	19
17	Unavailability of required equipment and machineries		8	7	13	2	0.66	18
18	Problems with subcontractor		7	12	9	2	0.64	21
19	Attitude of contractor's persons			11	15	4	0.75	11.5
20	Mistakes during construction			17	13		0.69	15
OTHER DELAYS								
21	Shortage of material		7	12	9	2	0.64	21
22	Bad weather conditions			13	11	6	0.75	11.5
23	Problems with neighbors and site conditions	3	4	16	7		0.58	24.5
24	Obstacles from government (regulations, elections, government changes, etc…)		4	2	13	11	0.81	3
25	Shortage of skill laborers			4	15	11	0.85	1

The table 4.3 shows contractor's responds for the questionnaire. Their responds were ranked by calculating Relative importance index.

Table 4-4: Importance of delay causes with respect to contractor's perspective

Description	RII	Rank	Delay Reason
Shortage of skill laborers	0.85	1	other
Changes to the scope during construction	0.84	2	client
Obstacles from government (regulations, elections, government changes, etc…)	0.81	3	other
Delay in providing necessary drawings	0.80	4	consultant
Delay in providing necessary approvals & instructions	0.79	5	consultant
Delay in delivery of required materials to the site	0.79	6	contractor
Client's financial problems	0.78	7.5	client
Slow decision making	0.78	7.5	client
Delay in contractor's interim payments by client	0.76	9.5	client
Mistakes & discrepancies involving to design drawings and BOQ	0.76	9.5	consultant
Attitude of contractor's persons	0.75	11.5	contractor
Bad weather conditions	0.75	11.5	other
Financial difficulties of contactor	0.74	13	contractor
Skill and experience of laborers	0.73	14	contractor
Mistakes during construction	0.69	15	contractor
Delay in handing over the site	0.68	16	client
Delay in approving contractor's payments	0.67	17	consultant
Unavailability of required equipment and machineries	0.66	18	contractor
Qualification of the contractor's technical staff allocated to the project	0.65	19	contractor
Attitude of consultant persons	0.64	21	consultant
Problems with subcontractor	0.64	21	contractor
Shortage of material	0.64	21	other
Lack of experience of the consultant	0.63	23	consultant
Delay due to ceremonial functions	0.58	24.5	client
Problems with neighbors and site conditions	0.58	24.5	other

According to contactor's perspective the first four causes in table 4.4 have higher impact and 19 causes have medium impact to delay in government funded projects.

4.2.3 General perspective

Table 4-5: Rank of causes according to both consultant's and contractor's responses

	Description	1	2	3	4	5	RII	Rank
CLIENT RELATED DELAYS								
1	Client's financial problems		5	16	27	12	0.75	4
2	Delay in contractor's interim payments by client	1	9	16	21	13	0.72	11
3	Changes to the scope during construction		9	18	18	15	0.73	7
4	Slow decision making		10	12	28	10	0.73	8
5	Delay in handing over the site	3	10	17	26	4	0.66	17.5
6	Delay due to ceremonial functions	7	15	23	15		0.55	25
CONSULTANT RELATED DELAYS								
7	Delay in providing necessary drawings		3	16	28	13	0.77	2
8	Lack of experience of the consultant	5	17	24	13	1	0.56	23.5
9	Delay in providing necessary approvals & instructions	2	10	18	19	11	0.69	13.5
10	Mistakes & discrepancies involving to design drawings and BOQ		9	22	22	7	0.69	13.5
11	Attitude of consultant persons	2	24	18	11	5	0.58	21
12	Delay in approving contractor's payments	5	20	19	14	2	0.56	23.5
CONTRACTOR RELATED DELAYS								
13	Financial difficulties of contactor		1	26	25	8	0.73	6
14	Skill and experience of laborers	1	9	16	22	12	0.72	12
15	Delay in delivery of required materials to the site		5	14	28	13	0.76	3
16	Qualification of the contractor's technical staff allocated to the project	2	7	12	30	9	0.72	9.5
17	Unavailability of required equipment and machineries		12	17	25	6	0.68	16
18	Problems with subcontractor	1	11	19	27	2	0.66	17.5
19	Attitude of contractor's persons	1		22	28	9	0.75	5
20	Mistakes during construction	1	9	30	19	1	0.63	19
OTHER DELAYS								
21	Shortage of material	4	18	20	16	2	0.58	20
22	Bad weather conditions		9	23	21	7	0.69	15
23	Problems with neighbors and site conditions	6	11	29	14		0.57	22
24	Obstacles from government (regulations, elections, government changes, etc…)		12	12	23	13	0.72	9.5
25	Shortage of skill laborers		3	11	30	16	0.80	1

The table 4.5 shows general (both consultant and contractor) responds for the questionnaire. Their responds were ranked by calculating Relative importance index.

Table 4-6: Importance of delay causes with respect to both contractor and contractor's perspective

Description	RII	Rank	Delay Reason
Shortage of skill laborers	0.80	1	other
Delay in providing necessary drawings	0.77	2	consultant
Delay in delivery of required materials to the site	0.76	3	contractor
Client's financial problems	0.75	4	client
Attitude of contractor's persons	0.75	5	contractor
Financial difficulties of contactor	0.73	6	contractor
Changes to the scope during construction	0.73	7	client
Slow decision making	0.73	8	client
Qualification of the contractor's technical staff allocated to the project	0.72	9.5	contractor
Obstacles from government (regulations, elections, government changes, etc…)	0.72	9.5	other
Delay in contractor's interim payments by client	0.72	11	client
Skill and experience of laborers	0.72	12	contractor
Delay in providing necessary approvals & instructions	0.69	13.5	consultant
Mistakes & discrepancies involving to design drawings and BOQ	0.69	13.5	consultant
Bad weather conditions	0.69	15	other
Unavailability of required equipment and machineries	0.68	16	contractor
Delay in handing over the site	0.66	17.5	client
Problems with subcontractor	0.66	17.5	contractor
Mistakes during construction	0.63	19	contractor
Shortage of material	0.58	20	other
Attitude of consultant persons	0.58	21	consultant
Problems with neighbors and site conditions	0.57	22	other
Lack of experience of the consultant	0.56	23.5	consultant
Delay in approving contractor's payments	0.56	23.5	consultant
Delay due to ceremonial functions	0.55	25	client

The first cause in table 4.8 has higher impact and balance 18 and 6 causes have medium and low impact for project delay.

The ranks received by each causes according to each perspective were tabulated in table 4.7

Table 4-7: Summary of ranks according to each perspective

	Description	consultant	contractor	general
CLIENT RELATED DELAYS				
1	Client's financial problems	6.5	7.5	4
2	Delay in contractor's interim payments by client	10.5	9.5	11
3	Changes to the scope during construction	16	2	7
4	Slow decision making	12	7.5	8
5	Delay in handing over the site	13.5	16	17.5
6	Delay due to ceremonial function(ex. foundation stone laying)	21	24.5	25
CONSULTANT RELATED DELAYS				
1	Delay in providing necessary drawings	4	4	2
2	Lack of experience of the consultant	24	23	23.5
3	Delay in providing necessary approvals & instructions	18	5	13.5
4	Mistakes & discrepancies involving to design drawings and BOQ	16	9.5	13.5
5	Attitude of consultant persons	23	21	21
6	Delay in approving contractor's payments	25	17	23.5
CONTRACTOR RELATED DELAYS				
1	Financial difficulties of contactor	6.5	13	6
2	Skill and experience of laborers	9	14	12
3	Delay in delivery of required materials to the site	4	6	3
4	Qualification of the contractor's technical staff allocated to the project	1	19	9.5
5	Unavailability of required equipment and machineries	8	18	16
6	Problems with subcontractor	10.5	21	17.5
7	Attitude of contractor's persons	4	11.5	5
8	Mistakes during construction	19	15	19
OTHER DELAYS				
1	Shortage of material	22	21	20
2	Bad weather conditions	16	11.5	15
3	Problems with neighbors and site conditions	20	24.5	22
4	Obstacles from government (regulations, elections, government changes, etc…)	13.5	3	9.5
5	Shortage of skill laborers	2	1	1

The rank correlation coefficients between two parties for all combinations of the selected groups of factors are depicted in Table 4.8. The Spearman rank correlation between consultants and contractor is 0.48. Therefore, there is no higher correlation between those two parties. The consultant's perspective has higher agreement with the general perspective than contractor and general perspectives.

Table 4-8: Spearman correlation coefficients

	consultant	contractor	general
consultant	1	0.48	0.85
contractor	0.48	1	0.82
general	0.85	0.82	1

The delay causes were arranged according to their importance with respect to each party and tabulated in table 4.9.

Table 4-9: Delay causes according to importance of each perspective

Rank	Consultant	Contractor	General
1	Qualification of the contractor's technical staff allocated to the project	Shortage of skill laborers	Shortage of skill laborers
2	Shortage of skill laborers	Changes to the scope during construction	Delay in providing necessary drawings
3	Delay in delivery of required materials to the site	Obstacles from government (regulations, elections, government changes, etc…)	Delay in delivery of required materials to the site
	Attitude of contractor's persons		
	Delay in providing necessary drawings		
4		Delay in providing necessary drawings	Client's financial problems
5		Delay in providing necessary approvals & instructions	Attitude of contractor's persons

6	Client's financial problems	Delay in delivery of required materials to the site	Financial difficulties of contactor
	Financial difficulties of contactor		
7		Client's financial problems	Changes to the scope during construction
		Slow decision making	
8	Unavailability of required equipment and machineries		Slow decision making
9	Skill and experience of laborers	Delay in contractor's interim payments by client	Obstacles from government (regulations, elections, government changes, etc…)
		Mistakes & discrepancies involving to design drawings and BOQ	Qualification of the contractor's technical staff allocated to the project
10	Delay in contractor's interim payments by client		
	Problems with subcontractor		
11		Attitude of contractor's persons	Delay in contractor's interim payments by client
		Bad weather conditions	
12	Slow decision making		Skill and experience of laborers
13	Delay in handing over the site	Financial difficulties of contactor	Mistakes & discrepancies involving to design drawings and BOQ
	Obstacles from government (regulations, elections, government changes, etc…)		Delay in providing necessary approvals & instructions
14		Skill and experience of laborers	
15	Changes to the scope during construction	Mistakes during construction	Bad weather conditions
	Mistakes & discrepancies involving to design drawings and BOQ		
	Bad weather conditions		

16		Delay in handing over the site	Unavailability of required equipment and machineries
			Delay in handing over the site
17		Delay in approving contractor's payments	Problems with subcontractor
18	Delay in providing necessary approvals & instructions	Unavailability of required equipment and machineries	
19	Mistakes during construction	Qualification of the contractor's technical staff allocated to the project	Mistakes during construction
20	Problems with neighbors and site conditions	Problems with subcontractor	Shortage of material
		Shortage of material	
		Attitude of consultant persons	
21	Delay due to ceremonial function(ex. foundation stone laying)		Attitude of consultant persons
22	Shortage of material		Problems with neighbors and site conditions
23	Attitude of consultant persons	Lack of experience of the consultant	Lack of experience of the consultant
			Delay in approving contractor's payments
24	Lack of experience of the consultant	Problems with neighbors and site conditions	
		Delay due to ceremonial function(ex. foundation stone laying)	
25	Delay in approving contractor's payments		Delay due to ceremonial function(ex. foundation stone laying)

4.3 Analysis of Delay Factors

4.3.1 Client Related Delay

Table 4-10: Descriptive analysis results for client related delays (Consultant & Contractor)

Client Related Delay		N	Minimum	Maximum	Mean	Std. Deviation
Consultant	Client's financial problems	30	2.00	5.00	3.6333	.85029
	Delay in contractor's interim payments by client	30	1.00	5.00	3.4000	1.03724
	Changes to the scope during construction	30	2.00	5.00	3.1000	.92289
	Slow decision making	30	2.00	5.00	3.3667	.88992
	Delay in handing over the site	30	1.00	4.00	3.2000	.88668
	Delay due to ceremonial function(ex. foundation stone laying)	30	1.00	4.00	2.6333	.88992
	Valid N (list wise)	30				
Contractor	Client's financial problems	30	2.00	5.00	3.9000	.88474
	Delay in contractor's interim payments by client	30	2.00	5.00	3.8000	1.03057
	Changes to the scope during construction	30	3.00	5.00	4.2000	.80516
	Slow decision making	30	2.00	5.00	3.9000	.95953
	Delay in handing over the site	30	1.00	5.00	3.4000	1.10172
	Delay due to ceremonial function(ex. foundation stone laying)	30	1.00	4.00	2.9000	1.02889
	Valid N (list wise)	30				

The table 4.10 shows mean and standard deviation for each causes of client related delay with respect to consultant's and contractor's perspectives. According to

consultant's perspective there is an average mean of 3.2222 and according to contractors perspective it is 3.6833.

Table 4.11 to Table 4.17and figure 4.2 to figure 4.7 clearly shows frequencies how contractor and consultant respond to the each causes related to client related delays.

