Addis Ababa University School of Commerce

Department of Project Management

Addis Ababa, Ethiopia

Causes of Delay in Public Building Construction Projects: A Case of Addis Ababa City Administration Public Building Construction Projects

By:

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A Project Work Presented in Partial Fulfillment of the Requirements for MA in Project Management

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Addis Ababa University School of Commerce
Department of Project Management
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DECLARATION

I, **Neway Seifu Hailu,** do hereby declare that this project work entitled **"Causes of Delay in Public Building Construction Projects: A Case of Addis Ababa City Administration Public Building Construction Projects"**, submitted in partial fulfillment of the requirements for the award of the degree of Master of Arts in Project Management to the School of Commerce , Addis Ababa University, through the Department of Project Management, is an authentic work and has not been submitted earlier to any university or institution for the award of any degree, diploma or prize to the best of my knowledge and belief.

NEWAY SEIFU HAILU

Signature: _____

Date: 30th of November, 2018

Addis Ababa, Ethiopia

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ACRONYMS/ABBREVIATIONS

AASHDE	Addis Ababa Saving Houses Development Enterprise
CSoT	Construction Sector Transparency Initiative
GTP	Growth and Transformation Plan
MoWUD	Ministry of Works and Urban Development
RII	Relative Importance Index

CONTENTS

List of figures

List of Tables

ABSTRACT

This study intended to assess the causes of delay in public building construction projects in Addis Ababa under taken by grade one contractors. In this project work 42 delay causing events in the public building construction projects were identified and categorized in to 5 main category groups and the most important and critical causes of delay causing factors were evaluated and ranked based on the RII values from the data collected. The method used for data collection was a questionnaire survey group of respondents form clients, consultants and contractors on the ongoing 28 projects that include senior professionals in the construction industry. The data collected was through a questionnaire survey. The respondents reply was ranked according to the RII and the rankings were tested for their agreement via spearman coefficient. The findings show that the top ten factors that cause construction delays in the public building construction projects in Addis Ababa are: (1) Difficulty in project financing; (2) Poor Project management system; (3) Delay in issuance of designs and working drawings; (4) Shortage of availability of imported construction materials; (5) Design errors and complexity of designs;(6)Delay in progress payments for completed works; (7) Late start & resource mobilization to site; (8) Financing problems; (9) Inaccurate Site investigation Report;(10) Price Inflation. This project work finally forwarded relevant recommendations in view of the research objectives and based on the findings of the study towards reducing and mitigating the delay causing factors. The key suggestions forwarded were: Owners should possess comprehensive financial plan, hire competitive contractors and consultants to the works. Consultants should avoid delay in response to any clarifications, avoid design errors, prepare a comprehensive final designs and working drawings. Finally contractors should develop financial plans, establish strong project management system and mobilize resources immediately after site possession.

Keywords: *Addis Ababa**,** Delay, Delay Causes, Public Building Construction*

CHAPTER ONE: INTRODUCTION

1.1. Background of the Study

A construction project is commonly acknowledged as successful, when it is completed on schedule, within budget and within the agreed quality, in compliance to the specifications and to stakeholders' satisfaction. Functionality, profitability to contractors, absence of claims and court proceeding and "fitness for purpose" for occupiers have also been used as measures of project success (Asaf & Al-Hejji, 2006).

The construction industry in Ethiopia, as in most developing countries, has made a significant contribution to the growth of the economy through infrastructure development and job creation. Public construction projects are parts of the country's development initiative; they share considerable amount of the country's scarce financial resources.(Kesete, 2018)

In Ethiopia, the construction industry is the highest recipient of government budget in terms of government development programs. Consequently, public construction projects consume an average annual rate of nearly 60% of the government's capital budget (MoWUD, 2006). The rapid growth of population in Addis Ababa presents extraordinary pressure on the existing housing policy and on the entire infrastructure like- water, electrical power supply, drainage and roads. Planned development of the past was unable to meet the needs of the community and forced to develop public housing re-development plan in GTP-I and GTP-II (Condominium Housing Program in Ethiopia cited by United Nations Human Settlement Program (2010)). For example, The Ethiopian Federal Democratic Government took considerable effort to improve the housing conditions in Addis Ababa city by maintaining different housing programs like- 10/90, 20/80 and 40/60 schemes respectively. 40/60 housing program was commenced in 2013 to provide public housing for middle income tenants on the basis of one bed rooms, two bed rooms

and three bed rooms with a setting price of 162,000 birr 250,000 birr and 386,000 birr respectively, (Addis Ababa Saving Houses Development Enterprise 2016), To add to that, the expansion of Universities, sugar factory projects and the industrial parks are among the highest recipients of the government's budget.

Even though the construction industry is growing and many domestic and international contractors are involved, completion of the project as per the contract is still an issue. There are many problems and conflicts that inevitably occur frequently which contribute negatively to the completion of the project as per the intended completion time stipulated in the applicable contract agreements. The time overrun in construction projects has become one of the most common problems in the industry that cause multitude of negative effects on the projects and its stakeholders. Therefore, this aspect has been constantly investigated by the researchers across the world with a great enthusiasm. Failure to deliver these projects on time discomfort both clients and end users who expect to benefit from them. This is totally undesirable to the concerned parties (clients, consultants and contractors) as it is costly for clients and contractors and has the potential to trigger disputes whose resolution is expensive.

The consequences of these delays include; cost overruns, loss of profits, increased overheads, stress, and dispute between parties, litigation and loss of opportunities. Identifying the root causes of the delay to come up with corrective measures is the best tool in minimizing and avoiding these kinds of consequences (Murali and Yau, 2006).

Therefore, this project works, as a case study, will seek to assess the causes of delays due to the failures of Employers, Consultants, and Contractors in the completion of public building construction projects during the construction phase.

1.1.1 Background of the Case Organization

Following the rapid population growth and increased socio-economic function of the Addis Ababa City, the demand for housing, infrastructure and facility has increased with unprecedented scale. The City administration has launched and funded large scale construction projects, public buildings, sub city office buildings and they are in their development phases. Due to the sheer scale of the projects, and their discrete development stance, the administration, in particular the Addis Ababa City Construction Bureau coordinates the development of the projects, monitor the proper administration of public housings in such a way that the projects are completed in the stipulated respective time and create synergy in responding to the demand. However, timely completions of the projects become unattainable. According to the sources from Addis Ababa construction bureau, currently there are 28 active construction projects executed by grade one contractors. It is common that many of the projects suffer time overrun caused by the client, the contractor and the consultant.

1.2. Problem Statement

Delay in a construction projects is counted as a common problem and became a main cause for projects to be extremely high cost, extended completion time and inferior quality deliverables. Building construction projects are exposed to many problems during construction that lead to the unnecessary delay and unable meet the contract time of the projects. It is common to people blame one party (the contractor, the consultant or the client), commonly the contractor, without giving due consideration to the stakeholders involved in the particular project. For clients, construction delay is a loss of revenue, decrease in productivity and unnecessary expenses, etc. For the contractor, construction delay results in higher overhead costs, longer work duration, increased labor cost, higher material and equipment costs etc. Completion of construction

projects on the contract time agreed by the parties indicates the commitment and efficiency of the participating parties. Delay in construction projects arise because of various causes and this delay ultimately leads to negative effects on the construction project.

Many public building construction projects in Ethiopia suffer delay, According to Construction Sector Transparency Initiative (CoST) Ethiopia, half of 16 government financed projects found to be failing to meet budget both in time and cost(Addis Fortune Oct 26, 2014,VOL 15 ,NO 756). In Ethiopia, only 8.25% projects were finished on the original targeted completion date and the remaining 91.75% delayed 352% of its contractual time (Werku Koshe, K. N. Jha,2016).

Therefore, to ensure that public building construction projects run smoothly without any delay, knowledge and understanding of the problems encountered during the construction process should be conducted more thoroughly. The factors that cause delays in the public building construction projects should be well addressed and mitigated so that the projects can be completed within the stipulated time.

In this project work, the most significant delay causes that affect the construction activities will be analyzed for the selected ongoing/active public building construction projects in Addis Ababa that are undertaken by grade one registered contractors.

1.3. Research Question

On the basis of the stated facts above, this study was committed to answering the following questions.

I. What are the delay causing factors in public construction projects?
II. What are the causes of delay in public building construction project in Addis Ababa?

III. How do clients perceive and rank the causes of delay?

IV. How do contractors perceive and rank the causes of delay?

V. How do consultants perceive the delay causing factors?

VI. How do the three parties rank the delay causing factors in terms of their respective perceptions

1.4. Objective of the Study

1.4.1 General Objectives

The general purpose of the study is to assess the main causes of delay that affect the smooth completion of projects during the construction phase for ongoing public building construction projects in Addis Ababa.

1.4.2 Specific Objectives

The following specific objectives were formulated to obtain the general objective:

I. Assess the main causes of delay during construction phase

II. Identify the main causes of delay during construction phase

III. Identify the delay causes attributed to client, contractor and consultant and

IV. Rank the delay causes attributed to client, contractor and consultant and

V. State the top ten delay causes of the public construction projects according to clients, consultants, contractors and combined views.

VI. Rank the causes of delay according to category

VII. Test the agreement of the ranking of causes of delay among these three participating parties (clients, consultants, and contractors) and their combined views.

1.5. Scope of the Study

The scope of this project is to carry out the assessment on causes of delay in ongoing/active public building construction projects in Addis Ababa. This study will focus on the active public building construction projects in Addis-Ababa undertaken by only grade one construction companies (contractors). The target projects are only construction projects that under the supervision and contract administration services of Addis Ababa City Administration Construction Bureau. During the questionnaire survey and interview, the perspectives included will only be from client, contractor and consultant.

1.6. Organization of the Study

The entire project work document is organized in to five chapters.

Chapter One outlines the background of the study, background of the case organization, problem statement, research objectives and scope of the study.

Chapter Two discusses the review of related literature on delay causes to building constructions. It explains the conceptual framework of the delay causes and effects in building construction projects. It also provides a brief review on the subject matter.

Chapter Three presents the research methodology of the study, which involves the research design, population, sample determination, data collection methods and data analysis.

Chapter Four analyses the findings of the study. Analysis of the quantitative data is conducted.

Chapter Five discusses the research conclusions and recommendations of the study.

The list of references and appendixes of the research instrument are included at the back of the report

1.7. Definition of Terms

In this project work the following terms refer to:

Construction Sector Transparency Initiative (CoST) is the leading global initiative improving transparency and accountability in public infrastructure to improve Value for Money spent on public infrastructure by increasing transparency in the delivery of construction projects**.**

Delay causes – refers to the factors or events which have negative contribution to project completion.

Participating parties – parties involved in the construction activities (owners, consultants and contractors)

Public building construction projects - in this study public building construction projects refer to building projects which are financed by the government and are property of the public.

Responding parties – refers to respondents form clients, consultant and contractors

Time overrun – this refers to the unexpected addition of excess time to the agreed period of construction projects. The failure to achieve timely completion of construction projects is denoted as time overrun.

CHAPTER TWO: LITERATURE RIVIEW

2.1.Introduction

Time is one of the major considerations throughout project management life cycle and can be regarded as one of the most important parameters of a project and the driving force of project success in addition to cost and quality. Hence completing projects on time is an indicator of efficiency and project success, but it is almost common that the construction process is subjected to many variables and unpredictable factors which result in time overrun.

Delay is generally acknowledged as the most common, costly, complex and risky problem encountered in construction projects, (Asaf & Al-Hejji, 2006) revealed that delay in construction is a global phenomenon affecting not only the construction industry but the overall economy of countries as well. Especially the developing countries are suffered with construction project delays due to in efficient construction practice and lack of project management experience. On their research works (Assaf SA and Al-Hejji S, 2006), identified that the main causes of delay are due to three participating parties namely clients, contractors, and consultants. Hence, in the paper they indicated the main causes of delay: According to clients are: contractors' improper planning, contractors' poor site management, subcontractors issue and skilled labor supple and productivity. According to contractors are: insufficient clients' payments to completed and ongoing works, subcontractors' issue, acquiring difficulties for work permit and approval, and availability and failure of equipment. According to consultants and engineers are: slow decisions of clients, contractors' poor site management, contractors' improper planning, insufficient clients' payments to completed and ongoing works, and shortage of equipment and material.

Construction delays can be defined as the late completion of work compared to the planned schedule or contract schedule. Construction delays can be minimized only when their causes are identified. According to (Seboru, 2015) the word "delay'' is defined as something happening at a later time than planned, expected, specified in a contract or beyond the date that the parties agreed upon for the delivery of a project. Delay is slowing down of work without stopping construction entirely and that can lead to time overrun either beyond the contract date or beyond the date that the parties have agreed upon for the delivery of the project.

Time overruns is defined as the difference between the actual completion time and the estimated completion time (Aibinu & Odeyinka, 2006). Time overrun as the time during which some part of construction project is completed beyond the project completion date or nor performed as planned due to an unanticipated circumstance. This is called project delay because the project completion date is to be extended.

Delays are incidents that impact a project's progress and postpone project activities; delay causing incidents may include weather delays, unavailability of resources, design delays, etc. In general, project delays occur as a result of project activities that have both external and internal cause and effect relationship, (M J Kamanga, 2013).

Promkuntong K & Jearkjirm V.(1996). Lo TY, Fung IWH & Tung KCF.(2006).Chan DWM, Kumaraswamy MM. (1996). Aibinu A, Odeyinka H. (2006).Identified many remarkable causes of delays such as: weather conditions, shortages of resources, shortage of materials and equipment, financial difficulties faced by clients and contractors, poor contract management etc. Different authors and researchers have different perceptions about causes of delays. The loss of control on time leads to failure of projects and the shortage of control may be caused as a result of lack of knowledge and awareness. Completing projects within the time is an indicator of an

efficient construction industry. The ability to estimate the completion time is normally dependent on the individual intuition, skill and experience of the planning engineer. Reaching to the end of any project is not a kind of success for the project owner.

Failure to achieve targeted time, budgeted cost and specified quality result in various unexpected negative effects on the projects. Usually, when the projects are delayed, they are either extended or accelerated the time and therefore, invite to the additional cost. The standard practices usually allow some percentage of the project cost as a contingency allowance in the contract price and this allowance is usually based on judgment. Although the contract parties agreed upon the extra time and cost associated with delay, in many cases there were problems between the owner and contractor as to whether the contractor was entitled to claim the extra cost,(Murali Sambasivan 2007).

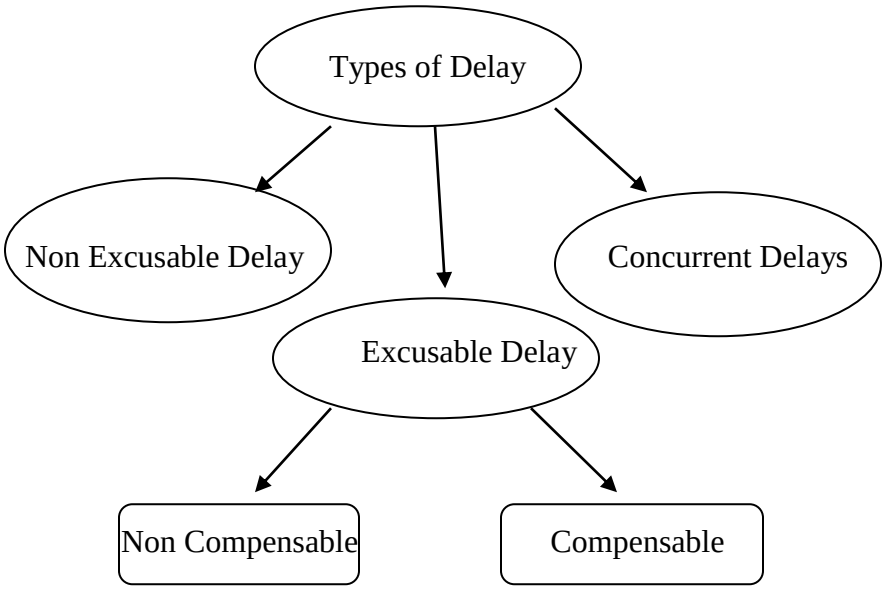
2.2. Theoretical Review

2.2.1 Types of Delays

(Menasi, 2007) Classified the types of delay into two different types according to liability as follows:

- Excusable delays which are in turn divided into (a) Compensable (Owner) and (b) Non-Compensable;
- Inexcusable delays; and
- Concurrent delays.

