

**A STUDY ON DELAYS IN BUILDING INDUSTRY IN
SRI LANKA FROM
PROFESSIONAL PERSPECTIVE**

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Declaration

I formally declare all of this to be my own work and, as far as I know, and believe it is, it does not contain previously written or written graduate material or diploma material, except if it had been recognized in the text. This is not unconsented.

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Dr. K.A.K Devapriya
Dissertation Supervisor

.....
Date

Abstract

A study on delays in building industry in Sri Lanka from Professional perspective

The author has selected this research to study about the delays in Sri Lankan building construction projects to identify significant causes of delay and its magnitudes, responsible parties for the delays, their adverse effects and its magnitudes on project completion and performances. Also, the research aimed to study the magnitude of remedies to minimize or avoid possible delays in building construction projects.

The research study achieved the Aim of the research by establishing the five numbers of interrelating linked objectives established at the beginning of the study. There are forty-four leading causes of delay divided into four groups according to the party responsible for such delays as; the contractor, the client, the consultant, and the government and external.

The research methodology adopted both a questionnaire survey and interviews, to collect the primary data to find the magnitude of causes of delays and effects from the outcomes of the data analysis according to that, twenty number of significant causes identified in this research study (Refer Table 18 & A9-4&5 under Appendix 9).

Thus, this research study recognized eight number of significant effects magnitude due to the identified of causes of delays such as time overrun, cost overrun, disputes, arbitration, idling of resources, litigation, negative social impact and total abundant. Also, the results confirmed that both the clients and the contractor are equally responsible for delays in Sri Lankan building construction projects.

Finally, this research study recommends fifteen remedies and its magnitude to minimize/mitigate potential delays in building construction projects in Sri Lanka described in the study. The outcomes of the research identify highest magnitude three significant remedies to avoid or minimize delays such as; the client shall pay the contractor on-time, the contractor shall improve labor productivity, and he shall have proper financial planning and proper management with planning to be improved.

Keywords: *Building construction projects, causes of delay, Effects of delay, Remedies for delay*

Dedication

“We all have dreams. However, in order to make dreams come into reality, it takes an awful lot of determination, dedication, self-discipline, and effort.”

Acknowledgments

I take this opportunity to thank and grant heartfelt gratitude to those who helped in various ways to succeed in this research study. Without continuous support from professionals, friends, and colleagues in the construction sector in Sri Lanka, the research would not have a chance to complete this study timely, and it would be much difficult task to achieve.

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Table of Contents

DECLARATION.....	I
ABSTRACT.....	II
DEDICATION.....	III
ACKNOWLEDGMENTS	IV
TABLE OF CONTENTS.....	V
LIST OF FIGURES	VIII
LIST OF TABLES	IX
LIST OF ABBREVIATIONS.....	XI
1 CHAPTER 1- INTRODUCTION	1
1.1 OVERVIEW OF THE SRI LANKAN CONSTRUCTION INDUSTRY	1
1.2 BACKGROUND	2
1.3 RESEARCH GAP & PROBLEM STATEMENT	2
1.4 AIM AND OBJECTIVES.....	3
1.4.1 Aim.....	3
1.5 LIMITATION OF THE RESEARCH	4
2 CHAPTER 2 - CRITICAL REVIEW OF THE LITERATURE.....	5
2.1 INTRODUCTION OF CONSTRUCTION CONTRACTS	5
2.1.1 Definition of contract	5
2.1.2 Definition of construction	6
2.1.3 Categories of construction.....	6
2.2 CONTRACTS ADMINISTRATION.....	8
2.2.1 Definition of administration	8
2.2.2 Construction administration and contract administration.....	8
2.3 PROCURING CONSTRUCTION PROJECT.....	9
2.3.1 Award of contract.....	10
2.3.2 Delays administrate under the contract	11
2.4 POST CONTRACT MANAGEMENT	12
2.4.1 Pre-contract & post contract management	12
2.4.2 Construction project stakeholders	12
2.4.3 The use of standard form contracts	13
2.4.4 Parties to the contract	13
2.4.5 Parties responsibilities and duties under the condition of contract.....	14

2.4.6	Construction performance under the condition of contract	14
2.5	CONTRACTUAL DELAYS	16
2.5.1	Definition of construction delays	16
2.5.2	Type of delay in Building Construction projects.....	17
2.5.3	The Delay in a legal point of view	19
2.5.4	Excusable delay as compensable delay	19
2.5.5	Excusable but non-compensable delay.....	20
2.5.6	Non-excusable delay	21
2.5.7	Concurrent Delays.....	22
2.6	CAUSES OF DELAYS IN CONSTRUCTION.....	23
2.6.1	Causes of delays in the contractors perspective	23
2.6.2	Causes of delays in the client perspective	29
2.6.3	Causes of delays in the consultant perspective.....	34
2.6.4	Causes of delays due to external factors.....	36
2.6.5	Causes of delays due to government impact	40
2.7	SUMMARY OF IDENTIFIED CAUSES OF DELAYS	40
2.8	GROUPED INTO IDENTIFIED CAUSES OF DELAYS.....	41
2.9	CAUSES OF DELAYS EFFECT TO PROJECT PERFORMANCE	45
2.10	SUMMARY FROM CAUSES OF DELAYS EFFECT TO PROJECT	50
3	CHAPTER 3 - REMEDIES FOR REDUCE DELAY	51
3.1	INDUSTRY STANDARD TO GET INVOLVED PROFESSIONALS IN DELAY ANALYSIS	51
3.2	DISPUTES RESOLUTION METHOD FOR DISPUTES RELATING TO THE DELAY	53
3.3	REMEDIES FOR CONTRACTORS PERSPECTIVE TO AVOID DELAY.....	54
3.4	REMEDIES FOR CLIENTS PERSPECTIVE TO REDUCE DELAY	57
3.5	REMEDIES FOR CONSULTANTS RESPECTIVE TO REDUCE DELAY	60
3.6	SUMMARY OF IDENTIFIED REMEDIES FOR CONSTRUCTION DELAY	61
4	CHAPTER 4 - RESEARCH METHODOLOGY	63
4.1	INTRODUCTION.....	63
4.2	RESEARCH DESIGN	63
4.3	REVIEWING THE LITERATURE.....	64
4.4	RESEARCH APPROACH.....	64
4.4.1	Quantitative Approach	66
4.4.2	Qualitative Approach	66
4.4.3	Mixed Approach.....	67
4.4.4	Approach to Data Collection.....	68
4.5	DATA COLLECTION	69
4.5.1	Population and Sampling Frame	69

4.5.2	Sample Size	70
4.5.3	Research instrument selection	72
4.5.4	Data collection process.....	74
4.6	ANALYSIS OF PROCEDURE.....	75
4.6.1	Questionnaire Construction.....	80
5	CHAPTER 5 - RESEARCH FINDINGS AND DISCUSSION.....	83
5.1	INTRODUCTION.....	83
5.2	DETAIL OF PARTICIPANTS AND RESPONSE RATE FROM QUESTIONNAIRE SURVEY	83
5.3	CAUSES OF DELAYS ON THE BUILDING PROJECTS IN SRI LANKA (QSR).....	89
5.4	EFFECTS OF DELAYS ON THE BUILDING PROJECTS IN SRI LANKA FROM QUESTIONNAIRE SURVEY	96
5.5	INTERVIEW DATA ANALYSIS	97
5.6	EFFECTS OF DELAYS ON THE BUILDING PROJECTS IN SRI LANKA BASED ON INTERVIEW RESULTS	100
5.7	REMEDIES FOR CONSTRUCTION DELAYS	101
5.8	DISCUSSION OF QUESTIONNAIRE AND INTERVIEW DATA	105
5.9	REMEDIES OF DELAYS TO PROFESSIONAL IN CONSTRUCTION INDUSTRY	107
6	CHAPTER 6 - CONCLUSIONS AND RECOMMENDATIONS.....	109
6.1	INTRODUCTION.....	109
6.2	CONCLUSION	109
6.3	RECOMMENDATIONS FOR FUTURE STUDIES	111
6.4	RESEARCHER'S REFLECTION	111
	REFERENCE.....	113

List of Figures

- Figure 1 – Definition of Construction (Grace, 2010)
- Figure 2 – Types of Main Construction (Wikipedia, 2017)
- Figure 3 – Construction Contracts (Brian and Peter, 2009)
- Figure 4 – Types of delay (Hamzah et al. (2011)
- Figure 5 – Excusable delay as a Compensable Delay (DesignBuilding, 2016).
- Figure 6 – Excusable but Non- Compensable Delay (DesignBuilding, 2016).
- Figure 7 – Excusable delay as Compensable Delay (DesignBuilding, 2016).
- Figure 8 – Concurrent Delay (Ahamed, 2016).
- Figure 9 – Research Philosophy and Pragmatism (Saunders et al., 2009).
- Figure 10 – Mixed Method Approach (Creswell, 2012)
- Figure 11 – The exploratory sequential design (Creswell and Vick, 2011)
- Figure 12 – Forms of interviews (Saunders et al., 2009). p.321
- Figure 13 – Fundamental Stages for Constructing a Questionnaire (Naoum, 2013)
- Figure 14 – Analysis of Professional Participants (QSR)
- Figure 15 – Analysis of Professionals Organisation
- Figure 16 – Analysis of Professional Engaged Sector/s in the Construction Industry (QSR)
- Figure 17 – Analysis of Professional Experiences (QSR)
- Figure 18 – Analysis of Project delays in the Building Construction Project (QSR)
- Figure 19 – Summary of Effects due to Delay Causes (QSR)
- Figure 20 – Percentage of Projects Delay compare to the total projects' professionals worked in Sri Lanka (INR)
- Figure 21 – Summary of Effects due to Delay Causes (INR)

List of Tables

- Table 1 – Some Project Stakeholders (Graham, 2008)
- Table 2 – Summary of Causes of Delays
- Table 3 – Causes of Delays Related to Client
- Table 4 – Causes of Delays Related to Consultant
- Table 5 – Causes of Delays Related to Contractor
- Table 6 – Causes of Delays Related to External Forces
- Table 7 – Causes of Delays Related to Government
- Table 8 – Major Effects of Delay Causes
- Table 9 – Remedies for Minimize / Avoid Delays to the Parties
- Table 10 – Critical Values of Q (rho) at various levels of probability (Spearman rank correction coefficient) (Naoum, 2013)
- Table 11 – Professionals Involved for Questionnaire Survey
- Table 12 – Professionals Organisation
- Table 13 – Professionals Experienced Sector/s have been engaged
- Table 14 – Professionals Experiences Range (QSR)
- Table 15 – Project Delays Percentage (QSR)
- Table 16 – Significant 15 no of Causes of Delays in Building Construction Project (QSR)
- Table 17 – Significant Causes of Delays in the Building Construction Project (QSR)
- Table 18 – Overall Significant 20 Causes of Delays in Building Projects (QSR)
- Table 19 – Most Significant Cases of Delays from Client's Representatives Views (QSR)
- Table 20 – Most Significant Cases of Delays from Consultant's Representatives Views (QSR)
- Table 21 – Most Significant Cases of Delays from the Contractor's Representatives Views (QSR)
- Table 22 – Effects of Delays due to Delays Identified from the Questionnaire Survey (QSR)
- Table 23 – Interviewers General Information
- Table 24 – Interviewer Results – Most Important Causes of Delay (INR)

- Table 25 – Effects of Delays due to Delays Identified from the Interview Results (INR)
- Table 26 – Interviewer Results – Remedies for Consultant
- Table 27 – Interviewer Results – Remedies for Contractor
- Table 28 – Interviewer Results – Remedies for Client
- Table 29 – RHO value for effect due to delays
- Table 30 – Top 15 number of remedies for professionals in the construction industry
-
- Table A8 – Overall ranking for 44 causes of delays analyzed by using Impact and Frequency RII values
- Table A9-1 – Interview results analysis for causes of delays
- Table A9-2 – Interview results analysis for the frequency of happening identified causes of delay
- Table A9-3 – Interview results analysis for both causes and frequency combined RII value
- Table A9-4 – Major Causes of delays comparison from Questionnaire and Interview analyzed results
- Table A9-5 – “RHO” Value calculation for Questionnaire and Interview Ranks
- Table A9-6 – Interview results for Remedies to Professional Practice
- Table A9-7 – Interview Overall results for Remedies to Professional Practice

List of Abbreviations

QSR – Questionnaire survey results

INR – Interview survey results

ICTAD – Institution of Construction Training and Development

CHAPTER 1- INTRODUCTION

1.1 Overview of the Sri Lankan Construction Industry

In Sri Lanka, all construction activities undertaken by the private, government, and semi-government, a contractor who registered with ICTAD were covered (Department of Census & Statistics Sri Lanka, 2013).

Daily News (2017) reported that Build Sri Lanka-2017 strengthen strategic support for the construction sector. Also, it stated that “crowd over 300 exhibitors from various sector of the construction industry in an Island-wide and over 20 Chinese companies registered as part of the ‘China Pavilion.’”

Furthermore, Daily news (2017) reported that “*China pavilion would comprise delegation of these companies looking expand the country's ever-growing presence in the building and construction sector of the country with innovative, cost-effective material, products, and services.*”

Sri Lankan construction industry is booming from this year and forthcoming years. There are many professional and different organizations involved in the construction. The construction is very complex, and many conflict and disputes arise during the execution of the project.

Also, the report of Build with Sri Lanka 2017 its highlighted that latest developments in the building construction industry provided a platform for business transactions, Stakeholders and decision - makers are taking part and are working on new business opportunities by organizing an ideal event for the availability of a new product, network, and new contracts.

1.2 Background

The construction industry is an instrument for them to achieves society goals for urban and rural development (Ibrahim, Amund, and Nabil, 2012). Also, construction projects involved high-risk activities that need to manage effectively in all stages.

Construction industry usually consists of a unique set of activities and that need to complete as a unique product. In the construction industry, significant delays considerably varied in the projects (Kesavan, Gobishanker, Gobidan and Disanayaka, 2015).

However, construction process depends on the various factors considered to various sources engage with contractor's performance, site conditions, external factors and contractually binding stakeholders in the construction project (Shebob, Dawood and Shah, 2017). Furthermore, Shebob et al. (2017) explained that practically in construction industry occurred delays and magnitude of delays very significantly happening in the project to project as well as country to country.

1.3 Research Gap & Problem Statement

That delays nature, characteristics factors, and their impact on a project vary between developing and developed countries Shebob et al. (2017). In this context, Sri Lanka considered a developing country. Yajas and Rangika (2010) found that the Sri Lankan construction industry, road construction project 56% - 88% of overran compared to the original project duration due to delays causes an impact on the projects.

Similarly Building construction project also overrun time and cost due to various of delays, for instance, Dolage and Rathnamali (2013) found that client, consultants, and contractor related factors are most significantly affected causes to time, cost overrun and the degree of agreement of perceptions on delay causes. Furthermore, the study found that the highest percentage of delay causes occurred between the clients and consultants (68%) and the lowest percentage occurred between the contractors and clients (50%).

According to Dolage and Rathnamali (2013), Smarakoon (2009) and other authors conducted a research study they occurred, causes of delays due to bad practices in the project. Previous researchers carried out studies to find the causes of delays, effects, and remedies, and they have not identified the magnitude and correlation of the findings in the researches. This research area author decided to find out the magnitude of mitigating their delay causes on each parties' professional practices. The author carried out this study to identify the magnitude of causes of the delays and their effects as well as find to remedies to stakeholders, such as client, consultant, and contract, to minimize/ avoid delays in construction projects.

1.4 Aim and Objectives

1.4.1 Aim

The research study aims to identify the magnitude of the significant cause of delays commonly effect in building construction industry and find remedies to professional practices for minimizing such delays and disputes in the building construction project.

Objectives

1. To critically identify types and significant causes of delays and effects to the global construction industry.
2. To identify the primary responsible parties to the type of delays occurred in the construction sector/industry.
3. To identify the most commonly happening significant causes of delay and effects in the Sri Lankan building construction industry.
4. To identify remedies for delay cause, which were profoundly happening in the building projects in Sri Lanka.
5. Provide recommendation for developing a strategy to improve project professionals' practices to minimize or avoiding delays.

The research aim and objectives sited based on the described research to find magnitude cases of delays and effects to the projects and magnitudes of remedies to the professional practices to minimize that delays in the building construction industry.

1.5 Limitation of the Research

This research study limited to carry out only building contraction in Sri Lanka. This research study outcome referred to based on the collected data analysis of the questionnaire and interview results.

Due to the time constrain interview carried out only selected five professionals, and this would have been more accurate when more professionals were interviewed.

CHAPTER 2 - CRITICAL REVIEW OF THE LITERATURE

2.1 Introduction of Construction Contracts

Beginning of this chapter provides the meaning of "Construction Contracts," "Contract Administration," "Post Contract Management and Contractual Delays," continued discussion on potential types of delays occurred, and how the parties manage base on the delay responsibility. Furthermore, this chapter provides possible delays caused in the global construction industry that identified by the researches from they have been researched previously from a deferent place of the world. Their studies identified such delays effect on project outcomes and similarly found remedies for minimizing delays in the construction project provided in another chapter. This chapter critically discusses the causes of delays in the construction industry and the primary research carried out to achieve other objectives Construction Contracts

2.1.1 Definition of contract

The definition of contracts defined by Ashok, Marvadi, and Shaival, 2015, their definition is an agreement enforced by law is a contract. Also, Roy (1992) defined the construction contract is “a binding agreement that is enforceable in law, containing the condition under which the construction of a facility will take place.”

Ananda (2015) stated that, the standard condition of contract, the term of “Contract” defined as the “Contract Agreement, Letter of Acceptance, the Letter of Tender, the Condition of Contract Conditions, the Specifications, the Drawings, the Schedules and the further documents (if any) which are listed in the Contract Agreement or in the Letter of Acceptance “. Furthermore, a contract formed with an offer and acceptance.

John (2009) the construction contract behaviour is a contractor agrees to perform work and supply of materials to build the distinct building or other works to benefit the employer.

John (2009) stated that the building and engineering contracts are not deferent between in legal terms, and the terms Construction Contract is adapted to cover both. Also, Brian and Peter (2009) explained that the meaning of the contract is contracting parties Peter (2009) explained that the meaning of the contract is contracting parties formalize the relationship between them to balance the risk by establishing their rights and obligation.

2.1.2 Definition of construction

Grace (2010) defined the construction is “a process that consists of the building or assembling of infrastructure.” John and Will (2008) defined the term of construction is the process of the erection, repair, and demolition of things to altering into the others for houses, offices, shops, damp, bridges, motorways, home extensions, chimneys, factories, and airport. Further, Brian and Peter (2009) defined the construction is a more extensive and complex industry that involves constructing the desired project with several organizations who are having deferent capabilities, a various range of professional and other representative bodies.

Also, Grace (2010) defined the construction project is to be occupied by the end-user where they all material and work necessary to finishes construction of the structure. According to the definition above that further illustrated the construction involves site preparation, foundations, mechanical, electrical work, and any other work necessary to complete the project.

2.1.3 Categories of construction

Construction categorized into three sectors which are known as buildings construction, infrastructure, and industrial. Further, building construction industry divides into two categories such as residential and non-residential; this divided into sub-sectors like as institutional or commercial. Wikipedia (2017) categorized the Infrastructure construction industry, usually termed to “a highway, heavy civil or heavy engineering. It includes larger public construction works of dams, bridges, highways, water, wastewater, and utility distribution. Industrial includes refineries, process chemical,

power generation, mills and manufacturing plants”. The industry broke down into other two types ways named sectors or markets.

Considering the above literature defined the construction is larger and complex industry embracing many types and sizes of organizations involved a various range of professional with other representative bodies to process for assembling of building or infrastructure project. Construction is inclusive of all material and works necessary to finish the project for the end-user to occupy. Type of construction project categorized into three ways which form the contract to formalizes the relationship between the contracting parties to balance the risk establishing rights and obligation between them.

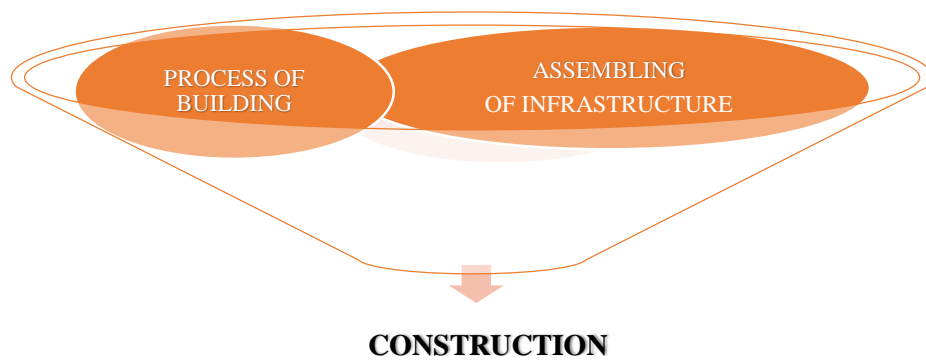


Figure 1 – Definition of Construction (Grace, 2010)

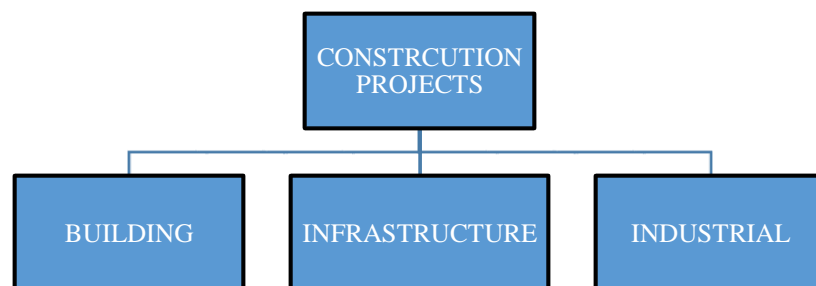


Figure 2- Types of Main Construction (Wikipedia, 2017)

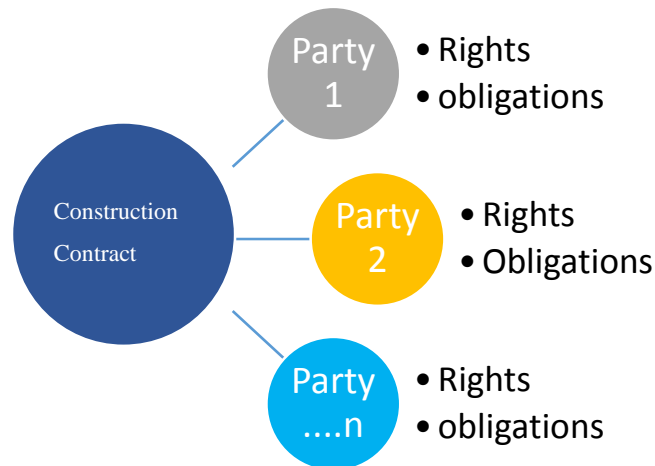


Figure 3- Construction Contracts (Brian and Peter, 2009)

2.2 Contracts Administration

2.2.1 Definition of administration

The project participants need to understand the construction administration and contract administration to manage the construction project effectively. Shaival et al., (2015) they defined administration is the act of managing duties, responsibilities, or rules and overly contract carrying out construction work in a manner planing on behalf of the appointee.

The formal contract provides administrative procedures and mechanism dealing with the construction contract. Brain and Peter (2009) stated that formal contracts establish administrative procedures to help to conduct formal notices. They established mechanisms for dealing with contract payments, delays, compensation, and disputes.

2.2.2 Construction administration and contract administration

Edward and Wayne (2006) stated that construction administration and contract administrate are terms easily confused. Also, they defined construction administration is the management or handling of the business relations between the parties entered into a contract.

Edward and Wayne (2006) defined the term of construction administration is used to raise the much broader responsibility relating all project-related function between the parties to a contract other than the traditional contract administration duties. However, the objective of contract administration needs to be reduced disputes or conflict by developing a better relationship between owner and contractor (Shaival et al., 20165).

Construction contract administration requires a knowledge of the law, Nael (2005) explained the construction contracts are concerned, administration of the contract requires a certain amount of the law.

2.3 Procuring construction project

John (2009) defined the procurement is the basis for all construction contract adopt a strategy to perform the proposals lies with procurement method to apply to the construction projects for setting up financed and construction works. It establishes through the consideration of separate or combined relations among all participants, developers, and financiers, designers, and contractors (John, 2009).

Brain and Peter (2009) stated that the procurement in the construction project requires to balance between time, quality and cost constraints, although professional services required to design of work, administrate the project, and manage the health and safety.

ISO 10845-1:2010 standard guides the process, method, and procedures for the establish procurement system to the organization in a fair, equitable, transparent, comparative and cost-effective way (Frank & Ronald, 2009). John and Will (2009) stated that the procurement method depending on the constraints of the project.

The ISO 10845 provided the procedure of tendering and selection particularly by providing recommendations and guidance to the public sector or private-sector organization of polices strategies and procedures for the procurement of construction projects (Frank & Ronald, 2009).

Tendering is part of the procurement process and its purpose described in two ways. John and Will (2009) stated that the primary purpose of tendering is a select suitable contractor at the right time, and the contractor offers a price at an appropriate time. John, A. k., John, B., & Craig, C. (2003) described that an offer is a statement, or course of conduct shows that the offeror intended to be bound by the laid down parameters, on condition that party known as the offeree accepts those parameters. The offer will be the basis to follow the contract (John & Will, 2009).

2.3.1 Award of contract

Sources of contract law today in Sri Lanka are the Roman-Dutch Law and the English Law (Weeramantry, 2012). The English law or statute law or one of the systems of personal law governs the matter in hand; the law to apply in matters of the contract is the Roman-Dutch Law (Weeramantry, 2012).

In additional, Weeramantry (2012) stated that Sri Lankan Judges and Jurists have in common with those of South Africa, provide aid of English law to develop and extend the principals of Roman-Dutch Law and the principles of English law have in matters crept unobtrusively into the law of Contracts in Sri Lanka and South Africa.

Under the English contract law, the contract is to build fulfill with formal requirements to render the promise bound in a contract, and its formal requirement of an additional, necessary pre-requisite that must be satisfied (Ewan, 2008). Also, the parties required to show that there has been an offer, acceptance, consideration, and intention to form legal relations and their formal requirements have been satisfied (Ewan, 2008) and further illustrated that formal requirement might take different forms and the contract must be,

- i. Made in writing
- ii. Evidenced in writing, or
- iii. Made by deed.