Table 4-11: Descriptive analysis results for client related delays (General perspective)

Client Related Delay	N	Minimum	Maximum	Mean	Std. Deviation
Client's financial problems	60	2.00	5.00	3.7667	.87074
Delay in contractor's interim payments by client	60	1.00	5.00	3.6000	1.04476
Changes to the scope during construction	60	2.00	5.00	3.6500	1.02221
Slow decision making	60	2.00	5.00	3.6333	.95610
Delay in handing over the site	60	1.00	5.00	3.3000	.99660
Delay due to ceremonial function(ex. foundation stone laying)	60	1.00	4.00	2.7667	.96316
Valid N (list wise)	60				

Table 4.11 clearly shows that the means and standard deviation of each cause of client related delays with respect to general view (both consultant and contractor). According to general view client related delays has average mean of 3.4527

4.3.1.1 Client's Financial Problems

Table 4-12: Frequency analysis for client's financial problems

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid disagree	3	10.0	10.0	10.0
	neutral	9	30.0	30.0	40.0
	agree	14	46.7	46.7	86.7
	strongly agree	4	13.3	13.3	100.0
	Total	30	100.0	100.0	
Contractor	Valid disagree	2	6.7	6.7	6.7
	neutral	7	23.3	23.3	30.0
	agree	13	43.3	43.3	73.3
	strongly agree	8	26.7	26.7	100.0
	Total	30	100.0	100.0	

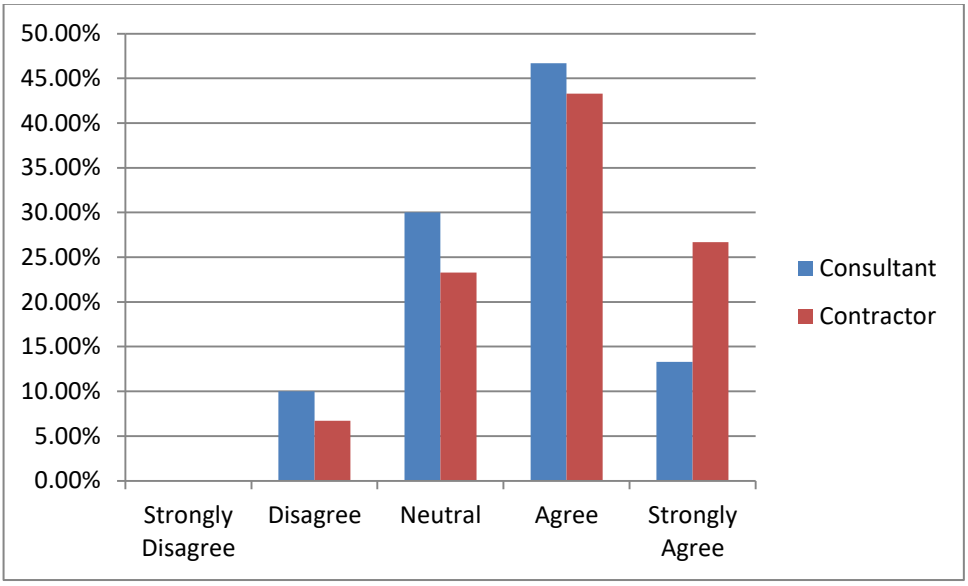

Figure 4-2: Responds for client's financial problems

4.3.1.2. Delay in contractor's interim payments by client

Table 4-13: Frequency analysis for delay in contractor's interim payments by client

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid strongly disagree	1	3.3	3.3	3.3
	disagree	4	13.3	13.3	16.7
	neutral	12	40.0	40.0	56.7
	agree	8	26.7	26.7	83.3
	strongly agree	5	16.7	16.7	100.0
	Total	30	100.0	100.0	
Contractor	Valid disagree	5	16.7	16.7	16.7
	neutral	4	13.3	13.3	30.0
	agree	13	43.3	43.3	73.3
	strongly agree	8	26.7	26.7	100.0
	Total	30	100.0	100.0	

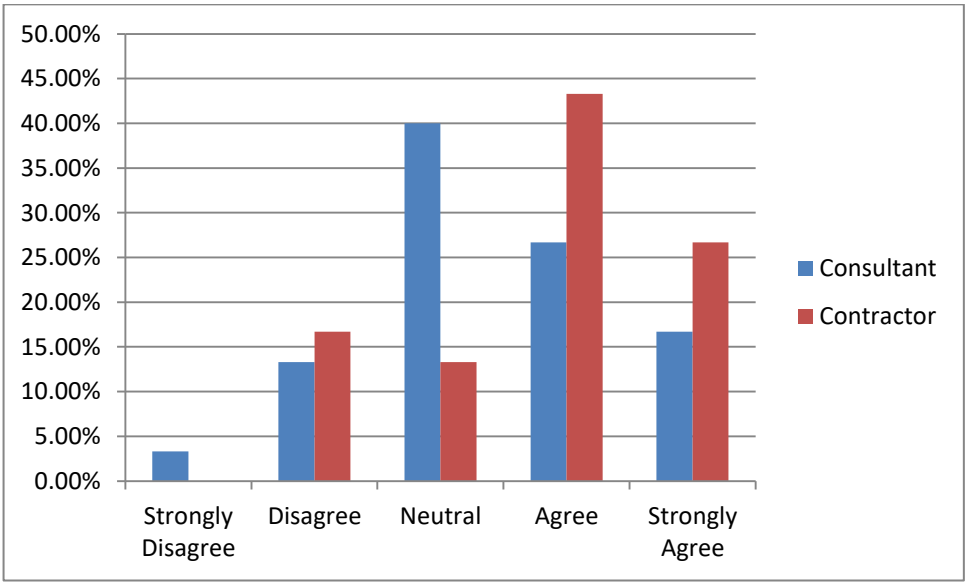

Figure 4-3: Responds for delay in contractor's interim payments by client

4.3.1.3 Changes to the scope during construction

Table 4-14: Frequency analysis for changes to the scope during construction

consultant/contractor			Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid	disagree	9	30.0	30.0	30.0
		neutral	11	36.7	36.7	66.7
		agree	8	26.7	26.7	93.3
		strongly agree	2	6.7	6.7	100.0
		Total	30	100.0	100.0	
Contractor	Valid	neutral	7	23.3	23.3	23.3
		agree	10	33.3	33.3	56.7
		strongly agree	13	43.3	43.3	100.0
		Total	30	100.0	100.0	

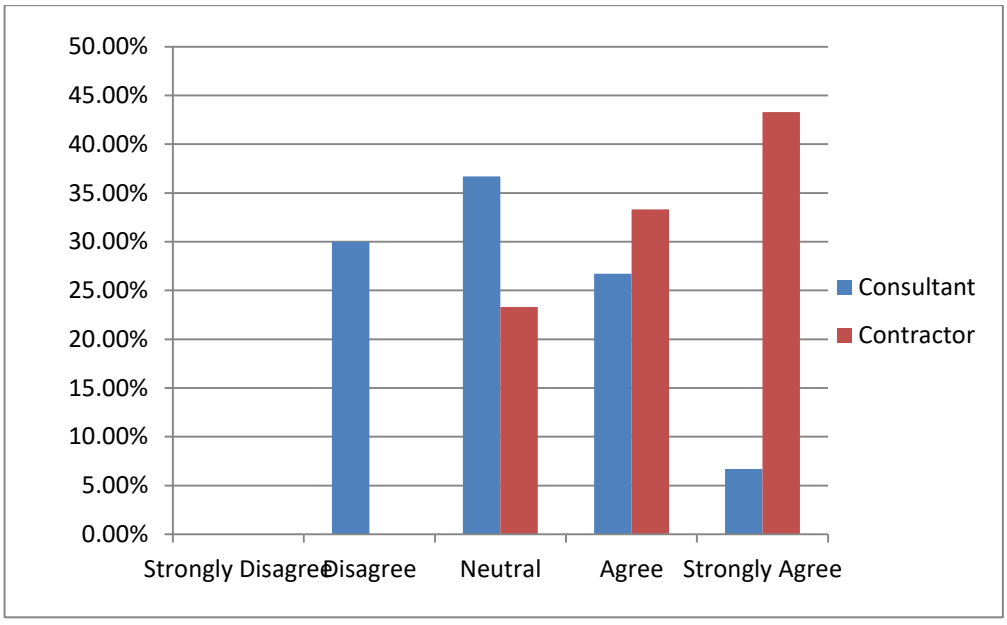

Figure 4-4: Responds for changes to the scope during construction

4.3.1.4 Slow decision making

Table 4-15: Frequency analysis for slow decision making

consultant/contractor			Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid	disagree	6	20.0	20.0	20.0
		neutral	9	30.0	30.0	50.0
		agree	13	43.3	43.3	93.3
		strongly agree	2	6.7	6.7	100.0
		Total	30	100.0	100.0	
Contractor	Valid	disagree	4	13.3	13.3	13.3
		neutral	3	10.0	10.0	23.3
		agree	15	50.0	50.0	73.3
		strongly agree	8	26.7	26.7	100.0
		Total	30	100.0	100.0	

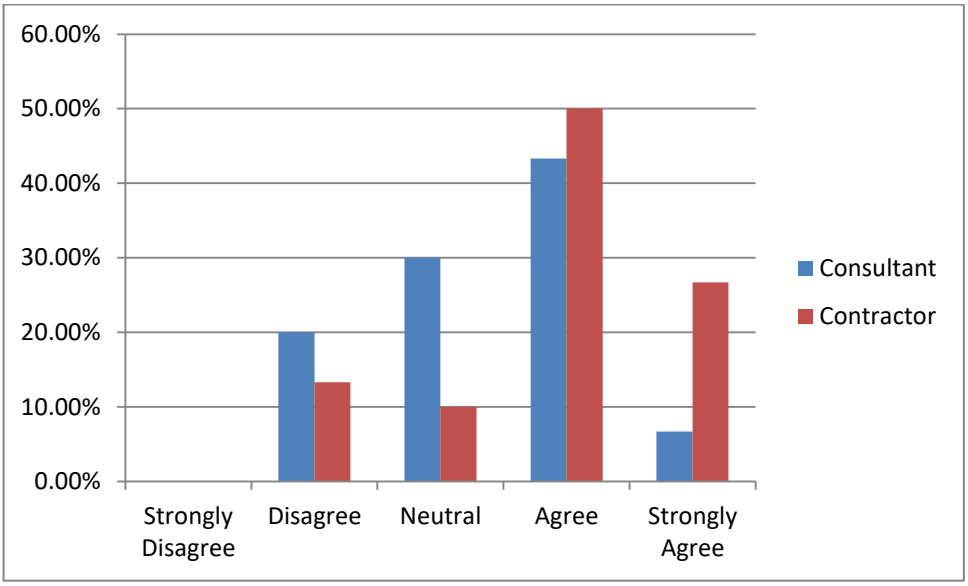

Figure 4-5: Responds for slow decision making

4.3.1.5 Delay in handing over the site

Table 4-16: Frequency analysis for delay in handing over the site

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid strongly disagree	1	3.3	3.3	3.3
	disagree	6	20.0	20.0	23.3
	neutral	9	30.0	30.0	53.3
	agree	14	46.7	46.7	100.0
	Total	30	100.0	100.0	
Contractor	Valid strongly disagree	2	6.7	6.7	6.7
	disagree	4	13.3	13.3	20.0
	neutral	8	26.7	26.7	46.7
	agree	12	40.0	40.0	86.7
	strongly agree	4	13.3	13.3	100.0
	Total	30	100.0	100.0	

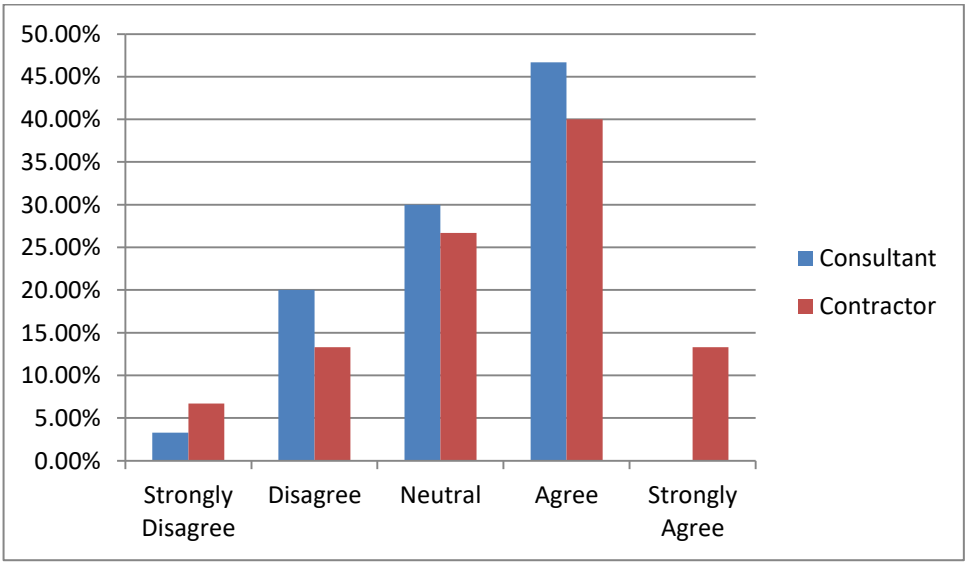

Figure 4-6: Responds for delay in handing over the site

4.3.1.6 Delay due to ceremonial function (ex. foundation stone laying)

Table 4-17: Frequency analysis for delay due to ceremonial function (ex. foundation stone laying)