Figure 1: Types of Delay



Source: (Menasi, 2007)

Delays may be caused by the owner (compensable delay), by the contractor (non-excusable delay), by acts of god, or a third party (excusable delay), or several different kinds of delays may happen either together or separately and affect the critical path of the project (concurrent delays).similarly, delays also classified as critical and non-critical.

Classification of the delay types can be summarized as below and their definition will be as follows:

2.2.2 Excusable versus Non-Excusable Delays

An excusable delay is a delay that is due to an unforeseeable event beyond the contractor's or the subcontractor's control. Delay to be excusable or non-excusable depends on the clauses incorporated in the contract. The authors note that standard construction contracts specify types of delay that will allow the contractor to an extension of time.

Many researchers give list of excusable delay in a project. Normally, based on common general provisions in public agency specifications, delays resulting from the following events would be considered as excusable:

a) General labor strikes

b) Fires

c) Floods

d) Owner-directed changes

e) Errors and omissions in the plans and specifications

f) Differing site conditions or concealed conditions

g) Uncommon severe weather

h) Intervention by outside agencies

i) Epidemics and quarantine restrictions.

Non-excusable delays are events that are within the contractor's control or that are foreseeable. Non-excusable delays are delays that are either caused by the contractor or not caused by the contractor but should have been foreseen by the contractor. He also points out that a non-excusable delay does not entitle the contractor to either a time extension or monetary compensation. Some examples of non-excusable delays are:

a) Late performance of sub-contractors

b) Untimely performance by suppliers

c) Faulty workmanship by the contractor or sub-contractors

d) A project-specific labor strike caused by either the contractor's unwillingness to meet with labor representative or by unfair labor practices.

2.2.3 Compensable Delays Versus Non-Compensable Delays

A compensable delay is a delay where the contractor is entitled to a time extension and to additional cost compensations. Relating back to the excusable and non-excusable delays, only excusable delays can be compensable. Non-compensable delays mean that although an excusable delay may have occurred, the contractor is not entitled to any added compensation resulting from the excusable delay. Thus, the question of whether a delay is compensable must be answered. Additionally, a non-excusable delay warrants neither additional compensation nor a time extension. Whether or not a delay is compensable depends primarily on the terms of the contract.

As stated in the excusable delays, again, the contract is the determinant whether or not a delay is considered non-excusable. Therefore contractors before they sign the contract, they have to clearly understand which delays are defined as excusable and which are as non-excusable.

2.2.4 Critical Versus Non-Critical Delays

Delays that affect the project completion or in some cases a milestone date, are considered as critical delays. Delays that do not affect the project completion or a milestone date are noncritical delays. If these activities are delayed, the project completion date or a milestone date will be delayed. The determining activities which truly control the project completion date depend on the following:

a) The project itself

b) The contractor's plan and schedule (particularly the critical path)

c) The requirement of the contract for sequence and phasing

d) The physical constraint of the project, i.e. how to build the job from a practical perspective

2.2.5 Concurrent Delays

A concurrent delay is the event in which a minimum of two delays take place simultaneously, either of which, had it occurred alone would have affected the entire completion schedule. The concept of concurrent delay has become a very common presentation as part of some analysis of construction delays.

The concurrency argument is not just from the standpoint of determining the project's critical delays but from the standpoint of assigning responsibility for damages associated with delays to the critical path. Owners will often cite concurrent delays by the contractor as a reason for issuing a time extension without additional compensation. Contractors will often cite concurrent delays by the owner as a reason why liquidated damages should not be assessed for its delays.

Unfortunately, few contract specifications include a definition of concurrent delay and how concurrent delays affect a contractor's entitlement to additional compensation for time extension or responsibility for liquidated damages. In analyzed concurrent delays, each delay is assessed separately and its impact on other activities and the project duration is calculated. There are some guidelines for concurrent delays classification.

Firstly, if excusable and non-excusable delays occur concurrently, only a time extension is granted to the contractor. Next, if excusable with compensation and excusable without compensation delays occur concurrently, the contractor is entitled to time extension, but not to damages. Lastly, if two excusable with compensation delays occur concurrently, the contractor is entitled to both time extension and damages. In addition, although the guidelines are useful for the purpose of carrying out the delay analysis, it is in the best interest of all parties involved in a construction project to agree, at the beginning, the definitions of such delays and accommodate them throughout the contract language.

There was no reliable method to differentiate the impact of contractor caused delays from client caused delays until the development of Critical Path Method (CPM) schedule analysis is developed. By the availability of sophisticated computerized techniques, the possibility to segregate the impacts of apparently concurrent client and contractor delays would be higher.

2.3. Empirical Review

2.3.1 Assessment of Causes of Delay in Construction Projects in Different Countries

A delay can happen in the construction industry in which a contractor, consultant, or client jointly or independently present to the reorganization of a project's completion time as specific in the contract document. According to (Asaf & Al-Hejji, 2006) delays in construction projects are a universal phenomenon. Delays happen to small and large projects in developing and developed nations, and are usually accompanied by cost overruns. Delay generally has a harmful effect on clients, contractors, and consultants in terms of project progress, relationships, and communication among parties, and on financial aspects, which sometimes may develop into serious disputes or legal battles in court.

It is normal for construction projects to face problems during the project implementation, and delay is one of the major problems. Delay is a problem that should be addressed properly before it grows and sincerely affects project time, cost, and quality. Moreover, it also will contribute to a detrimental relationship between those involved in the project.

Several studies have been conducted about causes of delay in construction projects for years in the past, many researches advanced and modified various factors and groups that result for causing delays into several groups.

The studies were carried to figure out the main causes of construction delay. Battaineh et. al. (Battaineh1 2002) survey stated that the most significant cause of delay in the traditional type of contract, in perspective of contractor and consultant. It is also stated that to imparting the economic feasibility of capital project, extensive delays provide a fertile ground for costly disputes and claims. The result indicated the contractor and consultant agreed that owner interface, inadequate contractor experience, finance and payment, labor productivity, slow decision making, improper planning and subcontractor are among the top ten important factors.

In Saudi Arabia, Assaf et. al. (Sadi A. Assaf * 2006) conduced a research about construction projects delay in different type of projects in the state. It was concluded that 70% of projects experience time overrun. The survey was conducted with 23 contractors, 19 consultant and 15 owners. Seventy-three cause of delay was recognized and the causes are grouped into nine classes. The outcome of the survey that agreed by all three parties is change order. The overall results are stated that the factor related to labor, contractor, project, owner and consultant are in the highest rank.

In Florida, Ahmed et. al. (Syed M. Ahmed 2003) identified the major causes of delay in building construction industries. The primary aim of this study is to identify the perception of the different parties regarding causes of delays, the allocation of responsibilities and the different types of delay. It was found that; the consultants play a very important role in design-related delays because they are in charge of the design process in conjunction with the owner of the project. Furthermore delay in payments categories do not have the same negative impact on project completion times as other factors considered in this study such as code, design and construction related issues.

130 public projects in Jordan has been investigated the causes of delay by Al-Momani (Al-Momani 2000) in year 2000. The whole projects indicated that poor design and carelessness of the owner, change orders, weather condition, site condition, late delivery, economic conditions, and increase in quantities are the main causes of delay. The presence of these factors has an impact on the successful completion of the projects at the time contractual particular.

Abdullah et. el. (Mohd Razaki Abdullah 2010) has made a survey of on delay on Majlis Amanah Rakyat (MARA) one of government agencies in Malaysia. MARA management procurement construction project phenomenal issues of delayed has been argument for a long time. Eighteen of causes have been identified. The respondents are person who work as consultant such as executive, resident engineers, and clerk of work and client, MARA itself consist of director, project officer and engineers. The studies has concluded that cash flow and financial difficulties faced by contractors, contractors' poor site management and ineffective planning and scheduling by contractors are the main causes of the delay.

Sambasivan (Murali Sambasivan 2007) has made the study about the cause of delay in Malaysia itself. About 150 respondents participated in the survey. This study identified 10 most important causes of delay from a list of 28 different causes and 6 different effects of delay. The ten most important causes were: contractor's improper planning, contractor's poor site management, inadequate contractor experience, inadequate client's finance and payments for completed work, problems with subcontractors, shortage in material, labor supply, equipment availability and failure, lack of communication between parties, and mistakes during the construction stage.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1. Research Design

The methodology considered and adopted for this project work focus on literature review and, structured questionnaire survey designed and employed to assess the knowledge and practice on the cause of delays in the public building construction projects. It also used a mixed research method (both quantitative and qualitative methods) in the data collection process. The quantifiable responses were analyzed through a quantitative method as the name implies. The qualitative data gives more emphasis to the non-quantifiable responses and it is chosen due to its flexible nature. Mixing the two methods allows the flexibility of the project work to produce and gather efficient information by minimizing the limitation of the one method and maximizing the strength of the other method. Therefore, the qualitative method was used to support the quantitative data that was collected in the project work. Finally, based on the obtained data and results of the analysis, conclusions and recommendations are provided.

As stated above, in order to present clear ideas about the related issues with delay of public building construction projects, two stages of study was conducted.

The first is a comprehensive review of the relevant literature, starting with identifying the causes of delay of building construction projects, then shedding light on all significant aspects of these issues as covered by previous works in the field.

The second stage is to request respondents' view using a structured type of questionnaire, which is prepared using a five point Likert scale (extremely important, very important, moderately important, slightly important and not important).

In the public building construction projects that are the target of this project work, from the lists of causes of delay discussed in the literature review, the most probable causes were sorted out and organized in a fashion to help understand the respondents. As a result List of 42 causes of delay is grouped in 5 main categories.

3.2. Data Collection

Data obtained from the questionnaires were used to analyze with an appropriate method (primary data collection and secondary data collection methods from literature) which may result in the successful project. Data collected from the different groups were analyzed and critically answered to the question in the main objective of the project work.

3.3. Sample Size and Sample Selection

Bhattacherjee (2012) emphasizes that social science research (the source of most of the research methodologies in management/business) is generally about inferring patterns of behaviors within specific populations. It is extremely important for a study of largely qualitative nature to choose a sample that is truly representative of the population so that the inferences derived from the sample can be generalized back to the population of interest.

There are 3119 Grade 1- Grade 6 construction firms registered in Ethiopia in the year 2016/17 participating in the construction works of the country. Out of which 133 are registered Grade one construction firms.

In determining the sample size, the study has considered the most common technique applied in such situations-Yamane's model (1967, cited in Zemenu, 2011). In this model, the number of sampled representatives is computed by considering the total population size, required minimum confidence level, and tolerable sampling error as presented below.

$n= N/(1+N(e)^2)$

Where *n = sample size*

N = population size

e = sampling error/level of precision

As per the data collected form Addis Ababa Construction Bureau given total grade one construction contractors undertaking public funded building construction projects in the city administration are 28 and the maximum standard error set to be 5% the sample size of the respondents is computed as follows.

$n= 28/ (1+28(0.05)^{2}) = 26$

Therefore, the minimum number of respondents will be 26.

Since the number of contractors in Addis Ababa is more than the number of clients/owners and contractors, therefore it is sufficient to utilize the same sample size for owners and consultants representatives as for contractor.

3.4. Target Population

The sample consists of professionals working in the building construction projects from clients/employers, contractors and consultants working on the targeted public building construction projects selected in Addis Ababa. Senior officials from each side were the target to get enough and reliable information based on their experiences in the construction industry. Questionnaires were distributed to the projects that are selected for the study purposes. The respondents were kindly requested to fill the questionnaire and submit the questionnaire as a result the sampling system will be a goal-directed sample.

3.5. Data Analysis Approach

The processes of data collection and the design of the questionnaire was start with the development of sample questionnaire with an intensive review of literature. To select the

significant causes and effects of delay, senior professionals working on the public building construction projects were consulted for their comments in the questionnaire. As a result; the clarity, completeness and applicability of the questionnaire was confirmed.

In the selected construction projects, based on the design a list of 42 causes of delay in the five main categories with different sub category was established. The data was collected from the stated amount of experienced respondents or participants on the targeted projects. The analysis of causes of delay in the construction project was using relative important index (RII) and correlation coefficient using Microsoft excels.

The major steps of the research methodology include;

i. Stating significant causes of delay
ii. Selection of participants based on the capacity in the respective projects,
iii. Assessing using a questionnaire survey,
iv. Analyzing and ranking the causes of delay using relative importance index RII, and
v. Analysis for correlation of the ranking between the respondents.

3.5.1. Ranking and Computation of Relative Importance Index (RII)

Relative Importance Index (RII): used to determine the relative importance of the various causes of delay using five-point Likert scale. The higher value of the relative important index (RII) represents the important cause of delay and Computed by Equation

$$RII = \frac{\sum WiFi}{A * N} = \frac{1 * F1 + 2 * F2 + 3 * F3 + 4 * F4 + 5 * F5}{5 * N}$$

Where;

i - Response category index,

Wi - The weight given by respondents,

Fi - The frequency of respondent for each weight,

A - The highest weight (5 in this case) and

N - The total number of respondents.

RII -The relative important index ranges from 0 to 1.

3.5.2. Spearman Rank Correlation

Spearman's rank correlation coefficient used to assess the relationship between two different parties to show their agreement or disagreement in the ranking of the variables. The spearman's rank correlation coefficient, r_s was used to measure and compare between the rankings of clients consultants, contractors and combined view for a single cause of delay. Therefore spearman rank correlation is use to consolidate the responses from the three stake holders to a single cause of delay.

The value of Rs ranged from -1 to 1and indicated as;

- if -1 or +1 perfect negative or positive agreement /correlation,
- between -1 to -0.5 or 1 to 0.5,strong negative or positive correlation /agreement,
- between -0.5 to 0 or 0 to 0.5, weak negative or positive correlation and
- 0 no correlation /agreement (Fallahnejad, 2013).

Spearman's rank Computed using Equation

$$rs = 1 - \frac{(6\sum d^2)}{(n^3 - n)}$$

Where;

r_s = Spearman's rank,

d = rank difference,

n = number of ranks.

3.5.3. Reliability and Validity Tests

It is believed that using different types of procedures for collecting data and obtaining that information through different sources can augment the validity and reliability of the data and their interpretation. The process of developing and validating an instrument is in large part focused on reducing error in the measurement process.

Reliability - The questionnaires collected from 68 respondents were processed in the reliability and consistency test. The reliability and validity test focused on the questions included in the second part. The 42 questions are organized (All rated on 5-point Lickert scales, from extremely important to (5) to not important (1)). Cronbach's alpha - the most widely used internal consistency coefficient was computed using the following formula.

$$\alpha=((k/(k-1))*(1-((\sum(S_i)^2)/(S_t)^2)$$

where, k= number of questions in the questionnaire

S_i = Standard deviation of i^{th} item

S_t = Standard deviation of sum score

The alpha is calculated and it is found to be $\alpha= 0.947$

The alpha indicates that the items form a scale that exhibits good reliability. In general, reliability coefficient alpha is indicated to be as:

$0.9 \leq \alpha$ Excellent (High Stakes Testing)

$0.7 \leq \alpha < 0.9$ Good (Low Stakes Testing)

$0.6 \leq \alpha < 0.7$ Acceptable

$0.5 \leq \alpha < 0.6$ Poor

$\alpha < 0.5$ Unacceptable

Consistency/Validity It assesses the consistency or reproducibility of quantitative measurements made by different observers measuring the same quantity. The respondents were selected according to the position in the respective construction projects and their experience in the construction industry. In this regard, the response from the respondents is highly expected to be consistent. Moreover, the researcher has delivered most of the survey in person and has explained the respondents about the importance of genuine information and respondents were required to verify their response with an explanation of supporting practices and experiences.