According to the standard form of condition of contract Federation International Des Ingenious – Conseils (FIDIC) defined contract Agreement is,

“The parties shall enter into contract agreement within 28 days after the contractor receive the letter of acceptance unless they agree otherwise. An agreement based upon the costs of stamp duties and similar charges imposed by law in connection with entry into the Contract Agreement bore by the Employer”.

Furthermore, FIDIC (1999) defined the *“Letter of Acceptance means formal acceptance sign by the Employer, of the Letter of Tender, including any annexed memoranda including an agreement between and sign by both Parties.”*

2.3.2 Delays administrate under the contract

In general, disputes occur because of various sources in the construction industry, and delays are crucial disputes in the construction sector. Shaival et al. (2015) stated: that claim split into two categories based on their occurrence of causes during the execution of the contract and administration of the contract.

Both client and contractor work for common objectives that are to complete the project within schedule and cost. Thus, administration contract claims are raised according to the delay in payment of running account bills and claims due to foreclosure or termination of the contract (Shaival et al., 2015).

If the disputes continued and resolved for long period parties may threaten, or initiate, litigation and that is a time-consuming, costly and involved risk as well as not sure of its results. Its outcome may not be satisfactory to their business relationship. Therefore, a result of this litigation approach needs to avoid when the disputes arise between the parties. Alternative dispute resolution approach provides the most significant opportunity to resolve the disputes and continue to baseness relationship, and arbitration is the decision binding on the parties (Shaival al et. 2015).

2.4 Post Contract Management

2.4.1 Pre-contract & post contract management

The project brief is used in the pre-contract management to finalized an agreement for the preferred option, and the detailed design to deliver within the identified parameters of cost, time, and quality. Furthermore, post-contract management admitted by starting construction works at the site (Samer, 2010).

2.4.2 Construction project stakeholders

The construction project involved parties, who acts in acquiring a direct benefit or loss of the project called as Stakeholders. They categorized into two types, internal stakeholders in legal contracts with the client as well as external stakeholders directly involved in the project (Graham, 2008).

Also, Graham (2008) described that the internal stakeholders around the client's side fall into two groups by splitting to the demand and the supply side, and external stakeholders categorized into the private and public sectors. Below Table-1, provide an example for this categorization.

Table-1 *Some Project Stakeholders (Graham, 2008)*

Internal stakeholders		External Stakeholders	
<i>Demand Side</i>	<i>Supply Side</i>	<i>Private</i>	<i>Public</i>
Client	Architects	Residents	Regulatory agency
Financiers	Engineers	Local landowners	Regulatory agencies
Client's employees	Principal contractors	Environmentalists	Local government
Client's customers	Trade contractors	Conservationists	National
Client's tenants	Material suppliers	Archaeologists	government
Client's suppliers			

The division of the construction splatted by considering a significant number of factors of diverse skills, and there is an extraordinary diversity of professional, specialist, and suppliers. It is a useful method to organized in a rational way of construction contract problem (John & Will, 2008).

Although each professional's disciplines like to focus upon its contribution and provide services to the client, John and Will (2008) categorized people into five groups named: builders, designers, regulators, purchasers, and users of the building.

2.4.3 The use of standard form contracts

Michael (2007) explained the Lord Diplock held that in the case of “*Schroeder Music Publishing Co. Ltd. V. Macaulay (1974)*” the standard form of contract,

“Two types of Standard forms of Contracts exist in the industry. The first, of very ancient origin, are those that set out the terms on which mercantile transactions of common occurrence are to carry out. The standard clauses in these contracts have been settled over the years by negotiation with representatives of the commercials interests involved and adopted because experience has shown that they facilitate the conduct of trade”.

John and Will (2009), stated that “procuring a building is a common practice to appoint the contractor choosing a standard-form of a building contract, and regulating terms in the contract enables to parties to reduce the emphasis on specific contractual terms during the bargaining process.”

2.4.4 Parties to the contract

The established choices of a contractual arrangement such as Management – Oriented contract, Design and Build, Traditional, Cost Reimbursement, Turnkey, and Framework Agreements. Typically, with the contract between client and designer, client and contractor, contractor, and subcontractors (Frank & Ronald, 2013).

2.4.5 Parties responsibilities and duties under the condition of contract

There is a various Standard form of Contract available in the construction industry. Each of the contract form defined and described contract-involved parties' responsibilities and duties under the Contract. For instance, contractor general obligation, employer obligation, and the engineer's duties and authority. According to the Federation Internationale des Ingenieurs-Conseils (FIDIC) (1999) defined as,

"The Contractor design, execute and complete the Works under the Contract and with the Engineer's instructions and shall remedy any defects in the works." An employer,

"Give the contractor right of access to, and possession of, all parts of the site within the time stated in the Contract," and *"The engineer duties and authority assigned to him in the contract appointed by the employer."*

In the New Engineering Contract (NEC) Short-term Contract (2005), Condition of Contract defined the Contractor's responsibility under the Standard Form Contract stated that following the available Works information the Contractor provides the Works.

2.4.6 Construction performance under the condition of contract

The parties involved in the project performance need to be followed right and obligation under the signed Contract of the construction project. Construction is a fast-moving, complex, and dynamic process which required to the successful coordination of multiple separate business entities- including project owner, professionals, specialist trade contractors/ subcontractors, legal advisor, and consultant. They need to ensure the delivery of a project on time, within the budget and achieve the required quality (Keane & Caletka, 2008).

The contractor and contractor's representatives performed the construction, and they have to follow according to the agreed sign contract. According to the FIDIC (1999) defined the contractor's obligation; "the contractor shall complete the whole of the

works, and if any section within the time for completion for the works or section compiled with the contract."

For Client obligations situated under FIDIC (1999) regulated several clauses, for instance, Clause 2.1 "Right of Access to the Site-the. The Employer shall give the Contractor right of access to and possession of, all parts of the Site within the time (or times) stated in the Appendix to Tender."

The Employer representative the Engineer obligation regulated under same FIDIC (1999) under clause 3.1, for instance, "Engineer's Duties and Authority- The Employer shall appoint the Engineer who shall carry out the duties assigned to him in the Contract. The Engineer's staff shall include suitably qualified engineers and other professionals who are competent to carry out these duties."

The similarly standard form of Contract available for consultant/client model service agreement recommended to such service invited on an international basis. Purpose of that service agreement use to pre-investment and feasibility studies, designs and administration of construction and project management for construction where they perform according to with recognized numerous clauses (Federation Internationale des Ingenieurs-Conseils- White Book, FIDIC 1999)

Also, Essays (2013) found that construction delay due to the time lag in completion of the project according to the agreement.

With referred to above literature described the parties need to perform duties and responsibilities to perform the construction project achieve client objectives. When the parties enter into a contract; following standard form of Contract, it legally enforced practice to perform duties. The project delays occurred due to inadequate performance under the Contract, and that leads to delay events. Also, parties involved in a construction project, liabilities based on law and contractual obligation Therefore project delay causes identify based on the agreements, and it required the demonstrate

cause-effect nexus between event, for instance, the employer's liability becomes 'the cause' as a result impact on the contractor's ability to perform the project work which became 'the effect'. Then delay analysis follows the causation requirement in such a way that consideration is used to assess the resulting damages. That liability for each event is decided by the Engineer, architect, project managers, arbitrator, adjudicator, judge, or dispute decider from a third party (Keane & Caletka, 2008). In the construction industry, delay analysis is followed by a professional perspective.

2.5 Contractual Delays

2.5.1 Definition of construction delays

The delay defined by Rao & Culas (2014) stated that, the construction activities late by the initially scheduled time. Aibinu and Jagboro (2002) found that the delay occurred due to the contractor or the client jointly or separately contribution to incomplete the project as per the agreed contract period.

Projects were intended to be the one-offs Construction. A project team engaged together to perform a unique development at a site considering the situations which will not repeat. It is most complex, and that requires the coordinate to manage to accrue permissions, manage people, goods, plant, and materials. Also, many despite occurs in the construction due to 'unknown' matters, for example, uncertain site conditions, incomplete design information, and suppliers. Consequently, delays are frequent in construction projects (Designing Building, 2016).

Projects define their typical tasks for a timely, budgetary, and technical performance to achieve specified quality. Projects broadened in recent decades in comparison to the scheduled time (Clarke, 1994).

Assaf and Al-Hejji (2006) defined that delay in construction is overrun the time either beyond the time for completion stated in the contract or parties agreed to extend the date to the delivery of a project. Generally, it is the additional days required for completion of the project activity.

Construction delays occurred due to resulting of a frequently mismanaged event or events and involved as a risk for the projects. The risk is identified by the systematic process that analyzed and managed the project to manage, minimized, shared, mitigated, or accepted to give some good results and minimize chances of further delay.

According to the above literature, their researchers elaborated the meaning of delays in the construction industry and commonly explained that the time is lagging to completion of the project according to contract agreement the fixed time.

2.5.2 Type of delay in Building Construction projects

Under this sub, the chapter importantly finds out the types of delay and causes of delays in achieving the first objective in the research aim. Designing Building (2016) very broadly described that; delay categorized in two ways,

- i. delays in activities based on the program available float (i.e., they that can be delayed without affecting the completion date),
- ii. that delays will affect the time for completion.

Also, Designing Building (2016) four types of construction contracts delay categories, such as delays,

- i. resulting from neutral causes,
- ii. due to the fault of the client,
- iii. occurred due to the fault of the contractor,
- iv. concurrent delays.

Ravisankar, Ananda, Kumar, and Krishnamurthy, 2014 identified main categories of type of delay, and there are four (04) basic ways to categorize such delays.

- i. Critical or noncritical,
- ii. Excusable or non-excusable,
- iii. Compensable or non-compensable,
- iv. Concurrent or non-concurrent.

Further, Williams (2003) delays categorized in another way which is due to Delays fault of the consultant, contractor or client under the following three (03) groups,

- i. Excusable compensable delays.
- ii. Excusable non-compensable delays and,
- iii. Non-excusable non-compensable delays.

Ahmed (2015) identified a similar explanation for delays which categorized into four types;

- i. Non-excusable or excusable,
- ii. Non-critical or critical,
- iii. Non-concurrent or concurrent and,
- iv. Non-compensable or compensable.

Also, the research followed by Majid (2006) found a similar type of delays categories which split into three groups,

- i. Concurrent delays
- ii. Non- excusable delays
- iii. Excusable delays

Further Majid (2006) was categorized excusable delays into two ways such as,

- i. Compensable and,
- ii. Non-compensable.

The research study conducted in Ghana construction projects, Fugar and Agyakwah (2010) found delay mainly categorized into three types such as,

- i. Excusable but non-compensable delay
- ii. Compensable delay and
- iii. Inexcusable delay.

Also, Hamzah, Khoury, Arshad, Tawil, & Ani, 2011 found similar type delays in the study and that shown in Figure 3.

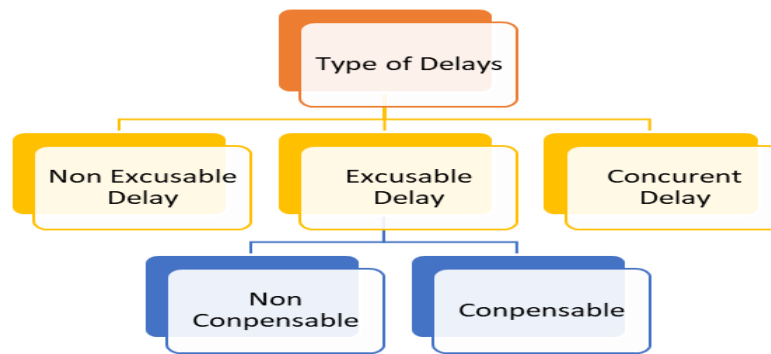


Figure 4- Types of delay (Hamzah et al. (2011).

The literature review identified significant three types of delays in building construction projects named Excusable delays, Non-Excusable delays, Concurrent delays, and further excusable delays divided into two types, such as Non-compensable and Compensable.

2.5.3 The Delay in a legal point of view

According to Kraeim and Diekmann (1987), the delay categorized into three ways based on the legal point of view such as,

- i. Compensable
- ii. Excusable delays as Compensable or Non-Compensable
- iii. Non-Excusable.

According to the above sub, chapters discussed literature from the various authors, and professional institution followed research studies identified major types of delays which are categorized into mainly four types and further discussed to elaborate that in a legal point of views in the following paragraphs.

2.5.4 Excusable delay as compensable delay

Delay event caused to project delays due to the client or his agent, such as Consultant, the Engineer, Architecture, Quantity Surveyor. According to that, the contractor entitled to an extension of time (EOT) and compensation for prolongation cost, which

are incurred related financial compensation due to identifying that delay event (DesignBuilding, 2016).

Also, DesignBuilding (2016) found this type of delay some activities emphasized as a failure of the consultant to provide information, variations, nominated subcontractor's work delay, delay in material delivered to the client, delay in site possession. Ibironke et al. (2013) found that this delay category happened when the owner's representative Architect is delaying issue drawings.

Considering the above, identified excusable delays as the compensable delay from previous researches can be summarised in a graphically for a better understanding of this delay.

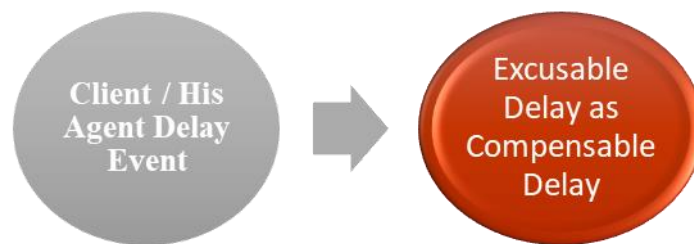


Figure 5- Excusable delay as a Compensable Delay (DesignBuilding, 2016).

2.5.5 Excusable but non-compensable delay

Where the delays control beyond the parties' these are categorized under the excusable delays, but non-compensable delays due to results of natural causes (DesignBuilding, 2016).

Further, DesignBuilding (2016) found that the type of delay events occurred due to causes of extremely adverse weather condition, national strikes, civil commotion or terrorism, force majeure, statutory changes are beyond the parties control fall into that type of delay. Also, such delayed events behaved that the contractor's entitlement only for the extension of time without cost compensation.

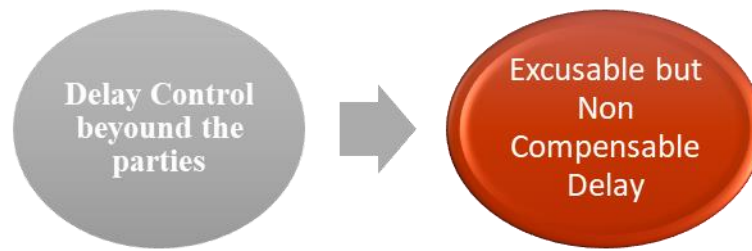


Figure 6- Excusable but Non- Compensable Delay (DesignBuilding, 2016).

2.5.6 Non-excusable delay

Non-Excusable types of delay widespread in various construction projects, and it generates a significant impact on the projects (Ibironke et al. (2013).

Design Building (2016) found that the delay caused due to the contractor or his representative fault will delay the project. As a result, the contractor pays Liquidated Acetated Damages (LAD) to the client. The research conducted by Majid (2006) found that non-excusable delays are higher because of the contractor but rather his subcontractors' fault or action.

Furthermore, Majid (2006) identified "delays happen due to lower productivity, equipment breakdown, contractor's in-proper planning, inadequate site management, unreliable subcontractors or/and suppliers." The contractor is not entitled to Extension of Time (EOT), and prolongation cost under this type of delays belongs to the contractor's fault.

Ibironke et al. (2013) found many issues causes to this type delay such as; higher project cost, work disturbance, claims, conflicts, work abandonment, and loss of productivity.

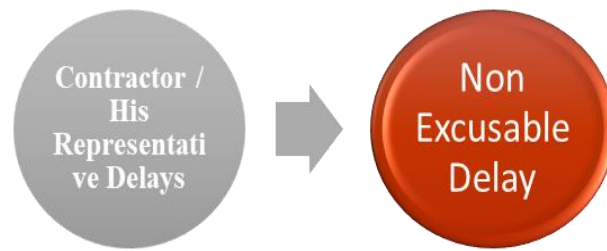


Figure 7- Excusable delay as a Compensable Delay (DesignBuilding, 2016).

2.5.7 Concurrent Delays

The most important point is to understand the actual meaning of the word "concurrent delay" as well as that need to understand "concurrency." According to the waiter (2012), It defined "as a situation where two or more overlapping delaying events are both said to be responsible for a delay to the completion date."

DesignBuilding (2016) illustrated that Concurrent delays refer to the complicated situation where more than one event was occurring within the same period, each of them individualistically affecting the time for completion or, where the events may happen at different times, but their effects (at least in part) felt concurrent.

Similar findings studied by Ahamed (2016) found "that concurrent delay mostly refers to the situation two or more delay activities occur at a different time but the impact felt either in whole or in part at the same time."

Furthermore, Design Building (2016) stated that "both parties' essential requirement to ensure them to keep good contemporary records to demonstrate that the event did occur and it effected to time for completion."

With referred to literature revive mainly identified four types of delays as a result of action or fault by the Contractor, consultant, beyond the control of both parties or whole, the parties involved the delays. Therefore, identify the cause of delays most import to minimize future delays. The following title section continues to discuss the possible delays identified in the construction industry.

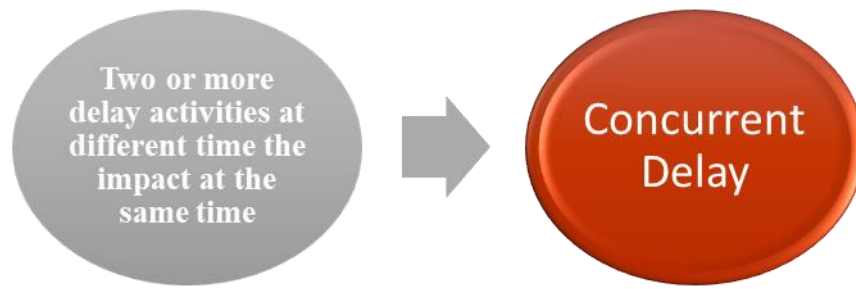


Figure 8- Concurrent Delay (Ahamed, 2016).

2.6 Causes of Delays in Construction

Chan and Kumaraswamy (1997) stated that the project characteristics based on several factors that related to different stakeholders such as the owner, the contractor, the consultant, and some factors as the project design, material, equipment, labor, and external causes. Further, it saw that many of the factors are interlinked and have cause and effect relationships. Research has been conducted across several parts of the world to determine the causes of construction delays as described below.

2.6.1 Causes of delays in the contractors' perspective

The research followed by Jurf & Beheiry (2012) found delay factors caused to cost and schedule overrun in the residential compound projects at Qatar between the years 2000 to 2005. According to Jurf and Beheiry (2012), found ten (10) number of significant causes of delays among the forty-two (42) causes of delays. That study identified causes of delays under the Contractor's responsibility, such as delays from sub-contractors and nominated suppliers, and delay due to safety. Moreover, the Contractor's financial difficulties are the most caused by delays. Also, they found that more than 85% of Qatar's randomly selected residential compound projects delayed for different reasons.

According to Murali et al., (2007), identified ten (10) significant causes of delay out of twenty-eight (28) different causes and six different effects of delay. There are ten essential causes listed as follows, Poor planning for Contractor, poor site management for Contractor, insufficient/inadequate experience of the Contractor, insufficient

customer funding and completed work payments, issues with subcontractors, lack of materials, labor supply, availability of equipment and failures for equipment, lack of communication among parties, Errors or mistakes during the phase of construction.

According to Sambasivan and Soon (2007), ten (10) significant delays in the Malaysian construction sector it has detected, such as Contractor's improper planning, Contractor's poor site management, inadequate contractor experience, and problems with subcontractors.

According to Semple, Harman, and Jergeas (1994), due to various factors, the delay was found to be a common problem in construction projects. However, delays lead to any project changes, such as late completion and loss of productivity.

According to Chileshe and Berko (2010) identified the causes of delays due to contractors' poor project management.

According to Alaghbari et al. (2007), identify the most common causes of delay in construction projects cost overrun and build high risky. They concluded that the delays caused by the contractors are generally due to poor managerial skills, lack of planning, poor understanding of accounting, and financial problem with the organization.

According to Danel (2014) found in the study of delays in Ghana construction projects, the Contractor's subcontract work delays and slow decision-making bureaucracy and contractors' improper planning.

According to research carried out by Mansfield (1994) "found sixteen (16) significant factors that caused delays, and the study identified that poor contract management by the Contractor.

James et al. (2014) found fifteen significant causes of delays in their study and identified liquidation of contractors, problems in project management, contractor's

equipment failures, construction errors/mistakes during the construction, inadequate organizational resources and labor strikes.

According to Chan and Kumaraswamy (1997), the research study identifies factors that cause delays in the Hong Kong construction project. Here the study analyzed as well as classified the significant reasons for the delays in two categories: the local constructing parties (clients, consultants as well as contractors) as well as project types. Research results showed that five (05) leading causes of the delays and specified the Contractor's poor site management as well as supervision.

The research study carried out by Ren, Tout, and Jones (2008) identified the five main reasons behind the Contractor's involvement in delay such as time is taken to prepare method statements, financial issues, the arrangements of the organizational chart, internal and external communication problems and mistakes during construction.

Sambasivan and Soon (2007) found that the causes of delays affected the project due to the Contractor's mistakes during the construction stage.

Odeh and Battaineh (2002) found significant important factors causing construction delays with the traditional type of contract. They found that the construction projects involved contractors and consultants' point of view identified there most essential causes of delays related to the traditional type of contracts. "They identified causes of delays by the Contractor stated that the contractors and consultant agreed for owner interference, inadequate contractor experience, financing problem and payments, low labor productivity, improper planning, and Subcontractors issues in the site construction work.

The research carried by the Durdyev, Omarov, and Ismail (2017) "identified delay causes in Cambodia residential projects, the most critical ten delay causes found among the thirty-one (31) delay causes. The study stated that the Contractor's delays cause to the project delay due to the on-site material shortages, improper scheduling, material delivery delay, insufficiently skilled labors, labor absenteeism, changes in

design, sub-contractors delay and site accident. Moreover, the research study described delay causes categorized into five groups, namely; external related factors, management related, material and equipment related, workforce relate, and project-related.

According to Pourrostan and Ismail (2012) identified delay causes in Iranian construction projects due to Contractor's insufficient site management, financial difficulties of the Contractor, problems with sub-contractor works, inadequate planning, and scheduling of works by the contractors.

Since the study followed by Stumpf (2000) found the causes continue to suffer a delay in a construction project due to contractor's unavailability of advanced technology, understanding of the project management techniques and other various factors of coursing disputes in the project.

Odeh and Battaineh (2002) found that causes of delays for a traditional contract in Jordan due to contractor poor labor productivity, Contractor's less experience, delays in sub-contract works, and improper planning.

The research study conducted by Mansfield, Ugwu, and Doran (1994) found significant causes of delays in Nigerian construction due to the Contractor's in-proper contract management and incorrect estimation during the tendering period.

Also, the research study carried out by Chan and Kumaraswamy (1997) identified that the causes of delays affect the project due to the Contractor's poor risk management and supervision during the construction.

According to Frimpong, Oluwoye, and Crawford (2003) identified that poor management by the Contractor, issues in material procurements, and weak technical performances to the construction work.and price escalation as essential causes of delays for groundwater projects in Ghana.

Assaf and Al-Hejji (2006) followed the research study in Saudi Arabia found that the leading causes of delays due to Contractor's poor site management, planning issues with the Contractor, insufficient labors on-site, construction accidents and facing financial difficulties by the Contractor. Further, they stated that the principal parties responsible for delays in construction projects as contractor representatives, client, and the consultant.

Nominee, Wachirathamrojn, Tantichattanont, and Sittivijan (1999) found that delays caused to all parties engaged in projects and significant causes effected due to contractors an organization lacking sufficient resources, and differences among the contractors.

Al - Momani (2000) found a delay due to the Contractor late delivery material, lack of knowledge/experience, sparse estimation, and bad decisions about company policies.

The study carried out by Umasankar et al. (2006) concluded that construction delays caused to large housing projects in India. They identified that the main reasons for delays due to the Contractor delayed applying the interim payment, insufficient working capital, the Contractor's low overall efficiency, and poor allocation of resources.

The major causes of delays identified the research study conducted by Megha Desai, and Rajiv Bhatt (2013) found that the Contractor faced with financing issues during the construction period and lacking professionals appointed for construction/contractual management.

The research conducted in Malaysian construction by Sambasivan and Soon (2007) recognized significant causes of delays due to Contractor's inadequate planning, issue with site management , less experience/ knowledge, inadequate labours, problems relating to subcontracting works, failure of Contractor's equipment, construction errors

and communication issues between parties by the Contractor during the construction period.

Chan and Kumaraswamy (1997) carried out the study in the Hong Kong construction industry they identified common causes of delays significant impact on project completion due to Contractor faced an issue with site management and supervision during the construction.

The research study conducted by Iyer, Chaphalkar, and Joshi (2008) found that the significant cases of delays effect to the project performance accidents and rework in the site due to contractors falt during the construction.

Also, Samuel, Anthony, Genevieve, and Titus, 2011 found significant causes of delays effect to the project construction the Contractor's poor site management and supervision, ineffective planning and scheduling of the project, delays in sub-contractor work, lack of resources to execute the work and rework due to the contractor's errors happened during the construction.

Osei and Adjei-Kumi, (2009) carried out the research study they found that the Labour-related delays according to lack of a credible artisanal recruitment system, unqualified workforce, inadequate labor management skills by the Contractor, lack of on-site supervision of labor, rework reason to contractors' fault. As a result, cost and time overrun of the construction project.

The research study conducted by Aziz and Abdel-Hakam (2016) to find cases of delays affected to the project and they found the Contractor faced financial and supervision issues and accidents happened due to the contractor fault during construction.