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid strongly disagree	4	13.3	13.3	13.3
	disagree	7	23.3	23.3	36.7
	neutral	15	50.0	50.0	86.7
	agree	4	13.3	13.3	100.0
	Total	30	100.0	100.0	
Contractor	Valid strongly disagree	3	10.0	10.0	10.0
	disagree	8	26.7	26.7	36.7
	neutral	8	26.7	26.7	63.3
	agree	11	36.7	36.7	100.0
	Total	30	100.0	100.0	

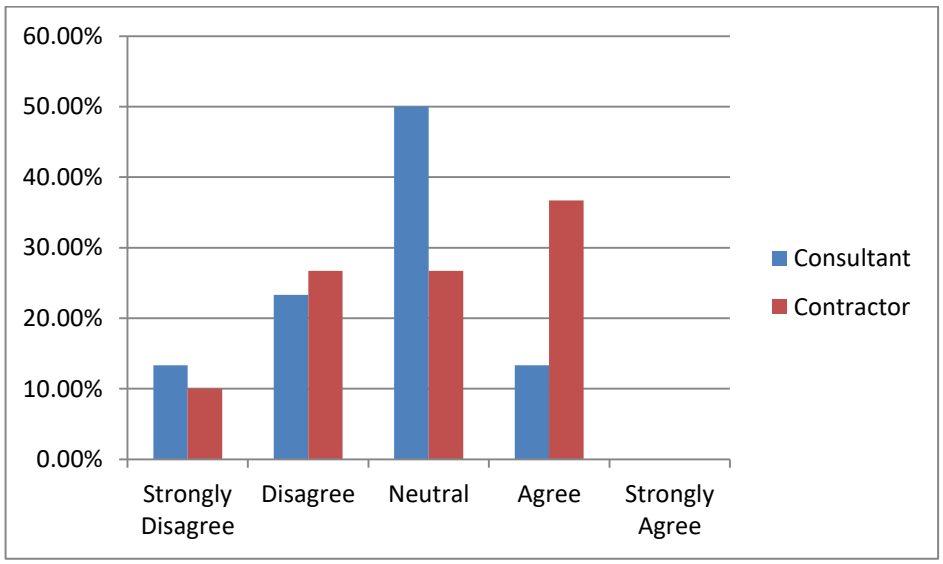

Figure 4-7: Responds for delay due to ceremonial functions (ex. foundation stone laying)

4.3.2 Consultant Related Delays

Table 4-18: Descriptive analysis results for consultant related delays (Consultant & Contractor)

consultant/contractor		N	Minimum	Maximum	Mean	Std. Deviation
Consultant	Delay in providing necessary drawings	30	2.00	5.00	3.7000	.79438
	Lack of experience of the consultant	30	1.00	5.00	2.4667	1.04166
	Delay in providing necessary approvals & instructions	30	1.00	5.00	2.9333	1.04826
	Mistakes & discrepancies involving to design drawings and BOQ	30	2.00	5.00	3.1000	.92289
	Attitude of consultant persons	30	1.00	5.00	2.5333	.97320
	Delay in approving contractor's payments	30	1.00	4.00	2.2667	.86834
	Valid N (list wise)	30				
Contractor	Delay in providing necessary drawings	30	2.00	5.00	4.0000	.83045
	Lack of experience of the consultant	30	2.00	4.00	3.1333	.68145
	Delay in providing necessary approvals & instructions	30	2.00	5.00	3.9667	.85029
	Mistakes & discrepancies involving to design drawings and BOQ	30	3.00	5.00	3.8000	.71438
	Attitude of consultant persons	30	2.00	5.00	3.2000	.99655
	Delay in approving contractor's payments	30	2.00	5.00	3.3333	.84418
	Valid N (list wise)	30				

The table 4.18 Shows mean and standard deviation for each cause of consultant related delays with respect to consultant's and contractor's perspectives. According

to consultant's perspective there is an average mean of 2.8333 and according to contractors perspective it is 3.5722.

Table 4.20 to 4.25 and figure 4.7 to figure 4.12 clearly shows frequencies how contractor and consultant responds to the each causes related to consultant related delays.

Table 4-19: Descriptive analysis results for consultant related delays (General perspective)

Consultant Related Delays	N	Minimum	Maximum	Mean	Std. Deviation
Delay in providing necessary drawings	60	2.00	5.00	3.8500	.81978
Lack of experience of the consultant	60	1.00	5.00	2.8000	.93519
Delay in providing necessary approvals & instructions	60	1.00	5.00	3.4500	1.08025
Mistakes & discrepancies involving to design drawings and BOQ	60	2.00	5.00	3.4500	.89110
Attitude of consultant persons	60	1.00	5.00	2.8667	1.03280
Delay in approving contractor's payments	60	1.00	5.00	2.8000	1.00507
Valid N (list wise)	60				

Table 4.19 clearly shows means and standard deviation of each cause's affect to consultant related delays with respect to general view (both client and contractor). According to general view consultant related delays have average mean of 2.6278.

4.3.2.1 Delay in providing necessary drawings

Table 4-20: Frequency analysis for delay in providing necessary drawings

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid disagree	1	3.3	3.3	3.3
	neutral	12	40.0	40.0	43.3
	agree	12	40.0	40.0	83.3
	strongly agree	5	16.7	16.7	100.0
	Total	30	100.0	100.0	
Contractor	Valid disagree	2	6.7	6.7	6.7
	neutral	4	13.3	13.3	20.0
	agree	16	53.3	53.3	73.3
	strongly agree	8	26.7	26.7	100.0
	Total	30	100.0	100.0	

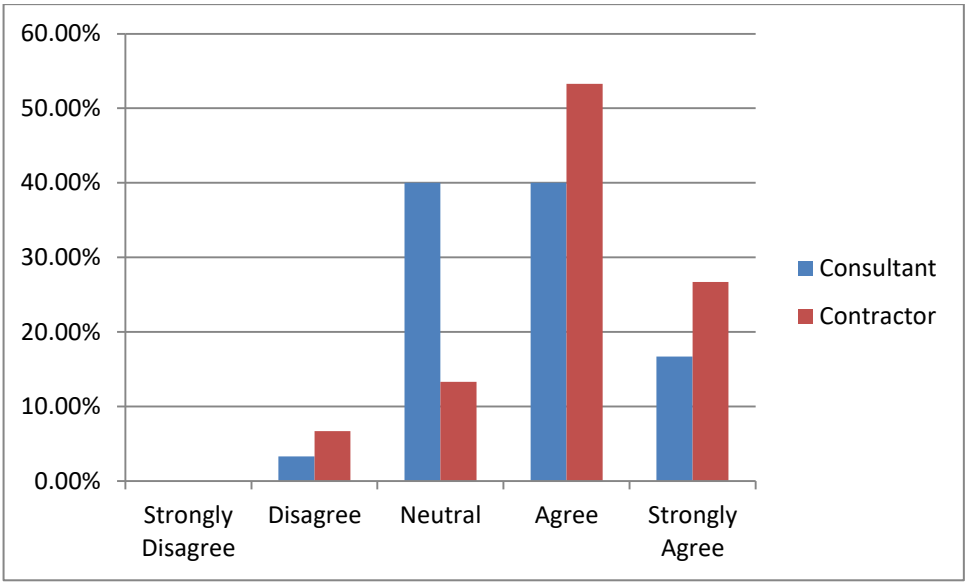

Figure 4-8: Responds for delay in providing necessary drawings

4.3.2.2 Lack of experience of the consultant

Table 4-21: Frequency analysis for lack of experience of the consultant

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid strongly disagree	5	16.7	16.7	16.7
	disagree	12	40.0	40.0	56.7
	neutral	8	26.7	26.7	83.3
	agree	4	13.3	13.3	96.7
	strongly agree	1	3.3	3.3	100.0
	Total	30	100.0	100.0	
Contractor	Valid disagree	5	16.7	16.7	16.7
	neutral	16	53.3	53.3	70.0
	agree	9	30.0	30.0	100.0
	Total	30	100.0	100.0	

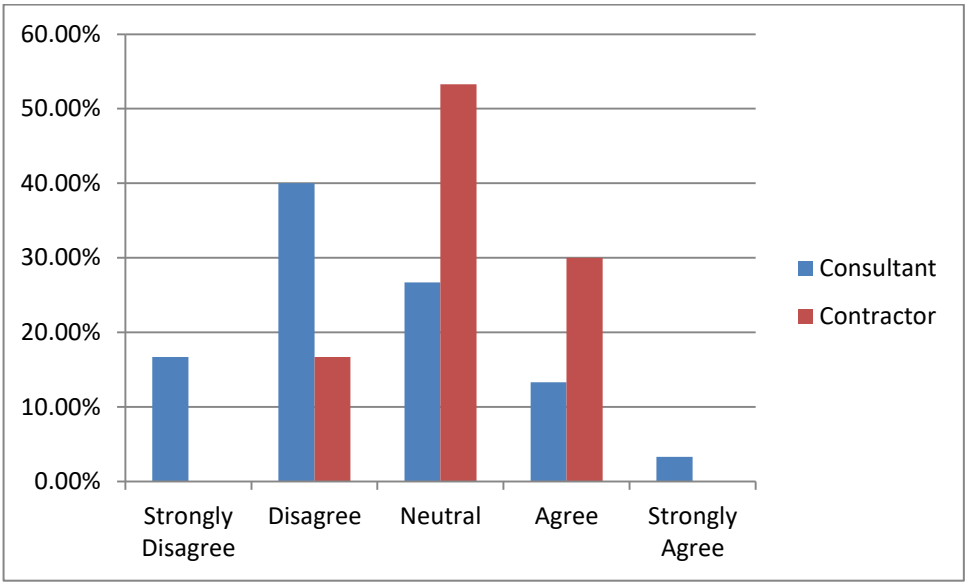

Figure 4-9: Responds for lack of experience of the consultant

4.3.2.3 Delay in providing necessary approvals & instructions

Table 4-22: Frequency analysis for delay in providing necessary approvals & instructions

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid strongly disagree	2	6.7	6.7	6.7
	disagree	8	26.7	26.7	33.3
	neutral	13	43.3	43.3	76.7
	agree	4	13.3	13.3	90.0
	strongly agree	3	10.0	10.0	100.0
	Total	30	100.0	100.0	
Contractor	Valid disagree	2	6.7	6.7	6.7
	neutral	5	16.7	16.7	23.3
	agree	15	50.0	50.0	73.3
	strongly agree	8	26.7	26.7	100.0
	Total	30	100.0	100.0	

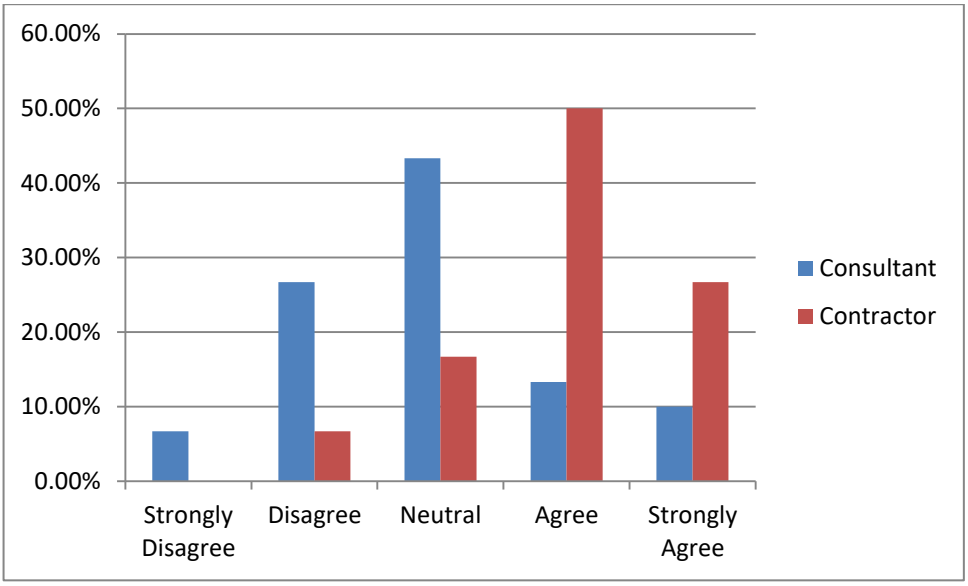

Figure 4-10: Responds for delay in providing necessary approvals & instructions

4.3.2.4 Mistakes & discrepancies involving to design drawings and BOQ

Table 4-23: Frequency analysis for mistakes & discrepancies involving to design drawings and BOQ