Given the above outcomes, the research instrument (survey questionnaire) was found to be consistent and reliable.

CHAPTER FOUR: INTERPRATATION AND RESULT ANALYSIS

4.1 Introduction

The results of the data collected by using the devised questionnaire survey, which was distributed among professionals working in the construction industry of Addis Ababa City, is presented and discussed in this chapter.

The first part of this chapter presents survey distribution and response rates by sector organization, respondents' designation and experience in the public building construction industry. The remaining parts focus on the main objectives of this survey, which analyses data and answer the research questions. It presents and ranks the causes of delay based on the opinions of the three different groups using relative importance index separately and in group. It also tests the agreement of respondents (clients, contractors and consultants) with correlation of the ranks using spearman's coefficient.

These delay causes as stipulated in the questionnaire survey, had a five point scale ranged from 1 to 5 in a level of importance from not important to extremely important causes to project delays and the results are discussed.

4.1.1 Data Analysis

The questionnaire distributed to clients/owners, consultants and contractors participating in the selected public building construction projects, was responded by project managers, resident engineers, construction contract administrators, site engineers, office engineers and other senior officials having different capacities related to the public building projects. The data collected was analyzed and ranked the causes of delay through RII using Microsoft Excel.

4.1.2 Percentage of Questionnaire Response

Based on the sample size calculation in the methodology part, 82 questionnaires were distributed, of which 28 questionnaires to contractors, 28 to consultants and 26 to clients/ owners were distributed. Accordingly, the following table Table 4.1 shows the distribution profile of the respondents' organization in terms of type.

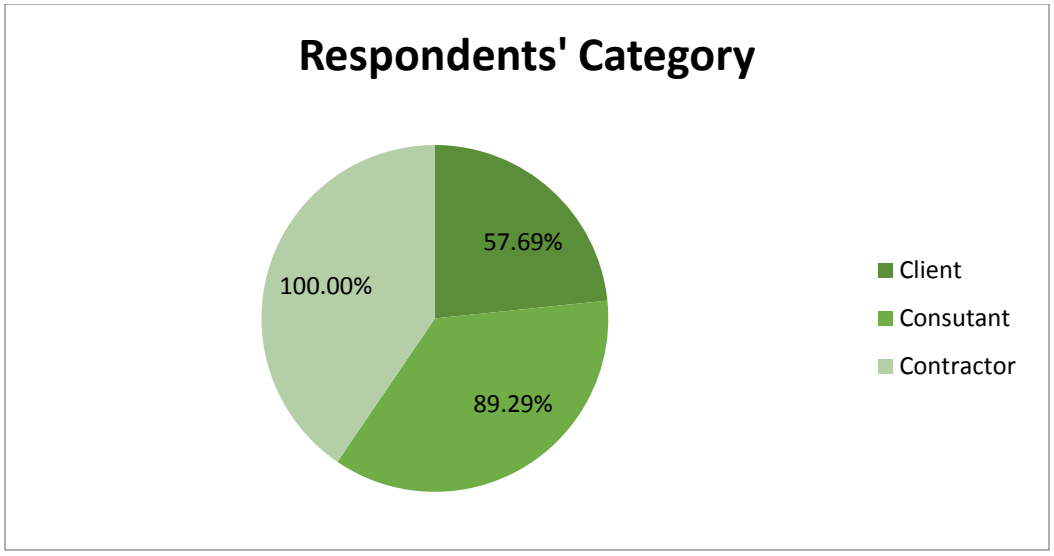
Table 4. 1: Distribution of Respondent's Profile

Category	**Number of Questionnaires Distributed**	**Number of Questionnaires Responded**	**Percentage of Questionnaires Responded**
Client	26	15	57.69%
Consultant	28	25	89.29%
Contractor	28	28	100.00%

Source: Own Survey, 2018

As can be seen form the above table, the percentage distribution (57.69 % of client, 89.29 % of Consultant and 100.00 % of Contractor) is fair enough to go forward with the analysis.

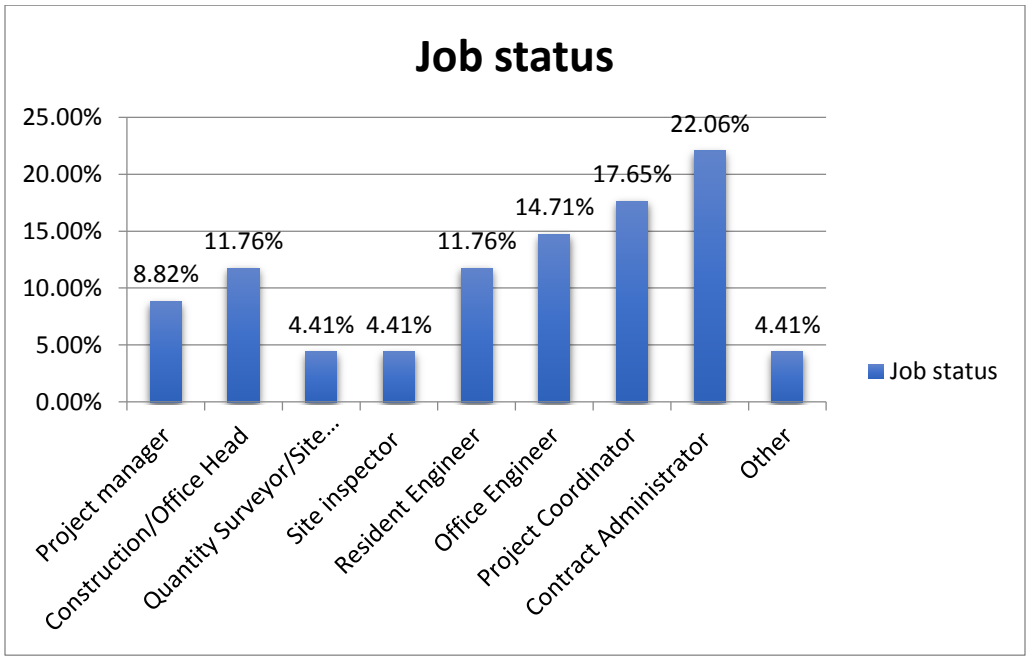
Figure 4. 1: Respondents' Category Ratio



Source: Own Survey, 2018

4.1.3 Respondents Designation

Figure 4. 2: Respondents' Designation

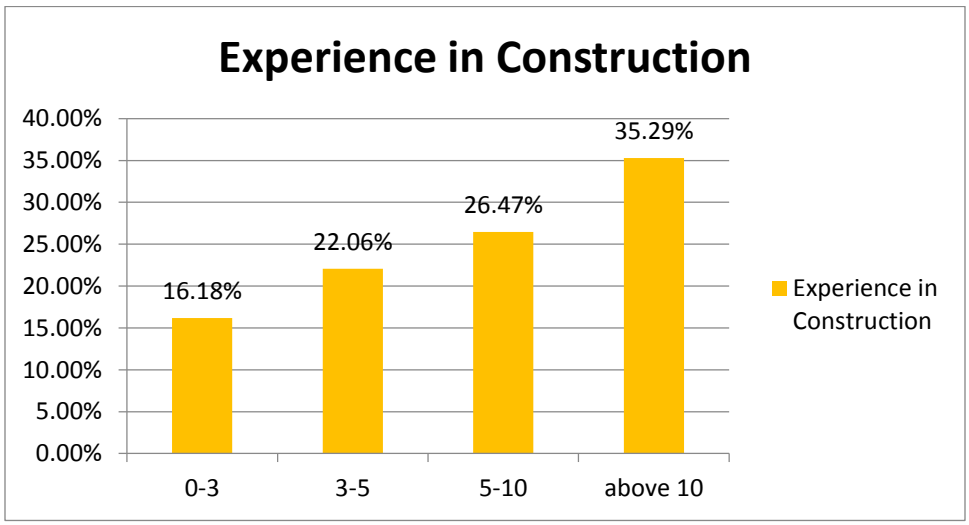


Source: Own Survey, 2018

The designation of the respondents in the above figure shows a relatively wider variety of professionals which are very relevant to the construction delay identification and analysis. The respondents have been assigned as senior project managers (8.82 %), quantity surveyors (4.41 %), contract administrators (22.06 %), office engineers (14.71 %), site inspectors (4.41 %) and construction office heads (11.76%).

Figure 4.3 below shows respondents' general profile and work experience in the construction industry and building construction projects.

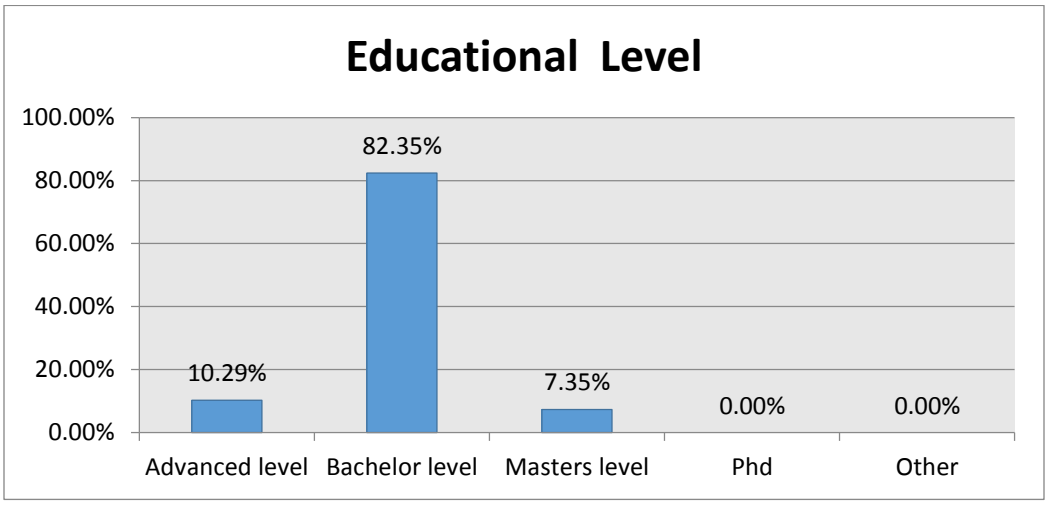
Figure4. 3: Respondents' Work experience



Source: Own Survey, 2018

On the percentage of years of work experience of the respondents, (11) 16.18 % of the respondents have 0-3 years of work experience, (15) 22.06 % of the respondents have 3-5 years of work experience, (18) 26.47 % of the respondents have 5-10 years of work experience, (24) 35.29 % of the respondents have more than twenty (10) years of work experience in the building construction sector (figure 4.3).

Figure 4. 4: Respondents' Education Level



Source: Own Survey, 2018

Figure 4.4 indicates respondents' educational background, 82.35 % are bachelor degree holders, 10.29 % are advance diploma level and 7.35% are second degree level professionals engaged in the public construction building.

4.2 Assessment and Identification of Causes of Delay in Public Building Projects

The construction delay is universally evident reality and is counted as a common problem in construction projects. Delays in building construction projects emerge because of various factors and causes.

The objective of conducting the analysis for this section is to establish the factors under the groups of causes identified from the literature review and ranking them according to their significant influence towards construction project delays

These causes are classified in to five main categories.

i. Client/owner related cause
ii. Contractor related causes
iii. Consultant related causes
iv. Resource related causes (material ,equipment and man power
v. External causes

Relative importance index RII was calculated for the response of clients', contractors', consultants' and overall combined respondents' view. Then ranking of the causes based on RII was calculated to reveal the most influential factors within each category of causes and from all causes in general.

4.3 Identification and Raking the Delay Causes Attributed to Clients, Contractors and Consultants

4.3.1 Identification and Ranking of Causes of Delay, Attributed to Clients

Table 4. 2 : Causes of delay ranked according to client's view, for client related causes

No.	Causes of Delay	Client /Owner					Client/Owner	
		5	4	3	2	1	RII	Rank
i	**Client/Owner Related Causes**							
1	Delay to furnish and deliver the site to the contractor	2	2	10	1	0	0.667	**29**
2	Late in revising and approving design documents by owners	1	4	6	4	0	0.627	**32**
3	Financing problems	4	6	1	4	0	0.733	**19**
4	Delay in progress payments for completed works	4	4	6	1	0	0.747	**17**
5	Slow in decision making	2	5	6	1	1	0.68	**28**
6	Poor communication and coordination	1	4	3	6	1	0.573	**36**
7	Scope change and Variation Orders	4	1	5	5	0	0.653	**31**
8	Unrealistic contract period	2	1	5	3	4	0.52	**39**
9	Suspension of works	1	1	6	3	4	0.493	**40**

Source: Own Survey, 2018

According to the client respondents, the client related cause of delay category is ranked as shown in the above table 4.2. This table shows the client respondents give less weight to the events in the category and are less important in contributing delay to the projects.

Table 4. 3 : Causes of delay ranked according to client's view for contractor related causes

No.	Causes of Delay	Client /Owner					Client/Owner	
		5	4	3	2	1	RII	Rank
ii	**Contractor Related Causes**							
10	Poor Project management system	12	1	2	0	0	0.933	**1**
11	Late start & resource mobilization to site	10	3	2	0	0	0.907	**2**
12	Difficulty in project financing(poor financial system)	9	2	3	1	0	0.853	**3**
13	Improper construction methodology and Reworks	6	6	1	2	0	0.813	**5**
14	Disagreement and conflict with Consultant and Client	7	2	3	3	0	0.773	**10**
15	Delay in sub-contractors works	5	3	6	1	0	0.76	**15**
16	Incompetent project staffing	5	4	4	2	0	0.76	**15**
17	Inadequate contractor Experience	6	3	2	4	0	0.747	**17**
18	Delay in material approval prior to delivery to site	1	2	10	0	2	0.6	**34**

Source: Own Survey, 2018

As can be seen from the above table 4.3 according to the client respondents the top the top three causes of delay are contractor related. According to the respondents, contractor related causes category group is perceived as the most important delay causing factors to the construction projects.

Table 4. 4 : Causes of delay ranked according to client's view for consultant related causes

No.	Causes of Delay	Client /Owner					Client/Owner	
		5	4	3	2	1	RII	Rank
iii	**Consultant Related Causes**							
19	Inaccurate Site investigation Report	8	1	4	2	0	0.8	**8**
20	Delay in issuance of designs and working drawings	8	2	3	2	0	0.813	**5**
21	Delay in payments approval for completed works	2	6	5	1	1	0.693	**26**
22	Delay in test and inspection of works	2	7	4	1	1	0.707	**24**
23	Design errors and complexity of designs	7	4	3	0	1	0.813	**5**
24	Lack of qualified supervisors on site	5	4	3	1	2	0.72	**22**
25	Poor communication with team and other stakeholders	2	6	4	1	2	0.667	**29**
26	Lack of detailing in BOQ ,designs and specification	5	6	1	3	0	0.773	**10**
27	Inadequate experience of consultant	6	5	1	3	0	0.787	**9**

Source: Own Survey, 2018

The consultant related causes of delay as ranked by the client respondents is shown in the above table 4.4, the table shows consultant related category causes are the second most contributors to the time overrun in the projects. Out of the nine delay causing factors, the five factors with ID No. 20, 23, 19, 26 in this category list are ranked in the top ten list of the overall raking.