The study carried out by Odeh and Battaineh (2002) explained from the perspective of construction contractors and consultants view of point. The results of the research showed that low labor productivity at work, improper planning, and Contractor faced an issue with subcontractors' work.

The research carried out by Al - Barak (1993) found that the causes of delays are severe factors caused by the Contractor's lack of experience, poor estimation practices, weak business policy regulations, reduced labor productivity, and inadequate planning by the Contractor.

The research studies conducted by Yasemin Nielsen et al., (2013) found causes of delays in Turkey construction project and concluded that the Contractor's week planning and scheduling, rework due to errors, the Contractor delayed delivering material to the site and poor site management.

Ravisankar and Ananad (2008) carried out the research study identified significant causes of delays affected to the project performance due to rework by the Contractor for his error in construction, week site management, wrong selection of type or capacity of equipment and inaccurate site investigation.

Further S.M.S. Samarakoon (2009) found that causes of delays in Sri Lanka, the contractors identified as the leading cause of delay effect due to improper project management by the Contractor during the construction.

2.6.2 Causes of delays in the client perspective

According to Jurf and Beheiry (2012) carried out a research study identified that the Client instructed a variation, client pressure to reduce contract price, and inadequate contract duration provided by the Client, and design changes in the residential compound project in Qatar.

According to Sambasivan and Soon (2007) found causes of delays due to inadequate Client's finance and payments delay for completed work in Malesian building construction projects.

Research carried out by Apolot, Alinaitwe, and Tindiwensi (2013), twenty-two delays in public sector construction in Uganda identified scope changes, payment deferment for the contractor, inadequate monitoring and control were the key three causes for delays or excess costs identified in the research.

According to Semple, Harman, and Jergeas (1994) found delays lead to any project changes, such as acceleration requirement, increased expenditure, and contract termination.

According to Chileshe and Berko (2010) identified the causes of delays such as delay in monthly payments to the contractors, variations, design changes, information delays from the Client, issues with funds and project financing, compensation issues with land acquisition, and disagreement on the valuation of work done.

According to Alaghbari et al. (2007) "identified the high importance of time for both the owner (in terms of performance) and the money to the contractor, it is the source of continuous disputes and claims leading to lawsuits. The Client caused delays identified as, late issuance of drawings and specifications, continuous change orders, and incorrect site information.

According to Danel (2014) found in the study of delays in Ghana construction projects and identified twenty-two (22) numbers of delay causes. They found the Client responsible for the significant causes of delays such as insufficient financial resources, delayed payments, project duration underestimation, poor communication among the parties; bank lending problems with developers and changes of orders.

According to research carried out by Mansfield (1994), "found causes of delays mainly related to inadequate finance arrangements and payment issues in Nigerian construction projects.

Under a research study carried out by James et al. (2014), fifteen significant causes of delays identified the main reason for project delays is financial problems.

The research study carried out by James et al. (2014) identified causes of delays due to client-initiated variations in the construction project. Also, Chan and Kumaraswamy (1997) carried out study identified causes of delays reason to Client initiated variations of work.

In accordance with the research study carried out by Ren, Tout, and Jones (2008) identified top five delay causes related to the project owners such as unrealistically estimation of the contract period, several prime cost sums and provisional sums, delays in the nomination of sub-contractors and suppliers, delays in payments to the main contractor.

According to Seboru (2015), Identified one hundred and forty-one (141) causes of delay in road construction projects in Kenya and those divided into twenty-five (25) categories. Also, the study identified the top 5 delay causes such as delay in client payment, client bureaucracy, and slow decision making, claims, and planning issues of the construction project.

According to Pourrostan and Ismail (2012) identified 28 delay causes in Iranian construction projects. According to the research study stated that the significant causes of delays due to payment delayed by the Client to the contractor, client-initiated variations, and latency of decision-making by the Client.

The research study carried by Mahamidl, Bruland, and Dmaidl (2012) found the causes of delays affect due to the Client decided to award the contract to the lowest bidder, and delay payments to the contractor.

Odeh and Battaineh (2002) found that causes of delays for a traditional contract in Jordan due to the owner's interference and issue variation, financing issues, and Client's slow decision making during the construction period.

The research followed by Mansfield, Ugwu, and Doran (1994) found significant causes of delays in Nigerian construction due to the client delay payment to the contractor's completed works.

Chan and Kumaraswamy (1997) found that the cases of delays affect project performance due to client-initiated variation and slow decision-making during the construction.

According to the research study carried out by Frimpong, Oluwoye, and Crawford (2003) concluded that the client delay in monthly payments to the constructor in Ghana construction project.

The research study conducted by Assaf and Al-Hejji (2006) identified that the leading causes of delays affected due to client issue change orders and delay payment to the contractor in Saudi Arabian construction project.

The research study carried out by Al - Momani (2000) found a delay due to the designer and changes by the client" during the construction.

The researches carried out by Desai and Bhatt (2013), and Assaf and Al-Hejji, (2006) identified the cause of delays in the construction projects. They identified the cause of delays due to the owner, and his representatives delayed payment to the contractor, possession to the site, unavailability of incentives for a contractor for finishing ahead of schedule and the Client issued change orders throughout the construction period.

The study carried out by Umasankar et al. (2006) concluded that construction delays caused to large housing projects in India. They identified that the main reasons for delays due to slow client decision-making and late issuance of the interim payments to the contractor.

Frank and Fugar (2010) identified delays in construction projects in Ghana due to the financial group, and they delayed in the preparation of payment certificates to the contractor, and difficulties in gaining access to credit.

The major causes of delays identified the research study conducted by Megha Desai, and Rajiv Bhatt (2013) found the project delays due to the owner delayed in contractor's payment, design changes by the owner or his agent during construction and partial payments during construction.

The research conducted in Malaysian construction by Sambasivan and Soon (2007) recognized significant causes of delays due to the Client faced the problem to pay finished work by the contractor.

Chan and Kumaraswamy (1997) conducted a study in the Hong Kong construction industry they identified common causes of delays happen to impact on project completion due to the Client initiated variations, slowness in decision making by all parties (Client, consultant as well as the contractor).

The research study carried out by Abdel-Hakam (2016) in the Egypt cases of delays occurred due to the client slowness in decision making relating to issues that happened in the construction of the project.

Eman, Farrell, and Abdelaal (2015) conducted the research study in Qatar Large building constructions, and they found significant causes of delays related to the client slowness in making decisions, the issuance of change orders and changes in project scope.

A significant cause of delays in construction projects with the traditional type of contracts the researches Odeh and Battaineh (2002) explained from the perspective of responsible parties' contractors, Client, and consultants. "The results of the research study showed that the owners and advisers who agreed to interfere with ownership faced financing issues and delays payments to the contractor and slow decision-making to resolve the issue in construction.

Ravisankar and Ananad (2008) carried out the research study identified significant causes of delays affected to the project performance due to the design changes made during construction by the owner and his / her employee and delay in financial support by the owner to the contractor.

Further S.M.S. Samarakoon (2009) found that causes of delays in Sri Lanka significant cases of delays due to the Client faced an issue with finance arrangement and delayed payment to the contractor.

2.6.3 Causes of delays in the consultant perspective

Daniel (2014) found in the study of delays in Ghana construction projects and identified consultant delays for instructions.

Jurf and Beheiry (2012) found a delay caused due to the consultant changed the design in the residential compound project in Qatar.

A research study carried out by James et al. (2014) found significant reasons for the delays due to the consultant changed the drawings and lack of communications. Also, the study identified insufficient consulting facts and slow decision – making by the consultant.

A research study carried out by James et al. (2014) identified causes of delays due to problems in contractual documents.

The research study carried out by Ren, Tout, and Jones (2008) identified the five most critical delaying causes for the consultant include approval delays, inadequate drawing, imperfect contract documents, modifications to designs and drawings and long inspection processes.

Also, the research carried out by Odeh and Battaineh (2002) found the consultant delay in evaluation of payments applications and slow decision making during the construction.

The research carried by the Durdyev, Omarov, and Ismail (2017) identified delay causes in Cambodia residential projects the most critical cause of delay changes in design by the consultant.

According to Pourrostan and Ismail (2012) identified significant delay causes in Iranian construction projects due to consultant delayed design finalizing, problems, and inappropriate design documents.

Also, Assaf and Al-Hejji (2006) followed the research study in Saudi Arabia found that the leading causes of delays due to the consultant delay recommendation to the contractor's payment.

Nominee, Wachirathamrojn, Tantichattanont, and Sittivijan (1999) found that delays caused to all parties engaged in projects and causes of delays effect to the project performance due to the issue of incomplete drawings and consulting and contracting deficiencies, and differences among consultants.

The research study carried by Al - Momani (2000) found a delay due to the insufficient evaluation practices followed by the consultant and delayed approvals process.

The researches carried out by Desai and Bhatt (2013), and Assaf and Al-Hejji, (2006) identified the cause of delays affected to the project due to the consultant delayed revising and approving design documents, Late approval of shop drawings and samples of material, slow process of decision making and poor communication with contract parties.

The study for the broader housing project in India, Umasankar et al. (2006) found that construction delays caused due to the consultant delayed issue of the drawings/detail.

Also, A. Sullivan and F. C. Harris, (1985) carried out the research study and identified factors affect to the project performance reason to the consultant having lack of processing expertise.

Emam, Farrell, and Abdelaal (2015) conducted the research study in Qatar Large building constructions, and they found significant causes of delays occurred due to the consultant issued document having discrepancies between specification and drawings, delays in finalizing claims, unrealistic project duration estimate. Furthermore, the study found that delay caused due to the consultant inadequately studied technical bids during the tendering stage, delays in the resolution of design problems and the issuing of drawings.

The research carried out by Al - Barak (1993) found that the causes of delays are severe factors caused by the consultant changed design during construction.

Several studies (Alhomidan, 2013; Desai & Bhatt, 2013) concluded causes of delays occurred due to the consultant prepared an inappropriate design; they changed design during construction, mistakes in design, late inspection, late design works, late approval, insufficient inspectors and incapable inspectors involved in the construction.

2.6.4 Causes of delays due to external factors

According to Jurf and Beheiry (2012), delay factors caused to cost and schedule overrun in the residential compound projects at Qatar between the years 2000 to 2005 due to a delay in material from outside the country.

Sambasivan and Soon (2007) found that the causes of delays affected the project due to a shortage of material, labor supply, shortage of equipment, and failure Lack of communication between parties. Mistakes during the construction stage.

Research carried out by Apolot, Alinaitwe, and Tindiwensi (2013), twenty-two delays in public sector construction in Uganda inflation, and the rate of interest were the key two causes for delays or excess costs identified in the research.

According to research carried out by Mansfield (1994) found sixteen (16) significant factors that caused delays and cost overruns in Nigeria. The study identified that one of the causes of delay is material shortages and overall price fluctuations.

According to the research study carried out by James et al. (2014) identified causes of delays due to bad weather and fluctuation of prices as external factors.

According to Chan and Kumaraswamy (1997), the research study identifies factors that cause delays affected due to unforeseen ground conditions in the Hong Kong construction project.

The research carried by the Durdyev, Omarov, and Ismail (2017) "identified project complexity and effect due to rain.

The research followed by Pourrostan and Ismail (2012) identified the causes of delays in Iranian construction projects due to adverse weather conditions.

The research study carried by Mahamidl, Bruland, and Dmaidl (2012) recognized causes of delays by contractor and consultant and the most critical causes of the delay identified as the political condition of the country.

The research study carried by Mahamidl, Bruland, and Dmaidl (2012) found that the causes of delays effect due to equipment shortfall in the market. Also, the research carried out by Mansfield, Ugwu, and Doran (1994) found that causes of delays affect the project performance due to material shortage and fluctuation in prices.

According to the research study followed by Chan and Kumaraswamy (1997) found that unforeseen site conditions effect to project in delays.

According to Frimpong, Oluwoye, and Crawford (2003) concluded that the price escalation and groundwater are essential causes of delays effect on projects in Ghana. Also, a research study carried by Frimpong, Oluwoye, and Crawford (2003) concluded that the significant causes of delays affect the project performance due to the groundwater in Ghana construction project.

Assaf and Al-Hejji (2006) followed the research study in Saudi Arabia found that the leading causes of delays changes in state regulations, social and cultural site limitations, and traffic control effect to the project performance.

Nominee, Wachirathamrojn, Tantichattanont, and Sittivijan (1999) found that delays caused to all parties engaged in projects and significant causes effected due to Subcontractor inadequacy.

The research carried out by Al-Barak (1993) found that the national slump in the economy is the severe factors cause to delay in the project performance.

The study carried out by Frank and Fugar (2010) found that the project's delays due to price fluctuation and shortage of material affected in Ghana construction projects.

The research conducted in Malaysian construction by Sambasivan and Soon (2007) recognized significant causes of delays due to the materials and labor shortage in the construction industry.

In the Hong Kong construction industry, Chan and Kumaraswamy (1997) found common causes of delays significant impact on project completion due to the unforeseen ground condition.

The Iyer, Chaphalkar, and Joshi (2008) contained in the study that the causes of delays effect to the project performance reasoning to weather conditions and unavailability of resources.

The causes of delays recognized in the research study conducted by Aziz and Abdel-Hakam (2016) in Egypt construction significant effect to the project due to an adverse weather condition, construction material storage, labor shortage, materials delivery delay and equipment shortage in the construction industry. Also, A. Sullivan and F. C. Harris, (1985) carried out the research study, and they identified factors that affect the project performance reasoning the consultant having lack of processing expertise. Also, A. Sullivan and F. C. Harris, (1985) carried out the research study and identified factors affect to the project performance reason to raw material supply difficulties, and problems with customs/import at entry points in the country, competitive shipments of one-off items, and long lead items.

Emam, Farrell, and Abdelaal (2015) conducted the research study in Qatar Large building constructions, and they found significant causes of delays happening due to delays in the delivery of material.

The research carried out by Al - Barak (1993) found that the causes of delays are severe factors caused by a national slump in the economy. The project time overrun due to the resource shortages in construction.

The research studies conducted by Yasemin Nielsen et al., (2013) found causes of delays in Turkey construction project caused due to the fluctuation of prices, and the complexity of the project.

Ravisankar and Ananad (2008) carried out the research study identified significant causes of delays in overall research results reasoning to high expectations for working teams, geological problems on-site and adverse weather conditions or natural disasters.

Further S.M.S. Samarakoon (2009) found that causes of delays in Sri Lanka significant cases of delays due to labor shortages in the construction industry.

2.6.5 Causes of delays due to government impact

Iyer, Chaphalkar, and Joshi (2008) contained in the study that the causes of delays effect to the project performance reasoning to government law and regulations changes in the state.

The research conducted by Osei and Adjei-Kumi (2009) identified that government-related delays affect to obtain permits from Local Authorities and lack of transparency with permit acquisition cost.

2.7 Summary of identified causes of delays

According to the above-recognized causes of a delay from earlier researches as well as other documents in different places around the world, they have identified a hundred sixteen (116) number of causes of delays.

Those (116) cases of delay among analyzing, there is total forty-four (44) number of common causes of delays identified with relatively responsible parties and a particular type of delays summarised in Table-2. Below identification reference, provide a label of Type of Delays, and concurrent delays are not available in the identified causes of delays list in the table. Concurrent delays depend on the two or more delay events caused by the client or his representative and contractor in the same period.

- Excusable delay as Compensable Delay- Type 1
- Excusable but Non-Compensable Delay-Type 2
- Non-Excusable Delay- Type 3
- Concurrent Delay

Table 2- Summary of Causes of Delays

No	Causes of Delays	Reponsible Parties	Type of Delays
1	Client initiated variations, additional & change orders	Client	Type 1
2	Client's slow decision making and improper planning	Client	Type 1
3	Poor communication and coordination by owner and other parties	Client	Type 1
4	Delay to furnish and deliver the site to the contractor by client	Client	Type 1
5	Delays in nomination of sub-contractors and suppliers by client	Client	Type 1
6	Financial issue and payment delay by owners for completed works	Client	Type 1
7	Incorrect site information by client	Client	Type 1
8	Lowest bid awarding	Client	Type 1
9	Suspension of work by owner cause delay.	Client	Type 1
10	Unrealistically estimation of contract period given by client	Client	Type 1
11	Consultant delays for instructions, approvals	Consultant	Type 1
12	Delay in approving design, shop drawings and sample materials by consultant	Consultant	Type 1
13	Delay in issuing change orders	Consultant	Type 1
14	Imperfect documents in the contract by consultant	Consultant	Type 1
15	Long inspection procedures or late inspection by consultant	Consultant	Type 1
16	Specification and drawing changes by consultant	Consultant	Type 1
17	Accidents during construction	Contractor	Type 3
18	Bad decisions in regulating company's policy	Contractor	Type 3
19	Contractor's financial difficulties and liquidation	Contractor	Type 3
20	Contractor's less experience	Contractor	Type 3
21	Contractor's low overall productivity	Contractor	Type 3
22	Contractor's poor site management	Contractor	Type 3
23	Delays from sub-contractors and nominated suppliers	Contractor	Type 3
24	Inadequate technical performances	Contractor	Type 3
25	Ineffective planning and scheduling of project	Contractor	Type 3
26	In-proper technical study carried out during bidding stage	Contractor	Type 3
27	Insufficient labours on site and skilled labours	Contractor	Type 3
28	Mistakes by the contractor during construction	Contractor	Type 3
29	Organization that lacks sufficient resources	Contractor	Type 3
30	Poor contract management	Contractor	Type 3
31	Poor risk management and supervision	Contractor	Type 3
32	Rework due to errors during construction	Contractor	Type 3
33	Wrong selection of type /capacity of equipment	Contractor	Type 3
34	Bad weather conditions /natural disasters (flood, earthquake)	External	Type 2
35	Complexity of project	External	Type 2
36	Inadequacy of sub-contractors	External	Type 2
37	Inflation and interest rate	External	Type 2
38	Lack of transparency with permit acquisition cost	External	Type 2
39	Overall price fluctuations	External	Type 2
40	Political condition	External	Type 2
41	Shortage in material, labour supply, equipment availability	External	Type 2
42	Unforeseen ground condition	External	Type 2
43	Government law and regulations	Government	Type 2
44	Government-related delays include delays in obtaining permit from local authorities	Government	Type 2

2.8 Grouped into identified causes of delays

Yeats (2007) developed a decision support system (DAS) for delay analysis in construction projects. That considered factors like shortage of equipment, external delay, labor, material, owner, contractor, management, subcontractor, and adverse weather condition.

The research study conducted by Terry (2013) identified standard methods currently available for the evaluation of extension time for delays to the major projects and problems relating to such evaluation used a causal mapping network, and the system dynamics approach used to study project impacts of delays.

The cases of delays recognized from those of the review of the literature discussed above-recognized causes grouped into various ways following a few of the responsible project parties and some based on the nature of the causes of delays without all of the parties involved to the project. Further, the study conducted by Ren, Atout, and Jones (2008) identified fifty-three (53) numbers of causes of delay in the research and found root causes for project delays in Dubai grouped under the main three categories like to, consultant, client and contractor related factor.

According to the study conducted by Mahamidl, Bruland, and Dmaid (2012) identified the total of fifty-two (52) numbers of delay causes recognized those grouped into eight categories such as; project, owner, material, and equipment, labors, external, design, contractor and consultant.

The research carried out by Mahamidl, Bruland, and Dmaid (2012) recommendation decided to focus on project parties like the owner, the consultant, the contractor, and the government. Base on the study identified a total of twenty-eight (28) numbers of causes of delay namely categorized into eight groups such as; factors related to external, client, consultant, contractor, labor and equipment, material, contract, and contractual relationship. The research-based on a questionnaire survey distributed to a hundred (100) contractor representatives and fifty consultants

Similar research carried out by Marzouk & El-Rasas (2014) found that the delay caused in Egyptian constructions there are forty-three (43) causes of delays were recognized under seven groups namely; related to the consultant, owner, material, external, project, contractor, and equipment related. Also, Aswathi and Thomas (2013): & Al-Barak (1993) stated that the most responsible party for the delays in construction projects are a contractor instead of consultants and owners.

According to Ogunlana and Promkuntong (1996) found delays in Thailand construction projects faced problems with there developing economies and identified the cause of delays Shortages/inadequacies in industry infrastructure (mainly supply of resources), Caused by clients, consultants, and contractor’s incompetence.

Kaming, Olomolaiye, Holt and Harris, 1997 they found that in the study, two different sets of factors influenced differently for cost and time overruns. Material costs increase due to inflation, inaccurate material estimates, and degree of complexity affected factors influenced to cost increases.

The research study carried out by Chan and Kumaraswamy (1997) categorized the attributes into the groped by splitting the project owner, contractor, consultant, design, material, equipment, labor, and external related factors. Although they identified, many of the factors are interlinked and have a relationship with the cause and effect of delays. Table 3 shows the delay causes that the client has identified through the various investigations that the researchers have followed.

Table 3- Causes of Delays Related to Client

Party	Sr.No	Causes of Delays	No of Reference
Client	1	Client-initiated variations, additional & change orders	23
	2	Client’s slow decision making and improper planning	12
	3	Poor communication and coordination by owner and other parties	6
	4	Delays in contractor’s payment by the owner	12
	5	Delays in the nomination of sub-contractors and suppliers by the client	2
	6	Financial issue and payment delay by owners for completed works	9
	7	Incorrect site information by the client	2
	8	Lowest bid awarding	1
	9	Suspension of work by owner cause delay.	3
	10	Unrealistically estimation of the contract period given by the client	2

The Consultant responsible delay causes identified by following the above literature review, and Table 4 shows these causes of delays related to the consultant.

Table 4- Causes of Delays Related to Consultant

Party	Sr.No	Causes of Delays	No of Reference
Consultant	1	Consultant delays for instructions, approvals	2
	2	Delay in approving shop drawings and sample materials by consultant	11
	3	Delay in issuing change orders	1
	4	Imperfect documents in the contract by consultant	12
	5	Lengthy inspection procedures or late inspection by a consultant	3
	6	Specification and drawing changes by consultant	1

The Contractor responsible delay causes identified by following the above literature review, and Table 5 shows these causes of delays related to the contractor.

Table 5- Causes of Delays Related to Contractor

Party	Sr.No	Causes of Delays	No of Reference
Contractor	1	Accidents during construction	3
	2	Bad decisions in regulating the company's policy	2
	3	Contractor's financial difficulties and liquidation	13
	4	Contractor's less experience	4
	5	Contractor's low overall productivity	3
	6	Contractor's poor site management	20
	7	Delays from sub-contractors and nominated suppliers by the contractor	5
	8	Inadequate technical performances	1
	9	Ineffective planning and scheduling of project	15
	10	In-proper technical study carried out during the bidding stage	2
	11	Insufficient labours on site and skilled labours	4
	12	Mistakes by the contractor during construction	4
	13	An organization that lacks sufficient resources	3
	14	Poor contract management	1
	15	Poor risk management and supervision	2
	16	Rework due to errors during construction	5
	17	Wrong selection of type /capacity of the equipment	3

The External factors of delay causes identified by following the above literature review, Table 6 shows these causes of delays related to external forces.

Table 6- Causes of Delays Related to External Forces

Party	Sr.No	Causes of Delays	No of Reference
External	1	Bad weather conditions /natural disasters (flood, earthquake)	7
	2	The complexity of the project	2
	3	Inadequacy of sub-contractors	3
	4	Inflation and interest rate	2
	5	Lack of transparency with a permit acquisition cost	1
	6	Overall price fluctuations	6
	7	Political condition	1
	8	· Shortage in material, labour supply, equipment availability in the market	13
	9	Unforeseen ground condition	1

Table 7 shows the Government causes to delay projects related to government action or fault.

Table 7- Causes of Delays Related to Government

Party	Sr.No	Causes of Delays	No of Reference
Government	1	Government law and regulations	2
	2	Government-related delays include delays in obtaining a permit from local authorities	1

2.9 Causes of delays effect to project performance

The research conducted by Jurf & Beheiry (2012) found delay factors causing cost and schedule overrun in the residential compound projects at Qatar between the years 2000 to 2005. The study carried out by Murali et al. (2007) found there are six main effects of delays named, time overrun, Cost overrun, Disputes, Arbitration, Litigation, Total abandonment.

According to the study carried out by Alaghbari et al. (2007) identified many causes affected due to a contractor's downfalls. A contractor is liable to delay damages when he delays finishes work later than the Owner accepted early completion of work but is still ahead of the official contract completion date.

The similar result observed by the K. L. Ravisankar et al. (2008) identified the significant problem during the implementation of the central sector projects, time, and cost overruns. Also, Aibinu et al. (2002) identified effects due to delay in the Nigerian construction sector and concluded time and cost overrun due to causes delay contributed by the contractor.

According to research carried out by Mansfield (1994) found sixteen (16) significant factors that caused delays and cost overruns in Nigerian building construction work.

External factor also affected to cause of delay identified in the study conducted by Kaming et al. (1997) and factors of influence examined thirty (31) high - rise project in Indonesia often occurred problem affected that overrunning costs than time overruns. Similar results identified in the research study conducted by the Kikwasi, G.J (2012) concluded that similar delay causes effected to cost overrun, negative social impact, idling resources, and dispute happen in the construction project.

According to the research study conducted by Tushar et al. (2016) found that issues with the delay caused to disputes, overrun the cost, overrun the time total desertion negotiations, litigation, legal proceedings, and abandonment. Due to these problems, the project members are also competing for cost overruns and additional time due to the constructing delays. There are different consequences of delays for each project participant, based on the type of project. The global impact is overwhelmed with cost and time, and the owner/client delay is the loss of money, loss of time, and other facilities. For the contractor, the delay means the loss of wealth for more expenditure on equipment's, other materials, and for hiring skilled labor.

A research study conducted by James, et al., (2014) identified effects due to these delays affected as time overrun, cost overrun, wastage, drop-down client's capital, disputes, abandonment of the project, reduce profit, litigation, and arbitration between the project involved parties.

Similar results identified by Aibinu and Jagboro (2002) and the revealed six delay impacts on the project delivery of time overruns, costs overruns, disputes, arbitration, total abandonment as well as litigation in the Nigerian construction industry.

According to Alaghbari et al. (2007), "identify the most common causes of delay in construction projects affected cost overrun and build high risk in the construction of the project.