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid disagree	9	30.0	30.0	30.0
	neutral	11	36.7	36.7	66.7
	agree	8	26.7	26.7	93.3
	strongly agree	2	6.7	6.7	100.0
	Total	30	100.0	100.0	
Contractor	Valid neutral	11	36.7	36.7	36.7
	agree	14	46.7	46.7	83.3
	strongly agree	5	16.7	16.7	100.0
	Total	30	100.0	100.0	

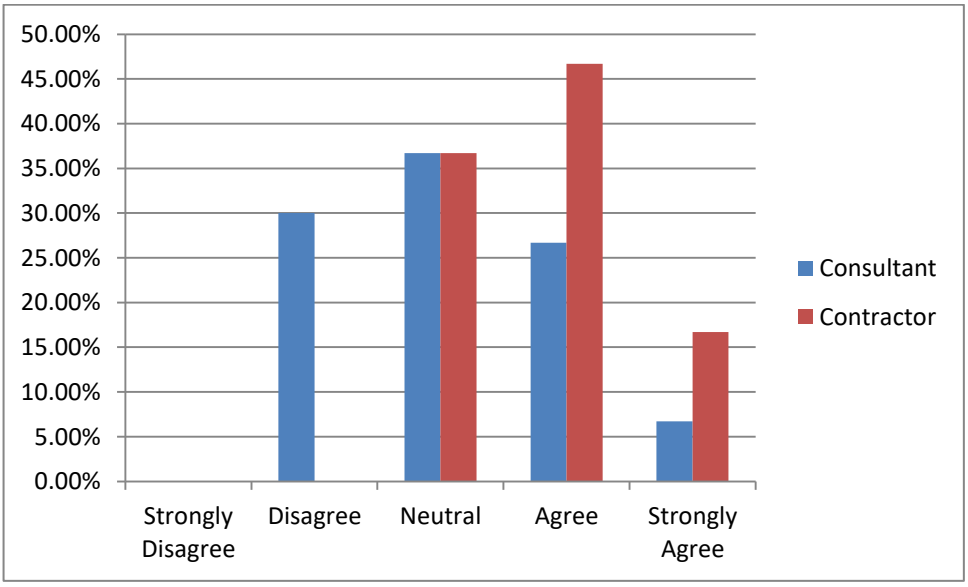

Figure 4-11: Responds for mistakes & discrepancies involving to design drawings and BOQ

4.3.2.5 Attitude of consultant persons

Table 4-24: Frequency analysis for attitude of consultant persons

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid strongly disagree	2	6.7	6.7	6.7
	disagree	16	53.3	53.3	60.0
	neutral	8	26.7	26.7	86.7
	agree	2	6.7	6.7	93.3
	strongly agree	2	6.7	6.7	100.0
	Total	30	100.0	100.0	
Contractor	Valid disagree	9	30.0	30.0	30.0
	neutral	9	30.0	30.0	60.0
	agree	9	30.0	30.0	90.0
	strongly agree	3	10.0	10.0	100.0
	Total	30	100.0	100.0	

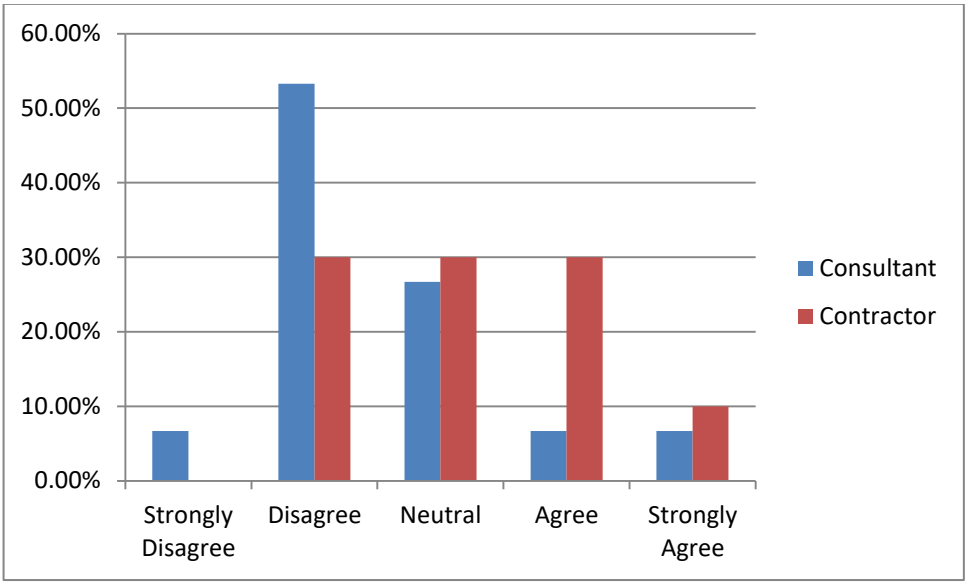

Figure 4-12: Responds for attitude of consultant persons

4.3.2.6 Delay in approving contractor's payments

Table 4-25: Frequency analysis for lack of experience of the consultant

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid strongly disagree	5	16.7	16.7	16.7
	disagree	15	50.0	50.0	66.7
	neutral	7	23.3	23.3	90.0
	agree	3	10.0	10.0	100.0
	Total	30	100.0	100.0	
Contractor	Valid disagree	5	16.7	16.7	16.7
	neutral	12	40.0	40.0	56.7
	agree	11	36.7	36.7	93.3
	strongly agree	2	6.7	6.7	100.0
	Total	30	100.0	100.0	

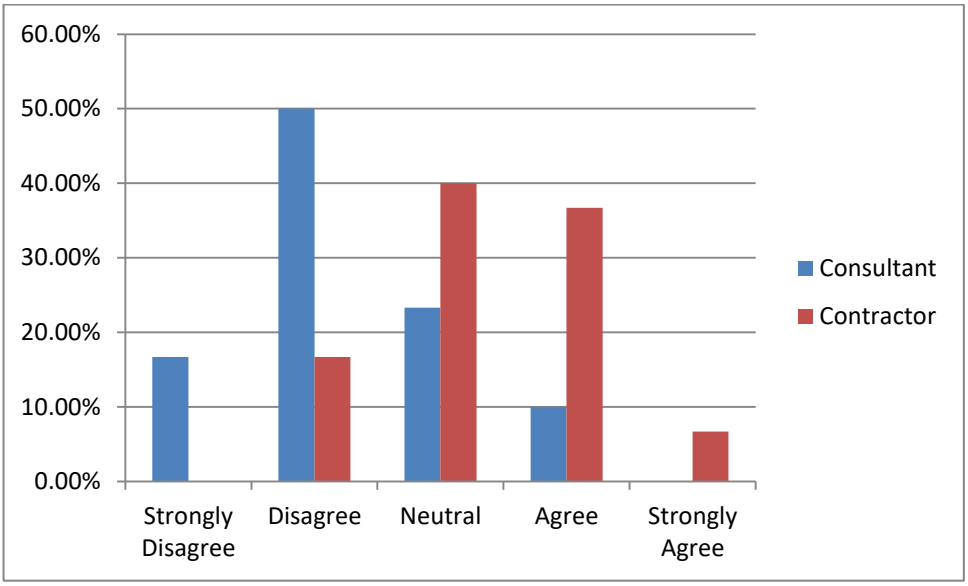

Figure 4-13: Responds for lack of experience of the consultant

4.3.3 Contractor related delays

Table 4-26: Descriptive analysis results for Contractor related delays (Contractor & Consultant)

consultant/contractor		N	Minimum	Maximum	Mean	Std. Deviation
Consultant	Financial difficulties of contactor	30	1.00	4.00	2.6333	.66868
	Skill and experience of laborers	30	2.00	5.00	3.5000	1.04221
	Delay in delivery of required materials to the site	30	2.00	5.00	3.7000	.70221
	Qualification of the contractor's technical staff allocated to the project	30	2.00	5.00	3.9667	.80872
	Unavailability of required equipment and machineries	30	2.00	5.00	3.5333	.89955
	Problems with subcontractor	30	1.00	4.00	3.4000	.85501
	Attitude of contractor's persons	30	1.00	5.00	3.7000	.87691
	Mistakes during construction	30	1.00	5.00	2.9000	.88474
	Valid N (list wise)	30				
Contractor	Financial difficulties of contactor	30	3.00	5.00	3.7000	.79438
	Skill and experience of laborers	30	1.00	5.00	3.6667	1.02833
	Delay in delivery of required materials to the site	30	2.00	5.00	3.9333	1.01483
	Qualification of the contractor's technical staff allocated to the project	30	1.00	5.00	3.2667	1.04826
	Unavailability of required equipment and machineries	30	2.00	5.00	3.3000	.95231
	Problems with subcontractor	30	2.00	5.00	3.2000	.88668
	Attitude of contractor's persons	30	3.00	5.00	3.7667	.67891
	Mistakes during construction	30	3.00	4.00	3.4333	.50401
	Valid N (list wise)	30				

The table 4.26 shows mean and standard deviation for each cause of contractor related delay with respect to consultant's and contractor's perspectives. According to

consultant's perspective there is an average mean of 3.4167 and according to contractors perspective it is 3.5333.

Table 4.28 to Table 4.35 and figure 4.12 to figure 4.18 clearly shows frequencies how contractor and consultant responds to the each causes related to contractor related delays

Table 4-27: Descriptive analysis results for contractor related delays (General perspective)

Contractor Related Delays	N	Minimum	Maximum	Mean	Std. Deviation
Financial difficulties of contactor	60	1.00	5.00	3.1667	.90510
Skill and experience of laborers	60	1.00	5.00	3.5833	1.02992
Delay in delivery of required materials to the site	60	2.00	5.00	3.8167	.87317
Qualification of the contractor's technical staff allocated to the project	60	1.00	5.00	3.6167	.99305
Unavailability of required equipment and machineries	60	2.00	5.00	3.4167	.92593
Problems with subcontractor	60	1.00	5.00	3.3000	.86944
Attitude of contractor's persons	60	1.00	5.00	3.7333	.77824
Mistakes during construction	60	1.00	5.00	3.1667	.76284
Valid N (list wise)	60				

Table 4.27 clearly shows means and standard deviation of each cause's affect to contractor related delays with respect to general view (both client and contractor). According to general view contractor related delays have average mean of 3.4750.

4.3.3.1 Financial difficulties of contractor

Table 4-28: Frequency analysis for financial difficulties of contractor

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid strongly disagree	1	3.3	3.3	3.3
	disagree	11	36.7	36.7	40.0
	neutral	16	53.3	53.3	93.3
	agree	2	6.7	6.7	100.0
	Total	30	100.0	100.0	
Contractor	Valid neutral	15	50.0	50.0	50.0
	agree	9	30.0	30.0	80.0
	strongly agree	6	20.0	20.0	100.0
	Total	30	100.0	100.0	

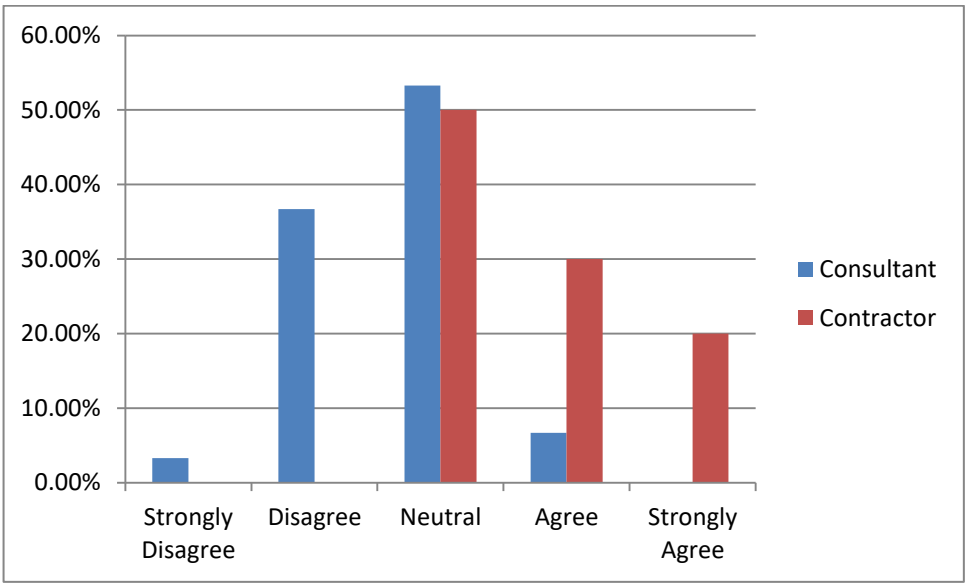

Figure 4-14: Responds for financial difficulties of contractor

4.3.3.2 Skill and experience of laborers

Table 4-29: Frequency analysis for skill and experience of laborers

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid disagree	6	20.0	20.0	20.0
	neutral	9	30.0	30.0	50.0
	agree	9	30.0	30.0	80.0
	strongly agree	6	20.0	20.0	100.0
	Total	30	100.0	100.0	
Contractor	Valid strongly disagree	1	3.3	3.3	3.3
	disagree	3	10.0	10.0	13.3
	neutral	7	23.3	23.3	36.7
	agree	13	43.3	43.3	80.0
	strongly agree	6	20.0	20.0	100.0
	Total	30	100.0	100.0	