Table 4. 5 : Causes of delay ranked according to client's view for resource and external related causes

No.	Causes of Delay	Client /Owner					Client/Owner	
		5	4	3	2	1	RII	Rank
iv	**Resource related Causes (Material, Equipment and Man power)**							
28	Availability of skilled and unskilled labor	6	4	2	3	0	0.773	**10**
29	Machineries allocation problem	4	6	3	0	2	0.733	**19**
30	Availability of local materials and sourcing	3	5	4	3	0	0.707	**24**
31	Low productivity of labor	5	7	1	0	2	0.773	**10**
32	Poor quality construction materials	5	4	3	1	2	0.72	**22**
33	Equipment availability on demand	3	8	3	1	0	0.773	**10**
34	Shortage of local construction materials in market	4	4	4	1	2	0.693	**26**
35	Shortage of availability of imported construction materials and goods on market	8	4	2	0	1	0.84	**4**
v	**External Causes**							
36	Changes in Regulations and Rules by government	1	0	7	4	3	0.493	**40**
37	Price Inflation	6	3	3	1	2	0.733	**19**
38	Force majeure (War, Conflict, Riot and violence)	2	4	5	1	3	0.613	**33**
39	Unforeseen site conditions	0	5	5	4	1	0.587	**35**
40	Weather and natural disaster (act of God)	0	4	5	3	3	0.533	**38**
41	Social and cultural factors	1	4	4	4	2	0.573	**36**
42	Environmental restrictions	0	1	7	2	4	0.44	**42**

Source: Own Survey, 2018

The above table 4.5 shows the ranking of the two last category groups, resource related and external related causes of delay. The client respondents have perceived the external causes category's contribution to delay to the projects is less important, almost not important factors to delay. From the 8 list of delay causing events, only four vents are ranked in the top four. The event with ID. No. 35, Shortage of Availability of Imported Construction Materials and Goods on Market, is the highest ranked event in the resource related category.

Generally from the above tables 4.2, 4.3, 4.4 and 4.5 , it can be seen that the causes of delay are ranked in order of their importance from one to 42 and the top three causes of delay based on maximum RII value from clients' view lie under contractor related causes category.

Poor project management system with RII 0.933 is the first cause, late start & resource mobilization to site with RII 0.907 is the second and difficulty in project financing (poor financial system) with RII 0.85 in the third row, as per the owners view, it can be noted that all causes of delay to construction projects arise from the contractors' related problems. Moreover, external related causes like Environmental restrictions with RII 0.44, changes in regulations and rules by government with RII 0.493 and client related cause, suspension of works with RII 0.493 are the three bottom most causes to influence construction project delay.

4.3.2 Identification and Ranking of Causes of Delay, Attributed to Consultants

Table 4. 6: Causes of delay ranked according to consultant's view for client related causes

No.	Causes of Delay	Consultant					Consultant		
		5	4	3	2	1	W	RII	Rank
i	**Client/Owner Related Causes**								
1	Delay to furnish and deliver the site to the contractor	11	8	0	3	3	96	0.768	**2**
2	Late in revising and approving design documents by owners	8	7	4	2	4	88	0.704	**18**
3	Financing problems	11	3	4	4	3	90	0.72	**11**
4	Delay in progress payments for completed works	5	9	3	6	2	84	0.672	**22**
5	Slow in decision making	6	9	9	0	1	94	0.752	**4**
6	Poor communication and coordination	3	7	11	2	2	82	0.656	**27**
7	Scope change and Variation Orders	3	11	7	3	1	87	0.696	**20**
8	Unrealistic contract period	5	10	6	2	2	89	0.712	**14**
9	Suspension of works	2	10	5	5	3	78	0.624	**35**

Source; Own Survey, 2018

From the above table 4.6 according to the consultant respondents the client related category causes, out of the nine lists the top three are the events with ID. No. 1, 5, and 8 of which the delay causing factor 'delay to furnish and deliver the site to the contractor' is ranked second from the list of 42 causes. The next delay cause which is perceived as very important delay causing factor is slow in decision making.

Table 4. 7: Causes of delay ranked according to consultant's view for contractor related causes

No.	Causes of Delay	Consultant					Consultant		
		5	4	3	2	1	W	RII	Rank
ii	**Contractor Related Causes**								
10	Poor Project management system	7	11	4	0	3	94	0.752	**4**
11	Late start & resource mobilization to site	9	7	5	1	3	93	0.744	**8**
12	Difficulty in project financing(poor financial system)	11	10	0	3	1	102	0.816	**1**
13	Improper construction methodology and Reworks	6	12	3	2	2	93	0.744	**8**
14	Disagreement and conflict with Consultant and Client	1	10	9	3	2	80	0.64	**30**
15	Delay in sub-contractors works	3	11	8	2	1	88	0.704	**18**
16	Incompetent project staffing	4	9	8	2	2	86	0.688	**21**
17	Inadequate contractor Experience	4	11	4	2	4	84	0.672	**22**
18	Delay in material approval prior to delivery to site	6	11	5	2	1	94	0.752	**4**

Source; Own Survey, 2018

According to the consultant respondents, table 4.7 above shows the ranking of contractor related factors. The ranking of the consultants to this category looks very important delay factors, out of the list of 9 delay events the five delay events/factors with ID. No. 12, 10,11, 18 and 13 are ranked in the top ten list. From the lists the event 'difficulty in project financing (poor financial system) is the first and most delay causing factor ass perceived by the consultant respondents.

Table 4. 8: Causes of delay ranked according to consultant's view for consultant related causes

No.	Causes of Delay	Consultant					Consultant		
		5	4	3	2	1	W	RII	Rank
iii	**Consultant Related Causes**								
19	Inaccurate Site investigation Report	5	10	6	2	2	89	0.712	**14**
20	Delay in issuance of designs and working drawings	9	7	7	0	2	96	0.768	**2**
21	Delay in payments approval for completed works	7	3	8	5	2	83	0.664	**24**
22	Delay in test and inspection of works	3	10	4	5	3	80	0.64	**30**
23	Design errors and complexity of designs	7	7	7	1	3	89	0.712	**14**
24	Lack of qualified supervisors on site	0	11	7	4	3	76	0.608	**37**
25	Poor communication with team and other stakeholders	1	5	13	4	2	74	0.592	**38**
26	Lack of detailing in BOQ ,designs and specification	7	7	6	3	2	89	0.712	**14**
27	Inadequate experience of consultant	4	7	6	5	3	79	0.632	**32**

Source; Own Survey, 2018

As can be learnt from the above table 4.8, the consultant respondents give less weight to the delay events in the consultant category groups. The only event perceived as highly delay causing factor is' delay in issuance of design and working drawings by consultants.

Table 4. 9: Causes of delay ranked according to consultant's view for resource and external related causes

No.	Causes of Delay	Consultant					Consultant		
		5	4	3	2	1	W	RII	Rank
iv	**Resource related Causes (Material, Equipment and Man power)**								
28	Availability of skilled and unskilled labor	6	8	8	1	2	90	0.72	**11**
29	Machineries allocation problem	4	8	6	4	3	81	0.648	**28**
30	Availability of local materials and sourcing	5	7	5	5	3	81	0.648	**28**
31	Low productivity of labor	2	9	7	5	2	79	0.632	**32**
32	Poor quality construction materials	4	7	8	5	1	83	0.664	**24**
33	Equipment availability on demand	6	9	6	2	2	90	0.72	**11**
34	Shortage of local construction materials in market	5	8	4	6	2	83	0.664	**24**
35	Shortage of availability of imported construction materials and goods on market	7	10	4	3	1	94	0.752	**4**
v	**External Causes**								
36	Changes in Regulations and Rules by government	1	8	8	4	4	73	0.584	**39**
37	Price Inflation	6	9	7	2	1	92	0.736	**10**
38	Force majeure (War, Conflict, Riot and violence)	10	2	2	4	7	79	0.632	**32**
39	Unforeseen site conditions	4	5	8	5	3	77	0.616	**36**
40	Weather and natural disaster (act of God)	3	4	8	3	7	68	0.544	**40**
41	Social and cultural factors	0	6	6	8	5	63	0.504	**42**
42	Environmental restrictions	0	10	2	9	4	68	0.544	**40**

Source; Own Survey, 2018

For consultant respondents, as shown in the above table 4.9, the two category groups resource related and external delay causes, the factors, except the factor with ID. No. 35, are not as such important to influence the construction projects as a result have less importance to the time overrun in project.

In General From the below table 4.6, 4.7, 4.8 and 4.9, it is indicated that the list of causes of delay are ranked according to their RII value. It is shown that the top three causes of delay based on the importance priority from consultants' view lie under contractor related, client related and consultant related causes category respectively.

Difficulty in project financing (poor financial system) with RII 0.816 is the first cause of delay, delay to furnish and deliver the site to the contractor and delay in issuance of designs and working drawings with equal RII of 0.768 are in the second row, as per the consultants view, it can be well noted that the top three causes of delay to construction projects arise from the all three participants: clients, consultant themselves and contractors related problems. In contrary to the above, external related causes like social and cultural factors with RII 0.504, Weather and natural disaster (act of God) and environmental restrictions with equal RII of 0.544 are the three bottom most causes to have less contribution in influencing the time overrun in public building construction projects.

4.3.3 Identification and Ranking of Causes of Delay, Attributed to Contractors

Table 4. 10: Causes of delay ranked according to contractor's view for owner related causes

No.	Causes of Delay	Contractor					Contractor		
		5	4	3	2	1	W	RII	Rank
i	**Client/Owner Related Causes**								
1	Delay to furnish and deliver the site to the contractor	9	12	6	1	0	113	0.807	**10**
2	Late in revising and approving design documents by owners	10	12	4	1	1	113	0.807	**10**
3	Financing problems	14	9	4	0	1	119	0.85	**3**
4	Delay in progress payments for completed works	16	9	3	0	0	125	0.893	**1**
5	Slow in decision making	11	11	5	0	1	115	0.821	**7**
6	Poor communication and coordination	6	10	10	0	2	102	0.729	**23**
7	Scope change and Variation Orders	8	8	11	1	0	107	0.764	**18**
8	Unrealistic contract period	10	10	5	1	2	109	0.779	**15**
9	Suspension of works	3	9	10	2	4	89	0.636	**38**

Source: Own Survey, 2018

Table 4.10 shows the perception of the contractor respondents for the owners related causes category, out of the nine lists five events are ranked in the top ten, moreover, the delay causing event in number 4 the delay in progress payment for completed works by owners is the key factor that contribute high to project delay.

Table 4. 11: Causes of delay ranked according to contractor's view for contractor related causes

No.	Causes of Delay	Contractor					Contractor		
		5	4	3	2	1	W	RII	Rank
ii	**Contractor Related Causes**								
10	Poor Project management system	12	10	4	0	2	114	0.814	**8**
11	Late start & resource mobilization to site	7	12	5	2	2	104	0.743	**20**
12	Difficulty in project financing(poor financial system)	16	8	2	2	0	122	0.871	**2**
13	Improper construction methodology and Reworks	6	7	10	4	1	97	0.693	**30**
14	Disagreement and conflict with Consultant and Client	6	3	13	3	3	90	0.643	**36**
15	Delay in sub-contractors works	2	13	9	2	2	95	0.679	**32**
16	Incompetent project staffing	2	10	11	5	0	93	0.664	**33**
17	Inadequate contractor Experience	4	12	8	3	1	99	0.707	**28**
18	Delay in material approval prior to delivery to site	7	10	7	2	2	102	0.729	**23**

Source: Own Survey, 2018

Contractor respondents identify the contractor related causes listed in the above table 4.11 as less important factors except for the two events which are difficulty in project financing and poor project management system which are ranked second and 8th respectively. Therefore, the majority events in the contractor related category list are not that much significant to contribute delay to the projects.

Table 4. 12: Causes of delay ranked according to contractor's view for consultant related causes

No.	Causes of Delay	Contractor					Contractor		
		5	4	3	2	1	W	RII	Rank
iii	**Consultant Related Causes**								
19	Inaccurate Site investigation Report	11	9	6	2	0	113	0.807	**10**
20	Delay in issuance of designs and working drawings	13	12	1	1	1	119	0.85	**3**
21	Delay in payments approval for completed works	9	11	6	1	1	110	0.786	**13**
22	Delay in test and inspection of works	5	11	10	1	1	102	0.729	**23**
23	Design errors and complexity of designs	15	7	5	0	1	119	0.85	**3**
24	Lack of qualified supervisors on site	3	12	9	3	1	97	0.693	**30**
25	Poor communication with team and other stakeholders	2	7	12	6	1	87	0.621	**39**
26	Lack of detailing in BOQ ,designs and specification	11	10	3	2	2	110	0.786	**13**
27	Inadequate experience of consultant	8	10	9	1	0	109	0.779	**15**

Source: Own Survey, 2018

The above table 4.11 shows the list of delay factors in the consultant related causes category as perceived and ranked by contractor respondents. The ranking shows that out of the list of 9 factors three delay events are in the top ten lists of which the two factors are ranked in third from all the 42 day causing factors.

Table 4. 13: Causes of delay ranked according to contractor's view for resource and external related causes

No.	Causes of Delay	Contractor					Contractor		
		5	4	3	2	1	W	RII	Rank
iv	**Resource related Causes (Material, Equipment and Man power)**								
28	Availability of skilled and unskilled labor	7	12	7	2	0	108	0.771	**17**
29	Machineries allocation problem	7	9	10	2	0	105	0.75	**19**
30	Availability of local materials and sourcing	8	8	8	3	1	103	0.736	**21**
31	Low productivity of labor	7	10	5	5	1	101	0.721	**26**
32	Poor quality construction materials	6	6	8	7	1	93	0.664	**33**
33	Equipment availability on demand	8	8	7	5	0	103	0.736	**21**
34	Shortage of local construction materials in market	8	9	5	4	2	101	0.721	**26**
35	Shortage of availability of imported construction materials and goods on market	12	12	3	1	0	119	0.85	**3**
v	**External Causes**								
36	Changes in Regulations and Rules by government	2	7	13	4	2	87	0.621	**39**
37	Price Inflation	13	6	8	0	1	114	0.814	**8**
38	Force majeure (War, Conflict, Riot and violence)	13	2	3	6	4	98	0.7	**29**
39	Unforeseen site conditions	4	9	6	7	2	90	0.643	**36**
40	Weather and natural disaster (act of God)	4	11	4	6	3	91	0.65	**35**
41	Social and cultural factors	0	4	8	11	5	67	0.479	**41**
42	Environmental restrictions	1	2	9	11	5	67	0.479	**41**

Source: Own Survey, 2018

According to the contractor respondents similar to the other respondents these category groups are ranked in the bottom most lists from the 42 delay causing factors. However, the resource related category event 'shortage of availability of imported construction materials and goods on market' is the top most event/factor which contributes high to project delay.

In summary As can be understood from the tables 4.10, 4.11,4.12 and 4.13 above, according to contractors view the most critical delay causes based on the RII value are; the client related cause of delay which is delay in progress payments for completed works (RII - 0.893) is the first top cause, difficulty in project financing (poor financial system) which is contractor related cause (RII 0.871) is the second and in the third there are three delay factors ranked with equal RRI of 0.85 found to be client, consultant and resource related problems with.

Based on the rank listed in above table, external causes like changes in regulations and rules by government with RII value 0.621, social and cultural factors and environmental restrictions with both RII of 0.479 are among the least causes in the row to influence the delay in public building construction projects.

4.3.4 Identification and Ranking of Causes of Delay, Attributed to All Parties Combined

Table 4. 14: Causes of delay ranked according to the combined view for owner related causes

No.	Causes of Delay	Combined		
		W	RII	Rank
i	**Client/Owner Related Causes**			
1	Delay to furnish and deliver the site to the contractor	259	0.762	**12**
2	Late in revising and approving design documents by owners	248	0.729	**17**
3	Financing problems	264	0.776	**8**
4	Delay in progress payments for completed works	265	0.779	**6**
5	Slow in decision making	260	0.765	**11**
6	Poor communication and coordination	227	0.668	**33**
7	Scope change and Variation Orders	243	0.715	**20**
8	Unrealistic contract period	237	0.697	**26**
9	Suspension of works	204	0.6	**38**

Source: Own Survey, 2018

The combined view of the three respondents to the owner related category as shown in table 4.14 above indicates, two delay causing factors 'delay in progress payments for completed works' and ' financing problems' are ranked 6^{th} and 8^{th} from the 42 delay causing factors.