Also, the result identified in the research conducted by Abedi, M., Fathi, M. S. and Mohammad (2011) found six significant effects of delay in construction projects included time overrun, cost overrun, dispute, arbitration, total abandonment, and litigation in the construction of the project.

Murali and Yau (2016) identified the effects of significant delays as time overrun, cost overrun, dispute, arbitration, litigation, and total abandonment. Furthermore, Manavizha and Adhikarib (2002) studied how the material causes associated with the causes of delays and identified effects likely cost overrun in Nepal's construction projects.

According to Alaghbari et al. (2007) "identified causes of delay generate claims from both the contractors and sub-contractors where issues may extend to lengthy court procedures with substantial financial losses.

Also, the research study conducted by Assaf and Al-Hejji (2006) and they found the changes in order and that around 70% of the projects overrun in time due to the most common reason of the delays.

The research conducted by Pourrostan and Ismail (2012) and They found that complete abolition, overrun time, disputes, arbitration, overrun costs, as well as litigation. The most adverse effects of costs overrun and time overrun by respondents both from consultants and contractors due to the causes of delays.

According to Chileshe and Berko (2010) identified the causes of delays effect to cost overrun in the Ghanaian road construction sector.

According to Chan and Kumaraswamy (1997) found there linked between the consultant-related and client-related causes effected to time overruns in construction projects in Hong Kong.

The research study carried out by Frimpong et al. (2003) stated that linked the client-related, consultant-related, and materials-related factors affected to cost and time overruns. Further, the study conducted by Nishani (2018) stated that the contractor needs to claimed by analyzing Extension of Time (EOT) due to the contractor faced the issue with the client delays effected to time overruns the contractual finished-date. otherwise, he will find himself subject to LDs for reasons within the client's control, not within his control."

Koushki and Kartam (2005) concluded that time and cost overrun due to the impact of the material selection time," their availability in local markets and also the presence of the supervisory engineers.

Cushman, Holiday, Coppi, and Fertitta,(1996) "found the contractor delayed in any event by causes within its control, that is, if there were a concurrent non-excusable delay. The general rule is that it would be inequitable to grant the contractor either an extension of time or additional compensation that held in the case of *Klingensmith Inc. v. the United States*. On the other hand, when the Owner and contractor concurrently delay the work, and responsibility for the delay cannot apportion, the contractor is generally not liable for liquidated damages. As job conditions change, this baseline has updated.

According to the research study carried by Kikwasi (2012) found the project delays affected the time and schedule of the work." Likewise, time overtook; the cost exceeded, the social impact of these delays is negative; the resources are inoperative and disputes.

Haseeb, Xinhai-Lu, Aneesa Bibi, Maloof-and-Dylan, and Rabbani (2011) identified as a clash effected between the party's relationship, raised the claim, full desertion the impacts due to delays in Pakistan's construction industry and a slowing in constructing sector growth.

In accordance with the research study followed by Ramabodu and Verster (2010) Identified critical factors affected on cost overruns in construction projects due to changes in the scope of the project's work, incomplete design on tenders, contractual claims (EOT with cost), lack of fund scheduling and monitoring, delays in costing variations and additional works.

The research study conducted in Irish Construction Industry by Annual (2007) It defined the fact that the contractors spend small amounts of time, money and effort in implementing first procedures as well as record-keeping at the beginning of a contract. Also, the mechanism could eventually save considerable time, money, and effort at the end of the contract to recover, loss, and expense arising from a delay and contract disruption. The study stated that designers and clients are the primary sources of delays, while both client and consultant specified the contractor and materials cause as sources of delay.

According to the research study carried by Samarakoon (2009), stated that the most damaging effect or delays identified as cost overrun in construction projects in Sri Lanka. Other adverse effects recognized as time overrun, disputes, and Arbitron. Further, the study stated that increasing emphasis on tight contracts, using the prime contractor relationship to pass time-risk him, and frequently with massive liquidated damages (LDs) for lateness.

According to Chileshe and Berko (2010) identified the causes of delays effect to cost overrun. The study concluded that there exist many causes of delays and disruptions, and their effects put construction projects at high risk that affect the performance of the project.

2.10 Summary from Causes of Delays Effect to Project

Deferent researches conducted by the researchers in deferent places of the world they have identified effects to project performance due to the described cases of delays. Most of the researches identified significant effects to the project performance and overrun the cost and time.

The research conducted by Samarakoon (2009) identified the cost-overrun is the damaging effects in the Sri Lankan construction projects due to delays, and the study recognized other adverse effects as time-overrun, disputes, and Arbitration. Also, other researchers identified similar impacts due to the causes of delays during their studies.

Also, “below Table 8 shows the summary of these effects identified from the above literature reviews.

Table 8- Major Effects of Delay Causes

Sr.No	Effects of Delays	No of Sources of Reference
1	Time overrun	15
2	Cost overrun	19
3	Disputes	10
4	Arbitration	7
5	Litigation	6
6	Total abandonment	6
7	Negative social impact	3
8	Idling resources	3

CHAPTER 3 - REMEDIES FOR REDUCE DELAY

3.1 Industry standard to get involved professionals in delay analysis

Construction projects occurred run into a delay, whereas a result of the contractor default, employer default, or external factors control of either party and delays claim became extremely complicated (Herbert Smith Freehills LLP, HSF,2011).

The construction project involved parties' views of the contract changes out of economic necessity, and the contract procured as per there results. Also, parties view change for a verity of other reasons considered into the project procurement. The party's views changed due to a wide range of reason, including client-initiated variations, unforeseen ground conditions, strikes, inflation, material shortage, adverse weather condition results caused by the incompetence of the contractor, consultant, client, and these changes create a dispute and or conflict in a construction project. If the parties intended to clear, then any changes regulated by the inclusion of the provision within the contract. In the professional perspective said that the contract is the essential document for avoiding disputes which include necessary basic elements (Peter and Paul, 1999).

However, if inappropriate terms considered in the contract documents, it becomes more complicated to reduce disputes. The contract itself does not create conflict, only the parties to the contract or their adverse. Even contracting parties follow contract requirement conflict does not arise, and the contract reflects the requirement of the parties to seldom do in practice. The reason for that the use of a standard form of contract parties misunderstanding and misinterpretation of its meaning, because of changing the perception of the participants (Peter and Paul, 1999).

According to the SCL (2002), which guided in the law and construction industry practices to participants in the international set out good practice rather than best practice, the amendment to the protocol stated the parties and the contract administrator need to comply with the contractual requirements relating to notice,

particulars, substantiation, and assessment about the delay. In the event, if the contractor complied with his contractual obligation and delay relating to the employer's delay, the contractor applies an extension of time (EOT) and compensation. Subjected to the Contract requirements, the employer grants to the extent that the employer risk event is reasonably predicted to prevent the works being completed by then prevailing contract completion date which based upon an appropriate delay analysis and derived conclusion which from a common-sense perspective. Further, the protocol stated that " however, whatever the contract says, the contractor should give the notice to the contract administrator which includes the Engineer, Project manager, and Employer, of any employers delays as soon as possible, also CA should notify the Contractor as early as possible of any employers delays."

With referred to above literature provides the construction industry on how to deal with the delay, and professionals have to follow the procedures to manage during the project execution.

Sweis, Hammad, and Abu (2008) identified the importance of early identification of construction delays and the development of significant delay-reducing remedies. Braimah (2013) found many methods and techniques developed over the years to understand or analyze delay in the construction industry.

The research study conducted by Shi, Cheung, and Arditi (2001) stated that even the simple project it is challenging to analyze delays following a large number of individual activities that are involved them.

According to the research study carried out by Ravisankar et al. (2008) described remedies for minimising delay causes affected to minimise the time-overrun in projects as a result of that reduced the cost-overrun of the projects by doing close monitoring, timely resolution of problems and follow systems improvement implemented by the Ministry of Statistics & Programme.

The many literature resources available in journals, articles, and books to manage this complexity in construction delays as well as introduced many techniques (Yang, Kao, and Lee, 2006).

The research focused on the awarding of contracts with duties and responsibility discharge based on the contract. As per professional obligation described under the contract, remedies require to find in the construction industry to that quantitative technical approach carried out in the research study.

3.2 Disputes resolution method for disputes relating to the delay

In the Society of Construction Law Delay and Disruption Protocol (SCL, 2017) stated that delay and disruption issues that manage within the contract, all too often become disputes that decide by the third party which is available in the industry as a dispute resolution method of adjudicators, dispute review boards, arbitrators or litigation. The number of such cases substantially reduced by the introduction of a transparent and unified approach to the understanding of programmed works, their expression in records, and the allocation of responsibility for the consequences of delay and disruption events.

With referred to above, SCL (2017) stated guidance if the delay becomes dispute alternative dispute method available in the construction industry, which sorts out while continuing execution of the project instead of following litigation action. Most of the standard form of contract, for instance, FIDIC (1999) situated clause for alternative dispute resolution method as arbitration, which includes in the signed contract. Therefore, professional involved in the building construction of they need to aware of the resolution method adapt to the contract and delay issue solve within the contract without court procedural.

3.3 Remedies for contractor's perspective to avoid delay

Mahamidl, Bruland, & Dmaidi (2012) recommended remedies for contractors including recruit enough and well-skilled staff, improve the skilled labor and productivity, well plan the finance, provide sufficient equipment, and improve communication.

The research conducted by Seboru (2015) recommended to the contractor improve planning considering the rainy days with other unaffected activities due to rain.

Mansfield, Ugwu, and Doran (1994) suggested solutions to the contractor prepare suitable material planning, maximize the utilization of local materials as well as implement labor-intensive programs.

The recommendation provided by Jurf & Beheiry (2012) the study highlighted that the contractors to advise the clients about potential risk on cost and expected time to complete and to obtain explicit quotations for material and equipment and make an agreement on delivery schedules in order to minimize delays in construction projects.

According to the study conducted by Marzouk and El-Rasas (2014) recommended to the Contractors to develop and establish an extensive financial plan, appropriate supply-chain-management, appoint experienced subcontractor and keep improving site management.

Furthermore, Sambasivan and Soon (2007), recommended to contractors designate suitable site managers with having a satisfactory experience, do proper planning and scheduling the work, and arrange proper finance as per project plan.

According to Chan & Kumaraswamy (1997) suggested to reduce and avoid potential future delays to the contractor improve contractors site management and monitoring, improve modern, technical and management level of knowledge through the introduction of continuous professional/career development (CPD) programs, review

site conditions appropriately with design drawings, improve communication of information among parties and formulating variation minimization tactics/strategies.

The research study conducted by Murali and Yau (2006) proposed remedies that the contractors' perceptions, for Instance; Contractors who do not have enough expertise should not take up the job. Suitable site managers should be able to perform work smoothly; contractors should appropriately plan their work, and contractors must make sure they have sound financial backing.

The research conducted by Pourrostam and Ismail (2012) suggested remedies to the contractors in maintaining better finance, developing human resources as well as proper procurement scheduling during the construction period.

Durdyev, Omarov, and Ismail (2017) carried out the research suggested and evaluated improvements to contractors to minimize project delays in on-time delivery of materials, improvement in coordination and the development of realistic work plans, provide workforce education and training, the use of foreign labor, monitor employees with electronic technologies, plan other activities during rainy seasons. Also, explained select best subcontractors to work, reduces accidents and trains workers in terms of health and safety regulations in order to improve site conditions.

In the Irish Construction Industry, the research carried out by Annual (2007) mentioned that reliable records and procedures minimize or avoid disputes in the construction of the project. It ensured that the contractor has evidence to prove his claim in cases where the claim becomes a dispute. Daily logs or progress reports must maintain under contract management/administration plans or contracts themselves frequently provide early warning indicators for possible changes and delays or other issues with the performance of contractors. It has thus stated that somehow the representative of the contracting officer (COR) or the technical representative of the contracting officer (contractors / COTRs) may initiate written reports identifying potential or actual delays in performance.

Logistics Management Institute Federal Acquisition Institute (LMI), Centre for Public Administration (CPA) (2000) disclosed that the Contracting Officer had not taken sufficient time to take necessary actions and with a specific recommendation for action. The 'Contractor's Contract Administrator (CA) should prepare a proper program to reduce the number of disputes relating to delay, showing the manner and sequence in which, the contractor plans to carry out the works.

The report of the society of construction law delay and disruption protocol (SCL, 2002) stated that the program needs to update real record progress as well as any extensions of time (EOT) approvals. The program can then be used as an instrument to manage change, determine EOTs and compensation periods. Contracting parties should also reach an explicit agreement on the type of records that should keep maintained.

The research study carried out by Othman, Sani, Agus, and, Mohamed Alias (2014) recommended minimizing the project delays in a private housing project. The recommendations provided remedies to the contractor in proper planning before the commencement of the project, approval, and confirmation of design concepts, construction drawings, and materials selections. Also, the study concluded the logistic planning required before construction and communication improvement. For Instance, regular & fruitful meeting and site walk with relevant parties in order to solve the problem in time, effective control and monitoring of site workers to improve productivity.

The research study conducted certain giddiness to the local construction industry in Sri Lanka by S.M.S. Samarakoon (2009) recommended that the remedies ensure that to set realistic time targets whereas efficient management, financial management, and material procurement are major regions about contractor management.

3.4 Remedies for client's perspective to reduce delay

Mahamidl, Bruland, & Dmaidi (2012) recommended for government included; conduct training programs for all the contractors, take a risk when donors delay the dibs and modify Laws and regulations to meet latest requirements. Recommendations for project owners to allow sufficient time for tender preparation and submission, on-time payments to contractors, check resource availability before awarding the contracts for lowest bidders, prepared proper detailed site investigations before awarding the contract in order to avoid future variations and improve the communication and coordination between parties.

Alinaitwe, Apolot, and Tindiwensi (2013) followed research to determine the causes of delays in Uganda and suggested measures to improve the scope of project management and improve relations between parties in order to reduce future delays following a collaborative approach.

Seboru (2015) conducted the research study recommended minimizing the project delays by improving the client's financial status, including payment guarantee clause in order to that the contractor can demand his payment from the guarantor.

Mansfield, Ugwu, and Doran (1994) suggested solutions to allow the adequate client time for a feasibility study and to arrange the project brief, program, and preparation by competent and qualified staff. Customers must ensure adequate funding and proper financial planning before starting a project. Promoting the public finance of the private sector and introducing procurement methods such as BOOT (Build-own-operate-transfer).

The research study carried out by Marzouk and El-Rasas (2014) recommended solutions to the client set the practical duration of the project, allow enough time to carry out feasibility studies and extensive financial plans, obtained essential authorization permit and enough funds for such approvals, select an experienced consultant, prepare appropriate tendering documents, on-time contractors payments and appoint experienced contractors.

Odeh and Battaineh (2002) suggested solutions to the client introduce an intensive early completion mechanism and implementing liquidated delay damage clauses. Also, the solutions stated that “classify craftsmen and develop human resource by conducting trainings, develop tender award system with giving high weight to past performances and capabilities by giving less weight for the tender price and adopt new procurement method like construction management and design-build to minimize future delays.

The research conducted by Murali and Yau (2006) divided the prescriptions between adopting into three groups:

- i. Prescriptions for the clients
- ii. Prescriptions for the consultants
- iii. Prescriptions for the contractors.

Clients must perform prescriptions while selecting the contractors; clients must ensure that contractors are not chosen only based on the lowest bid, the select contractor should be adequate experience, technological capacity, financial capacity, and sufficient workforce to carry out the project. The clients should not often interfere with the execution of the project and continue to make substantial changes to its requirements. These cause excessive delays in the project; the clients must be able to pay the contractor finance on time after the work completed. In order to payments made in line with the schedule, clients should cooperate closely with the funding bodies and institutions, and clients should make quick and smart decisions to resolve problems arising in their execution.

Sambasivan and Soon (2007) recommended mitigation methods highlighting to the owners the contractor selection should not only have based on the lowest bid, and it should consider the experience, technical capacity, workforce capacity, and financial capability. Also, they suggested that during the construction period, the client should not make significant modifications as well as interfere with construction every time, ensure enough money availability to on-time payments and take decisions quickly when problems arise execution of the project.

The research conducted by Pourrostan and Ismail (2012) highlighted to project owners' recommendations to minimize or avoid delays by improving the process of client payment, appointing appropriate project managers, proper planning of procurement schedule, completing pre-design inexactly as soon as possible to avoid future changes and use pre-conceived experts.

The research study conducted by Sullivan and Harris (1985) stated that the management needs to mitigate the effects of fragmentation and specialisms by adopting a project strategy that will combine the skills of individuals and groups from contributing organizations. In order to have the best balance of resources available at the right time. The client's point of view, they should develop a strong management team for large projects which involved many contractual agreements, and only the client can view the project in its entirety.

Also, the research carried out by Othman, Sani, Agus and, Mohamed Alias (2014) described that New rules and regulations (District Office) established and transmitted as quickly as possible to developers/contractors to inform them of changes to the rules and regulations. The client shall adhere to the original plans and shall allocate sufficient budget for any contractual changes. The study results suggested that proper site management, as well as proper wages and compensation needed to avoid or minimize the delay in the project. That needed to monitored/observed strictly work progress, 'counter check' for the accuracy of work progress data on actual physical completion against expended costs, proposes a 'bonus scheme' for early completion, and effective planning and scheduling would solve the problem.

The research study conducted certain giddiness to the local construction industry in Sri Lanka by S.M.S. Samarakoon (2009) recommended that the remedies ensure that client pay much more attention about aspects of projects, identification or relief needs or buildings, to minimize changes in structural design throughout the construction to avoid delay in construction.

3.5 Remedies for consultants respective to reduce delay

Mahamidl, Bruland, & Dmaidl (2012) conducted a research study recommended remedies to the consultant to provide comprehensive documents on time and be flexible while evaluating the contractor's work.

The research conducted by Seboru (2015) described improvements for the consultant to speed up approval procedures by reducing red tape and bureaucracy of client and speed up finalizing claim before that become a course of delay.

The recommendation is given by Jurf & Beheiry (2012), based on their research, including planners and designers, to pay special attention to available materials during planning and designing.

According to the study conducted by Marzouk and El-Rasas (2014) suggested solutions for consultants to respond to the contractor's requests on time and set up an appropriate mechanism for assessing variations.

Furthermore, Sambasivan and Soon (2007) recommended to the consultants to draft clear and specific (explicit) agreement, with all details and mechanisms for dispute resolution, approval of drawings on a timely basis and inspection within a suitable time frame.

Another point of view to reduced disputes and overcome delays the research conducted by Murali and Yau (2006) recommended remedies to the consultant should include issues within the contract duration, follow dispute resolution mechanism, the mechanism for assessing causes of delay and any risk management plans, requests to consultants while drawing the agreement between client and contractor. Also, the study suggested that consultants must prepare and approve drawings on time and that consultants monitor their work closely by carrying out inspections on a timely basis.

3.6 Summary of identified remedies for construction delay

Deferent places of the world they have identified remedies for delays effect to the project performance. Most of the researches were identified mainly three parties need to improve on their activities to minimize the effect of the delay to the project, namely Client, Consultant, and Contractor.

According to the research conducted by S.M.S. Samarakoon (2009) recommended remedies ensured that minimize delays, and other researchers recommended similar remedies to parties involved in the project to minimize delay throughout the construction. As below Table 9 shows the summary of significant remedies identified from the above literature reviews.

Table 9- Remedies for Minimize / Avoid Delays to the Parties

Party	No	Reamdy	No of References
Client	1	Establish realistic project duration	1
	2	Allow sufficient time to do feasibility study and prepare comprehensive financial plan	1
	3	Obtain necessary approval with allow sufficient fund for those approvals and improve the client's finance	6
	4	Adopt new procurement method like construction management and design-build	1
	5	Allow sufficient time for tender preparation and submission	2
	6	On time payments to contractors	1
	7	Check resource availability before awarding the contracts for lowest bidders	3
	8	While selecting the contractors are not selected based only on the lowest bid	2
	9	Proper in detailed site investigations to be carried out before finalising the drawings and award the tender	4
	10	Effective planning, scheduling and programme should prepared by qualified and experienced personnel	4
	12	Speed up finalising claim until become course of delay	1
	11	Clients must make quick decisions to solve any problem during the execution and speed up approval procedures	3
	13	Client to stick to original plans and to allocate adequate budget for any contract modifications	2
	14	Close monitoring of the work progress	3
	15	Improve communication and the relationship between parties towards collaborative approach to minimise future delays	2

Party	No	Remedy	No of References
Contractor	1	Recruit enough and well skilled staff	3
	2	Improve the skilled labour and productivity, well plan the finance	2
	3	Provide sufficient equipment	1
	4	Improve communication and the relationship between parties towards collaborative approach to minimise future delays	2
	5	Contractor's proper management & planning to be improved	8
	6	Should plan the rainy days with other unaffected activities due to rain	1
	7	Introduce labour-intensive programmes	1
	8	Identified potential risk with assess cost impact inform to client	4
	9	Contractors must make sure they have a sound financial backing	1
	10	The contractors would be efficient material procurement.	1

Party	No	Reamdy	No of References
Consultant	1	Provide comprehensive documents on time	4
	2	To be flexible during evaluating the contractor's work	2
	3	On-time approval of drawings and do inspection within appropriate time.	2
	4	Improve communication and the relationship between parties towards collaborative approach to minimise future delays	2

CHAPTER 4 - RESEARCH METHODOLOGY

4.1 Introduction

The research methodology is the principle and procedure of a logical process that applies to a scientific investigation (Chard Fellows and Anita Liu, 1997). Once the study has completed the literature review must require designing research in detail.

The research design is an action plan for getting the answers and conclusions on these questions (S.G Naoum, 2013). This chapter constitutes approaches to data collection and analysis of relevant data that the contents of this chapter illustrated in Figure 3.1 & 3.2.

4.2 Research Design

The research needs to be systematically planned, organized, and analyzed with a specific goal. Research design provides the 'plan' or 'the procedures' to the researcher to research in a scientific manner (Saunders, Lewis, & Thornhill, 2009).

The research strategy designed by formulating issues for the research goals, choosing a research approach which is also vital because it provides a clear picture of what data should be collected, where the data may be gathered and also how gathered data support the research question (Saunders, Lewis & Thornhill, 2009).

It also helps to understand the appropriate approach and restriction of the data available. From the beginning of the research, the aim is to understand philosophy and pragmatism (Saunders, Lewis & Thornhill, 2009).

This section presents the design of this research study to collect and analyze data to achieve the research aim and objectives. Below figure 9 presented research philosophy followed to established research methodology to this research study. It has presented

simplify in strategy, techniques, and procedures to follow in any research studies. Simplify in strategy, techniques, and procedures to follow in any research Studies.

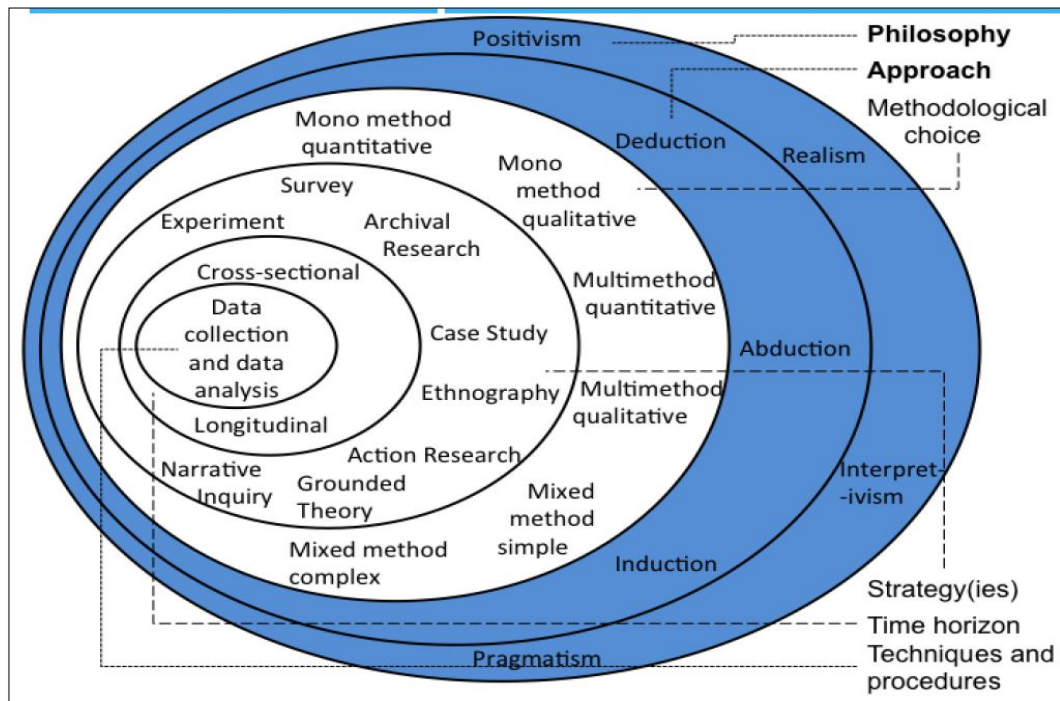


Figure 9 - Research Philosophy and Pragmatism (Saunders et al., 2009).

4.3 Reviewing the Literature

The study usually begins with the revival of technical literature, which includes the reading and evaluation of what others wrote about the topic. Could be descriptive as well as analytical (Naoum, 2013).

4.4 Research Approach

The research reading terminology is the writer used research method and techniques terms that may be incomprehensible to other people (Naoum, 2013). As explained by Naoum (2013), quantitative approach and qualitative approach are the main two-research approach.

Usually, researchers select both quantitative and qualitative methods combination to provide an exceptional understanding of the research problem consider the research approach (Creswell, 2012).

The researchers enable to get benefit from the advantages associated with each strategy with the possibility of avoiding the weakness of each.

Mixed research method helpful when unexpected results arise from a prior study and help generalize to a degree and quality of data. Also, it helps design and validate an instrument for the research study (Creswell, 2012).



Figure 10- Mixed Method Approach (Creswell, 2012)

The proper strategy for research depends on the availability of data and the type of research. For this study, it selected a mixed method for getting the benefit to researchers to generalize to a degree and quality of data and helpful in deciding an instrument.