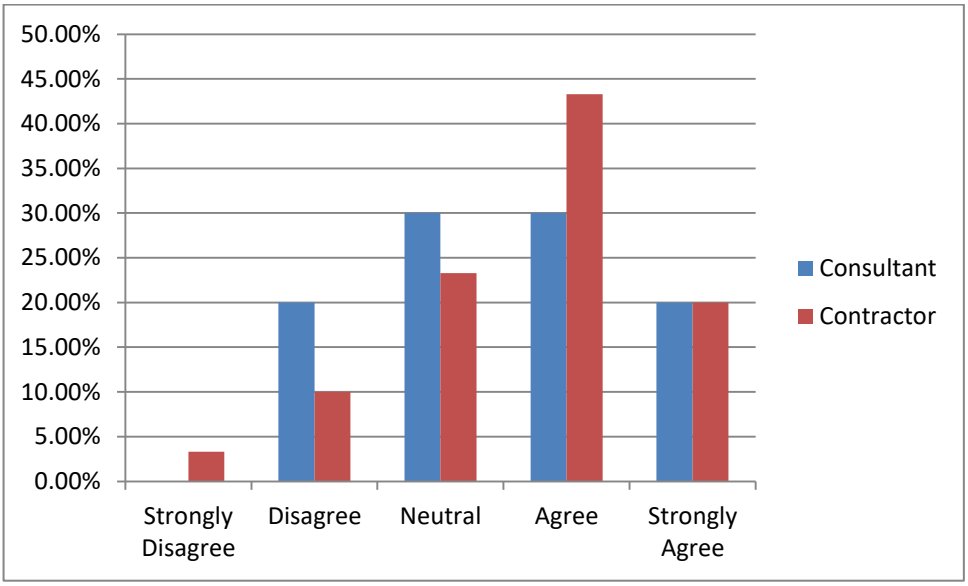

Figure 4-15: Responds for skill and experience of laborers

4.3.3.3 Delay in delivery of required materials to the site

Table 4-30: Frequency analysis for Delay in delivery of required materials to the site

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid disagree	2	6.7	6.7	6.7
	neutral	7	23.3	23.3	30.0
	agree	19	63.3	63.3	93.3
	strongly agree	2	6.7	6.7	100.0
	Total	30	100.0	100.0	
Contractor	Valid disagree	3	10.0	10.0	10.0
	neutral	7	23.3	23.3	33.3
	agree	9	30.0	30.0	63.3
	strongly agree	11	36.7	36.7	100.0
	Total	30	100.0	100.0	

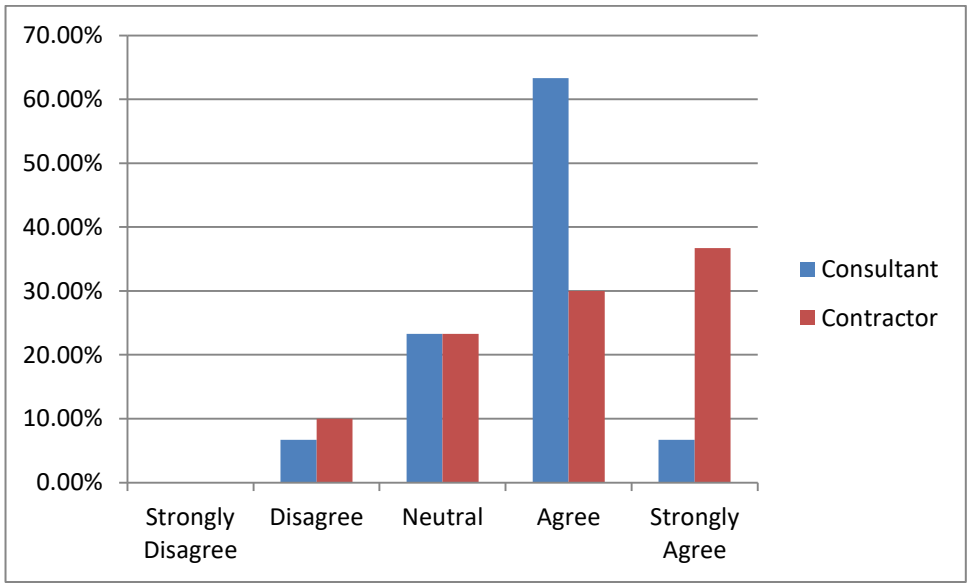

Figure 4-16: Responds for delay in delivery of required materials to the site

4.3.3.4 Qualification of the contractor's technical staff allocated to the project

Table 4-31: Frequency analysis for Qualification of the contractor's technical staff allocated to the project

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid disagree	2	6.7	6.7	6.7
	neutral	4	13.3	13.3	20.0
	agree	17	56.7	56.7	76.7
	strongly agree	7	23.3	23.3	100.0
	Total	30	100.0	100.0	
Contractor	Valid strongly disagree	2	6.7	6.7	6.7
	disagree	5	16.7	16.7	23.3
	neutral	8	26.7	26.7	50.0
	agree	13	43.3	43.3	93.3
	strongly agree	2	6.7	6.7	100.0
	Total	30	100.0	100.0	

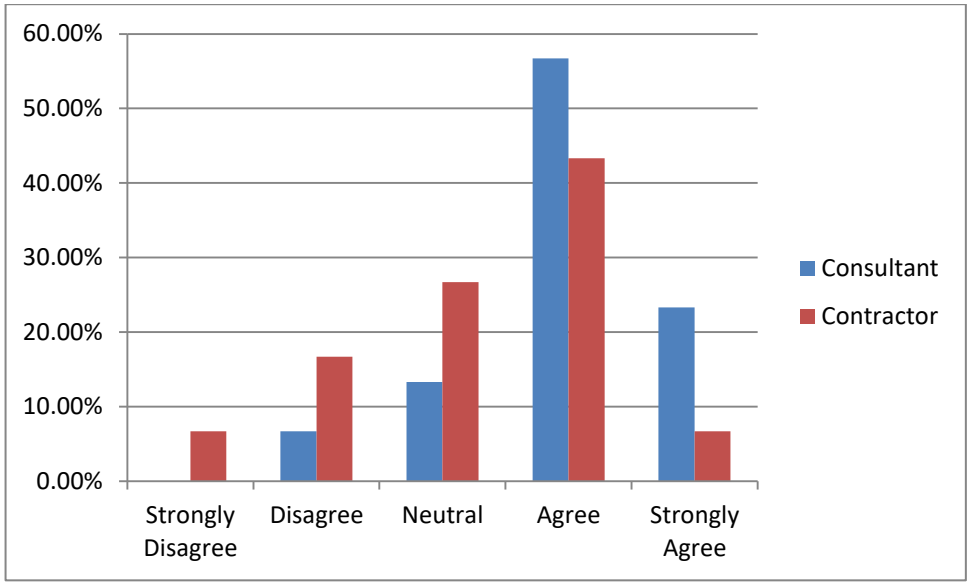

Figure 4-17: Responds for Qualification of the contractor's technical staff allocated to the project

4.3.3.5 Unavailability of required equipment and machineries

Table 4-32: Frequency analysis for unavailability of required equipment and machineries

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid disagree	4	13.3	13.3	13.3
	neutral	10	33.3	33.3	46.7
	agree	12	40.0	40.0	86.7
	strongly agree	4	13.3	13.3	100.0
	Total	30	100.0	100.0	
Contractor	Valid disagree	8	26.7	26.7	26.7
	neutral	7	23.3	23.3	50.0
	agree	13	43.3	43.3	93.3
	strongly agree	2	6.7	6.7	100.0
	Total	30	100.0	100.0	

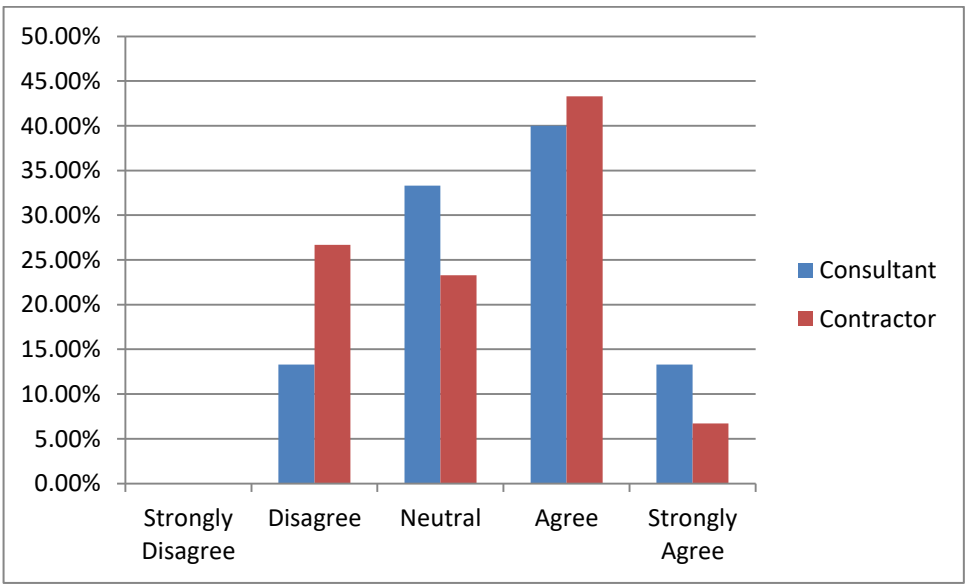

Figure 4-18: Responds for unavailability of required equipment and machineries

4.3.3.6 Problems with subcontractor

Table 4-33: Frequency analysis for problems with subcontractor unavailability of required equipment and machineries

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid strongly disagree	1	3.3	3.3	3.3
	disagree	4	13.3	13.3	16.7
	neutral	7	23.3	23.3	40.0
	agree	18	60.0	60.0	100.0
	Total	30	100.0	100.0	
Contractor	Valid disagree	7	23.3	23.3	23.3
	neutral	12	40.0	40.0	63.3
	agree	9	30.0	30.0	93.3
	strongly agree	2	6.7	6.7	100.0
	Total	30	100.0	100.0	

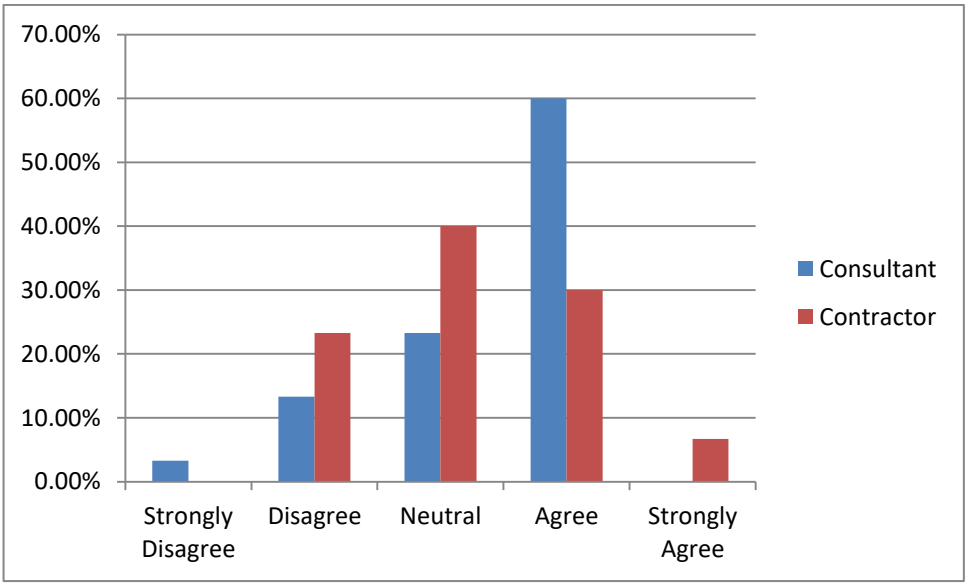

Figure 4-19: Responds for problems with subcontractor unavailability of required equipment and machineries

4.3.3.7 Attitude of contractor's persons

Table 4-34: Frequency analysis for attitude of contractor's persons

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid strongly disagree	1	3.3	3.3	3.3
	neutral	11	36.7	36.7	40.0
	agree	13	43.3	43.3	83.3
	strongly agree	5	16.7	16.7	100.0
	Total	30	100.0	100.0	
Contractor	Valid neutral	11	36.7	36.7	36.7
	agree	15	50.0	50.0	86.7
	strongly agree	4	13.3	13.3	100.0
	Total	30	100.0	100.0	