Table 4. 15: Causes of delay ranked according to the combined view for contractor related causes

No.	Causes of Delay	Combined		
		W	RII	Rank
ii	**Contractor Related Causes**			
10	Poor Project management system	278	0.818	**2**
11	Late start & resource mobilization to site	265	0.779	**6**
12	Difficulty in project financing(poor financial system)	288	0.847	**1**
13	Improper construction methodology and Reworks	251	0.738	**15**
14	Disagreement and conflict with Consultant and Client	228	0.671	**32**
15	Delay in sub-contractors works	240	0.706	**23**
16	Incompetent project staffing	236	0.694	**28**
17	Inadequate contractor Experience	239	0.703	**24**
18	Delay in material approval prior to delivery to site	241	0.709	**21**

Source: Own Survey, 2018

According to the combined views, the contractor related category is the most contributing factor to the delay in projects. From the lists, the first, second and sixth rank are the delay events caused by contractors. Table 4.15 above shows the contractor related causes ranked according to the combined view of the three respondents.

Table 4. 16: Causes of delay ranked according to the combined view for contractor related causes

No.	Causes of Delay	Combined		
		W	RII	Rank
iii	**Consultant Related Causes**			
19	Inaccurate Site investigation Report	262	0.771	**9**
20	Delay in issuance of designs and working drawings	276	0.812	**3**
21	Delay in payments approval for completed works	245	0.721	**19**
22	Delay in test and inspection of works	235	0.691	**30**
23	Design errors and complexity of designs	269	0.791	**5**
24	Lack of qualified supervisors on site	227	0.668	**33**
25	Poor communication with team and other stakeholders	211	0.621	**36**
26	Lack of detailing in BOQ ,designs and specification	257	0.756	**13**
27	Inadequate experience of consultant	247	0.726	**18**

Source: Own Survey, 2018

Table 4.16 above indicates two events in the consultant related causes ranked in 3rd and 5th form the overall delay causes. And also three factors including the two are listed in the top ten lists according to the combined view of clients, consultants and contractors, this category delay cause stood second to influence projects timely completion.

Table 4. 17: Causes of delay ranked according to the combined view for resource and external related causes

No.	Causes of Delay	Combined		
		W	RII	Rank
iv	**Resource related Causes (Material, Equipment and Man power)**			
28	Availability of skilled and unskilled labor	256	0.753	**14**
29	Machineries allocation problem	241	0.709	**21**
30	Availability of local materials and sourcing	237	0.697	**26**
31	Low productivity of labor	238	0.7	**25**
32	Poor quality construction materials	230	0.676	**31**
33	Equipment availability on demand	251	0.738	**15**
34	Shortage of local construction materials in market	236	0.694	**28**
35	Shortage of availability of imported construction materials and goods on market	276	0.812	**3**
v	**External Causes**			
36	Changes in Regulations and Rules by government	197	0.579	**40**
37	Price Inflation	261	0.768	**10**
38	Force majeure (War, Conflict, Riot and violence)	223	0.656	**35**
39	Unforeseen site conditions	211	0.621	**36**
40	Weather and natural disaster (act of God)	199	0.585	**39**
41	Social and cultural factors	173	0.509	**41**
42	Environmental restrictions	168	0.494	**42**

Source: Own Survey, 2018

Table 4.17 above indicates ranks of the two category groups resource related and externals related delay causes, for the table it can be shown that the resource related cause ‘ shortage of availability of imported construction materials and goods on market’ contributes major role towards project delay. The rest delay causing factors are not considered important for the time

overrun in projects. As perceived by the combined view of the three parties, external related causes of delay are not as such important.

To Generalize the combined view analysis, From the above tables 4.14, 4.15,4.16 and 4.17 it can be seen that the top four causes of delay based on the RII value from the combined or overall view of clients', contractors' and consultant' are difficulty in project financing (poor financial system) (RII .847) is in the first, poor project management system (RII 0.818) in a second and both delay in issuance of designs and working drawings and shortage of availability of imported construction materials and goods on market(RII 0.812) are at the third row and the fourth important cause is a consultant related cause which is design errors and complexity of designs (RII 0.791) .

Therefore, form the combined (clients', consultants' and contractors') view table 4.8 we can learn that the first and second causes are from the contractor related category and the third, two events, from consultant and resource related category.

In addition, the events in the fifth category, the external causes, changes in regulations and rules by government (RII 0.579), social and cultural factors (RII 0.509) and environmental restrictions (RII 0.494) are the less important events to influence the delay in the public contraction project under the focus of this study.

According to the overall view on causes of delay, all the least important causes are from the external group category. Hence, the external causes are least to influence as causes of delay in Addis Ababa public construction projects.

4.4 Top ten delay causes in public building construction projects

4.4.1 Top ten delay causes, according to clients' views

According to the clients'/owners' perspective on causes of delay to public construction projects, the top ten causes are sorted out based on their RII rank. The ranks are as shown in the table 4.18 below.

Table 4. 18: Clients' view top ten delay causes

ID	Causes of delay	RII	Rank	Category
10	Poor Project management system	0.933	1	Contractor related
11	Late start & resource mobilization to site	0.907	2	Contractor related
12	Difficulty in project financing(poor financial system)	0.853	3	Contractor related
35	Shortage of availability of imported construction materials and goods on market	0.84	4	Resource Related
13	Improper construction methodology and Reworks	0.813	5	Contractor related
20	Delay in issuance of designs and working drawings	0.813	5	Consultant related
23	Design errors and complexity of designs	0.813	5	Consultant related
19	Inaccurate Site investigation Report	0.8	8	Consultant related
27	Inadequate experience of consultant	0.787	9	Consultant related
14	Disagreement and conflict with Consultant and Client	0.773	10	Contractor rleated
26	Lack of detailing in BOQ ,designs and specification	0.773	10	Consultant related
33	Equipment availability on demand		10	Resource related

Source: Own Survey, 2018

4.4.2 Top ten delay causes, according to consultants' views

According to the consultants' perspective on causes of delay to public building construction projects, the top ten causes are sorted out based on their RII and ranked according to their importance. The ranks are as shown in the table 4.19 below.

Table 4. 19: Consultants' view top ten delay causes

ID	Causes of delay	RII	Rank	Category
12	Difficulty in project financing(poor financial system)	0.816	1	Contractor related
1	Delay to furnish and deliver the site to the contractor	0.768	2	Client/owner related
20	Delay in issuance of designs and working drawings	0.768	2	Consultant related
5	Slow in decision making	0.752	4	Client/ Owner related
10	Poor Project management system	0.752	4	Contractor related
18	Delay in material approval prior to delivery to site	0.752	4	Contractor related
35	Shortage of availability of imported construction materials and goods on market	0.752	4	Resource related
11	Late start & resource mobilization to site	0.744	8	Contractor related
13	Improper construction methodology and Reworks	0.744	8	Contractor related
37	Price Inflation	0.736	10	External causes

Source: Own Survey, 2018

4.4.3 Top ten delay causes, according to contractors' views

According to the contractors' view, the top ten delay causes are as shown in the below table 4.20.

Table 4. 20: Contractors' view top ten delay causes

ID	Causes of delay	RII	Rank	Category
4	Delay in progress payments for completed works	0.893	1	Client related
12	Difficulty in project financing(poor financial system)	0.871	2	Contractor related
3	Financing problems	0.85	3	Client related
20	Delay in issuance of designs and working drawings	0.85	3	Consultant related
35	Shortage of availability of imported construction materials and goods on market	0.85	3	Resource related
23	Design errors and complexity of designs	0.85	3	Consultat related
5	Slow in decision making	0.821	7	Client related
10	Poor Project management system	0.814	8	Contractor related
37	Price Inflation	0.814	8	External related
1	Delay to furnish and deliver the site to the contractor	0.807	10	Client related
2	Late in revising and approving design documents by owners	0.807	10	Client related

Source: Own Survey, 2018

4.4.4 Top ten delay causes according to the combined view

When we see the top 10 most events that cause delay to construction projects according to the combined view, it can be elaborated in the below table. As it shown in table 4.9 below, all the parties have recognized that ‘difficulty in project financing’, ‘poor project management system’ and ‘late issuance of designs, ‘shortage of availability of imported construction materials´ are among the ten most significant factors causing time overrun.

Table 4. 21: Combined view top ten delay causes

ID	Causes of delay	RII	Rank	Category
12	Difficulty in project financing(poor financial system)	0.847	1	Contractor related
10	Poor Project management system	0.818	2	Contractor related
20	Delay in issuance of designs and working drawings	0.812	3	Consultant related
35	Shortage of availability of imported construction materials and goods on market	0.812	3	Resource related
23	Design errors and complexity of designs	0.791	5	Consultant related
4	Delay in progress payments for completed works	0.779	6	Client related
11	Late start & resource mobilization to site	0.779	6	Contractor related
3	Financing problems	0.776	8	Ceint related
19	Inaccurate Site investigation Report	0.771	9	Consultant related
37	Price Inflation	0.768	10	External related

Source: Own Survey, 2018

4.5 Rank of cause of delay category wise

According to the five category set for the study purposes (client related, contractor related, consultant related, resource related and external related), It is reflected that each responding parties (client, consultant and contractor) has got different perceptions toward the delay causes

category. The following table 4.22 shows the perception of clients, consultant and contractors towards the delay causes.

Table 4. 22: Perceptions of clients, consultant and contractors to category of delay causes

No.	Causes of Delay Category	Client/Owner Perceptions		Consultant Perceptions		Contractor Perceptions		Combined Perception	
		RII	Rank	RII	Rank	RII	Rank	RII	Rank
i	Client/Owner Related Causes	0.633	4	0.7	2	0.787	1	0.721	4
ii	Contractor Related Causes	0.794	1	0.724	1	0.727	4	0.741	1
iii	Consultant Related Causes	0.753	2	0.671	4	0.767	2	0.729	2
iv	Resource related Causes (Material, Equipment and Man power)	0.752	3	0.681	3	0.744	3	0.722	3
v	External Causes	0.591	5	0.605	5	0.641	5	0.617	5

Source: Own Survey, 2018

From the 5 category list table 4.22 above, according to the clients'/owners' perceptions, the causes for delay are: Contractor related (RII 0.794) stood first, consultant related (RII 0.753) in the second, resource related (0.752) in the third, client/owner related (RII 0.633) in the fourth and external causes (RII 0.591) in fifth.

According to the consultants' perceptions the order is: contractor related (RII 0.724) in first, client related (RII 0.7) in second, resource related in third (RII 0.681), consultant related (RII 0.671) in fourth and external related causes (RII 0.591) in fifth.

According to contractors' perceptions the perceived order is: client related (RII 0.787) contribute most importantly for delay and it is in the first, consultant related (RII 0.767) in in second, resource related (RII 0.744) in third, contractor related (RII 0.727) in fourth and external related (RII .641) in placed last.

Finally according to the combined perception of all responding parties, it is perceived that contractor related (RII 0.741), consultant related (RII 0.729), resource related (RII 0.721), client/owner related (RII 0.722) and external related (RII 0.617) are placed from first to fifth.

4.6 Test on agreement of ranking of causes of delay among clients, consultant and contractors

4.6.1 Spearman rank correlation among the three parties

As stipulated in Chapter 3 section 3.5, spearman's rank correlation coefficient used to assess the relationship between two different parties to show their agreement or disagreement in the ranking of the variables. Therefore spearman rank correlation is use to consolidate the responses from the three stake holders to a single cause of delay.

Accordingly, If the $\mathbf{r_s}$ value lies in the range -1 or +1there exist perfect negative or positive agreement /correlation, if between -1 to -0.5 or 1 to 0.5, strong negative or positive correlation /agreement exists, if between -0.5 to 0 or 0 to 0.5, weak negative or positive correlation and 0 no correlation /agreement exists between the responding parties (Fallahnejad, 2013). Hence, to test the agreement and disagreement among the responding parties (client, consultant and contractor) and the combined view, the rank correlation coefficients between two parties for all combinations for the selected category groups of factors are depicted in Table 4.23.

Table 4. 23: Correlation Coefficient ($\mathbf{r_s}$) among respondents' in category ranking

No.	Category	Correlation Coeffcient Client, Consultant,Contractor and Combined					
		Client Vs Consultant	Client vs Contractor	Consultant vs Conractor	Client vs Combined	Consultant vs Combined	Contractor vs Combined
1	Client /Owner Related	0.448	0.892	0.556	0.964	0.532	0.976
2	Contractor Related	0.376	0.46	0.832	0.64	0.898	0.916
3	Consultant Related	0.718	0.79	0.934	-0.716	0.94	0.952
4	Resource Related	0.31	0.514	0.514	0.796	0.538	0.904
5	External Related	0.694	0.802	0.856	0.892	0.874	0.946

Source: Own Survey, 2018

In addition the correlation coefficient for overall ranking of the delay causes in all categories is presented in the below table 4.24 as following:

Table 4. 24: Coefficient of correlation for overall ranking of delay causes

Causes of Delay	Correlation Coefficient (r_s) Overall Ranking					
	Client Vs Consultant	Client vs Contractor	Consultant vs Conractor	Client vs Combined	Consultant vs Combined	Contractor vs Combined
r_s Overall Ranking for Causes of Delay	0.546	0.483	0.743	0.738	0.870	0.902

Source: Own Survey, 2018

Table 4.23 and 4.24 shows spearman rank correlation coefficient (r_s) between client, contractor, consultant and combined result for inside category ranking and overall ranking of causes of delay respectively.

In the category group tanking, all the respondents' correlations are in the range 'strong agreement'. However, the client vs combined with correlation coefficient of -0.716 is in a strong negative agreement that is the clients are strongly disagree to the combined view in consultant

related category ranking. in addition clients and consultant have weak positive agreement on the resource related, client related and contractor related category raking.

Finally when the overall ranking coefficient of correlation is investigated, the value lies in the range between +0.5 to +1.0 except for the client versus contractor (0.483). This correlation indicates the respondents are strongly correlated to the overall ranking table 4.11. However, the client and contractor have weak positive correlation to the overall ranking of the delay causing factors.

CHAPTER FIVE: SUMMARY CONCLUSION AND RECOMENDATIONS

5.1 Summary

When summarized, this project work tries to identify and rank to delay causing factors of public building construction projects in Addis Ababa under the Addis Ababa Construction Bureau. 42 delay causing factors /events were identified and categorized in to five main categories. The outcomes that have been indicated from the questionnaire survey are summarized as: the delay causing factors caused by contractors the top most factors which contribute high degree of importance to the delay in the construction projects that are targets of this study. The second important delay causing factors are the consultant related category. Resource related and owner related causes are in third and fourth place to affect the smooth completion of the projects in this study. Finally, external related causes category are last and are perceived to be not important delay causing events by the respondents from owners, consultants and contractors.

5.2 Conclusion

This project work has focused on causes of delay of public building construction projects in Addis Ababa under the Addis Ababa Construction Bureau. The study has assessed and identified the main delay causes. Accordingly, the main delay causes are client, consultant, contractor, resource and external related causes. The study sought the views of clients, consultants, and contractors on the relative importance of the factors that cause delays in public building construction projects in Addis Ababa.

The study has shown the rank of the list of delay causes as perceived by each party, it is shown that the perceptions of the clients, the consultants and the contractors to the delay causes have some degree of differences. The event which is perceived as highly important to the one was not

as much important to the other. In addition, this project work has indicated the top ten delay causes according to the view of clients', consultants' and contractors'.

Generally in the study the causes of delay are ranked according to their importance from rank 1 to 42. And in addition the top ten delay causes were explicitly indicated according to the view of the three responding parties (clients, consultants, contractors) and combination of all is stated and listed in a rank accordingly.

According to the owners respondents the following delay factors are ranked from one to four: Poor Project management system, late start & resource mobilization to site, difficulty in project financing (poor financial system) and Shortage of availability of imported construction materials and goods on market.