4.4.1 Quantitative Approach

The quantitative research methodology comprises to make measurements by collecting data, and it helps to determine the requirements of the data to the particular research project. The quantitative method provides to collect factual data to study the relationship between facts identified in previously executed any research literature (Chard, F., Anita, L., 1997).

Also, Naoum, (2013), defines the quantitative method is 'objective' in nature, which describes as an inquiry into a theory composed of variables, measured with numbers and analyzed with statistical procedures to determine whether the hypothesis or theory holds.

The quantitative data are reliable measures of a tangible, countable, and sensible feature of the world (Bouma and Atkinson, 1995). Researchers use this method when they require to get facts about the concept, a question or an attribute or to collect factual evidence and study the relationship between these facts in order to test a particular theory or hypothesis (Naoum, 2013).

4.4.2 Qualitative Approach

The qualitative method is used to understand the insight of the people's perceptions of the world, whether as individuals or groups. The method benefited to researchers understand, opinions and views of people investigated the data gathered to detailing and rich content of the scope. Especially people having a scientific background, often quantitative tradition questions are the objectivity of qualitative data (Chard, F., Anita, L., 1997).

Naoum (2013) states that the qualitative method nature to be 'subjective,' and that emphasizes to researchers get to understand, meanings, experiences, description, and likewise. The information gathered base on this research approach can be classified into two categories, namely, exploratory research and attitudinal research. Exploratory

research conducts when the researcher is having a limited amount of knowledge about the topic.

The exploratory research technique follows to intertwined with the need for a clear and precise statement of the identified problem. This research theory uses less clear than in quantitative design because there is no standard terminology or rules about placement (Naoum, 2013).

This qualitative approach has acknowledged the potential to get beneath the manifestation of problems where issues are subject to quantitative studies, and it facilitates appreciation and understands of fundamental causes and principles, other than the behaviour (Chard, F., Anita, L., 1997).

4.4.3 Mixed Approach

Computing quantitative and qualitative methods as discussed above, those have noticed many features in each method to the research study. The difference between quantitative and qualitative research methods is that each one may be somehow quantifiable, but such measurements will not convey the importance of a particular impact of some over others (Naoum, 2013).

Both qualitative and quantitative are possible, and possibly highly appropriate to use mixed research method within one study (Mark. S., Philip. L., Adrian. T., 2009). The mixed approach research method usually represents in the research that involves collecting, analyzing and interpreting data following quantitative and qualitative research methods in a single study or in series of studies that examine the same underlying phenomenon (Roslyn, 2015).

Creswell and Vick (2011) stated that researchers think to use mixed methods decision based on the points considered that reflects interaction, priority, timing, and mixing. In addition, recommended there are six (6) primary mixed methods designs that provide a useful framework to researchers working in the design studies such as, “(a)

the convergent parallel design, (b) The explanatory sequential design, (c) The exploratory sequential design, (d) The embedded design, (e) The transformative method, (f) The multiphase design (Creswell and Vick, 2011).”

The exploratory research sequence of design also referred to exploratory design and used sequential timing. The exploratory design prioritizes the collection and analysis of qualitative data in the first phase. Secondly using that result, the researcher conducted a quantitative phase to test or generalize the initial findings and interprets how the quantitative results build on the initial qualitative results (Creswell and Vick, 2011), and this study falls into the category of mixed-method research.

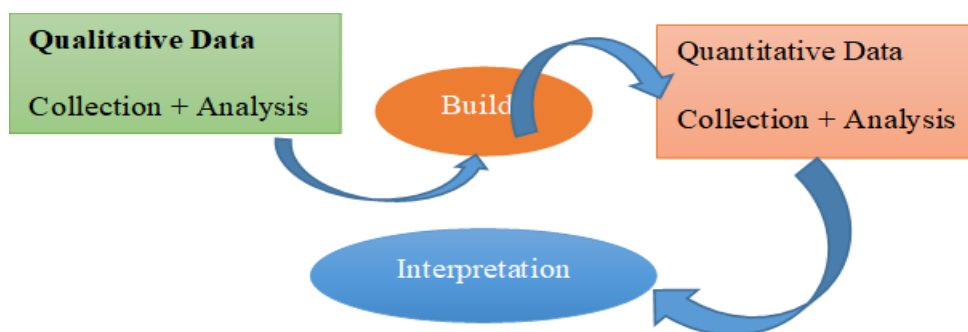


Figure 11-The exploratory sequential design (Creswell and Vick, 2011)

4.4.4 Approach to Data Collection

The research study needed to adopt the data collection method based on the nature of the investigation and available type of data and information. Out of there two main types of data collection methods, which started as 'fieldwork' (primary data collection) and 'desk study' (Secondary data collection), we need to decide the one should we use for a particular study. Fieldwork research is a primary data collection by the researcher, and it may associate with three practical approaches, such as; the survey approach, the case study approach, and the problem-solving approach (Naoum, 2013).

Among the possible approach for data collection for this research study, the survey method and case study method are there. Surveys are used to collect data from a

significant number of respondents within a limited period and generalize result by data abstracted from a particular sample or population (Naoum, 2013).

Generally, a survey analyses the opinions of people, so the research study asks questions to establish an individual's attitudes or beliefs in respect of a particular issue and to analyze a range of response to see whether patterns exist within the population as a whole (CEM, 2013). According to Tan (2002) stated that a case study is a difficult task because of the lack of availability of details due to the confidential nature of negotiations.

Since the case studies go deeply into particular situations, with real people and real events, they are often not possible to draw generalized conclusions about a hypothesis that apply across a whole population (CEM, 2013). Therefore, this study adopted to go with 'survey approach' which is the most suitable approach for data collection.

4.5 Data Collection

4.5.1 Population and Sampling Frame

Before collecting data, it needs to consider the selection, and the sample size, as this will effect on the number of questionnaires or interviews to conduct, or how many people are to observed (CEM, 2013).

Sample selection is critical for the quality of the study and needs to handle with great care to choose the best suit sample. The researcher is necessary to obtain data from only part of the total population with concern to the research project, that part of the population is the sample (Chard and Anita, 1997).

The researcher must have to ensure that the selected sample shall represent the whole population so that their characteristics need to be as same as its population sample selection drawn randomly or non-randomly (Naoum, 2013).

In a random sample, each member of the population equal chances has to select and obtain a list of professional of say, Quantity surveyor, Engineers, Project Managers and Architectures in the Sri Lankan Construction Industry (Chard, F., Anita, L., 1997).

Selected Sampling- In this method, a population is selected with the interview approach, and choose a list of names and address of participants with specific characteristics (Naoum, 2013). For instance, Quantity Surveyors, Project Managers, Architects, and Lawyers in Sri Lankan construction industry considered, and from this population, a sample selected to collect data by through quantitative approach in the research study.

The researcher gathered data on delay causes in building construction from professionals involved with the construction industry in Sri Lanka, such as Quantity Surveyors, Engineers, Project Managers, Architects, and Commercial Managers. The research is impossible to carry out among the whole population due to the practical consideration of time, cost, and therefore, a proper population sample necessary to carry out the research.

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4.5.2 Sample Size

Determination of sample size is so essential to ensure the quality of the analyze. The researcher shall bear in mind that a sufficient number of respondents are needed to get a significant result from a specific population. Discover how many people the research needs to send a survey invitation to obtain it required sample (Scott, 2013).

There are various formulae available to determine the sample size and, are based on quantitative or categorical nature of the data. It requires the variation in the population to determine as to the maximum describe the error and acceptable error for an instance intimate level (The Research Advisor, 2006).

In this research study, the required sample size is estimated by the following formula as appropriate. The research considered a margin of error of less than 5%, there normal

distribution (Z) score is 1.96 and assumed that 95% for typical confidence intervals. Also, assumed expect responses as 50% among the selected sample, which is 0.5 of the standard deviation. The formula to calculate sample size evaluated as below (The Research Advisor, 2006);

$$\begin{aligned}
 \text{Necessary Sample Size} &= \frac{(Z_{\text{Score}})^2 \times SD \times (1- SD)}{(\text{MoE})^2} \\
 &= \frac{1.96^2 \times 0.5 \times (1-0.5)}{0.05^2} \\
 \text{Say} &= \underline{384.16}
 \end{aligned}$$

Where, MoE= Margin of Error,

SD = Standard Deviation

Population size assumed fifty-five (55) professionals for the research study and calculated true sample size derived as below equation.

$$\begin{aligned}
 \text{Calculated True Sample Size} &= 384.16 \times 55 / (384.16+55-1) \\
 &= \underline{48} \text{ (rounded number)}
 \end{aligned}$$

When the research study round it to an actual sample size up to the nearest whole person, the value counts as 48. Accordingly, 48 professionals need to be surveyed to have a 95% confidence level with a margin of error of 5% in the results. Therefore, the research would need to a survey at least 48 of the 55 professionals.

4.5.3 Research instrument selection

Research instrument needs to collect the data or information after decided on the research approach and type data to be collected. There are two primary research techniques available to collect data and information from the respondents, namely postal questionnaires and personal interviews.

Either both techniques can be used as necessary to the researcher decided research study (Naoum, 2013). Postal questionnaires are indeed a fast method to conduct a survey and, it needs to allow four weeks from the date of the initial mailing to a conclusion of final analysis (Naoum, 2013).

The advantages of questionnaire surveys are speedy responses, and they are economical. Moreover, it is easy to arrange data, which received responses and to do analysis statically. Nevertheless, the disadvantages of questionnaire surveyor are the possibility of having in-complete answers, which leads to a low rate of response (Muijs, 2011).

Another primary technique is the personal interview to gather information as well as options. A researcher conducts face-to-face interpersonal interviews asking open questions designed to collect answers related to the research objectives (Naoum, 2013).

According to Saunders et al., (2009), the interviews can be carried out in different ways, whereas structured interviews, semi-structured interviews, and unstructured interviews. These kinds of interviews explained in figure 12.

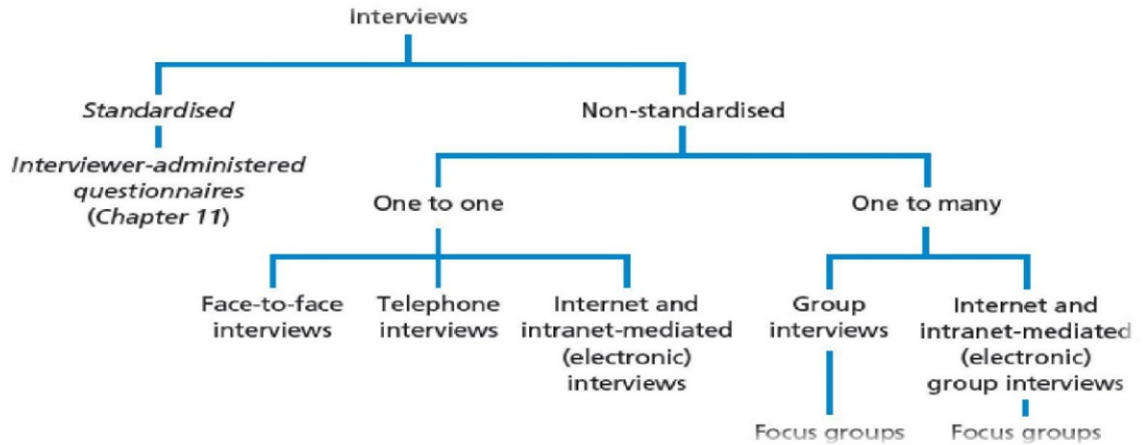


Figure 12 – Forms of interviews (Saunders et al., 2009).

In a structured interview, all the questions presented to the respondents in the same order, with the same wording and, the interviewer controls the questionnaire process through the interview. It may start with some 'open' questions; however, then it shall move to 'closed' question format.

The structured interviews are convenient to receive more accurate answers, and the response rate is relatively high. Singularly if interviewers directly contacts, respondents particular answer can be further clarifying straight forward (Naoum, 2013).

The Semi-structured interview uses the researcher to identify responses that receive from the interview thinks in what direction. The interview questions and the questionnaire are categorized into an open-ended and open which researcher can be identified level of answers from the respondents (Naoum, 2013).

The interviews conducted using semi-structured form proceed with both 'open-ended' and 'closed-ended' questioning, but it is not required to ask in any specific order, and a schedule is not required (Naoum, 2013).

In this research, the topic of study on delays in building industry in Sri Lanka from a professional perspective with their responsible parties, and the effect of such delays to the project performance.

In the construction sector, professionals have different viewpoints, and the researcher has the chance to select different personnel for the interviews. In order to maintain equality of the research, the researcher interviewed different professionals working for different entities such as the contractor, consultant, and client organizations in the construction industry.

The researcher sent a set of structured pre-prepared questions before conduct the interviews. The selected personnel in different sectors as above described can have an idea about the nature of questions and can be prepared by themselves for the interview. Structured questionnaire directed to identify the remedies for significant causes of delays. The highest level of 'causes of delay' identified by the questionnaire survey tested with a two-tailed test aiming the answers with better correlation.

4.5.4 Data collection process

A pilot study completed before the research study collects the final data from the selected respondents. It provided with a trial run for the questionnaire to identify any ambiguities in the questions, and to improve some questions to get the best outcome from the interviews. Also, it ensures the effectiveness of the study at the standard level, and their recommendations can use to improve questions further (Bell, 2014).

A set of questions distributed with the selected professional sample to conduct the actual surveyor. The sample size selected by calculating value following formula described in the subsection 3.04.2 and forty-eight (48) respondents required to avoid result presence bias due to the low response rates of the questionnaires.

It has sent to fifty (55) professionals working in Client, Consultant, and Contractor organizations. The analysis carried out after receiving responses and followed up to

get responses within the scheduled period. Questionnaires sent electronically using the “Survey Monkey” service. Further, follow up non-respondents within two-week time reminding before the end of the target date for collect responses sending a message through electronic mail.

4.6 Analysis of Procedure

The above sections identified for research strategy and data collection techniques in the interviews and questionnaire adapted to suitable data collection techniques to achieve the objective of this research study. Under this title below discussed suitable data, analysis method used in this research after collecting data from questionnaire and interviews. The collected data evaluating process presented logically and analytically into each component of their available data (Willem and Irmtraud, 2014).

Author-prepared general question beginning of the questionnaire, for instance, the profession of the respondents, specified construction area they have experienced, the organization they employed. The literature reviewed identified Forty-Four (44) number of Cases of delays in the Global construction industry and these causes taken into a questionnaire for identifying impact to project delays. Respondents have the opportunity to rate like as; “Very high, High, Medium, Low and Very Low”; each causes base on their professional experience, knowledge, and specialist in the construction industry.

Analysis of collecting data used the standard analytical method of Relative Importance Index (RII) used most of the researchers to the analysis of data. RII equation described as below,

Equation -1 for Causes of Delays

$$RII = \frac{\sum_{i=0}^4 W_i X_i}{\sum_{i=0}^4 X_i}$$

Where,

W = Weight assigned to the i^{th} response, for instance, 0,1,2,3, and 4.

X_i = frequency of i^{th} responses percentage.

i = Response category index, for instance,

Very High	4
High	3
Medium	2
Low	1
Very Low	0

With referred to the research objective, identified causes of delays categorized into a level by analysis calculation of the important relative index for this research. The research questionnaire data related to the objective of “most commonly happening delay causes in the Sri Lankan building construction industry” used as similar RII calculation method. Equation described in Equation -2.

Equation -2 for the frequency of delay courses happening

$$RII = \frac{\sum_{i=0}^4 W_i X_i}{\sum_{i=0}^4 X_i}$$

Where,

W = Weight assigned to the i^{th} response, for instance, 0,1,2,3, and 4.

X_i = frequency of i^{th} responses percentage.

i = Response category index, for instance,

Continual	4
Frequently	3
Occasional	2
Rare	1
Never	0

The most important causes of delays in Sri Lankan building construction industry identified by results of the above both causes and frequency RII values multiplying from the Equation-1 and Equation-2 and get value for each cause that Equation-3 provided an equation as below.

Equation-3 for identifying significant causes of delays

$$\text{Entire RII} = \text{RII (Impact x frequency)}$$

Based on the entire RII highest result by Equation-3 will provide significant causes of delays, and the lowest result gave the least causes of delays to the building construction project in Sri Lanka. Another objective of significant effect due to the causes of delays data calculation carried as a similar RII method, and Equation-4 described as below.

Equation -4 for the significant effect due to delay courses

$$\text{RII} = \frac{\sum_{i=0}^4 W_i X_i}{\sum_{i=0}^4 X_i}$$

Where,

W_i = “Weight assigned to the i^{th} response, for instance, 0,1,2,3, and 4.”

X_i = “frequency of i^{th} responses percentage.”

i = “Response category index, for instance.”

Strongly Agreed	4
Agreed	3
Neutral	2
Disagreed	1
Strongly Disagreed	0

Equation 3 and four results achieve the third research objective. Similar RII method used to analyze for data collected from the interviews and result carried forward to both results merging to the research findings. Naoum (2013) stated that rho calculation measures the amount and significance of a correlation between people's rank on many causes.

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

Where,

d_i = The difference in ranking between each pair of factors,

N = Number of factors.

Based on the total questionnaire number of factors, N value considered Forty-four (44) cause of delays in the construction industry. Further, there identified a high level of causes of delays taken into interview questioner and result in the analysis by similar RII method.

Observed result tested that answer achieved in good correlation. Naoum (2013) has given a table for the show the rho value and if it is greater than the critical value of 0.478 and 0.005 of the level of significance for a two-tailed test, that answers achieved in good correlation.

Table 10 – Critical Values of (rho) at various levels of probability
(Spearman rank correction coefficient) (Naoum, 2013).

N (number of subjects)	Level of significance for one-tailed test			
	.05	.025	.01	.005
	Level of significance for two-tailed test			
	.10	.05	.02	.01
5	.900	1.000	1.000	–
6	.829	.886	.943	1.000
7	.714	.786	.893	.929
8	.643	.738	.833	.881
9	.600	.683	.783	.833
10	.564	.648	.746	.794
12	.506	.591	.712	.777
14	.456	.544	.645	.715
16	.425	.506	.601	.665
18	.399	.475	.564	.625
20	.377	.450	.534	.591
22	.359	.428	.508	.562
24	.343	.409	.485	.537
26	.329	.392	.465	.515
28	.317	.377	.448	.496
30	.306	.364	.432	.478

Note: When there is no exact number of subjects use the next lowest number.

With referring to the research objective, identified remedies through the qualitative research carried to interview to find remedies for the delay in the building construction project in Sri Lanka. The research interview collected data related to the objective of “remedies for the delay because which were highly happening in the building projects in Sri Lanka” used as a similar RII calculation method for analysis of data. Equation described in Equation -5.

Equation -5 for remedies for delay courses

$$RII = \frac{\sum_{i=0}^4 W_i X_i}{\sum_{i=0}^4 X_i}$$

Where,

W= Weight assigned to the ith response, for instance, 0,1,2,3, and 4.

X_i= frequency of ith interviewer responses percentage.

i = Response category index, for instance,

Strongly Agreed	4
Agreed	3
Neutral	2
Disagreed	1
Strongly Disagreed	0

Based on the RII highest result by Equation-5 provides main remedies for causes of delays and the lowest result gave the least remedies for causes of delays to the building construction project in Sri Lanka.

4.6.1 Questionnaire Construction

There are three fundamental stages available for constructing the research study questionnaire, and it graphically described as follows (Naoum, 2013).



Figure 13 – Fundamental Stages for Constructing a Questionnaire (Naoum, 2013)

Questions are mainly two-type form, namely open or closed. The researcher determines a required number of responses considered into closed questions, that benefited to researcher manage easily collect responses from the respondents (Chard and Anita, 1997).

There are two types of questionnaires select for the research study, the "open" or "unrestricted" type questionnaires select as respondents to freely respond, and open-ended questions use to get people's opinion on the research study questionnaire (Naoum, 2013). The various type of formats available for opinion type of questions can be asked from the respondents, and the Likert scale and rating scale are the most common type formats for questions respondents. People can provide their views or opinion of an object, event except for an attributional statement on the survey object. Their response can be categorized as a quantified, and they reflect the intensity of the particular judgment given to them (Naoum, 2013).

The opinion questions (subjective measurement) use to selecting rating scale type question and following some common sets of responses categories use into the questions and allowed a point in higher to least in respectively, some question responses category refers to;

1. Strongly disagree - (1 point)
2. Disagree - (2 points)
3. Neither agree nor disagree - (3 points)
4. Agree - (4 Points)
5. Strongly agree -(5 points)

A similar type of category used for some set of questions and allocate point in higher to least in respectively;

1. Very Low - (1 point)
2. Low - (2 points)
3. Medium - (3 points)
4. High - (4 Points)
5. Very High -(5 points)

Further similar category type use for some set of questions and allocate point in higher to least in respectively;

1. Never- (0 point)
2. Rear- (1 point)
3. Occasional- (2 points)
4. Frequently- (3 Points)
5. Continual-(4 points)

That is provided facilitate to respondents involve with the survey give response different to others, because of professionals having various experiences raise the argument in response fall in to “neither agree nor disagree,” this category included into the questions (Refer Appendix 1).

CHAPTER 5 - RESEARCH FINDINGS AND DISCUSSION

5.1 Introduction

This research followed by collecting data from both questionnaire and face to face interviews which described under the above Chapter-4 of research methodology. The questionnaire survey conducted by preparing the structured questionnaire and interviews followed by a semi-structured questionnaire.

Both surveys received responses analyze results given the opportunity to conclude the aim of this research. The research questionnaire survey consists mainly of four sets of questions, which enable to quickly collect data from the responders and facilitate them to identify the questions to respond. Below subsections describe the data collection and analysis of each method.

5.2 Detail of Participants and response rate from Questionnaire Survey

The first section focused on general information to get an idea about the respondent's profession, type of organization employing for, which sector/s they experienced and aware of delays for building project as per their experiences.

Questionnaire survey distributed among approximately fifty-five (55) professionals in the Sri Lanka construction industry using SurveyMonkey by sending emails to each.

The questionnaire survey optimizes the responses, reminder emails, and over the phone call to the respondents. The questionnaire survey was received effective forty-nine responses from respondents, and two responses declined to respond, and the other four respondents incompleting.

Under section one questionnaire, question number 1 was aimed to identify the respondent's profession, and below table 11 provides the deferent level of professionals who participated in this research study.

Table 11 – Professionals Involved for Questionnaire Survey

Professionals	Responses	
Quantity Surveyor/sr. QS	34	69.39%
Project Manager	6	12.24%
Project Engineer	5	10.20%
Contracts Administrator	2	4.08%
Commercial Manager	2	4.08%
Answered	49	100%

Further below, Figure 13 shows the analysis of a professional’s percentage based on 49 number of respondents. The maximum percentage of involved professionals were under the category of quantity surveying, and all other professional categories participated in a considerable percentage, which provides the positive outcome of the survey results.

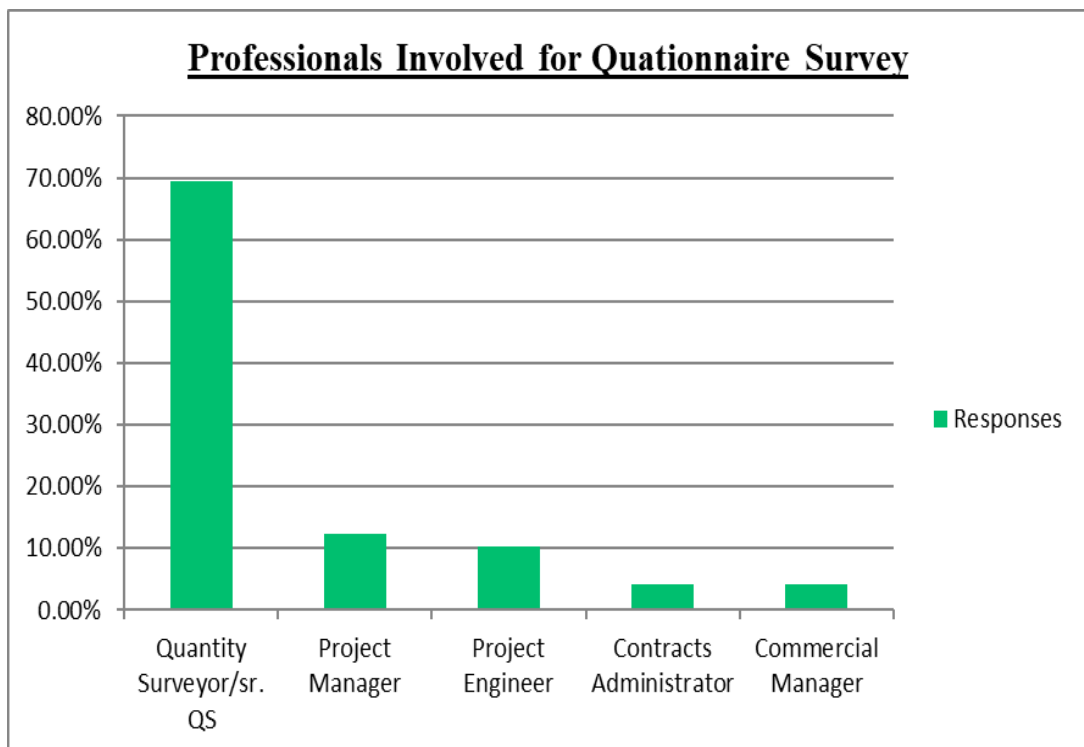


Figure 14- Analysis of Professional Participants (QSR)

The second question was aimed to identify the respondents are worked on which type of organization shows below Table 12.

Table 12- Professionals Organisation (QSR)

Organisation	Responses	
Contractor	25	51.02%
Consultant	19	38.78%
Client	5	10.20%
Answered	49	100%

The maximum percentage of professionals who participated were from contractor organizations, and the second-highest percentage was from consultant organizations. Another percentage for the client party participant, which was also considerable level responses contribute to this research and enhance the reliability of the research outcomes. Refer to Figure-15 to identify analyzed results.