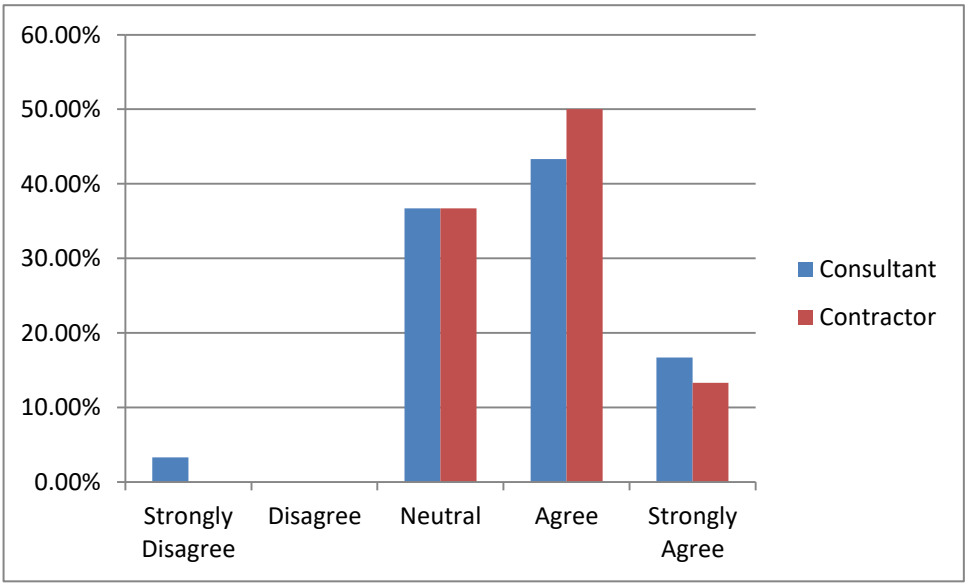

Figure 4-20: Responds for attitude of contractor's persons

4.3.3.8 Mistakes during construction

Table 4-35: Frequency analysis for mistakes during construction

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid strongly disagree	1	3.3	3.3	3.3
	disagree	9	30.0	30.0	33.3
	neutral	13	43.3	43.3	76.7
	agree	6	20.0	20.0	96.7
	strongly agree	1	3.3	3.3	100.0
	Total	30	100.0	100.0	
Contractor	Valid neutral	17	56.7	56.7	56.7
	agree	13	43.3	43.3	100.0
	Total	30	100.0	100.0	

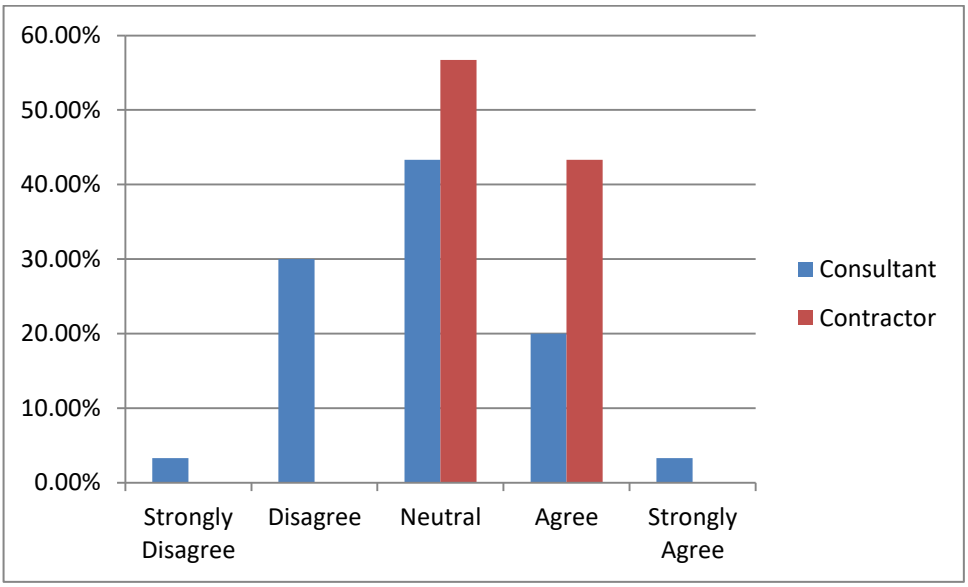

Figure 4-21: Responds for mistakes during construction

4.3.4 Other Delays

Table 4-36: Descriptive analysis results for other related delays (Consultant & Contractor)

consultant/contractor		N	Minimum	Maximum	Mean	Std. Deviation
Consultant	Shortage of material	30	1.00	4.00	2.6000	1.00344
	Bad weather conditions	30	2.00	5.00	3.1000	.88474
	Problems with neighbors and site conditions	30	1.00	4.00	2.8000	.92476
	Obstacles from government (regulations, elections, government changes, etc…)	30	2.00	5.00	3.2000	.92476
	Shortage of skill laborers	30	2.00	5.00	3.7333	.86834
	Valid N (list wise)	30				
Contractor	Shortage of material	30	2.00	5.00	3.2000	.88668
	Bad weather conditions	30	3.00	5.00	3.7667	.77385
	Problems with neighbors and site conditions	30	1.00	4.00	2.9000	.88474
	Obstacles from government (regulations, elections, government changes, etc…)	30	2.00	5.00	4.0333	.99943
	Shortage of skill laborers	30	3.00	5.00	4.2333	.67891
	Valid N (list wise)	30				

The table 4.24 shows mean and standard deviation for each cause of other delays with respect to consultant's and contractor's perspectives. According to consultant's perspective there is an average mean of 3.0867 and according to contractors perspective it is 3.6267.

Table 4.38 to Table 4.42 and figure 4.22 to figure 4.26 clearly shows frequencies how contractor and consultant responds to the each causes related to other delays

Table 4-37: Descriptive analysis results for other delays (General perspectives)

Other Delays	N	Minimum	Maximum	Mean	Std. Deviation
Shortage of material	60	1.00	5.00	2.9000	.98635
Bad weather conditions	60	2.00	5.00	3.4333	.88999
Problems with neighbors and site conditions	60	1.00	4.00	2.8500	.89868
Obstacles from government (regulations, elections, government changes, etc…)	60	2.00	5.00	3.6167	1.04300
Shortage of skill laborers	60	2.00	5.00	3.9833	.81286
Valid N (list wise)	60				

Table 4.37 clearly shows means and standard deviation of each cause of other delays with respect to general view (both client and contractor). According to general view other delays have average mean of 3.3567.

4.3.4.1 Shortage of material

Table 4-38: Frequency analysis for shortage of material

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid strongly disagree	4	13.3	13.3	13.3
	disagree	11	36.7	36.7	50.0
	neutral	8	26.7	26.7	76.7
	agree	7	23.3	23.3	100.0
	Total	30	100.0	100.0	
Contractor	Valid disagree	7	23.3	23.3	23.3
	neutral	12	40.0	40.0	63.3
	agree	9	30.0	30.0	93.3
	strongly agree	2	6.7	6.7	100.0
	Total	30	100.0	100.0	

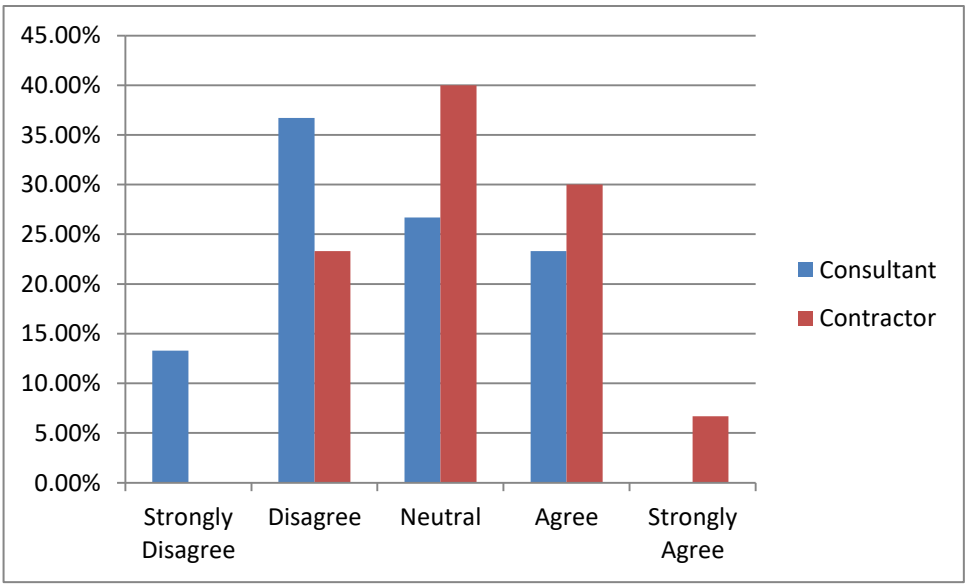

Figure 4-22: Responds for shortage of material

4.3.4.2 Bad weather conditions

Table 4-39: Frequency analysis for bad weather conditions

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid disagree	9	30.0	30.0	30.0
	neutral	10	33.3	33.3	63.3
	agree	10	33.3	33.3	96.7
	strongly agree	1	3.3	3.3	100.0
	Total	30	100.0	100.0	
Contractor	Valid neutral	13	43.3	43.3	43.3
	agree	11	36.7	36.7	80.0
	strongly agree	6	20.0	20.0	100.0
	Total	30	100.0	100.0	

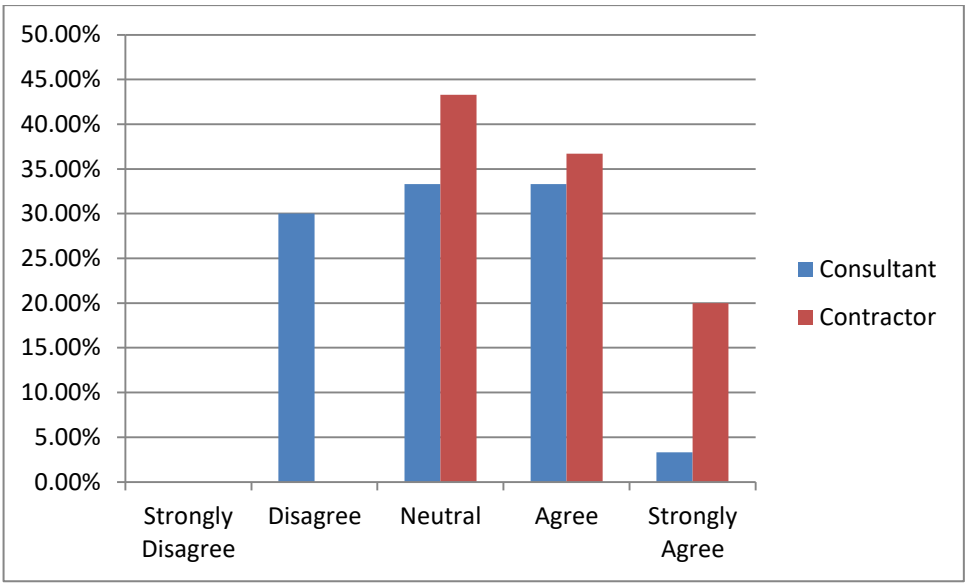

Figure 4-23: Responds for bad weather conditions

4.3.4.3 Problems with neighbors and site conditions

Table 4-40: Frequency analysis for problems with neighbors and site conditions

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid strongly disagree	3	10.0	10.0	10.0
	disagree	7	23.3	23.3	33.3
	neutral	13	43.3	43.3	76.7
	agree	7	23.3	23.3	100.0
	Total	30	100.0	100.0	
Contractor	Valid strongly disagree	3	10.0	10.0	10.0
	disagree	4	13.3	13.3	23.3
	neutral	16	53.3	53.3	76.7
	agree	7	23.3	23.3	100.0
	Total	30	100.0	100.0	

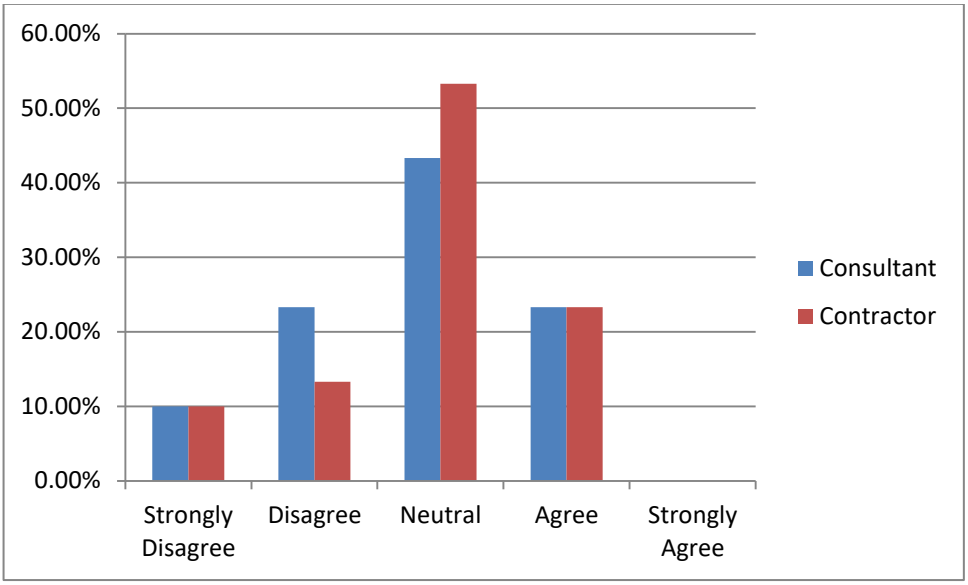

Figure 4-24: Responds for problems with neighbors and site conditions

4.3.4.4 Obstacles from government (regulations, elections, government changes, etc…)

Table 4-41: Frequency analysis for obstacles from government (regulations, elections, government changes, etc…)