For consultants the most important delay factors which took the highest rank are the following: difficulty in project financing (poor financial system), delay to furnish and deliver the site to the contractor, delay in issuance of designs and working drawings and slow in decision making.

According to the contractors perceptions the main important and the top delay causes are: delay in progress payments for completed works, difficulty in project financing(poor financial system), financing problems and delay in issuance of designs and working drawings.

Finally the study also showed that all the three groups of respondents generally agreed on the 42 delay factors stated. The most significant and top ten factors causing time overrun identified in this project work based on the perceptions of all the three main parties combined are the following:

i. Difficulty in project financing (poor financial system) with RII 0.847 - Contractor relate cause

ii. Poor project management system with RII 0.818 – Contractor related cause

iii. Delay in issuance of designs and working drawings RII 0.812 – Consultant related cause

iv. Shortage of availability of imported construction materials and goods on market RII 0.812 – Resource related cause.

v. Design errors and complexity of designs RII 0.791 – Consultant related cause

vi. Delay in progress payments for completed works with RII 0.779 – Client/owner related cause

vii. Late start & resource mobilization to site with RII 0.779 – Contractor related cause

viii. Financing problems with RII 0.776 Client/owner related cause

ix. Inaccurate site investigation Report with RII 0.771 – Consultant related cause

x. Price Inflation RII 0.768 – External related cause

The 42 delay causing factors were also categorized into five main categories and were ranked according to their RII value. The results show that all the responding groups (clients/owners, consultants, and contractors) are observed to agree that the contractor related delay factors (RII 0.741) are the most influential factors for delay. Consultant related factors (RII 0.729) considered the second most important factor causing delay followed by resource related factors (RII 0.722), Clients/owners related factors (RII 0.721) and external related factors(RII 0.617).

The agreement of the ranking of the delay causes are tested according the Spearman's rank correlation coefficient calculated, it shows that there exists a reasonably strong agreement between each two groups of parties on ranking of the significance of delay causes. The highest degree of agreement (74.2%) is between consultant and contractors; while the lowest (48.3%) is between clients and contractors and in the middle is between clients and consultants with 54.6% of agreement. All rank coefficients are positive for each group of factors causing time overrun, a

fairly strong agreement is indicated between consultant- contractor and client consultant and but weak positive agreement is observed between client and contractor.

The correlation of each party to the combined view also shows strong agreement the contractors, consultants and clients have 90.2%, 87.0% and 73.8% of agreement with the combined perceptions respectively.

5.3 Recommendation

As can be observed from the results of the combined or overall perceptions, the top ten most important delay factors arise from all the participation parties (clients, consultants and contractors). The recommendations made in general and particularly to all the parties for mitigating factors causing time overrun based an expert opinion are the following:

For owners:

- Owners should possess a comprehensive financial plan and cash flow enough to finance the construction projects on hand to avoid the project financing problems.
- Owners should effect immediately payment of the dues to the contractor for the work being carried as well as the payments of finished items according to the terms of the contract.
- Need to make sufficient time available for consultants to do a proper design
- Owners should make sure tender documents are complete, clear and free of errors and/or contradictions
- Owners should hire competitive and experienced contractors and consultants in the field of works.

For consultants:

- Consultants should avoid delaying the response to contractors' queries as well as the approval of submitted materials and shop drawings.
- Consultants should prepare a comprehensive and final designs and working drawings ahead to the commencement of works by the contractor and hold a sufficient number of design review sessions with the client before finalizing the design.
- Should avoid design errors and complexity of designs
- Should establish strong contract administration cervices to control and evaluate variation orders initiated by owners.
- Should have a thorough knowledge on the site conditions where the construction project is to be erected.

For contractors:

- Should develop a comprehensive financial plans and cash flows, to avoid the poor financing system of the project on hand.
- Should establish strong project management system led by professionals who mobilize and who understand the critical activities to handle and mitigate any delay that may rise during construction activities.
- Should mobilize resources and should start commencement of works immediately after possession of site.
- Should prepare materials procurement plan and state the lead time ahead for imported construction materials to minimize the delay caused from shortage of the imported resources.
- Every attempt must be made to retain the same labor gang throughout project duration.

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Appendix

Appendix 1 Questionnaire developed

ADDIS ABEBA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

SCHOOL OF COMMERCE

MA IN PROJECT MANAGEMENT

QUESTIONNAIRE

Dear respondents,

The main purpose of this questionnaire is to collect information on "Assessment of causes of delay in public building construction projects: The case of Addis Ababa city." You are kindly requested to answer the questions in the questionnaire based on your personal knowledge and experience regarding the responsibilities in your respective projects.

The questionnaire has two sections; the first section (Section A) consists of questions aimed at collecting General information (profile and experience in construction) of the respondents. The second section (Section B) is aimed at identifying the causes of delay due to the project participants (stakeholders).

Hence, I kindly request you to fill up this questionnaire which will be of immense help in my study. This study is solely intended for academic purposes and confidentiality of your response is highly guaranteed.

Please provide information as much as you can and timely reply is very crucial for the further actions, the analysis.

Thank you very much for your time and your kind cooperation

Neway Seifu (student MA in project Management)

SECTION A – General Information

1. Organization type

   Owner/ client ☐ Contractor ☐ Consultant ☐

2. Gender

   Male ☐ Female ☐

3. Job Status/Title

   Project Manager ☐ Construction/Office head ☐ Quantity Surveyor/Site Engineer ☐ Site inspector ☐

   Resident Engineer ☐ Office Enginee ☐ Project Coordinator ☐ Contract Admin. ☐ Other ☐

4. Current Educational level

   Advanced Level ☐ Bachelor ☐ Masters ☐ PhD ☐ Other ☐

5. Experience in Construction Industry

   0-3 years ☐ 3-5 years ☐ 5-10 years ☐ above 10 years ☐

Please indicate the significance rate of each factor by ticking the appropriate box. Add any remark if any relating to each factor on the last column.

5 = extremely important 4 = very important 3= moderately important 2 = slightly important 1 = not important

SECTION – B Causes of Delay in public building construction projects

Please Tick on one of the numbers according to their significance

Ser. No.	**Causes of Delay**	**Importance**					**Remark**
		5	**4**	**3**	**2**	**1**	
i	**Client/Owner Related Causes**						
1	Delay to furnish and deliver the site to the contractor						
2	Late in revising and approving design documents by owners						
3	Financing problems						
4	Delay in progress payments for completed works						
5	Slow in decision making						
6	Poor communication and coordination						
7	Scope change and Variation Orders						
8	Unrealistic contract period						
9	Suspension of works						
ii	**Contractor Related Causes**						
10	Poor Project management system						
11	Late start & resource mobilization to site						
12	Difficulty in project financing(poor financial system)						
13	Improper construction methodology and Reworks						
14	Disagreement and conflict with Consultant and Client						

Ser. No.	**Causes of Delay**	**Importance**					**Remark**
		5	**4**	**3**	**2**	**1**	
15	Delay in sub-contractors works						
16	Incompetent project staffing						
17	Inadequate contractor Experience						
18	Delay in material approval prior to delivery to site						
iii	**Consultant Related Causes**						
19	Inaccurate Site investigation Report						
20	Delay in issuance of designs and working drawings						
21	Delay in payments approval for completed works						
22	Delay in test and inspection of works						
23	Design errors and complexity of designs						
24	Lack of qualified supervisors on site						
25	Poor communication with team and other stakeholders						
26	Lack of detailing in BOQ ,designs and specification						
27	Inadequate experience of consultant						
iv	**Resource related Causes (Material, Equipment and Man power)**						
28	Availability of skilled and unskilled labor						
29	Machineries allocation problem						

Ser. No.	**Causes of Delay**	**Importance**					**Remark**
		5	**4**	**3**	**2**	**1**	
30	Availability of local materials and sourcing						
31	Low productivity of labor						
32	Poor quality construction materials						
33	Equipment availability on demand						
34	Shortage of local construction materials in market						
35	Shortage of availability of imported construction materials and goods on market						
v	**External Causes**						
36	Changes in Regulations and Rules by government						
37	Price Inflation						
38	Force majeure (War, Conflict, Riot and violence)						
39	Unforeseen site conditions						
40	Weather and natural disaster (act of God)						
41	Social and cultural factors						
42	Environmental restrictions						

5 = extremely important, 4 = very important, 3 = moderately important , 2 = slightly important ,1 = not important

Thank You!

Appendix 2 respondents' row data

No.	Causes of Delay	Client/Owner's View					Consultant View					Contractor View				
		Client /Owner					Consultant					Contractor				
		5	4	3	2	1	5	4	3	2	1	5	4	3	2	1
i	**Client/Owner Related Causes**															
1	Delay to furnish and deliver the site to the	2	2	10	1	0	11	8	0	3	3	9	12	6	1	0
2	Late in revising and approving design documents	1	4	6	4	0	8	7	4	2	4	10	12	4	1	1
3	Financing problems	4	6	1	4	0	11	3	4	4	3	14	9	4	0	1
4	Delay in progress payments for completed works	4	4	6	1	0	5	9	3	6	2	16	9	3	0	0
5	Slow in decision making	2	5	6	1	1	6	9	9	0	1	11	11	5	0	1
6	Poor communication and coordination	1	4	3	6	1	3	7	11	2	2	6	10	10	0	2
7	Scope change and Variation Orders	4	1	5	5	0	3	11	7	3	1	8	8	11	1	0
8	Unrealistic contract period	2	1	5	3	4	5	10	6	2	2	10	10	5	1	2
9	Suspension of works	1	1	6	3	4	2	10	5	5	3	3	9	10	2	4
ii	**Contractor Related Causes**															
10	Poor Project management system	12	1	2	0	0	7	11	4	0	3	12	10	4	0	2
11	Late start & resource mobilization to site	10	3	2	0	0	9	7	5	1	3	7	12	5	2	2
12	Difficulty in project financing(poor financial	9	2	3	1	0	11	10	0	3	1	16	8	2	2	0
13	Improper construction methodology and Reworks	6	6	1	2	0	6	12	3	2	2	6	7	10	4	1
14	Disagreement and conflict with Consultant and	7	2	3	3	0	1	10	9	3	2	6	3	13	3	3
15	Delay in sub-contractors works	5	3	6	1	0	3	11	8	2	1	2	13	9	2	2
16	Incompetent project staffing	5	4	4	2	0	4	9	8	2	2	2	10	11	5	0
17	Inadequate contractor Experience	6	3	2	4	0	4	11	4	2	4	4	12	8	3	1
18	Delay in material approval prior to delivery to site	1	2	10	0	2	6	11	5	2	1	7	10	7	2	2
iii	**Consultant Related Causes**															
19	Inaccurate Site investigation Report	8	1	4	2	0	5	10	6	2	2	11	9	6	2	0
20	Delay in issuance of designs and working drawings	8	2	3	2	0	9	7	7	0	2	13	12	1	1	1
21	Delay in payments approval for completed works	2	6	5	1	1	7	3	8	5	2	9	11	6	1	1
22	Delay in test and inspection of works	2	7	4	1	1	3	10	4	5	3	5	11	10	1	1
23	Design errors and complexity of designs	7	4	3	0	1	7	7	7	1	3	15	7	5	0	1
24	Lack of qualified supervisors on site	5	4	3	1	2	0	11	7	4	3	3	12	9	3	1
25	Poor communication with team and other	2	6	4	1	2	1	5	13	4	2	2	7	12	6	1
26	Lack of detailing in BOQ ,designs and specification	5	6	1	3	0	7	7	6	3	2	11	10	3	2	2
27	Inadequate experience of consultant	6	5	1	3	0	4	7	6	5	3	8	10	9	1	0
iv	**Resource related Causes (Material, Equipment and Man power)**															
28	Availability of skilled and unskilled labor	6	4	2	3	0	6	8	8	1	2	7	12	7	2	0
29	Machineries allocation problem	4	6	3	0	2	4	8	6	4	3	7	9	10	2	0
30	Availability of local materials and sourcing	3	5	4	3	0	5	7	5	5	3	8	8	8	3	1
31	Low productivity of labor	5	7	1	0	2	2	9	7	5	2	7	10	5	5	1
32	Poor quality construction materials	5	4	3	1	2	4	7	8	5	1	6	6	8	7	1
33	Equipment availability on demand	3	8	3	1	0	6	9	6	2	2	8	8	7	5	0
34	Shortage of local construction materials in market	4	4	4	1	2	5	8	4	6	2	8	9	5	4	2
35	Shortage of availability of imported construction materials and goods on market	8	4	2	0	1	7	10	4	3	1	12	12	3	1	0
v	**External Causes**															
36	Changes in Regulations and Rules by government	1	0	7	4	3	1	8	8	4	4	2	7	13	4	2
37	Price Inflation	6	3	3	1	2	6	9	7	2	1	13	6	8	0	1
38	Force majeure (War, Conflict, Riot and violence)	2	4	5	1	3	10	2	2	4	7	13	2	3	6	4
39	Unforeseen site conditions	0	5	5	4	1	4	5	8	5	3	4	9	6	7	2
40	Weather and natural disaster (act of God)	0	4	5	3	3	3	4	8	3	7	4	11	4	6	3
41	Social and cultural factors	1	4	4	4	2	0	6	6	8	5	0	4	8	11	5
42	Environmental restrictions	0	1	7	2	4	0	10	2	9	4	1	2	9	11	5

Appendix 3 Rank of delay causes according to clients' view

No.	Causes of Delay	Client /Owner					Client/Owner	
		5	4	3	2	1	RII	Rank
i	**Client/Owner Related Causes**							
1	Delay to furnish and deliver the site to the contractor	2	2	10	1	0	0.667	**29**
2	Late in revising and approving design documents by	1	4	6	4	0	0.627	**32**
3	Financing problems	4	6	1	4	0	0.733	**19**
4	Delay in progress payments for completed works	4	4	6	1	0	0.747	**17**
5	Slow in decision making	2	5	6	1	1	0.68	**28**
6	Poor communication and coordination	1	4	3	6	1	0.573	**36**
7	Scope change and Variation Orders	4	1	5	5	0	0.653	**31**
8	Unrealistic contract period	2	1	5	3	4	0.52	**39**
9	Suspension of works	1	1	6	3	4	0.493	**40**
ii	**Contractor Related Causes**							
10	Poor Project management system	12	1	2	0	0	0.933	**1**
11	Late start & resource mobilization to site	10	3	2	0	0	0.907	**2**
12	Difficulty in project financing(poor financial system)	9	2	3	1	0	0.853	**3**
13	Improper construction methodology and Reworks	6	6	1	2	0	0.813	**5**
14	Disagreement and conflict with Consultant and Client	7	2	3	3	0	0.773	**10**
15	Delay in sub-contractors works	5	3	6	1	0	0.76	**15**
16	Incompetent project staffing	5	4	4	2	0	0.76	**15**
17	Inadequate contractor Experience	6	3	2	4	0	0.747	**17**
18	Delay in material approval prior to delivery to site	1	2	10	0	2	0.6	**34**
iii	**Consultant Related Causes**							
19	Inaccurate Site investigation Report	8	1	4	2	0	0.8	**8**
20	Delay in issuance of designs and working drawings	8	2	3	2	0	0.813	**5**
21	Delay in payments approval for completed works	2	6	5	1	1	0.693	**26**
22	Delay in test and inspection of works	2	7	4	1	1	0.707	**24**
23	Design errors and complexity of designs	7	4	3	0	1	0.813	**5**
24	Lack of qualified supervisors on site	5	4	3	1	2	0.72	**22**
25	Poor communication with team and other stakeholders	2	6	4	1	2	0.667	**29**
26	Lack of detailing in BOQ ,designs and specification	5	6	1	3	0	0.773	**10**
27	Inadequate experience of consultant	6	5	1	3	0	0.787	**9**
iv	**Resource related Causes (Material, Equipment and Man power)**							
28	Availability of skilled and unskilled labor	6	4	2	3	0	0.773	**10**
29	Machineries allocation problem	4	6	3	0	2	0.733	**19**
30	Availability of local materials and sourcing	3	5	4	3	0	0.707	**24**
31	Low productivity of labor	5	7	1	0	2	0.773	**10**
32	Poor quality construction materials	5	4	3	1	2	0.72	**22**
33	Equipment availability on demand	3	8	3	1	0	0.773	**10**
34	Shortage of local construction materials in market	4	4	4	1	2	0.693	**26**
35	Shortage of availability of imported construction materials and goods on market	8	4	2	0	1	0.84	**4**
v	**External Causes**							
36	Changes in Regulations and Rules by government	1	0	7	4	3	0.493	**40**
37	Price Inflation	6	3	3	1	2	0.733	**19**
38	Force majeure (War, Conflict, Riot and violence)	2	4	5	1	3	0.613	**33**
39	Unforeseen site conditions	0	5	5	4	1	0.587	**35**
40	Weather and natural disaster (act of God)	0	4	5	3	3	0.533	**38**
41	Social and cultural factors	1	4	4	4	2	0.573	**36**
42	Environmental restrictions	0	1	7	2	4	0.44	**42**