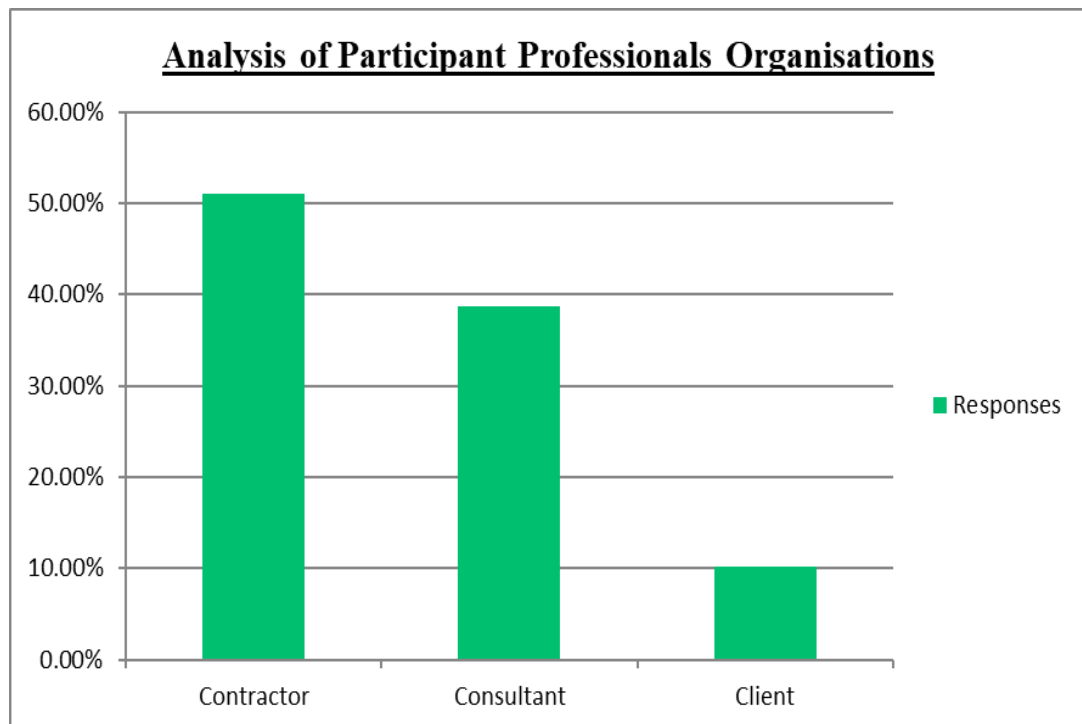


Figure 15 – Analysis of Professionals Organisation (QSR)

Third questions based on gather information of the respondents experienced on which sector/s they have been engaged in the construction industry. Responses provided professionals list presented in below Table 13.

Table 13- Professionals Experienced Sector/s have been engaged (QSR)

Industry Sector/s	Responses	
Building (residential, commercial, hotel, school, etc.)	37	75.51%
Building & Infrastructure (Building, Bridges, Roads, Stadium, Tunnel, etc.)	10	20.41%
Industrial (Oil & Gas, Marine, mining, etc.)	1	2.04%
Above All	1	2.04%
Answered	49	100%

The highest percentage of professionals participated had to experience in the building sector, and the second-highest percentage of experience of respondents had experience in both building and infrastructure sectors.

The reliability of the answers rated to the building sectors experience, which gives a most related opinion for the given questions, and that lead to observed research objectives. Respondents data analyzed results given below figure 16.

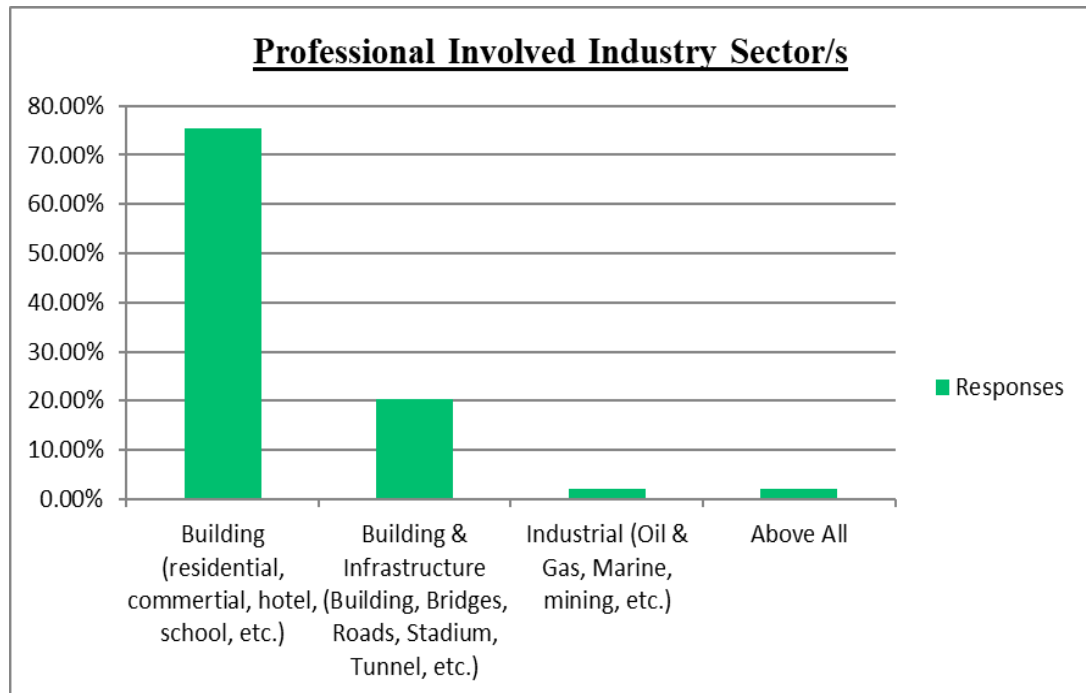


Figure 16 – Analysis of Professional Engaged Sector/s in the Construction Industry (QSR)

The fourth question focused on identifying the professionals gained experience in their engaged construction sectors, which enable to ensure responses reliability to the research questionnaire. Professionals experiences ranges are in below Table 14 and based on the research respondents.

Table 14- Professionals Experiences Range (QSR)

Experiences	Responses	
Less than 5 years	1	2.04%
5-10 years	12	24.49%
10-15 years	15	30.61%
15-20 years	17	34.69%
Over 20 years	4	8.16%
Answered	49	92%

The highest percentage participated had experience ranging from 15-20 years, and the second-highest percentage had experience from 10-15 years, and the 3rd highest percentage was 5-10 years experienced professionals.

Over 20 years, experienced professionals' participation was around 8%, and only one respondent had experienced less than five years. According to the research data analysis, the maximum percentage of respondents had more than five years of experience in the building sector which is a sufficient awareness in the industry, which is benefited to achieve reliable responses to the questionnaire survey — analysis data presented below Figure 17.

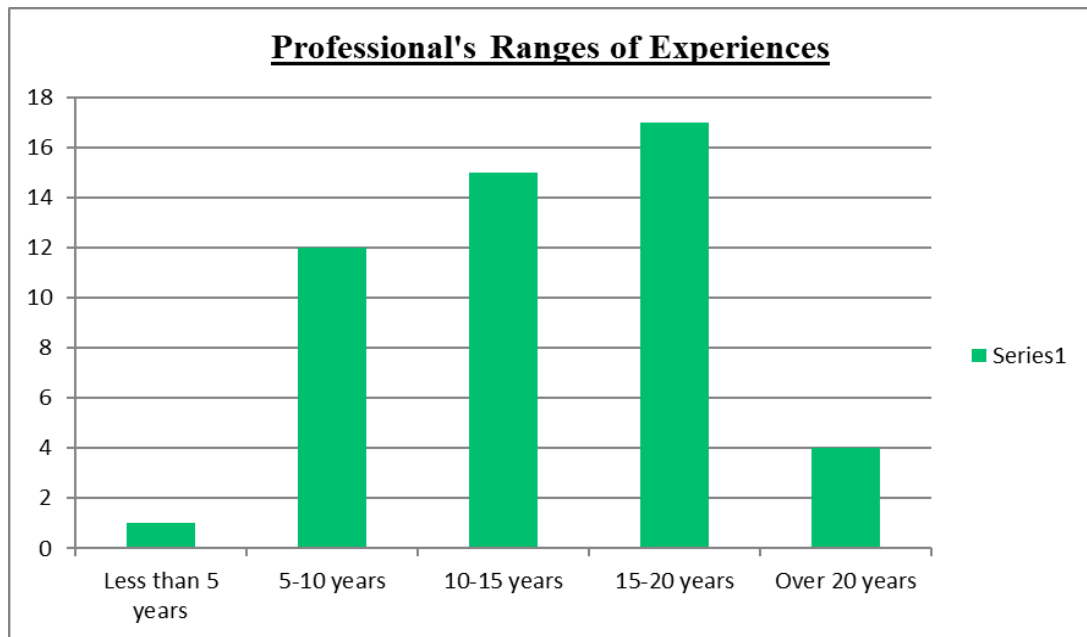


Figure 17 – Analysis of Professional Experiences (QSR)

The fifth question aimed to get the idea about delays that occurred in the building construction project in Sri Lanka. The responses received from the respondent's listed below Table 15.

Table 15- Project Delays Percentage (QSR)

Building Project Delays %	Responses	
0-20%	9	18.37%
20-40%	17	34.69%
40-60%	13	26.53%
60-80%	6	12.24%
80-100%	4	8.16%
100%	-	-
Answered	49	100%

The research involved professionals had most experiences who have more than five years relates to the result as above described, and this question response presents which they have occurred delays in building construction project. The maximum percentage of respondents agreed that the building project was delayed percentage range as 20-

40%, and respondents' percentage is 34.69%. Second, the highest respondents' percentage is 26.53% to the delay range for 40-60%, and considerably, 18.37% responded to the delays range as 0-20% of building construction project. Also, 12.24% of respondents agreed that the project delay occurred 60-80% of delays in the building construction projects and lowest respondent percentage of 8.16% to the delay range as 80-100%. The responses received from the questionnaire survey analyzed results present in the below Figure 18.

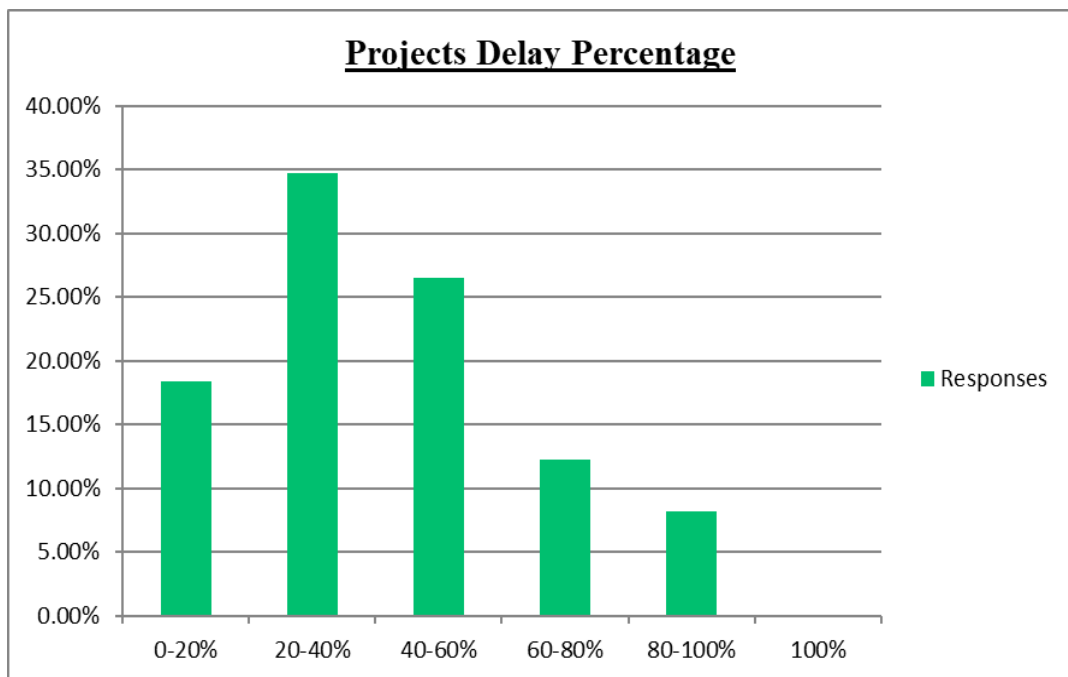


Figure 18 – Analysis of Project delay percentage in the Building Construction Project (QSR)

5.3 Causes of Delays on the Building projects in Sri Lanka (QSR)

The sections two and three related on objectives of the research and each question having 44 numbers of sub-questions to identify the causes and frequency from the identified that 44 number of causes of delays.

The following paragraphs describe received responses analysis for causes and its frequency has taken into RII calculations and finally combined that RII results in sort

in descending order to identify the most 20 causes of delays in building construction project. Further RII values calculate similar way by uses of interview responses results, and combined RII value sort out began heist to the lowest rank.

Finally, both identified causes rank tested by calculating “rho” value to conclude the most significant 20 causes to the building project delays in the Sri Lankan construction industry. Question number 6 focused on identifying the most significant causes of delays, which impacted to a project by calculating RII values as described above chapter 4, and table 16 shown RII values which considered that value more than 0.6 in ranked from highest to least value in a heist to least rank in this research study.

Table 16- Significant 20 no. of Causes of Delays in Building Construction Project (QSR)

Party	Major Causes	Causes RII	Rank
Client	Client’s slow decision making and improper planning	1.23	1
Client	Client initiated variations, additional & change orders	1.20	2
contractor	Ineffective planning and scheduling of project	0.90	3
contractor	Poor risk management and supervision	0.90	4
Consultant	Delay in approving design, shop drawings and sample materials by consultant	0.88	5
contractor	Poor contract management	0.87	6
Consultant	Delay in issuing change orders	0.86	7
Consultant	Consultant delays for instructions, approvals	0.83	8
Consultant	Specification and drawing changes by consultant	0.79	9
Client	Financial issue and payment delay by owners for completed works	0.79	10
contractor	Contractor’s poor site management	0.78	11
contractor	Delays from sub-contractors and nominated suppliers	0.75	12
contractor	Insufficient labours on site and skilled labours	0.73	14
External	Bad weather conditions /natural disasters (flood, earthquake)	0.72	13
External	Inadequacy of sub-contractors	0.71	15
contractor	Rework due to errors during construction	0.68	16
contractor	Organization that lacks sufficient resources	0.67	17
contractor	Inadequate technical performances	0.66	18
contractor	Mistakes by the contractor during construction	0.65	19
External	Shortage in material, labour supply, equipment availability	0.64	20

The question no.7 is focused on identifying the frequency of significant delay occurrences as below table 17 and analyzed the RII values to identify the top 20 causes. RII values, which considered that more than 0.6 in ranked from highest to least value in a heist to least rank in this research study.

Table 17- Frequency Significant Causes of Delays (20) in Building Project (QSR)

Party	Frequency of Causes	Frequency RII	Rank
Client	Client initiated variations, additional & change orders	1.17	1
Client	Client's slow decision making and improper planning	0.98	2
contractor	Ineffective planning and scheduling of project	0.94	3
External	Bad weather conditions /natural disasters (flood, earthquake)	0.93	4
Consultant	Delay in issuing change orders	0.89	5
contractor	Mistakes by the contractor during construction	0.85	6
contractor	Poor contract management	0.83	7
Client	Financial issue and payment delay by owners for completed works	0.81	8
contractor	Poor risk management and supervision	0.79	9
Consultant	Specification and drawing changes by consultant	0.79	10
Consultant	Delay in approving design, shop drawings and sample materials by consultant	0.78	11
contractor	Contractor's poor site management	0.74	12
contractor	Contractor's low overall productivity	0.74	13
Consultant	Imperfect documents in the contract by consultant	0.72	14
contractor	Insufficient labours on site and skilled labours	0.71	15
contractor	Rework due to errors during construction	0.68	16
External	Inadequacy of sub-contractors	0.68	17
Consultant	Consultant delays for instructions, approvals	0.66	18
contractor	Delays from sub-contractors and nominated suppliers	0.64	19
contractor	Organization that lacks sufficient resources	0.61	20

The Combination of the above two RII values of delay causes and frequency gives the most critical delay causes and analyzed RII values with relevant rank shows below table 18.

Table 18- Overall Significant 20 Causes of Delays in Building Projects (QSR)

Party	Major Causes	Causes RII (1)	Frequency RII (2)	Combined RII (1) x (2)	Rank
Client	Client initiated variations, additional & change orders	1.20	1.17	1.40	1
Client	Client's slow decision making and improper planning	1.23	0.98	1.21	2
contractor	Ineffective planning and scheduling of project	0.90	0.94	0.84	3
Consultant	Delay in issuing change orders	0.86	0.89	0.76	4
contractor	Poor contract management	0.87	0.83	0.72	5
contractor	Poor risk management and supervision	0.90	0.79	0.71	6
Consultant	Delay in approving design, shop drawings and sample materials by consultant	0.88	0.78	0.68	7
External	Bad weather conditions /natural disasters (flood, earthquake)	0.72	0.93	0.68	8
Client	Financial issue and payment delay by owners for completed works	0.79	0.81	0.64	9
Consultant	Specification and drawing changes by consultant	0.79	0.79	0.63	10
contractor	Contractor's poor site management	0.78	0.74	0.58	11
contractor	Mistakes by the contractor during construction	0.65	0.85	0.55	12
Consultant	Consultant delays for instructions, approvals	0.83	0.66	0.55	13
contractor	Insufficient labours on site and skilled labours	0.73	0.71	0.52	14
External	Inadequacy of sub-contractors	0.71	0.68	0.49	15
contractor	Delays from sub-contractors and nominated suppliers	0.75	0.64	0.48	16
contractor	Rework due to errors during construction	0.68	0.68	0.47	17
contractor	Contractor's low overall productivity	0.57	0.74	0.42	18
contractor	Organization that lacks sufficient resources	0.67	0.61	0.41	19
Consultant	Imperfect documents in the contract by consultant	0.56	0.72	0.40	20

According to the above results presented the most significant causes of delays identified based on the questionnaire survey results analysis and calculated combined RII values sort into the highest value to least value respectively rank in highest to least level. These results considered questionnaire survey identified 20 number of causes of delays and its magnitude effect on the building construction project in Sri Lanka.

Further below discuss each responder from client, consultant, and contractors view of point hoe they identified the most significant causes of delays and its magnitude in building construction in Sri Lanka. These discussions expect to compare overall results

identified the magnitude of delays with each type of parties responded results identified causes of delays magnitude and to discuss most common causes of delays identify from the professional perspective in building construction in Sri Lanka.

According to the responses gathered from the Client’s representatives, below table 19 shows the most significant 20 number of the causes delays in the Sri Lankan building construction industry.

Table 19- Most Significant Cases of Delays from Client’s Representatives Views (QSR)

Party	Major Causes	Causes RII (1)	Frequency RII (2)	Combined RII (1) x (2)	Rank
Client	Client’s slow decision making and improper planning	2.00	1.40	2.80	1
Client	Client initiated variations, additional & change orders	1.20	1.32	1.58	2
contractor	Poor contract management	1.20	1.24	1.49	3
contractor	Ineffective planning and scheduling of project	1.12	1.20	1.34	4
contractor	Poor risk management and supervision	1.12	1.20	1.34	5
contractor	Insufficient labours on site and skilled labours	1.16	0.88	1.02	6
External	Bad weather conditions /natural disasters (flood, earthquake)	0.72	1.28	0.92	7
External	Inadequacy of sub-contractors	1.28	0.68	0.87	8
Client	Financial issue and payment delay by owners for completed works	0.60	1.40	0.84	9
Consultant	Specification and drawing changes by consultant	0.88	0.88	0.77	10
contractor	Contractor’s poor site management	0.76	0.84	0.64	11
contractor	Organization that lacks sufficient resources	0.84	0.88	0.74	12
Client	Suspension of work by owner cause delay.	0.72	0.84	0.60	13
contractor	Contractor’s low overall productivity	0.48	1.20	0.58	14
External	Unforeseen ground condition	1.00	0.56	0.56	15
contractor	Rework due to errors during construction	0.88	0.60	0.53	16
Government	Government law and regulations	0.88	0.56	0.49	17
contractor	Contractor’s less experience	0.64	0.76	0.49	18
External	Shortage in material, labour supply, equipment availability	0.84	0.56	0.47	19
contractor	Delays from sub-contractors and nominated suppliers	0.84	0.56	0.47	20

When considering the Consultant respondents point of view identified the most significant 20 number of causes of delays shown in below table 20.

Table 20- Most Significant Cases of Delays from Consultant's Representatives Views (QSR)

Party	Major Causes	Causes RII (1)	Frequency RII (2)	Combined RII (1) x (2)	Rank
Client	Client initiated variations, additional & change orders	1.29	1.13	1.46	1
contractor	Contractor's poor site management	1.03	1.03	1.06	2
Client	Client's slow decision making and improper planning	1.13	0.87	0.98	3
contractor	Poor contract management	1.14	0.82	0.94	4
contractor	Mistakes by the contractor during construction	0.91	1.00	0.91	5
contractor	Ineffective planning and scheduling of project	0.95	0.95	0.90	6
Consultant	Delay in issuing change orders	0.82	0.95	0.77	7
Consultant	Delay in approving design, shop drawings and sample materials by consultant	0.84	0.89	0.75	8
contractor	Rework due to errors during construction	0.88	0.79	0.69	9
contractor	Poor risk management and supervision	0.86	0.77	0.67	10
External	Inadequacy of sub-contractors	0.83	0.79	0.65	11
Consultant	Specification and drawing changes by consultant	0.76	0.83	0.64	12
External	Bad weather conditions /natural disasters (flood, earthquake)	0.70	0.87	0.60	13
contractor	Organization that lacks sufficient resources	0.87	0.67	0.58	14
contractor	Delays from sub-contractors and nominated suppliers	0.78	0.73	0.57	15
contractor	Contractor's low overall productivity	0.69	0.83	0.57	16
contractor	Insufficient labours on site and skilled labours	0.76	0.74	0.56	17
Consultant	Consultant delays for instructions, approvals	0.76	0.73	0.55	18
contractor	Wrong selection of type /capacity of equipment	0.62	0.87	0.54	19
Client	Financial issue and payment delay by owners for completed works	0.69	0.78	0.54	20

According to the responses gathered from the Contractor's representatives, below table 21 shows the most significant 20 no of the causes delays in the Sri Lankan building construction industry.

Table 21- Most Significant Cases of Delays from the Contractor's Representatives Views (QSR)

Party	Major Causes	Causes RII (1)	Frequency RII (2)	Combined RII (1) x (2)	Rank
Client	Client initiated variations, additional & change orders	1.18	1.13	1.33	1
Consultant	Delay in issuing change orders	1.39	0.95	1.32	2
Client	Client's slow decision making and improper planning	1.22	0.87	1.06	3
Consultant	Delay in approving design, shop drawings and sample materials by consultant	1.16	0.89	1.03	4
contractor	Ineffective planning and scheduling of project	0.95	0.95	0.90	5
Client	Financial issue and payment delay by owners for completed works	1.12	0.78	0.88	6
Consultant	Consultant delays for instructions, approvals	1.16	0.73	0.84	7
contractor	Contractor's poor site management	0.81	1.03	0.83	8
Consultant	Specification and drawing changes by consultant	0.93	0.83	0.77	9
contractor	Poor risk management and supervision	0.96	0.77	0.74	10
External	Bad weather conditions /natural disasters (flood, earthquake)	0.82	0.87	0.71	11
contractor	Poor contract management	0.76	0.82	0.62	12
contractor	Insufficient labours on site and skilled labours	0.80	0.74	0.60	13
contractor	Mistakes by the contractor during construction	0.57	1.00	0.57	14
External	Inadequacy of sub-contractors	0.68	0.79	0.54	15
contractor	Delays from sub-contractors and nominated suppliers	0.73	0.73	0.53	16
contractor	Inadequate technical performances	0.73	0.70	0.52	17
contractor	Organization that lacks sufficient resources	0.72	0.67	0.48	18
contractor	Wrong selection of type /capacity of equipment	0.53	0.87	0.47	19
contractor	Rework due to errors during construction	0.59	0.79	0.46	20

Based on the responses were received from the client, consultant and contractor the most significant cause of delays identified as "Client initiated variations, additional and changed orders," and next delay identified by above three parties "Client slow decision making and improper planning" within first three ranks. Also, other significant causes of delay are identified by above describe three parties, and there are the most common causes of delay. Therefore, causes of delay concluded based on the three parties such as client, consultant, and contractor's representatives' responses combined results as a most significant delay causes recognized from questionnaire surveyor as shown above table 18.

The above table results are evidenced that all three parties are responsible for the project delays. However, two significant delays causes identified from the client party involve causes of delays, such as client-initiated variations, additional and change orders, slow decision making, and improper planning on the project.

5.4 Effects of Delays on the Building projects in Sri Lanka from Questionnaire Survey

The eight-question focused on identifying the effects due to the above leading causes of a delay from the questionnaire survey results. The time overrun is the main effect due to delay and cost overrun, dispute, idling resources identified as other effects, respectively, which listed in below figure 16 and table 23.

Table 22- Effects of Delays due to Delays Identified from the Questionnaire Survey (QSR)

Effects	IRR	Rank
Time overrun	1.88	1
Cost overrun	1.83	2
Dispute	1.26	3
Idling resources	1.12	4
Arbitration	0.98	5
Negative social impact	0.93	6
Litigation	0.66	7
Total abandonment	0.61	8

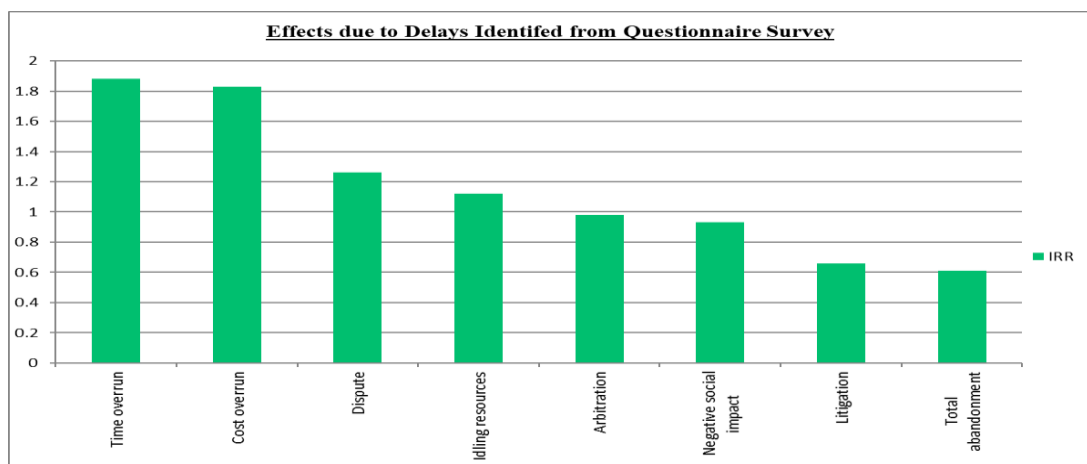


Figure 19- Summary of Effects due to Delay Causes (QSR)

The following subchapter describes the data collected from interviews conducted with professionals.