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid disagree	8	26.7	26.7	26.7
	neutral	10	33.3	33.3	60.0
	agree	10	33.3	33.3	93.3
	strongly agree	2	6.7	6.7	100.0
	Total	30	100.0	100.0	
Contractor	Valid disagree	4	13.3	13.3	13.3
	neutral	2	6.7	6.7	20.0
	agree	13	43.3	43.3	63.3
	strongly agree	11	36.7	36.7	100.0
	Total	30	100.0	100.0	

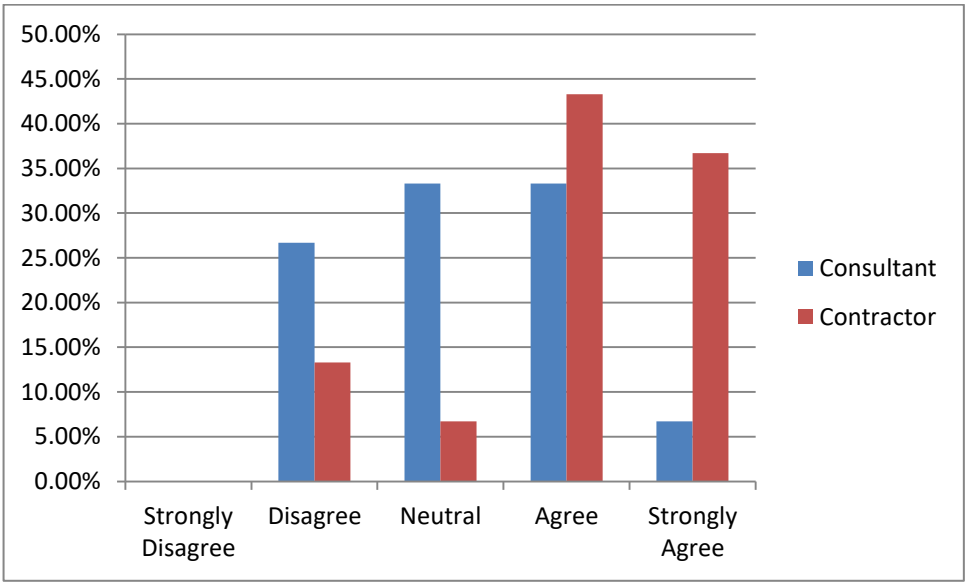

Figure 4-25: Responds for obstacles from government (regulations, elections, government changes, etc…)

4.3.4.5 Shortage of skill laborers

Table 4-42: Frequency analysis for Shortage of skill laborers

consultant/contractor		Frequency	Percent	Valid Percent	Cumulative Percent
Consultant	Valid disagree	3	10.0	10.0	10.0
	neutral	7	23.3	23.3	33.3
	agree	15	50.0	50.0	83.3
	strongly agree	5	16.7	16.7	100.0
	Total	30	100.0	100.0	
Contractor	Valid neutral	4	13.3	13.3	13.3
	agree	15	50.0	50.0	63.3
	strongly agree	11	36.7	36.7	100.0
	Total	30	100.0	100.0	

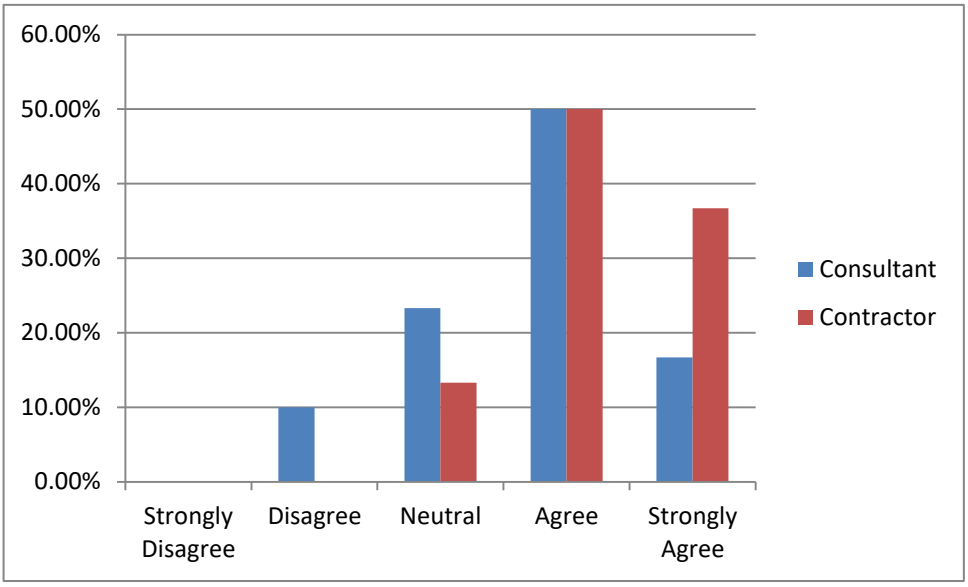

Figure 4-26: Responds for Shortage of skill laborers

Table 4-43: Average means for each delay factor with different perspectives and their relevant ranks.

	Consultant		Contractor		General	
	mean	rank	mean	rank	mean	rank
Client related causes	3.2222	2	3.6833	1	3.4528	2
Consultant related causes	2.8333	4	3.5722	3	3.2028	4
Contractor related causes	3.4166	1	3.5333	4	3.4750	1
Other causes	3.0867	3	3.6267	2	3.3567	3

According to table 4.43 the contractor related delays has most effect on delay in completion of government funded buildings. But according to the contractor it has the lowest impact on delay in completion of projects. Consultant's perspective relative to this factor is same as the general perspective. The second most important factor is client related delays and it is the most important factor with respect to contractor's perspective and ranked as number 1. The third important factor is other delays and according to contractor it is the second most important factor. Consultant's perspective is same as the general. Lowest importance factor is consultant related delays and according to contractor's perspective it has the third importance. Consultant's perspective is similar to general perspective for above all delay factors.

4.3.5 Correlation analysis between each perspective

Table 4-44: Spearman rank correlation coefficient

Factor	**Perception**	**Consultant**	**Contractor**	**General**
Client	Consultant	1	0.31	0.60
	Contractor	0.31	1	0.89
	General	0.60	0.89	1
Consultant	Consultant	1	0.77	0.94
	Contractor	0.77	1	0.89
	General	0.94	0.89	1
Contractor	Consultant	1	0.35	0.82
	Contractor	0.35	1	0.76
	General	0.82	0.76	1
Other	Consultant	1	0.90	0.90
	Contractor	0.90	1	1
	General	0.90	1	1

Spearman correlations for each factor with different perspectives are shown in table 4.44. According to the table 4.44 there are higher correlation between consultant and contractor for consultant related delay causes and other delay causes where values are 0.77 and 0.90 respectively. For client and consultant related delay causes, there is low correlations between consultant and contractor where the values are 0.31 and 0.35 respectively.

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4.4 Analysis of effects due to delay

4.4.1 Consultant's perspective

Table 4-45: Rank of effects according to consultant's perspective

	Description	1	2	3	4	5	RII	Rank
1	Increase the final cost of project		1	7	20	2	0.75	3
2	Delay in Client's future plans due to lapse of funds		3	6	13	8	0.77	2
3	Wastage and under-utilization of resources		5	3	18	4	0.74	4
4	Additional cost for clients due to rentals		2	10	14	4	0.73	5
5	Abandoned of project	1	6	11	10	2	0.64	8
6	Reduced contractor's profit		3	10	15	2	0.71	6
7	Disputes between parties involved		2	13	13	2	0.70	7
8	Litigation	1	11	13	5		0.55	10
9	Arbitration		12	13	5		0.55	9
10	Badly affect to the quality of work		3	10	4	13	0.78	1

Table 4.45 shows how respondents answered to each questions and the relevant rank according to the value of relative importance index.

Table 4-46: Impact of effects according to consultant

Description	RII	Rank
Badly affect to the quality of work	0.78	1
Delay in Client's future plans due to lapse of funds	0.77	2
Increase the final cost of project	0.75	3
Wastage and under-utilization of resources	0.74	4
Additional cost for clients due to rentals	0.73	5
Reduced contractor's profit	0.71	6
Disputes between parties involved	0.70	7
Abandoned of project	0.64	8
Arbitration	0.55	9
Litigation	0.55	10

Each effect is listed according to their importance and shown in table 4.46. According to consultant's perspective delay in construction projects will have higher impact to quality of the work and has relative importance index value 0.78. The second most importance effect is delay in client's future plans due to laps of funds. According to consultants increase the final cost of the project is the third most importance effect.

4.4.2 Contractor's perspective

Table 4-47: Rank of effects according to contractor's perspective

	Description	1	2	3	4	5	RII	Rank
1	Increase the final cost of project			3	20	7	0.83	2
2	Delay in Client's future plans due to lapse of funds		3	8	13	6	0.75	4
3	Wastage and under-utilization of resources			2	21	7	0.83	1
4	Additional cost for clients due to rentals		4	12	11	3	0.69	7
5	Abandoned of project		2	16	11	1	0.67	8
6	Reduced contractor's profit		2	10	10	8	0.76	3
7	Disputes between parties involved			13	13	4	0.74	5
8	Litigation	2	6	16	6		0.57	10
9	Arbitration	2	3	20	5		0.59	9
10	Badly affect to the quality of work	1	2	6	19	2	0.73	6

Table 4.47 shows how respondents answered to each questions and the relevant rank according to the value of relative importance index.

Table 4-48: Impact of effects according to contractor

Description	RII	Rank
Wastage and under-utilization of resources	0.83	1
Increase the final cost of project	0.83	2
Reduced contractor's profit	0.76	3
Delay in Client's future plans due to lapse of funds	0.75	4
Disputes between parties involved	0.74	5
Badly affect to the quality of work	0.73	6
Additional cost for clients due to rentals	0.69	7
Abandoned of project	0.67	8
Arbitration	0.59	9
Litigation	0.57	10

Each effect is listed according to their importance and shown in table 4.48 According to contractor's perspective wastage and underutilization of resource is the most important effect and has Relative importance index value 0.83. The second most importance effect is increase the final cost of the project. According to contractors, reducing the contractor's profit is the third important effect.

4.4.3 General Perspective

Table 4-49: Rank of effects according to both consultant's and contractor's perspective

	Description	1	2	3	4	5	RII	Rank
1	Increase the final cost of project		1	10	40	9	0.79	1
2	Delay in Client's future plans due to lapse of funds		6	14	26	14	0.76	3
3	Wastage and under-utilization of resources		5	5	39	11	0.79	2
4	Additional cost for clients due to rentals		6	22	25	7	0.71	7
5	Abandoned of project	1	8	27	21	3	0.66	8
6	Reduced contractor's profit		5	20	25	10	0.73	5
7	Disputes between parties involved		2	26	26	6	0.72	6
8	Litigation	3	17	29	11		0.56	10
9	Arbitration	2	15	33	10		0.57	9
10	Badly affect to the quality of work	1	5	16	23	15	0.75	4

Table 4.49 shows how respondents answered to each questions and the relevant rank according to the value of relative importance index.

Table 4-50: Impact of effects according to consultant

Description	RII	Rank
Increase the final cost of project	0.79	1
Wastage and under-utilization of resources	0.79	2
Delay in Client's future plans due to lapse of funds	0.76	3
Badly affect to the quality of work	0.75	4
Reduced contractor's profit	0.73	5
Disputes between parties involved	0.72	6
Additional cost for clients due to rentals	0.71	7
Abandoned of project	0.66	8
Arbitration	0.57	9
Litigation	0.56	10

Each effect is listed according to their importance and shown in table 4.50. According to General (both contractor and consultant) perspective, project delay is strongly affect to the cost of the project and has Relative importance index value 0.79. The second most importance effect is wastage and underutilization of resources. Delay in client's future plans due to laps of funds is ranked as third.

Table 4-51: Summary of effect ranks according to each perspective

No.	Description	Rank		
		Consultant	Contractor	General
1	Increase the final cost of project	3	2	1
2	Delay in Client's future plans due to lapse of funds	2	4	3
3	Wastage and under-utilization of resources	4	1	2
4	Additional cost for clients due to rentals	5	7	7
5	Abandoned of project	8	8	8
6	Reduced contractor's profit	6	3	5
7	Disputes between parties involved	7	5	6
8	Litigation	10	10	10
9	Arbitration	9	9	9
10	Badly affect to the quality of work	1	6	4

Table 4-52: Spearman correlation coefficient

	consultant	contractor	general
consultant	1	0.63	0.84
contractor	0.63	1	0.92
general	0.84	0.92	1

Spearman rank correlation is calculated between each perspective and tabulated in table 4.52. The correlation between consultants and contractors is 0.63. There is higher correlation between the contractor and general perspective than the consultant and general perspectives.