Appendix 4 Rank of delay causes cording to consultants' view

No.	Causes of Delay	Consultant					Consultant		
		5	4	3	2	1	W	RII	Rank
i	**Client/Owner Related Causes**								
1	Delay to furnish and deliver the site to the contractor	11	8	0	3	3	96	0.768	**2**
2	Late in revising and approving design documents by owners	8	7	4	2	4	88	0.704	**18**
3	Financing problems	11	3	4	4	3	90	0.72	**11**
4	Delay in progress payments for completed	5	9	3	6	2	84	0.672	**22**
5	Slow in decision making	6	9	9	0	1	94	0.752	**4**
6	Poor communication and coordination	3	7	11	2	2	82	0.656	**27**
7	Scope change and Variation Orders	3	11	7	3	1	87	0.696	**20**
8	Unrealistic contract period	5	10	6	2	2	89	0.712	**14**
9	Suspension of works	2	10	5	5	3	78	0.624	**35**
ii	**Contractor Related Causes**								
10	Poor Project management system	7	11	4	0	3	94	0.752	**4**
11	Late start & resource mobilization to site	9	7	5	1	3	93	0.744	**8**
12	Difficulty in project financing(poor financial [illegible])	11	10	0	3	1	102	0.816	**1**
13	Improper construction methodology and [illegible]	6	12	3	2	2	93	0.744	**8**
14	Disagreement and conflict with Consultant and	1	10	9	3	2	80	0.64	**30**
15	Delay in sub-contractors works	3	11	8	2	1	88	0.704	**18**
16	Incompetent project staffing	4	9	8	2	2	86	0.688	**21**
17	Inadequate contractor Experience	4	11	4	2	4	84	0.672	**22**
18	Delay in material approval prior to delivery to site	6	11	5	2	1	94	0.752	**4**
iii	**Consultant Related Causes**								
19	Inaccurate Site investigation Report	5	10	6	2	2	89	0.712	**14**
20	Delay in issuance of designs and working	9	7	7	0	2	96	0.768	**2**
21	Delay in payments approval for completed	7	3	8	5	2	83	0.664	**24**
22	Delay in test and inspection of works	3	10	4	5	3	80	0.64	**30**
23	Design errors and complexity of designs	7	7	7	1	3	89	0.712	**14**
24	Lack of qualified supervisors on site	0	11	7	4	3	76	0.608	**37**
25	Poor communication with team and other	1	5	13	4	2	74	0.592	**38**
26	Lack of detailing in boq, designs and [illegible]	7	7	6	3	2	89	0.712	**14**
27	Inadequate experience of consultant	4	7	6	5	3	79	0.632	**32**
iv	**Resource related Causes (Material, Equipment and Man power)**								
28	Availability of skilled and unskilled labor	6	8	8	1	2	90	0.72	**11**
29	Machineries allocation problem	4	8	6	4	3	81	0.648	**28**
30	Availability of local materials and sourcing	5	7	5	5	3	81	0.648	**28**
31	Low productivity of labor	2	9	7	5	2	79	0.632	**32**
32	Poor quality construction materials	4	7	8	5	1	83	0.664	**24**
33	Equipment availability on demand	6	9	6	2	2	90	0.72	**11**
34	Shortage of local construction materials in	5	8	4	6	2	83	0.664	**24**
35	Shortage of availability of imported construction materials and goods on market	7	10	4	3	1	94	0.752	**4**
v	**External Causes**								
36	Changes in Regulations and Rules by	1	8	8	4	4	73	0.584	**39**
37	Price Inflation	6	9	7	2	1	92	0.736	**10**
38	Force majeure (War, Conflict, Riot and	10	2	2	4	7	79	0.632	**32**
39	Unforeseen site conditions	4	5	8	5	3	77	0.616	**36**
40	Weather and natural disaster (act of God)	3	4	8	3	7	68	0.544	**40**
41	Social and cultural factors	0	6	6	8	5	63	0.504	**42**
42	Environmental restrictions	0	10	2	9	4	68	0.544	**40**

Appendix 5 Rank of delay causes cording to contractors' view

No.	Causes of Delay	Contractor					Contractor		
		5	4	3	2	1	W	RII	Rank
i	**Client/Owner Related Causes**								
1	Delay to furnish and deliver the site to the contractor	9	12	6	1	0	113	0.807	**10**
2	Late in revising and approving design documents by owners	10	12	4	1	1	113	0.807	**10**
3	Financing problems	14	9	4	0	1	119	0.85	**3**
4	Delay in progress payments for completed works	16	9	3	0	0	125	0.893	**1**
5	Slow in decision making	11	11	5	0	1	115	0.821	**7**
6	Poor communication and coordination	6	10	10	0	2	102	0.729	**23**
7	Scope change and Variation Orders	8	8	11	1	0	107	0.764	**18**
8	Unrealistic contract period	10	10	5	1	2	109	0.779	**15**
9	Suspension of works	3	9	10	2	4	89	0.636	**38**
ii	**Contractor Related Causes**								
10	Poor Project management system	12	10	4	0	2	114	0.814	**8**
11	Late start & resource mobilization to site	7	12	5	2	2	104	0.743	**20**
12	Difficulty in project financing(poor financial [illegible])	16	8	2	2	0	122	0.871	**2**
13	Improper construction methodology and Reworks	6	7	10	4	1	97	0.693	**30**
14	Disagreement and conflict with consultant and Client	6	3	13	3	3	90	0.643	**36**
15	Delay in sub-contractors works	2	13	9	2	2	95	0.679	**32**
16	Incompetent project staffing	2	10	11	5	0	93	0.664	**33**
17	Inadequate contractor Experience	4	12	8	3	1	99	0.707	**28**
18	Delay in material approval prior to delivery to site	7	10	7	2	2	102	0.729	**23**
iii	**Consultant Related Causes**								
19	Inaccurate Site investigation Report	11	9	6	2	0	113	0.807	**10**
20	Delay in issuance of designs and working drawings	13	12	1	1	1	119	0.85	**3**
21	Delay in payments approval for completed works	9	11	6	1	1	110	0.786	**13**
22	Delay in test and inspection of works	5	11	10	1	1	102	0.729	**23**
23	Design errors and complexity of designs	15	7	5	0	1	119	0.85	**3**
24	Lack of qualified supervisors on site	3	12	9	3	1	97	0.693	**30**
25	Poor communication with team and other	2	7	12	6	1	87	0.621	**39**
26	Lack of detailing in boq, designs and specification	11	10	3	2	2	110	0.786	**13**
27	Inadequate experience of consultant	8	10	9	1	0	109	0.779	**15**
iv	**Resource related Causes (Material, Equipment and Man power)**								
28	Availability of skilled and unskilled labor	7	12	7	2	0	108	0.771	**17**
29	Machineries allocation problem	7	9	10	2	0	105	0.75	**19**
30	Availability of local materials and sourcing	8	8	8	3	1	103	0.736	**21**
31	Low productivity of labor	7	10	5	5	1	101	0.721	**26**
32	Poor quality construction materials	6	6	8	7	1	93	0.664	**33**
33	Equipment availability on demand	8	8	7	5	0	103	0.736	**21**
34	Shortage of local construction materials in market	8	9	5	4	2	101	0.721	**26**
35	Shortage of availability of imported construction materials and goods on market	12	12	3	1	0	119	0.85	**3**
v	**External Causes**								
36	Changes in Regulations and Rules by government	2	7	13	4	2	87	0.621	**39**
37	Price Inflation	13	6	8	0	1	114	0.814	**8**
38	Force majeure (War, Conflict, Riot and violence)	13	2	3	6	4	98	0.7	**29**
39	Unforeseen site conditions	4	9	6	7	2	90	0.643	**36**
40	Weather and natural disaster (act of God)	4	11	4	6	3	91	0.65	**35**
41	Social and cultural factors	0	4	8	11	5	67	0.479	**41**
42	Environmental restrictions	1	2	9	11	5	67	0.479	**41**

Appendix 6 RII for Clients, Consultants, contractors and combined view

No.	Causes of Delay	Client/Owner		Consultant		Contractor		Combined	
		RII	Rank	RII	Rank	RII	Rank	RII	Rank
i	**Client/Owner Related Causes**								
1	Delay to furnish and deliver the site to the contractor	0.667	29	0.768	2	0.807	10	0.762	12
2	Late in revising and approving design documents by owners	0.627	32	0.704	18	0.807	10	0.729	17
3	Financing problems	0.733	19	0.72	11	0.85	3	0.776	8
4	Delay in progress payments for completed works	0.747	17	0.672	22	0.893	1	0.779	6
5	Slow in decision making	0.68	28	0.752	4	0.821	7	0.765	11
6	Poor communication and coordination	0.573	36	0.656	27	0.729	23	0.668	33
7	Scope change and Variation Orders	0.653	31	0.696	20	0.764	18	0.715	20
8	Unrealistic contract period	0.52	39	0.712	14	0.779	15	0.697	26
9	Suspension of works	0.493	40	0.624	35	0.636	38	0.6	38
ii	**Contractor Related Causes**								
10	Poor Project management system	0.933	1	0.752	4	0.814	8	0.818	2
11	Late start & resource mobilization to site	0.907	2	0.744	8	0.743	20	0.779	6
12	Difficulty in project financing(poor financial system)	0.853	3	0.816	1	0.871	2	0.847	1
13	Improper construction methodology and Reworks	0.813	5	0.744	8	0.693	30	0.738	15
14	Disagreement and conflict with Consultant and Client	0.773	10	0.64	30	0.643	36	0.671	32
15	Delay in sub-contractors works	0.76	15	0.704	18	0.679	32	0.706	23
16	Incompetent project staffing	0.76	15	0.688	21	0.664	33	0.694	28
17	Inadequate contractor Experience	0.747	17	0.672	22	0.707	28	0.703	24
18	Delay in material approval prior to delivery to site	0.6	34	0.752	4	0.729	23	0.709	21
iii	**Consultant Related Causes**								
19	Inaccurate Site investigation Report	0.8	8	0.712	14	0.807	10	0.771	9
20	Delay in issuance of designs and working drawings	0.813	5	0.768	2	0.85	3	0.812	3
21	Delay in payments approval for completed works	0.693	26	0.664	24	0.786	13	0.721	19
22	Delay in test and inspection of works	0.707	24	0.64	30	0.729	23	0.691	30
23	Design errors and complexity of designs	0.813	5	0.712	14	0.85	3	0.791	5
24	Lack of qualified supervisors on site	0.72	22	0.608	37	0.693	30	0.668	33
25	Poor communication with team and other stakeholders	0.667	29	0.592	38	0.621	39	0.621	36
26	Lack of detailing in BOQ ,designs and specification	0.773	10	0.712	14	0.786	13	0.756	13
27	Inadequate experience of consultant	0.787	9	0.632	32	0.779	15	0.726	18
iv	**Resource related Causes (Material, Equipment and Man power)**								
28	Availability of skilled and unskilled labor	0.773	10	0.72	11	0.771	17	0.753	14
29	Machineries allocation problem	0.733	19	0.648	28	0.75	19	0.709	21
30	Availability of local materials and sourcing	0.707	24	0.648	28	0.736	21	0.697	26
31	Low productivity of labor	0.773	10	0.632	32	0.721	26	0.7	25
32	Poor quality construction materials	0.72	22	0.664	24	0.664	33	0.676	31
33	Equipment availability on demand	0.773	10	0.72	11	0.736	21	0.738	15
34	Shortage of local construction materials in market	0.693	26	0.664	24	0.721	26	0.694	28
35	Shortage of availability of imported construction materials and goods on market	0.84	4	0.752	4	0.85	3	0.812	3
v	**External Causes**								
36	Changes in Regulations and Rules by government	0.493	40	0.584	39	0.621	39	0.579	40
37	Price Inflation	0.733	19	0.736	10	0.814	8	0.768	10
38	Force majeure (War, Conflict, Riot and violence)	0.613	33	0.632	32	0.7	29	0.656	35
39	Unforeseen site conditions	0.587	35	0.616	36	0.643	36	0.621	36
40	Weather and natural disaster (act of God)	0.533	38	0.544	40	0.65	35	0.585	39
41	Social and cultural factors	0.573	36	0.504	42	0.479	41	0.509	41
42	Environmental restrictions	0.44	42	0.544	40	0.479	41	0.494	42

Appendix 7 Spearman's correlation coefficient determination (within internal category)