5.5 Interview Data Analysis

Face to face interviews was conducted by a pre-preparing semi-structured set of questions to collect data for this study. The author interviewed with selected professionals from deferent sectors such as Client, Consultant, Contractor, etc., in the construction industry. They have deferent experiences on their professional carries, and deferent point of views answers were provided to interview focused questions which use to the quality of the research outcomes. List of interviewed professional's general information shows in below table 23.

Table 23 – Interviewers General Information

Interviewer Code Name	Engaged Sector in industry	Position	Experience (Years)	Building Construction Experience
Expert 1	Contractor	Project Manager	18	10
Expert 2	Consultant	Contracts Manager	20	15
Expert 3	Project Management	Commercial Manager	19	16
Expert 4	Client	Sr. Quantity Surveyor	16	16
Expert 5	Contractor	Project Engineer	19	11

Interview questionnaire consists of two sections, namely Section-1 as “General Question” and Section-2 as “Questions relevant to the research objectives.” In Section 1, the first four questions related to the profession, overall experience, building construction experience, and scale of the project they have engaged. Collected this information presents above table 23.

First, two questions were aimed to identify the professions and whether they had experience in the building construction projects. All responses have considerable experience in Sri Lankan building construction projects engaged with differences in the high level of positions. According to the respondent's responses, four professionals having 19 years of total experiences and one professional have 20 years of experience, that percentages are 80% and 20% respectively.

Among the total experiences of them, three professionals having 10-15 years of experience and two professionals having 16 years of experiences, that percentages are 60% and 40% respectively. Interview respondents' responses to Section 2 first question, stated that most of the building construction projects were delayed due to major causes of delays. Respondents were responded to question 2 and three by describing following their experience.

Expert 1 (personal communication, January 4, 2019) described that one of the building projects he worked was also delayed by 43% compared to original completion time. According to the discussion had with Expert 2 (personal communication, January 9, 2019) and Expert 3 (personal communication, January 19, 2019) average of 35-38% delayed the current and previous building construction projects in Sri Lanka. Expert 5 (personal communication, January 27, 2019) explained that an average of 30% delay experience in his current ongoing project. Expert 4 (personal communication, January 22, 2019) points out that his ongoing project is delaying 25% compare to original completion time. That delay range of building construction project percentage, as shown in below figure 17.

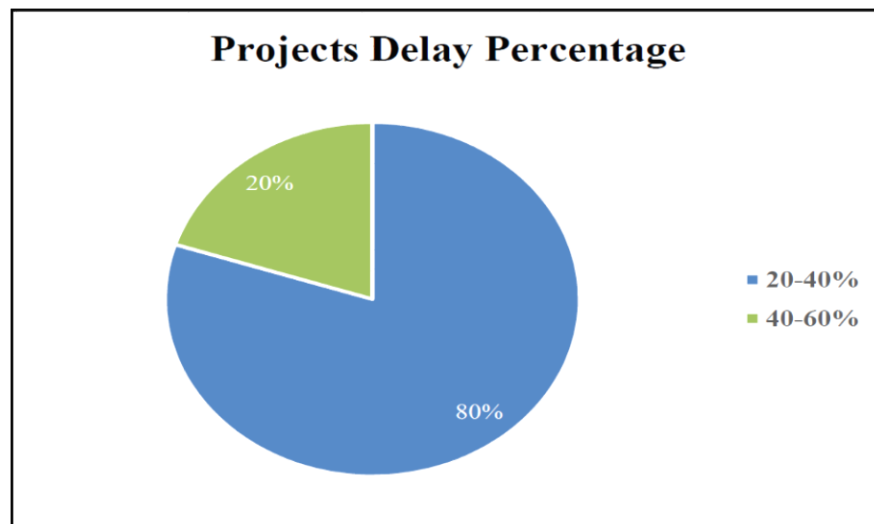


Figure 20 – Percentage of Projects Delay compare to the total projects' professionals worked in Sri Lanka (INR)

The set of questions under section 2, the fourth question was focused on identifying the significant causes of delay for the impact and frequency of rate to project delays. The table A9-1 available in Appendix 9 shows the major causes of delays identified by each interviewee considering its impacts based on their experience in building construction project in Sri Lanka. Below table A9-2 shows the frequency of causes impacts happening in the building construction industry.

According to the table, A9-1 and A9-2 show analyzed RII values, and these values used to calculate the combined RII value, based on that identified the most significant 20 delay causes similar consideration as above questionnaire survey shown in the below table 24.

Table 24- Interviewer Results- Most Important Causes of Delay (INR)

Rank	Cause of Delay	RII Course	RII Frequency	RII Combined
1	Client initiated variations, additional & change orders	2.08	3.00	6.24
2	Client's slow decision making and improper planning	3.00	2.00	6.00
3	Imperfect documents in the contract by consultant	2.00	1.40	2.80
4	Consultant delays for instructions, approvals	1.32	2.00	2.64
5	Delay in issuing change orders	1.32	2.00	2.64
6	Delay in approving design, shop drawings and sample materials by consultant	1.32	1.96	2.59
7	Poor risk management and supervision	2.00	1.20	2.40
8	Contractor's poor site management	1.20	2.00	2.40
9	Delays from sub-contractors and nominated suppliers	1.20	2.00	2.40
10	Incorrect site information by client	1.40	1.32	1.85
11	Delay to furnish and deliver the site to the contractor by client	1.40	1.20	1.68
12	Insufficient labours on site and skilled labours	1.40	1.20	1.68
13	Shortage in material, labour supply, equipment availability	0.80	2.00	1.60
14	Bad weather conditions /natural disasters (flood, earthquake)	1.28	1.20	1.54
15	Financial issue and payment delay by owners for completed works	1.08	1.40	1.51
16	Inadequacy of sub-contractors	0.84	1.28	1.08
17	Ineffective planning and scheduling of project	1.40	0.72	1.01
18	Lowest bid awarding by client	1.00	1.00	1.00
19	Poor contract management	1.20	0.72	0.86
20	Contractor's low overall productivity	0.88	0.88	0.77

5.6 Effects of Delays on the Building projects in Sri Lanka based on Interview Results

The fourth question focused on identifying the effects because of the above-identified significant causes of delay. The main effects identified as time overrun and other effects observed as a cost overrun, dispute, arbitration, idling resources, litigation, negative social impact, and total abandonment and below figure 18 and table 25 shown the calculated RII values and with their rank.

Table 25- Effects of Delays due to Delays Identified from the Interview Results (INR)

Sr. No	Cause of Delay	RII	Rank
1	Time overrun	3.00	1
2	Cost overrun	3.00	2
3	Dispute	2.00	3
4	Arbitration	1.32	4
8	Idling resources	0.88	5
5	Litigation	0.72	6
7	Negative social impact	0.48	7
6	Total abandonment	0.36	8

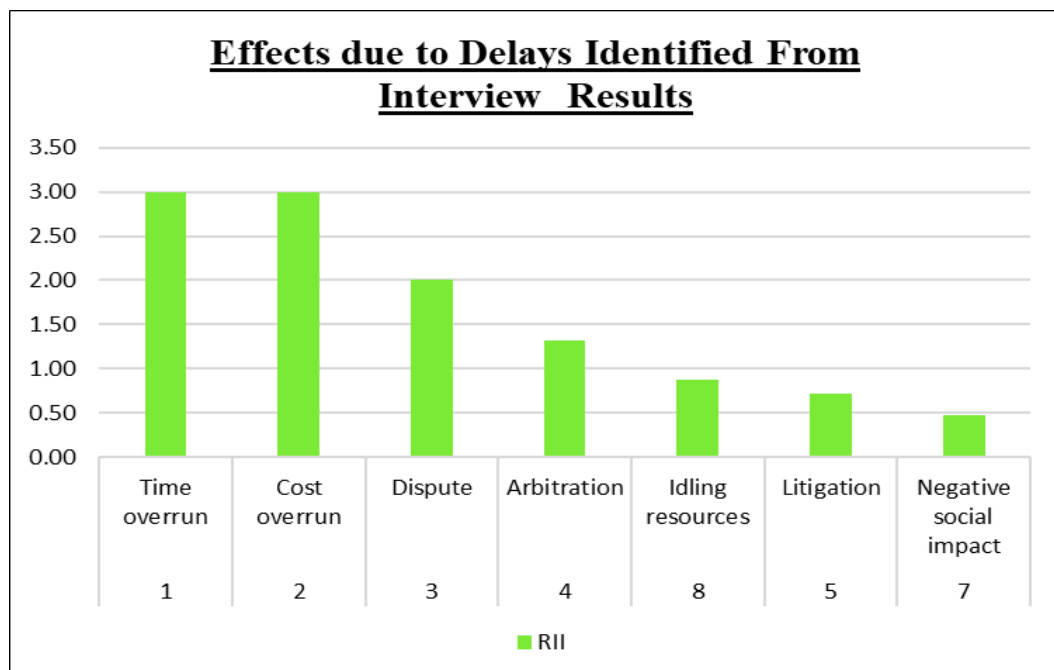


Figure 21- Summary of Effects due to Delay Causes (INR)

5.7 Remedies for Construction Delays

The next set of questions were related to identify the remedies for minimizing or avoid delays causes in the building construction projects in Sri Lanka. Question 5 focused on identifying the essential remedies to minimize or avoid delay causes for project involved parties as a client, consultant, and contractor.

According to the interviewer's responses were used to analyze of the RII values for the remedies and below table 26,27 and 28 shown each responsible parties' consultant, contractor, and client-related remedies in respectively.

Table 26- Interviewer Results- Remedies for Consultant

Responsible Party	Remedy	MP	JD	UR	GK	LK	RII	Rank
Consultant	Provide comprehensive documents on time	4	3	4	3	4	1.92	1
	On-time approval of drawings and do inspection within appropriate time.	4	3	4	4	3	1.92	2
	Improve communication and the relationship between parties towards collaborative approach to minimise future delays	3	2	2	3	3	1.40	3
	To be flexible during evaluating the contractor's work	2	1	1	1	2	0.68	4

According to the interviewer's resonances to remedies for consultant, first higher rank of remedy is identified as providing comprehensive documents on time to the contractor. Expert 1 (personal communication, January 4, 2019) described that when signing the contract; their document must be readily available to issue to the contracting parties; if not work, progress will delay.

Expert 5 (personal communication, January 27, 2019) stated that the consultant grant approvals must be on time for the works, inspection, and material submission. The consultant was delaying approvals for the contractor's requests of inspection for the works, that work unable to carry out the works according to the schedule.

The interviewer's respondents to remedies to the contractor has given higher rank to improve the skills of labors and productivities of the works. Expert 2 (personal communication, January 9, 2019) stated that the contractors are having a crowd of people, but they may not enough skills to perform the work which may be affected to delay of the work as a result of remedies to default works or delay of the works. In Table 27 shown analyzed RII values arranged in highest to lowest rank accordingly.

Table 27- Interviewer Results- Remedies for Contractor

Responsible Party	Remedy	MP	JD	UR	GK	LK	RII	Rank
Contractor	Improve the skilled labour and productivity, well plan the finance	4	4	3	4	4	2.68	1
	Contractor's proper management & planning to be improved	4	4	4	4	3	2.68	2
	Recruit enough and well skilled staff	4	4	3	3	4	1.92	3
	Contractors must make sure they have a sound financial backing	3	4	3	4	3	1.72	4
	Identified potential risk with assess cost impact inform to client	3	2	3	2	3	1.40	5
	Improve communication and the relationship between parties towards collaborative approach to minimise future delays	3	2	3	3	2	1.40	6
	Introduce labour-intensive programmes	2	2	2	2	1	1.32	7
	The contractors would be efficient material procurement.	3	4	3	3	2	1.32	8
	Provide sufficient equipment	2	3	3	2	2	1.20	9
	Should plan the rainy days with other unaffected activities due to rain	1	2	1	2	1	0.68	10

Table 28- Interviewer Results- Remedies for Client

Responsible Party	Remedy	MP	JD	UR	GK	LK	RII	Rank
Client	On time payments to contractors	4	4	4	4	4	4.00	1
	Check resource availability before awarding the contracts for lowest bidders	4	3	3	3	3	2.08	2
	Proper in detailed site investigations to be carried out before finalising the drawings and award the tender	4	4	3	3	4	1.92	3
	Clients must make quick decisions to solve any problem during the execution and speed up approval procedures	4	4	4	3	3	1.92	4
	Speed up finalising claim until become course of delay	4	3	4	4	3	1.92	5
	Obtain necessary approval with allow sufficient fund for those approvals and improve the client's finance	3	4	4	3	3	1.72	6
	Adopt new procurement method like construction management and design-build	3	4	4	3	3	1.72	7
	Client to stick to original plans and to allocate adequate budget for any contract modifications	4	3	4	3	3	1.72	8
	Establish realistic project duration	2	2	3	2	2	1.40	9
	Close monitoring of the work progress	3	2	2	2	2	1.40	10
	While selecting the contractors are not selected based only on the lowest bid	4	2	3	4	3	1.20	11
	Allow sufficient time to do feasibility study and prepare comprehensive financial plan	2	3	2	2	3	1.20	12
	Allow sufficient time for tender preparation and submission	2	3	2	2	3	1.20	13
	Effective planning, scheduling and programme should prepared by qualified and experienced personnel	2	4	4	3	2	1.08	14
	Improve communication and the relationship between parties towards collaborative approach to minimise future delays	2	3	2	4	2	1.00	15

Also, the table 28 shown interviewers result for remedies to client and analysis RII values arranged in highest to lower rank. Expert 1 (personal communication, January 4, 2019) described the contractors' face difficulties to manage their cash flow due to client fails to make a payment on time as an advance payment, interim payment, claim, etc. As a result of delay payment, the contractor also delays to payment for his suppliers, sub-contractors, and other liabilities consequences lead to delay of the work progress. Expert 5 (personal communication, January 27, 2019) stated that every payment application delays approval by the client and take a long time to settle. According to interviewers' resonances results in the analysis most effective remedies to the client identified as on-time payment to the contractor.

Question 6 aims to find the main responsible party for the project performance due to the impact of above-identified causes of delays. According to the view of Expert 2 (personal communication, January 9, 2019) stated that both the client and contractor

are the main responsible parties for project delays, overall, the contractor is most responsible for the delay. Therefore remedies require from a professional perspective to avoid/minimize the delay.

According to the Expert 4 (personal communication, January 22, 2019) views, who is working for the client, the consultant is the most responsible party to cause delays, and they also require remedies to professional practices. Also, Expert 1 (personal communication, January 4, 2019) and Expert 5 (personal communication, January 27, 2019) those are working for the contractor, stated similar point of views and remedies for professional practices would be benefited to all the parties to avoid or minimize the causes of delays.

Further Expert 3 (personal communication, January 19, 2019) stated that both the contractor and consultant are most responsible parties to building construction project delay, which required remedies to follow in professional practices that will benefit to the construction industry.

Question 7 focused on identifying the interviewers have obtained any of other specific delay causes. According to the view of Expert 2 (personal communication, January 9, 2019) who is working for a consultant organization, stated that the client unnecessarily increases the scope of work.

Question 8 focused on obtaining any other remedies that they think more weight to minimize or avoid and disputes due to the cause of delays in building construction project in Sri Lanka. Expert 4 (personal communication, January 22, 2019) who is working for a client, view of point out that Sri Lankan construction project is still followed by the tradition procurement path which is a time consume and risk retained by the client. Therefore, the construction industry needs to admitted other internationally use collaborative procurements path for the building construction projects, which will be shared risk with both the parties and benefited from finishing the project without delay. For the last question, interviewers responded by proving that the importance of such research study considering the future building construction project in Sri Lanka.

5.8 Discussion of Questionnaire and interview data

Both questionnaire and interviews obtained results for significant causes of delay, responsible parties for building construction project delays, effects and remedies to professionals' practice for minimizing or avoid delays in Sri Lankan building construction projects discussed in this subchapter.

Based on the obtained results from the questionnaire surveyor and interviews, the most significant causes of delay almost similar in rank regardless of some minor differences which are shown in table A9-4 in appendix 9 for detail comparison. According to the above results used to calculate "rho" value for interview and questionnaire rank is 0.734 shown in the table A9-5 in Appendix 9 which is better than the critical value of 0.478 specified in table 10 above. This value provided in the data gathered from interviews and questionnaires has a higher correlation value in their responses.

However, the interview responses give more reliable results than the questionnaire results, as explained by Kjeffree (2011), and it allows discussing directly in-depth about the questions about the research topic, While the questionnaire survey sometime may not get a truthful answer.

In order to the above interview results able to the finalized the magnitude of cases of delays by calculating rho values and questionnaire survey results tested with that interview results for a two-tailed test aiming the answers with better correlation. The research finalized the magnitude of causes of delays based on the calculated rho(>0.478) value satisfying limit of the value range. According to that questionnaire survey results presented rank taken into a recommendation to achieves the research objective to find significant causes of delays magnitude in Sri Lankan Building construction Industry. Above table 18 shown on the finalized results.

Also, interview results able to the finalized the magnitude of effects related to delays caused by calculating rho(>0.952) values and questionnaire survey results tested with that interview results for a two-tailed test aiming the answers with better correlation.

The results concluded as both the contractor and client are most responsible parties for delays and another party as a consultant. Based on the questionnaire, results appeared that all parties such as client, consultant, and contractor are responsible for building construction project delays. In order to questionnaire survey results are considered realizable answers as above described client and contractor are equally responsible parties to Sri Lankan building construction project delays. According to the results observed from the interview and questionnaire survey identified the effects and its magnitude varying due to causes of delays described in the as above Chapter/sub-chapters — the below table 29 shown the correlation of the above-identified results.

Table 29- rho value for effect due to delays

Sr. No	Cause of Delay	interview Rank (2)	Questionar Rank (1)	di (2) - (1)	di ²
1	Time overrun	1	1	-	-
2	Cost overrun	2	2	-	-
3	Dispute	3	3	-	-
4	Arbitration	4	5	1	1
8	Idling resources	5	4	(1)	1
5	Litigation	6	7	1	1
7	Negative social impact	7	6	(1)	1
6	Total abandonment	8	8	-	-
$\sum di^2$					4
N					8
rho					0.952
					> 0.929

The critical value for above-identified 6 number of effects shown in table 10 is 0.929, whereas the above table gives the higher value of 0.952, which presented the answers are much correlative. According to this result, the reliability of the answers concluded based on the questionnaire survey results analyzed rank considered to the above list and effects magnitude observed due to delays happens in building construction project in Sri Lanka.

5.9 Remedies of delays to professional in Construction Industry

This subchapter describes the overall remedies to professionals in building construction industry in Sri Lanka, which focused on achieving the 5th objective. As per above, subchapter 5.07 described results from professionals to each parties' remedies ranked in highest to lower rank based on RII values. According to the above subchapter table 26,27 and 28 shown identified essential remedies to each responsible party as a Consultant, Contractor, and client.

Also, the same responses used to analyze overall RII values, which more than the value 1.4 to identify the top 15 number of overall remedies for the professionals. These results arranged in highest to lower rank respectively and outcomes of analyzed results shown in below table 30.

Table 30 – Top 15 number of remedies for professionals in the construction industry

Responsible Party	Remedy	RII	Overall Rank
Client	On time payments to contractors	4.00	1
Contractor	Improve the skilled labour and productivity, well plan the finance	2.68	2
Contractor	Contractor's proper management & planning to be improved	2.68	3
Client	Check resource availability before awarding the contracts for lowest bidders	2.08	4
Client	Proper in detailed site investigations to be carried out before finalising the drawings and award the tender	1.92	5
Client	Clients must make quick decisions to solve any problem during the execution and speed up approval procedures	1.92	6
Client	Speed up finalising claim until become course of delay	1.92	7
Contractor	Recruit enough and well skilled staff	1.92	8
Consultant	Provide comprehensive documents on time	1.92	9
Consultant	On-time approval of drawings and do inspection within appropriate time.	1.92	10
Client	Obtain necessary approval with allow sufficient fund for those approvals and improve the client's finance	1.72	11
Client	Adopt new procurement method like construction management and design-build	1.72	12
Client	Client to stick to original plans and to allocate adequate budget for any contract modifications	1.72	13
Contractor	Contractors must make sure they have a sound financial backing	1.72	14
Contractor	Identified potential risk with assess cost impact inform to client	1.40	15

As per the results outcomes of the above analysis, most of the remedies identified for both the client and contractor to avoid or minimize the delay in building construction industry in Sri Lanka. Also, two remedies belong to consultant party to avoid and minimize the delays. Most effective remedy belongs to the client as on-time payment to contractor and contractor's remedies as improving the skilled labor, productivity and proper financial plan which identified as a second-highest rank in an overall remedy for professional practices. According to the above findings summarised the overall outcome for the research study carried out to achieve the objectives and aim of the research.

CHAPTER 6 - CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter 6 discusses the finalized research findings and conclusions of each objective achieved results succeeded in the aim of the research. Also, it discusses in under few titles relates to research conclusion, recommendations for future studies, limitation of the research, and future research directions for similar researches and author's reflection.

6.2 Conclusion

Above chapter 1 discussed this research study aimed to examine the delay causes in Sri Lankan building construction projects, effects to project performance and to provide the recommendation to minimize/ avoid delays and consequently enhance the performance of building construction project in Sri Lanka.

The aim of the research was achieved by cohesively linking total five (5) number of objectives established at the first stage to conduct this research. The first objective was focused on identifying the significant type of causes of delays that effect to the global construction industry. There were identified 44 number of significant causes of delays and mainly four types of delays by reviewing literature across the global industry as described in the above chapter 2.

The second object fulfilled by reviewing literature review across the global industry as described in the above chapter 2. According to that, concluded that the project stakeholders mainly divided into internal and external stakeholders. The internal stakeholders mainly involved in the construction as a client, principal contractor, and consultant. Furthermore, a literature review concluded by identifying four types of delays existing in the construction industry, such as excusable delay as compensable delay, excusable but non-compensable delay, non-excusable delay, and concurrent delays.

The third and fourth objectives were to examine to identify the most commonly happening delay causes, and significant delay causes that has a high impact on the building construction project in Sri Lanka. The combination of RII values gives the most significant causes of delays with its magnitude, in order to most significant 20 causes of delays magnitude concluded in this research study which clearly described on the above tables 18,24, 29, and both interview's and questionnaire combined results presented in table A9-4 & 5 under appendix 9.

The fifth objective was aimed to provide a recommendation for developing a strategy to improve project professionals' practices to minimize or avoiding delays. Table 30 shows the top 15 remedies identified based on their magnitude according to interview respondents results calculated RII values, which considered the values more than 1.4 providing remedies to minimizing or avoid delay in building construction project in Sri Lanka. Regarding the previous researcher found the interview results are most reliable than the questionnaire survey, in order outcomes of this result concluded to the fifth objective of the research study.

This research study recommended remedies for client perspective, by on-time payment to the contractor and remedies for contractors perspective improve the skilled labor productivity, well plan the finance and contractor's proper management with improved planning are the top 3 most significant remedies magnitude for client and contractors professionals to minimize the delay in building construction industry.

Thus, the research study results recommended to consultant has to provide comprehensive documents on time and on-time approval with allowing sufficient find for those approvals and improve the client's fiancé for minimizing or avoid delays in building construction project. According to the above remedies are recommended to the client, contractor, and consultant to follow the identified magnitude remedies to minimize or avoid delay in building construction project in Sri Lanka.

6.3 Recommendations for future studies

This research study focused on delaying causes with its magnitude in building construction project and remedies magnitude for professional practices in Sri Lanka. Further research can be carried out for causes of delays and remedies for professionals in an infrastructure project in Sri Lanka.

6.4 Researcher's Reflection

The selected research topic was the most bordered, namely; a study on delays in building industry in Sri Lanka from a professional perspective. While continuing through the literature, the author managed to narrow and rename the topics to; A survey on causes and remedies of delays in Sri Lankan Building Construction Industry from Professional perspective.

Initially, the author decided to carry out only a questionnaire survey to primary collect data. Further reviewing literature, readings, and supervisor's guidance, the author, admitted importunacy of interviews in addition to the questionnaire surveyor.

The author initially proposed a research study has amended following the feedback received from the supervisor. First and third objectives in the research proposal those have combined into one subject, which listed as the first objective. Further other objectives were modified suited to the research study topic.

Also, new subchapters were added by following the order of subject matters on "Delay in Construction" as per contract administration, post-contract management, contractual delays. Also, new subchapters added literature related to the project performance procuring construction project, award of the contract, and delay administrates under the contract, construction project stakeholders, the uses of the standard form of contract, and parties' responsibilities and duties under the condition of the contract.

Furthermore, a new chapter added to remedies of delays in construction law under chapter 3. These modifications and alteration were helped to arrange the research objectives in proper order.

Finally, the author has acquired more excellent knowledge via doing this research study process, that would have been enabled to carry out confidently in the future research study of similar nature.