Table 4-53: Importance of delay impacts according to each perspective

Rank	Consultant	Contractor	General
1	Badly affect to the quality of work	Wastage and under-utilization of resources	Increase the final cost of project
2	Delay in Client's future plans due to lapse of funds	Increase the final cost of project	Wastage and under-utilization of resources
3	Increase the final cost of project	Reduced contractor's profit	Delay in Client's future plans due to lapse of funds
4	Wastage and under-utilization of resources	Delay in Client's future plans due to lapse of funds	Badly affect to the quality of work
5	Additional cost for clients due to rentals	Disputes between parties involved	Reduced contractor's profit
6	Reduced contractor's profit	Badly affect to the quality of work	Disputes between parties involved
7	Disputes between parties involved	Additional cost for clients due to rentals	Additional cost for clients due to rentals
8	Abandoned of project	Abandoned of project	Abandoned of project
9	Arbitration	Arbitration	Arbitration
10	Litigation	Litigation	Litigation

Effects due to delay in completion of government funded buildings were ordered according to each perspective and tabulated in table 4.53.

CHAPTER 5: CONCLUSION

5.1 Conclusion on findings

By considering all considered perspectives, nineteen out of twenty five causes have considerable impact on delay in government funded building construction projects in western province. Namely those causes are shortage of skill laborers, delay in providing necessary drawings, delay in delivery of required materials to the site, client's financial problems, attitude of contractor's personal, financial difficulties of contactor, changes to the scope during construction, slow decision making, qualifications of the contractor's technical staff allocated to the project, obstacles from government, delay in contractor's interim payments by client, skill and experience of laborers, delay in providing necessary approvals & instructions, mistakes & discrepancies involving to design drawings and BOQ, bad weather conditions, unavailability of required equipment and machineries, delay in handing over the site, problems with subcontractor and mistakes during construction. The main delay cause which is shortage of skilled laborers has been categorized under other related causes. It was clearly derived that, besides client, consultant and contractor there are some other factors which have higher effect towards delay of projects. Due to all of these causes falling within the medium impact region, some other causes should be there that has a higher impact towards the delay in government funded building construction projects.

Shortage of material, attitude of consultant personal, problems with neighbors, site conditions, lack of experience of the consultant, delay in approving contractor's payments and delay due to ceremonial function have the least impact to the delay in project as per the findings.

Most of the government funded projects are carried out by selecting a contractor through an open competitive bidding procedure and most of the time the lowest bidder with required qualifications will be selected. Due to competitiveness of the construction industry, the bidders quote low prices and when the work is being executed they face a problem in selecting skill labors for their quoted prices. This mainly impact the government funded building construction projects as it causes a lack of skill labors to perform the relevant tasks.

According to the groups of delay causes, contractor related delay causes have higher impact toward the government funded building construction project delay. Whereas the client, other and consultant related causes have become second, third and fourth place respectively. Furthermore answering for the delay causes by consultant and contractor has a bias for themselves and which is illustrated in Table 4.43.

As a result for delay in completion of government funded building construction projects, one or several following, will be subjected to the project according to their level of importance. Increase in the final cost of project, wastage and under-utilization of resources, delay in client's future plans due to lapse of funds, badly affected quality of work, reduced contractor's profit, disputes between stakeholders, additional cost for clients due to rentals, abandoning of project have medium level of impact whereas arbitration and litigation have a considerable lesser impact.

Furthermore the answers given for this section of the questioner has a positive relationship between consultant and client than for the delay causes. Therefore, it proves that when answering for questions which are relevant to themselves, it will be answered in a bias manner while favoring them.

5.2 Recommendation to rectify delay causes

In order to minimize the delay in completion of government funded projects, the government agency, contractor and consultant should work together while minimizing the effect of the delay causes.

Shortage of skill laborers

The younger generation in the country is very reluctant to join with the construction industry and the existing skill laborers are going abroad for greener pastures. Therefore a scarcity of skill laborers like masons, carpenters, plumbers, etc.. are in the country. Most of the skill workers who usually work with the construction industry reside outside the western province and they are not available throughout the year. Progress of all projects directly depends on the skill labor factor and shortage of skill labors will lead to delay in projects. Due to these reasons, for large scale projects, skill laborers are brought from other countries like China, India, Nepal, Indonesia, etc…

The government of Sri Lanka should come up with a proper plan to introduce valuable courses that produces skill workers so that it will attract younger generations to these fields. Also professional status and recognition should be given to them after getting certified in the relevant course.

Delay in providing necessary drawings

To minimize the above delay, consultants should complete and hand over all necessary drawings at site handing over time to the contractor. Most of government consultancy firms will take more time to prepare drawings due to lack of staff. Therefore, the tendering should not be done until the drawings are finalized.

Delay in delivery of required materials to the site

The engineers of the contractor should identify required materials early and should act upon to get them delivered to the site on time. Some specialized materials (A/C, fire, etc...) have to be ordered through subcontractors and tendering procedure has to be followed to select those subcontractors. Therefore, materials which will take more time to deliver have to be attended early and the engineer should also be concerned about the weather which can affect to the material supply. Also contractor's head office should take actions to provide the necessary materials to the site in time on request.

Client's financial problems

Before awarding the contract to the contractor, the government agency (department/ministry) should check whether the available funds are enough to complete the project within the project duration. Although the total estimated cost of the project is approved, sometimes the government agency will not receive the requested amount of funds from the treasury. Due to this problem, some projects are delayed more than its initial contract period. Therefore, if the available funds are not enough to complete the project, it is better to prevent from awarding the contract to the contractor and re tendering per stage. As a negative impact stage wise construction will face some quality issues due to attendance of several contractors.

Attitude of contractor's persons

Most of the contractors in government funded projects are not following programs and expects time extensions at the beginning of the project. There is a mindset where they think that the delay in government projects is not a big issue. Due to this negative mindset, they give priority to projects of other clients. Therefore in order to complete the project on time contractor's personal should have a proper mindset where all projects are given importance. If a contractor fails to maintain higher quality and timely delivery should not be selected for future projects in government sector.

Financial difficulties of contactor

Due to competition of the industry, the contractors quote low prices in order to get the contract. During the contract execution time, the contractor will face practical problems in getting the work done for the quoted rates and will subsequently face financial problems. Therefore, before bidding for a project contractor should visit the site and identify the client's requirement by properly reading the bidding document. Rates should be double checked before submitting the document. The advanced payment should be used only for the relevant contract. Contractor should identify their capacity and prevent from bidding for another project if their financial situation allows them not to. Also contractor should submit interim claims regularly.

Changes to the scope during construction

With the change of government agency staff, the requirements will be changed and there can be requests to do changes to the original drawings. These changes will cost more and will take more time. Therefore the client has a responsibility to minimize the changes to the agreed initial scope. At the initial stage, all drawings especially which are relevant to internal arrangements and services should be finalized jointly with the client. The relevant parties should be smart to complete the projects with minimal changes while keeping the client happy.

Slow decision making

In government funded projects, most clients are reluctant to make decisions and to

shoulder responsibilities relevant to the project. Therefore, it will take more time to take decisions regarding the project. In order to prevent this, the government agency (client) should nominate responsible person/s with the knowledge of contract agreement, in order to take the important decisions regarding the project. They should provide necessary decisions as soon as possible.

Qualification of the contractor's technical staff allocated to the project

Most of contractors in government funded projects are trying to reduce their number of staff and employ inexperience, less qualified staff in order to reduce cost of the project. These people are unable to manage the project and it will directly impact completion of project on time. Therefore, the contractor should employ academically well qualified experience staff according to the agreement and with reference to the capacity of the project. Also they should have enough capacity to handle subcontractors to achieve the targets on time.

Obstacles from government (regulations, elections, government changes, etc…)

Delays due to this reason are difficult to mitigate and it does not happen regularly. But this has an impact as it will cause to delay the project as per the recent experience in year 2015.

Delay in contractor's interim payments by client

The government agency should take necessary actions to request required funds from the treasury in time and do payments as soon as possible after receiving engineer's certificate for the payment.

Skill and experience of laborers

Most of contractors are using unskilled and inexperienced workers in place of skill laborers and that will cause to less efficiency and poor quality. The contractors fail to employ skill labors to their projects due to low price in the bid. But contractor should employ skilled and experience workers to prevent from this delay cause.

Delay in providing necessary approvals & instructions

In order to minimize this delay contractor should request instruction and approvals in

time with all necessary documents and engineer should take prompt actions to provide necessary approvals and instructions without any delay.

Mistakes & discrepancies involving to design drawings and BOQ

The most common mistake arises when the drawing not matching with the BOQ description. The contractor usually quotes for the BOQ description and special rate have to be approved to execute according to the drawing when there are mismatches in the BOQ and the drawing. Approval of special rates requires time and will lead to delay the project. Also some problems will rise due to different interpretation of BOQ descriptions and mistakes in drawings. These mistakes and discrepancies in drawings and BOQ will slow the work progress until those mistakes are finalized. Therefore the consultants should take necessary actions to minimize those errors by working in collaboration with all parties such as structural engineers, architect, quantity surveyors, etc... Also contactor has a responsibility to identify those errors before commencing the work.

Bad weather conditions

The unexpected weather conditions can't be avoided except to be faced. As a result of these weather conditions progress of the project will be badly affected and extension to the contract period has to be granted. In some situations this effect can be minimized by changing work program and keeping additional storage of materials.

Unavailability of required equipment and machineries

Unavailability of required equipment and machineries will delay the work because it will take some time to hire and some time it will not be available when required. In order to minimize this effect contractor should have owned or full time rented the machineries which are required to execute the project.

Delay in handing over the site

In some government funded projects, although the project is awarded to the contractor, it will take much longer time to handover the site to contractor for constructions. The reasons for this are delay in clearance of land, problems in

acquisition and so on. In order to prevent from this, the government agency should take necessary actions to prevent from awarding the project until the problem is solved.

Problems with subcontractor

The contractors of the government funded project should employed suitable subcontractors without violating conditions of contract and they have to manage their problems without affecting to the project. When this becomes a nominated subcontractor, the client (government agency) has a responsibility to solve the problems like delay in payments by the main contractor.

Mistakes during construction

This will result due to not following and studying required documents (drawings, BOQ, etc…) before commencing the work. This will lead to double work and sometime contractor has to bear additional cost to rectify these mistakes. In government funded projects the project should be delivered according to the agreement and any changes to the project should be answerable to the government. Therefore contractor's staff should follow all necessary documents before commencing the work and if there are any doubtful, they should take necessary actions to solve it by contacting consultant to the project.

5.3 Recommendations for future studies

Due to difficulty in finding engineers from client's perspective this research is only based on two perspectives consultant and contractor. By doing this research with those three perspectives, it will provide better output.

For this research the sample was selected only considering the western province. This research can be done for other provinces also, because the delay causes will differ from one area to the other. This research can be extended by considering all building projects or considering all type of projects like road, irrigation, railway, etc…

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Appendix A: Questionnaire

Questionnaire for MBA Research

Title of Research: Causes and effects of delay in completion of Government Funded Building Construction Projects in Western Province, Sri Lanka.

Name of the organization:-……

Type of organization:- Consultation / Construction

Total working experience in years: - ……..

Instructions

Please select your choice by marking "X" symbol on the relevant number which has been graded as follows.

1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

Delay causes

Client Related Delays						
		1	2	3	4	5
1	Client's financial problems					
2	Delay in contractor's interim payments					
3	Changes to the scope during construction					
4	Slow decision making					
5	Delay in handing over the site					
6	Delay due to ceremonial functions (eg. Foundation stone laying, etc…)					

Consultant Related Delays						
		1	2	3	4	5
1	Delay in providing necessary drawings					
2	Lack of experience of the consultant					
3	Delay in providing necessary approvals & instructions					
4	Mistakes & discrepancies involving to design drawings and BOQ					
5	Attitude of consultant persons					
6	Delay in approving contractor's payments					

Contractor Related Delays						
		1	2	3	4	5
1	Financial difficulties of contactor					
2	Skill and experience of laborers					
3	Delay in delivery of required materials to the site					
4	Qualification of the contractor's technical staff allocated to the project					
5	Unavailability of required equipment and machineries					
6	Problems with subcontractor					
7	Attitude of contractor's persons					
8	Mistakes during construction					

Other delays						
		1	2	3	4	5
1	Shortage of material					
2	Bad weather conditions					
3	Problems with neighbors and site conditions					
4	Obstacles from government (regulations, elections, government changes, etc…)					

5	Shortage of skill laborers					

Effects of Delay

Effects						
		1	2	3	4	5
1	Increase the final cost of the project					
2	Delays in client’s future plans due to lapse of funds					
3	Wastage and under-utilization of man power and resources					
4	Additional cost for client due to rentals					
5	Abandoned of project					
6	Reduced contractor's profit					
7	Disputes between parties involved					
8	Litigation					
9	Arbitration					
10	Badly affect to the quality of work					