Ser. No.	Causes of Delay	Analysis RII and Ranking								Spearman Correlation					
		Client/Owne		Consultant		Contractor		Combined		Client Vs Consultant	Client vs Contractor	Consultant vs Conractor	Client vs Combined	Consultant vs Combined	Contractor vs Combined
		RII	Rank	RII	Rank	RII	Rank	RII	Rank						
i	**Client/Owner Related Causes**														
1	Delay to furnish and deliver the site to the contractor	0.67	4	0.77	1	0.81	4	0.76	4	0.0125	0	0.0125	0	0.0125	0
2	Late in revising and approving design documents by owners	0.63	6	0.7	5	0.81	4	0.73	5	0.0014	0.0056	0.0014	0.0014	0	0.0014
3	Financing problems	0.73	2	0.72	3	0.85	2	0.78	2	0.0014	0	0.0014	0	0.0014	0
4	Delay in progress payments for completed works	0.75	1	0.67	7	0.89	1	0.78	1	0.05	0	0.05	0	0.05	0
5	Slow in decision making	0.68	3	0.75	2	0.82	3	0.77	3	0.0014	0	0.0014	0	0.0014	0
6	Poor communication and coordination	0.57	7	0.66	8	0.73	8	0.67	8	0.0014	0.0014	0	0.0014	0	0
7	Scope change and Variation Orders	0.65	5	0.7	6	0.76	7	0.72	6	0.0014	0.0056	0.0014	0.0014	0	0.0014
8	Unrealistic contract period	0.52	8	0.71	4	0.78	6	0.7	7	0.0222	0.0056	0.0056	0.0014	0.0125	0.0014
9	Suspension of works	0.49	9	0.62	9	0.64	9	0.6	9	0	0	0	0	0	0
									6*∑d2/(n3-n)	0.552	0.108	0.444	0.036	0.468	0.024
	Client /Owner Related Category								1-(6*∑d2/(n3-n))	**0.448**	**0.892**	**0.556**	**0.964**	**0.532**	**0.976**
ii	**Contractor Related Causes**														
10	Poor Project management system	0.93	1	0.75	2	0.81	2	0.82	2	0.0014	0.0014	0	0.0014	0	0
11	Late start & resource mobilization to	0.91	2	0.74	4	0.74	3	0.78	3	0.0056	0.0014	0.0014	0.0014	0.0014	0
12	Difficulty in project financing(poor financial system)	0.85	3	0.82	1	0.87	1	0.85	1	0.0056	0.0056	0	0.0056	0	0
13	Improper construction methodology and Reworks	0.81	4	0.74	4	0.69	6	0.74	4	0	0.0056	0.0056	0	0	0.0056
14	Disagreement and conflict with Consultant and Client	0.77	5	0.64	9	0.64	9	0.67	9	0.0222	0.0222	0	0.0222	0	0
15	Delay in sub-contractors works	0.76	6	0.7	6	0.68	7	0.71	6	0	0.0014	0.0014	0	0	0.0014
16	Incompetent project staffing	0.76	6	0.69	7	0.66	8	0.69	8	0.0014	0.0056	0.0014	0.0056	0.0014	0
17	Inadequate contractor Experience	0.75	8	0.67	8	0.71	5	0.7	7	0	0.0125	0.0125	0.0014	0.0014	0.0056
18	Delay in material approval prior to delivery to site	0.6	9	0.75	2	0.73	4	0.71	5	0.0681	0.0347	0.0056	0.0222	0.0125	0.0014
									6*∑d2/(n3-n)	0.624	0.54	0.168	0.36	0.102	0.084
	Contractor Related Category								1-(6*∑d2/(n3-n))	**0.376**	**0.46**	**0.832**	**0.64**	**0.898**	**0.916**
iii	**Consultant Related Causes**														
19	Inaccurate Site investigation Report	0.8	3	0.71	2	0.81	3	0.77	3	0.0014	0	0.0014	0	0.0014	0
20	Delay in issuance of designs and working drawings	0.81	1	0.77	1	0.85	1	0.81	1	0	0	0	0	0	0
21	Delay in payments approval for completed works	0.69	8	0.66	5	0.79	4	0.72	6	0.0125	0.0222	0.0014	0.0056	0.0014	0.0056
22	Delay in test and inspection of works	0.71	7	0.64	6	0.73	7	0.69	7	0.0014	0	0.0014	0	0.0014	0
23	Design errors and complexity of designs	0.81	1	0.71	2	0.85	1	0.79	2	0.0014	0	0.0014	0.0014	0	0.0014
24	Lack of qualified supervisors on site	0.72	6	0.61	8	0.69	8	0.67	8	0.0056	0.0056	0	0.0056	0	0
25	Poor communication with team and other stakeholders	0.67	9	0.59	9	0.62	9	0.62	9	0	0	0	0	0	0
26	Lack of detailing in BOQ ,designs and specification	0.77	5	0.71	2	0.79	4	0.76	4	0.0125	0.0014	0.0056	0.0014	0.0056	0
27	Inadequate experience of consultant	0.79	4	0.63	7	0.78	6	0.73	18	0.0125	0.0056	0	0.2722	0.0004	0.0005
									6*∑d2/(n3-n)	0.282	0.21	0.066	1.716	0.06	0.048
	Consultant Related Category								1-(6*∑d2/(n3-n))	**0.718**	**0.79**	**0.934**	**-0.72**	**0.94**	**0.952**
iv	**Resource related Causes (Material, Equipment and Man power)**														
28	Availability of skilled and unskilled labor	0.77	2	0.72	2	0.77	2	0.75	2	0	0	0	0	0	0
29	Machineries allocation problem	0.73	5	0.65	6	0.75	3	0.71	4	0.002	0.0079	0.0179	0.002	0.0079	0.002
30	Availability of local materials and sourcing	0.71	7	0.65	6	0.74	4	0.7	6	0.002	0.0179	0.0079	0.002	0	0.0079
31	Low productivity of labor	0.77	2	0.63	8	0.72	6	0.7	5	0.0714	0.0317	0.0079	0.0179	0.0179	0.002
32	Poor quality construction materials	0.72	6	0.66	4	0.66	8	0.68	8	0.0079	0.0079	0.0317	0.0079	0.0317	0
33	Equipment availability on demand	0.77	2	0.72	2	0.74	4	0.74	3	0	0.0079	0.0079	0.002	0.002	0.002
34	Shortage of local construction materials in market	0.69	8	0.66	4	0.72	6	0.69	7	0.0317	0.0079	0.0079	0.002	0.0179	0.002
35	Shortage of availability of imported construction materials and goods on market	0.84	1	0.75	1	0.85	1	0.81	1	0	0	0	0	0	0

	Resource Related Category									**6*∑d2/(n3-n)**	0.69	0.486	0.486	0.204	0.462	0.096
										1-(6*∑d2/(n3-n))	**0.31**	**0.514**	**0.514**	**0.796**	**0.538**	**0.904**
v	**External Causes**															
36	Changes in Regulations and Rules by government	0.49	6	0.58	4	0.62	5	0.58	5	0.0119	0.003	0.003	0.003	0.003	0
37	Price Inflation	0.73	1	0.74	1	0.81	1	0.77	1	0	0	0	0	0	0
38	Force majeure (War, Conflict, Riot and violence)	0.61	2	0.63	2	0.7	2	0.66	2	0	0	0	0	0	0
39	Unforeseen site conditions	0.59	3	0.62	3	0.64	4	0.62	3	0	0.003	0.003	0	0	0.003
40	Weather and natural disaster (act of	0.53	5	0.54	5	0.65	3	0.59	4	0	0.0119	0.0119	0.003	0.003	0.003
41	Social and cultural factors	0.57	4	0.5	7	0.48	6	0.51	6	0.0268	0.0119	0.003	0.0119	0.003	0
42	Environmental restrictions	0.44	7	0.54	5	0.48	6	0.49	7	0.0119	0.003	0.003	0	0.0119	0.003
	External Related Category									**6*∑d2/(n3-n)**	0.306	0.198	0.144	0.108	0.126	0.054
										1-(6*∑d2/(n3-n))	**0.694**	**0.802**	**0.856**	**0.892**	**0.874**	**0.946**

Appendix 8 Spearman's coefficient of correlation to overall ranking of all causes of delay

Ser. No.	Causes of Delay	Client/Owne		Consultant		Contractor		Combined		Client Vs Consultant	Client vs Contractor	Consultant vs Conractor	Client vs Combined	Consultant vs Combined	Contractor vs Combined
		RII	Rank	RII	Rank	RII	Rank	RII	Rank						
i	**Client/Owner Related Causes**														
1	Delay to furnish and deliver the site to the contractor	0.67	**29**	0.768	**2**	0.81	**10**	0.762	**12**	0.0098	0.0049	0.0009	0.0039	0.0014	0.0001
2	Late in revising and approving design documents by owners	0.63	**32**	0.704	**18**	0.81	**10**	0.729	**17**	0.0026	0.0065	0.0009	0.003	0	0.0007
3	Financing problems	0.73	**19**	0.72	**11**	0.85	**3**	0.776	**8**	0.0009	0.0035	0.0009	0.0016	0.0001	0.0003
4	Delay in progress payments for completed works	0.75	**17**	0.672	**22**	0.89	**1**	0.779	**6**	0.0003	0.0035	0.006	0.0016	0.0035	0.0003
5	Slow in decision making	0.68	**28**	0.752	**4**	0.82	**7**	0.765	**11**	0.0078	0.006	0.0001	0.0039	0.0007	0.0002
6	Poor communication and coordination	0.57	**36**	0.656	**27**	0.73	**23**	0.668	**33**	0.0011	0.0023	0.0002	0.0001	0.0005	0.0014
7	Scope change and Variation Orders	0.65	**31**	0.696	**20**	0.76	**18**	0.715	**20**	0.0016	0.0023	0.0001	0.0016	0	0.0001
8	Unrealistic contract period	0.52	**39**	0.712	**14**	0.78	**15**	0.697	**26**	0.0084	0.0078	0	0.0023	0.0019	0.0016
9	Suspension of works	0.49	**40**	0.624	**35**	0.64	**38**	0.6	**38**	0.0003	0.0001	0.0001	0.0001	0.0001	0
										0	0	0	0	0	0
ii	**Contractor Related Causes**									0	0	0	0	0	0
10	Poor Project management system	0.93	**1**	0.752	**4**	0.81	**8**	0.818	**2**	0.0001	0.0007	0.0002	0	0.0001	0.0005
11	Late start & resource mobilization to site	0.91	**2**	0.744	**8**	0.74	**20**	0.779	**6**	0.0005	0.0044	0.0019	0.0002	0.0001	0.0026
12	Difficulty in project financing(poor financial system)	0.85	**3**	0.816	**1**	0.87	**2**	0.847	**1**	0.0001	0	0	0.0001	0	0
13	Improper construction methodology and Reworks	0.81	**5**	0.744	**8**	0.69	**30**	0.738	**15**	0.0001	0.0084	0.0065	0.0014	0.0007	0.003
14	Disagreement and conflict with Consultant and Client	0.77	**10**	0.64	**30**	0.64	**36**	0.671	**32**	0.0054	0.0091	0.0005	0.0065	0.0001	0.0002
15	Delay in sub-contractors works	0.76	**15**	0.704	**18**	0.68	**32**	0.706	**23**	0.0001	0.0039	0.0026	0.0009	0.0003	0.0011
16	Incompetent project staffing	0.76	**15**	0.688	**21**	0.66	**33**	0.694	**28**	0.0005	0.0044	0.0019	0.0023	0.0007	0.0003
17	Inadequate contractor Experience	0.75	**17**	0.672	**22**	0.71	**28**	0.703	**24**	0.0003	0.0016	0.0005	0.0007	0.0001	0.0002
18	Delay in material approval prior to delivery to site	0.6	**34**	0.752	**4**	0.73	**23**	0.709	**21**	0.0122	0.0016	0.0049	0.0023	0.0039	0.0001
iii	**Consultant Related Causes**									0	0	0	0	0	0
19	Inaccurate Site investigation Report	0.8	**8**	0.712	**14**	0.81	**10**	0.771	**9**	0.0005	0.0001	0.0002	0	0.0003	0
20	Delay in issuance of designs and working drawings	0.81	**5**	0.768	**2**	0.85	**3**	0.812	**3**	0.0001	0.0001	0	0.0001	0	0
21	Delay in payments approval for completed works	0.69	**26**	0.664	**24**	0.79	**13**	0.721	**19**	0.0001	0.0023	0.0016	0.0007	0.0003	0.0005
22	Delay in test and inspection of works	0.71	**24**	0.64	**30**	0.73	**23**	0.691	**30**	0.0005	0	0.0007	0.0005	0	0.0007
23	Design errors and complexity of designs	0.81	**5**	0.712	**14**	0.85	**3**	0.791	**5**	0.0011	0.0001	0.0016	0	0.0011	0.0001
24	Lack of qualified supervisors on site	0.72	**22**	0.608	**37**	0.69	**30**	0.668	**33**	0.003	0.0009	0.0007	0.0016	0.0002	0.0001
25	Poor communication with team and other stakeholders	0.67	**29**	0.592	**38**	0.62	**39**	0.621	**36**	0.0011	0.0014	0	0.0007	0.0001	0.0001
26	Lack of detailing in BOQ ,designs and specification	0.77	**10**	0.712	**14**	0.79	**13**	0.756	**13**	0.0002	0.0001	0	0.0001	0	0
27	Inadequate experience of consultant	0.79	**9**	0.632	**32**	0.78	**15**	0.726	**18**	0.0071	0.0005	0.0039	0.0011	0.0026	0.0001
										0	0	0	0	0	0
iv	**Resource related Causes (Material, Equipment and Man power)**									0	0	0	0	0	0
28	Availability of skilled and unskilled labor	0.77	**10**	0.72	**11**	0.77	**17**	0.753	**14**	0	0.0007	0.0005	0.0002	0.0001	0.0001
29	Machineries allocation problem	0.73	**19**	0.648	**28**	0.75	**19**	0.709	**21**	0.0011	0	0.0011	0.0001	0.0007	0.0001
30	Availability of local materials and sourcing	0.71	**24**	0.648	**28**	0.74	**21**	0.697	**26**	0.0002	0.0001	0.0007	0.0001	0.0001	0.0003
31	Low productivity of labor	0.77	**10**	0.632	**32**	0.72	**26**	0.7	**25**	0.0065	0.0035	0.0005	0.003	0.0007	0
32	Poor quality construction materials	0.72	**22**	0.664	**24**	0.66	**33**	0.676	**31**	0.0001	0.0016	0.0011	0.0011	0.0007	0.0001
33	Equipment availability on demand	0.77	**10**	0.72	**11**	0.74	**21**	0.738	**15**	0	0.0016	0.0014	0.0003	0.0002	0.0005
34	Shortage of local construction materials in market	0.69	**26**	0.664	**24**	0.72	**26**	0.694	**28**	0.0001	0	0.0001	0.0001	0.0002	0.0001
35	Shortage of availability of imported construction materials and goods on market	0.84	**4**	0.752	**4**	0.85	**3**	0.812	**3**	0	0	0	0	0	0

v	External Causes														
36	Changes in Regulations and Rules by government	0.49	40	0.584	39	0.62	39	0.579	40	0	0	0	0	0	0
37	Price Inflation	0.73	19	0.736	10	0.81	8	0.768	10	0.0011	0.0016	0.0001	0.0011	0	0.0001
38	Force majeure (War, Conflict, Riot and violence)	0.61	33	0.632	32	0.7	29	0.656	35	0	0.0002	0.0001	0.0001	0.0001	0.0005
39	Unforeseen site conditions	0.59	35	0.616	36	0.64	36	0.621	36	0	0	0	0	0	0
40	Weather and natural disaster (act of God)	0.53	38	0.544	40	0.65	35	0.585	39	0.0001	0.0001	0.0003	0	0	0.0002
41	Social and cultural factors	0.57	36	0.504	42	0.48	41	0.509	41	0.0005	0.0003	0	0.0003	0	0
42	Environmental restrictions	0.44	42	0.544	40	0.48	41	0.494	42	0.0001	0	0	0	0.0001	0
									Σd^2	**0.454**	**0.517**	**0.257**	**0.262**	**0.13**	**0.098**
									$rs=1-(6*\Sigma d^2/(n^3-n))$	**0.546**	**0.483**	**0.743**	**0.738**	**0.87**	**0.902**

Appendix 9 Spearman's correlation (each respondents' group and overall)

		Correlation Coeffcient Client, Consultant,Contractor and Combined					
No.	Category	Client Vs Consultant	Client vs Contractor	Consultant vs Conractor	Client vs Combined	Consultant vs Combined	Contractor vs Combined
1	Client /Owner Related	0.448	0.892	0.556	0.964	0.532	0.976
2	Contractor Related	0.376	0.46	0.832	0.64	0.898	0.916
3	Consultant Related	0.718	0.79	0.934	-0.716	0.94	0.952
4	Resource Related	0.31	0.514	0.514	0.796	0.538	0.904
5	External Related	0.694	0.802	0.856	0.892	0.874	0.946

	Correlation Coefficient (r_s) Overall Ranking					
Causes of Delay	Client Vs Consultant	Client vs Contractor	Consultant vs Conractor	Client vs Combined	Consultant vs Combined	Contractor vs Combined
r_s Overall Ranking for Causes of Delay	0.546	0.483	0.743	0.738	0.870	0.902

Appendix 10 Respondents' backgrounds data

1	**Respondents**	Client	Consultant	Contractor
		15	25	28
			Total	68
2	**Gender**			
	Male	9	21	23
	Female	6	4	5
3	**Job status**			0
	Project manager	1	0	5
	Construction/Office Head	0	3	5
	Quantity Surveyor/Site Engineer	1	0	2
	Site inspector	1	1	1
	Resident Engineer	1	7	0
	Office Engineer	3	2	5
	Project Coordinator	3	4	5
	Conract Administrator	3	8	4
	Other	2	0	1
4	**Educational Level**	0		0
	Advanced level	3	0	4
	Bachelor level	9	25	22
	Masters level	3	0	2
	Phd	0	0	0
	Other	0	0	0
5	**Experience in Construction**	0		0
	0-3	2	6	3
	3-5	4	8	3
	5-10	6	3	9
	above 10	3	8	13