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Appendix – 1 Sources of Reference for Identified Causes of Delays

Party	Sr.No	Causes of Delays	Sources of Reference
Client	1	Client initiated variations, additional & change orders	Chan and Kumaraswamy (1997), Chileshe and Berko (2010), James, et al.,(2014), Pourrostam & Ismail (2012), Desai and Bhatt (2013), Assaf and Al-Hejji (2006),Danel (2014), Jurf & Beheiry (2012), Durdyev, Omarov, & Ismail (2017) Emam, Farrell & Abdelaal (2015),Alaghbari et al. (2007), Al-Momani (2000), Odeh and Battaineh (2002), Odeh & Battaineh (2002), Yasemin Nielsen et al (2013), Chileshe and Berko (2010) Alhomidan (2013), Desai and Bhatt (2013), Megha Desai & Rajiv Bhatt (2013), Ravisankar K.L, and Ananad K.S (2008), Emam, Farrell & Abdelaal (2015), Apolot, Alinaitwe, & Tindiwensi (Undated), Iyer, Chaphalkar, and Joshi (2008)
	2	Client's slow decision making and improper planning	Odeh & Battaineh (2002), Chan and Kumaraswamy (1997), Odeh and Battaineh (2002), Odeh and Battaineh (2002), B. Umasankar et.al(2006), Aziz & Abdel-Hakam (2016), Desai and Bhatt (2013), Assaf and Al-Hejji (2006), Pourrostam and Ismail (2012), James, et al. (2014), Danel (2014),Seboru (2015)
	3	Poor communication and coordination by owner and other parties	Desai and Bhatt (2013), Assaf and Al-Hejji (2006), Danel (2014), Murali et al, (2007), Sambasivan and Soon (2007), Ren,Atout & Jones (2008)
	4	Delays in contractor's payment by owner	Megha Desai & Rajiv Bhatt (2013), Ren,Atout & Jones (2008), B. Umasankar et al (2006), Pourrostam & Ismail (2012), Assaf & Al-Hejji (2006), Seboru (2015), Mansfield, Ugwu, & Doran (1994), Desai, and Bhatt (2013), Assaf and Al-Hejji (2006), Chileshe and Berko (2010), Mahamidl, Bruland, & Dmaidl (2012), Frimpong, Oluwoye, & Crawford (2003)
	5	Delays in nomination of sub-contractors and suppliers by client	Ren,Atout & Jones (2008),Al-Barak (1993)
	6	Financial issue and payment delay by owners for completed works	Sambasivan and Soon (2007), Samarakoon S.M.S. (2009) Odeh and Battaineh (2002), Chileshe and Berko (2010), Murali et al (2007), Danel (2014), K L Ravisankar, and Dr.S Ananad Kumar (2008),Desai, and Bhatt (2013), Assaf and Al-Hejji, (2006)
	7	Incorrect site information by client	Alaghbari et al. (2007), Chileshe and Berko (2010)
	8	Lowest bid awarding	Mahamidl, Bruland, & Dmaidl (2012)
	9	Suspension of work by owner cause delay.	Desai, and Bhatt (2013), Assaf and Al-Hejji (2006), Iyer, Chaphalkar, & Joshi (2008)
	10	Unrealistically estimation of contract period given by client	Ren,Atout & Jones (2008), Emam, Farrell & Abdelaal (2015)

Party	Sr.No	Causes of Delays	Sources of Reference
Consultant	1	Consultant delays for instructions, approvals	Danel (2014), Ren,Atout & Jones (2008)
	2	Delay in approving shop drawings and sample materials by consultant	Desai, and Bhatt (2013), Assaf and Al-Hejji (2006), Pourrostam & Ismail (2012), Emam, Farrell & Abdelaal (2015), Al-Momani (2000), Desai, and Bhatt (2013), Assaf and Al-Hejji (2006), Alhomidan (2013), Desai and Bhatt (2013), Umasankar B. et al (2006), Alaghbari et al. (2007)
	3	Delay in issuing change orders	Emam, Farrell & Abdelaal (2015)
	4	Imperfect documents in the contract by consultant	Ren,Atout and Jones (2008), James, et al. (2014), Emam, Farrell and Abdelaal (2015), Pourrostam and Ismail (2012), Alhomidan (2013), Desai and Bhatt (2013), Alhomidan (2013), Desai and Bhatt (2013), Alhomidan (2013), Desai and Bhatt (2013), Noulmanee A, Wachirathamrojn J, Tantichattanont P and Sittivijan P. (1999), Ren,Atout & Jones (2008)
	5	Long inspection procedures or late inspection by consultant	Ren,Atout & Jones (2008), Alhomidan (2013), Desai and Bhatt (2013)
	6	Specification and drawing changes by consultant	Ren,Atout & Jones (2008)

Party	Sr.No	Causes of Delays	Sources of Reference
Contractor	1	Accidents during construction	Assaf and Al-Hejji (2006), Iyer, Chaphalkar, and Joshi (2008), Durdyeve, Omarov, & Ismail (2017)
	2	Bad decisions in regulating company's policy	Al-Momani (2000), Al-Barak (1993)
	3	Contractor's financial difficulties and liquidation	Aziz and Abdel-Hakam (2016), Mahamidl, Bruland, & Dmaidi (2012), Assaf & Al-Hejji (2006), Ren,Atout & Jones (2008), Odeh and Battaineh (2002), Megha D. and Rajiv Bhatt (2013), Odeh & Battaineh (2002), Jurf & Beheiry (2012),Pourrostam and Ismail (2012), Assaf and Al-Hejji (2006), Ren,Atout & Jones (2008), Odeh and Battaineh (2002), James, et al. (2014)
	4	Contractor's less experience	Murali et al. (2007), Odeh and Battaineh (2002), Sambasivan and Soon (2007) Odeh and Battaineh (2002)
	5	Contractor's low overall productivity	Odeh and Battaineh (2002), Odeh and Battaineh (2002), Umasankar B. et al (2006)
	6	Contractor's poor site management	Murali et al. (2007), Assaf and Al-Hejji (2006),Aziz and Abdel H. (2016), Mansfield, Ugwu, & Doran (1994), Pourrostam & Ismail (2012), James, et al. (2014), Osei-Tutu and Adjei-Kumi (2009), Samarakoon S.M.S. (2009), Osei-Tutu and Adjei-Kumi (2009), Sambasivan and Soon (2007), Frimpong, Oluwoye, & Crawford (2003), Chileshe and Berko (2010), Yasemin Nielsen et al (2013), Chan and Kumaraswamy (1997), Chan and Kumaraswamy (1997), Samuel O., Afram, Anthony B.D., Genevieve E. E., and Titus E. K. (2011), Stumpf (2000), Mansfield (1994), Alaghbari et al. (2007), Ravisankar K.L., and Ananad K.S. (2008)
	7	Delays from sub-contractors and nominated suppliers by contractor	Odeh and Battaineh (2002), Samuel O. et al (2011), Jurf and Beheiry (2012), Danel (2014), Umasankar B. et al (2006)
	8	Inadequate technical performances	Frimpong, Oluwoye, & Crawford (2003)
	9	Ineffective planning and scheduling of project	Samuel O., Afram, Anthony B.D., Genevieve E. E., and Titus E. K., (2011) Alaghbari et al. (2007), Pourrostam and Ismail (2012), Yasemin Nielsen et al (2013), Seboru (2015), Assaf & Al-Hejji (2006), Odeh and Battaineh (2002), Samarakoon S.M.S. (2009), Danel (2014), Odeh and Battaineh (2002), Murali et al. (2007), Odeh and Battaineh (2002), Danel (2014), Odeh and Battaineh (2002), Murali et al. (2007)
	10	In-proper technical study carried out during bidding stage	Al-Barak (1993), Emam, Farrell & Abdelaal (2015)
	11	Insufficient labours on site and skilled labours	Durdyeve, Omarov, & Ismail (2017), Assaf & Al-Hejji (2006), Sambasivan and Soon (2007), Durdyeve, Omarov, & Ismail (2017)
	12	Mistakes by the contractor during construction	Sambasivan and Soon (2007), Ren, Atout & Jones (2008), Murali et al. (2007), James, et al. (2014)
	13	Organization that lacks sufficient resources	Noulmanee A, Wachirathamrojn J, Tantichattanont P and Sittivijan P. (1999), Ren, Atout & Jones (2008), James, et al. (2014)
	14	Poor contract management	Mansfield (1994)
	15	Poor risk management and supervision	Chan and Kumaraswamy (1997), Aziz and Abdel-Hakam (2016)
	16	Rework due to errors during construction	Iyer, Chaphalkar, and Joshi (2008), Yasemin Nielsen et al (2013), Ravisankar K. L., and Ananad K.S. (2008), Samuel O. A, Anthony B. D., Genevieve E. E., and Titus E. K., (2011), Osei T. and Adjei K.(2009)
	17	Wrong selection of type /capacity of equipment	Ravisankar K.L., and Ananad K. S. (2008), Sambasivan and Soon (2007), James, et al.(2014)

Party	Sr.No	Causes of Delays	Sources of Reference
External	1	Bad weather conditions /natural disasters (flood, earthquake)	Al-Momani (2000), Aziz and Abdel H. (2016), Ravisankar K. L., and Ananad K. S. (2008), James, et al.(2014), Iyer, Chaphalkar, and Joshi (2008), Durdyev, Omarov, & Ismail (2017), Yasemin N. et al (2013)
	2	Complexity of project	Durdyev, Omarov, & Ismail (2017), Yasemin N. et al (2013)
	3	Inadequacy of sub-contractors	Sambasivan and Soon (2007), Noulmanee A, Wachirathamroj J, Tantichattanont P and Sittivijan P. (1999)
	4	Inflation and interest rate	Apobot, Alinaitwe, & Tindiweni (Undated), Chileshe and Berko (2010)
	5	Lack of transparency with permit acquisition cost	Osei-Tutu and Adjei-Kumi (2009)
	6	Overall price fluctuations	Mansfield (1994), Frimpong, Oluwoye, & Crawford (2003), James, et al. (2014), Mansfield, Ugwu, & Doran (1994), Yasemin Nielsen et al (2013), Ravisankar K. L. and Ananad K. S. (2008)
	7	Political condition	Mahamidl, Bruland, & Dmaidl (2012)
	8	· Shortage in material, labour supply, equipment availability in the market	Durdyev, Omarov, & Ismail (2017), Mansfield, Ugwu, & Doran (1994), Sambasivan and Soon (2007), Mansfield (1994), Murali et al, (2007), Aziz & Abdel-Hakam (2016), Mahamidl, Bruland, & Dmaidl (2012), Samarakoon S.M.S. (2009), Ravisankar K. L., and Ananad K. S. (2008) , Jurf & Beheiry (2012), Frimpong, Oluwoye, & Crawford (2003), Emam, Farrell & Abdelal (2015), Yasemin Nielsen et al (2013)
	9	Unforeseen ground condition	Chan and Kumaraswamy (1997)

Party	Sr.No	Causes of Delays	Sources of Reference
Government	1	Government law and regulations	Iyer, Chaphalkar, and Joshi (2008) Assaf & Al-Hejji (2006)
	2	Government-related delays include delays in obtaining permit from local authorities	Osei-Tutu and Adjei-Kumi (2009)

Appendix – 2 Sources of Reference for Identified Remedies for Delays

Party	No	Remedy	Reference
Client	1	Establish realistic project duration	Marzouk & El-Rasas (2014)
	2	Allow sufficient time to do feasibility study and prepare comprehensive financial plan	Marzouk & El-Rasas (2014)
	3	Obtain necessary approval with allow sufficient fund for those approvals and improve the client's finance	Marzouk & El-Rasas (2014), Seboru (2015), Murali Sambasivan and Yau Wen Soon (2006), Sambasivan & Soon (2007), Pourrostam & Ismail (2012), M.A. Othuman Mydin, N. Md Sani, N.A Agus Salim and, N. and Mohamed Alias, (2014)
	4	Adopt new procurement method like construction management and design-build	Odeh & Battaineh (2002)
	5	Allow sufficient time for tender preparation and submission	Mahamidl, Bruland, & Dmaid (2012), Mansfield, Ugwu, & Doran (1994)
	6	On time payments to contractors	Mahamidl, Bruland, & Dmaid (2012)
	7	Check resource availability before awarding the contracts for lowest bidders	Mahamidl, Bruland, & Dmaid (2012), Mansfield, Ugwu, & Doran (1994), Murali Sambasivan and Yau Wen Soon (2006)
	8	While selecting the contractors are not selected based only on the lowest bid	Murali Sambasivan and Yau Wen Soon (2006), Sambasivan & Soon (2007)
	9	Proper in detailed site investigations to be carried out before finalising the drawings and award the tender	Mahamidl, Bruland, & Dmaid (2012), Marzouk & El-Rasas (2014), Pourrostam & Ismail (2012), M.A. Othuman Mydin, N. Md Sani, N.A Agus Salim and, N. and Mohamed Alias, (2014)
	10	Effective planning, scheduling and programme should prepared by qualified and experienced personnel	Mansfield, Ugwu, & Doran (1994), Jurf & Beheiry (2012), Pourrostam & Ismail (2012), M.A. Othuman Mydin, N. Md Sani, N.A Agus Salim and, N. and Mohamed Alias, (2014)
	12	Speed up finalising claim until become course of delay	Seboru (2015)
	11	Clients must make quick decisions to solve any problem during the execution and speed up approval procedures	Murali Sambasivan and Yau Wen Soon (2006), Sambasivan & Soon (2007), Seboru (2015)
	13	Client to stick to original plans and to allocate adequate budget for any contract modifications	M.A. Othuman Mydin, N. Md Sani, N.A Agus Salim and, N. and Mohamed Alias, (2014), S.M.S. Samarakoon (2009)
	14	Close monitoring of the work progress	M.A. Othuman Mydin, N. Md Sani, N.A Agus Salim and, N. and Mohamed Alias, (2014), S.M.S. Samarakoon (2009), Alinaitwe, Apolot, & Tindiwensi (2013)
	15	Improve communication and the relationship between parties towards collaborative approach to minimise future delays	Mahamidl, Bruland, & Dmaid (2012), improve the supervision and site management, Alinaitwe, Apolot, & Tindiwensi (2013)

Party	No	Reamdy	Reference
Consultant	1	Provide comprehensive documents on time	Mahamidl, Bruland, & Dmaidi (2012), Marzouk & El-Rasas (2014), Sambasivan & Soon (2007), Murali and Yau Wen Soon, (2006)
	2	To be flexible during evaluating the contractor's work	Mahamidl, Bruland, & Dmaidi (2012), Marzouk & El-Rasas (2014)
	3	On-time approval of drawings and do inspection within appropriate time.	Sambasivan & Soon (2007), Murali and Yau Wen Soon, (2006)
	4	Improve communication and the relationship between parties towards collaborative approach to minimise future delays	Mahamidl, Bruland, & Dmaidi (2012), improve the supervision and site management, Alinaitwe, Apolot, & Tindiwensi (2013)

Party	No	Reamdy	Reference
Contractor	1	Recruit enough and well skilled staff	Mahamidl, Bruland, & Dmaidi (2012), Sambasivan & Soon (2007), Sullivan and F. C. Harris, (1985)
	2	Improve the skilled labour and productivity, well plan the finance	Mahamidl, Bruland, & Dmaidi (2012), Sambasivan & Soon (2007)
	3	Provide sufficient equipment	Mahamidl, Bruland, & Dmaidi (2012)
	4	Improve communication and the relationship between parties towards collaborative approach to minimise future delays	Mahamidl, Bruland, & Dmaidi (2012), improve the supervision and site management, Alinaitwe, Apolot, & Tindiwensi (2013)
	5	Contractor's proper management & planning to be improved	Seboru (2015), Mansfield, Ugwu, & Doran (1994), Marzouk & El-Rasas (2014), Sambasivan & Soon (2007), The society of construction law delay and disruption protocol, 2002), S.M.S. Samarakoon (2009), Chan & Kumaraswamy (1997), Murali and Yau Wen Soon, (2006)
	6	Should plan the rainy days with other unaffected activities due to rain	Seboru (2015)
	7	Introduce labour-intensive programmes	Mansfield, Ugwu, & Doran (1994)
	8	Identified potential risk with assess cost impact inform to client	Jurf & Beheiry (2012), Irish Construction Industry Annual (2007), Institute Federal Acquisition Institute (LMI), Center for Public Administration (CPA) (2000)
	9	Contractors must make sure they have a sound financial backing	Murali and Yau Wen Soon (2006)
	10	The contractors would be efficient material procurement.	S.M.S. Samarakoon (2009)

Appendix – 3 Sources of Reference for Identified Effect of Delays

Sr.No	Effects of Delays	Sources of Reference
1	Time overrun	Murali et al, (2007), Jurf & Beheiry (2012), Kaming et al. (1997), Aibinu et.al (2002), Kaming et al. (1997), Tushar et al. (2016) , (James, et al., 2014) ,Aibinu and Jagboro (2002), Murali Sambasivan and Yau Wen Soon (2016), time overruns, (Pourrostam & Ismail, 2012) ,Chan and Kumaraswamy (1997) ,Frimpong et al. (2003) , Abedi, M., Fathi, M. S. and Mohammad (2011), (Kikwasi, G.J., 2012)., S.M.S. Samarakoon (2009)
2	Cost overrun	K. L. Ravisankar et al. (2008), Murali et al, (2007), Jurf & Beheiry (2012), Aibinu et.al (2002), Kaming et al. (1997), Kikwasi, G.J (2012), Aibinu et.al (2002), Kikwasi, G.J (2012), Tushar et al. (2016) ,(James, et al., 2014) ,Aibinu and Jagboro (2002) ,Murali Sambasivan and Yau Wen Soon (2016), Manavizha and Adhikarib (2002),(Pourrostam & Ismail, 2012) , Frimpong et al. (2003) , Abedi, M., Fathi, M. S. and Mohammad (2011), (Kikwasi, G.J., 2012)., Ramabodu and Verster (2010) , S.M.S. Samarakoon (2009)
3	Disputes	Kikwasi, G.J (2012), Murali et al, (2007), Jurf & Beheiry (2012),(James, et al., 2014) ,Aibinu and Jagboro (2002) ,Murali Sambasivan and Yau Wen Soon (2016),(Pourrostam & Ismail, 2012), Abedi, M., Fathi, M. S. and Mohammad (2011) ,(Kikwasi, G.J., 2012)., S.M.S. Samarakoon (2009)
4	Arbitration	(James, et al., 2014), Murali et al, (2007) ,Aibinu and Jagboro (2002) ,Murali Sambasivan and Yau Wen Soon (2016),(Pourrostam & Ismail, 2012) ,Abedi, M., Fathi, M. S. and Mohammad (2011) , S.M.S. Samarakoon (2009)
5	Litigation	(James, et al., 2014), Murali et al, (2007) , Aibinu and Jagboro (2002) ,Murali Sambasivan and Yau Wen Soon (2016),(Pourrostam & Ismail, 2012) , Abedi, M., Fathi, M. S. and Mohammad (2011)
6	Total abandonment	Tushar et al. (2016), (James, et al., 2014) ,Aibinu and Jagboro (2002) ,Murali Sambasivan and Yau Wen Soon (2016),(Pourrostam & Ismail, 2012), Abedi, M., Fathi, M. S. and Mohammad (2011)
7	Negative social impact	Kikwasi, G.J (2012), Kikwasi, G.J (2012), (Kikwasi, G.J., 2012).
8	Idling resources	Kikwasi, G.J (2012), Kikwasi, G.J (2012),(Kikwasi, G.J., 2012).

Appendix – 4 Research Questioners Sample

Appendix – 5 Research Questioners Responses Sample

Appendix – 6 Interview Questioners

Name: W.A.D. N Pramuka

Student No: 159166 F

University: University of Moratuwa Sri Lanka

MSc program: Construction Law and Dispute Resolution

This is questionnaires providing in advance to an interviewer to providing a response during the interview at the time. It is facilitated interviewer to provide better responses for successes in the interview process and that responses are most valuable to the outcome of the research.

Research Topic;

A STUDY ON DELAYS IN BUILDING INDUSTRY IN SRI LANKA FROM
PROFESSIONAL PROSPECTIVE

Aim of Research

The aim of this research study is to identify the major cause of delays commonly happening in building construction industry in Sri Lanka and find remedies to professional practices for minimizing such delays and disputes in the building construction project.

Participants for Research Study (Interview)

This study aim is to identified delays and remedies in building construction projects in Sri Lanka, and outlooks of different area personals practices (i.e., Client, Consultant, Contractor, The Engineer and Project Management) reflect the delays and their responsibilities due to a different working arrangement.

In order to maintain equality of the answers, the author has planned to interview equal standing professionals (6 Nos) from different sectors in Sri Lankan building construction industry. According to your professional experience in building construction industry, you have been kindly selected for an interview for this research

study representing the sectors among the above mentioned. I would like to discuss the following areas during an interview with you.

Section-1-General Questions;

1. What is your current profession, please describe?
2. How many years' do you have experience in your' working area?
3. How many years' do you have experience in building construction?
4. What type of scale projects do you have in the experience?

Section-2 - Questions relevant to the research objectives;

1. When considering the Building construction projects where you worked or working in Sri Lanka, are those delayed or not?
2. Approximately how many building projects were delayed where you worked in Sri Lanka?
3. What does the average percentage of the project in delay compare to its original contract duration?
4. I have identified the highest level of causes of delays from the Questioner surveys as listed below. In your experience, provide a rate for “impact to project delay” and “frequency of occurrence.” Your answers and results of the questionnaire taken into the two-tailed test, in order to that answers achieved in good correlation.

Impact - Very Low (0), Low (1), Medium (2), High (3) and Very High (4)

Frequency - Never (0), Rare (1), Occasional (2), Frequently (3) and Continual (4).

Major Cases of Delays	Impact	Frequency
To identified data analysis from Questionnaire (to be listed base on questionnaire survey result)		

5. The literature review has been identified remedies for minimizing or avoid delay causes in the Building project as below list. Please provide your scale of rating to select the remedies to Sri Lankan Building construction professionals

as above identified significant causes of delays. Below rating, scales can be used to

6. provide your rating scale. Rating Scale: Strongly Disagree (0), Disagree (1), Neutral (2), Agreed (3), Strongly Agreed (4)
7. Overlay in this discussion, who will be the main responsible party to delay building project in Sri Lanka?
8. According to the above discussed/identified causes of delays, are there any other specific delay causes that you think more weight to delays to Building Construction projects in Sri Lanka?
9. Similarly, above-identified remedies for delay causes, are there any other specific remedies that you think more weight to minimize/avoid due to causes of delays in Building Construction Projects in Sri Lanka?
10. In overall view and to our discussions, any special note that you can point out related to my research topic.

Thank You.

Party	No	Remedy	Respond Rate
Client	1	Establish realistic project duration	
	2	Allow sufficient time to do feasibility study and prepare comprehensive financial plan	
	3	Obtain necessary approval with allow sufficient fund for those approvals and improve the client's finance	
	4	Adopt new procurement method like construction management and design-build	
	5	Allow sufficient time for tender preparation and submission	
	6	On time payments to contractors	
	7	Check resource availability before awarding the contracts for lowest bidders	
	8	While selecting the contractors are not selected based only on the lowest bid	
	9	Proper in detailed site investigations to be carried out before finalising the drawings and award the tender	
	10	Effective planning, scheduling and programme should prepared by qualified and experienced personnel	
	12	Speed up finalising claim until become course of delay	
	11	Clients must make quick decisions to solve any problem during the execution and speed up approval procedures	
	13	Client to stick to original plans and to allocate adequate budget for any contract modifications	
	14	Close monitoring of the work progress	
	15	Improve communication and the relationship between parties towards collaborative approach to minimise future delays	
Party	No	Remedy	
Contractor	1	Recruit enough and well skilled staff	
	2	Improve the skilled labour and productivity, well plan the finance	
	3	Provide sufficient equipment	
	4	Improve communication and the relationship between parties towards	
	5	Contractor's proper management & planning to be improved	
	6	Should plan the rainy days with other unaffected activities due to rain	
	7	Introduce labour-intensive programmes	
	8	Identified potential risk with assess cost impact inform to client	
	9	Contractors must make sure they have a sound financial backing	
	10	The contractors would be efficient material procurement.	
Party	No	Remedy	
Consultant	1	Provide comprehensive documents on time	
	2	To be flexible during evaluating the contractor's work	
	3	On-time approval of drawings and do inspection within appropriate time.	
	4	Improve communication and the relationship between parties towards collaborative approach to minimise future delays	

Appendix – 7 Interview Questioners Responses Sample

Appendix – 8 Questionnaire Data RII Analysis

Table A8 – Overall ranking for 44 causes of delays analyzed by using Impact and Frequency RII values

Party	Major Causes	Causes RII (1)	Frequency RII (2)	Combined RII (1) x (2)	Rank
Client	Client initiated variations, additional & change orders	1.20	1.17	1.40	1
Client	Client's slow decision making and improper planning	1.23	0.98	1.21	2
contractor	Ineffective planning and scheduling of project	0.90	0.94	0.84	3
Consultant	Delay in issuing change orders	0.86	0.89	0.76	4
contractor	Poor contract management	0.87	0.83	0.72	5
contractor	Poor risk management and supervision	0.90	0.79	0.71	6
Consultant	Delay in approving design, shop drawings and sample materials by consultant	0.88	0.78	0.68	7
External	Bad weather conditions /natural disasters (flood, earthquake)	0.72	0.93	0.68	8
Client	Financial issue and payment delay by owners for completed works	0.79	0.81	0.64	9
Consultant	Specification and drawing changes by consultant	0.79	0.79	0.63	10
contractor	Contractor's poor site management	0.78	0.74	0.58	11
contractor	Mistakes by the contractor during construction	0.65	0.85	0.55	12
Consultant	Consultant delays for instructions, approvals	0.83	0.66	0.55	13
contractor	Insufficient labours on site and skilled labours	0.73	0.71	0.52	14
External	Inadequacy of sub-contractors	0.71	0.68	0.49	15
contractor	Delays from sub-contractors and nominated suppliers	0.75	0.64	0.48	16
contractor	Rework due to errors during construction	0.68	0.68	0.47	17
contractor	Contractor's low overall productivity	0.57	0.74	0.42	18
contractor	Organization that lacks sufficient resources	0.67	0.61	0.41	19
Consultant	Imperfect documents in the contract by consultant	0.56	0.72	0.40	20
contractor	Inadequate technical performances	0.66	0.59	0.39	21
External	Shortage in material, labour supply, equipment availability	0.64	0.54	0.35	22
Consultant	Long inspection procedures or late inspection by consultant	0.57	0.57	0.33	23
Client	Incorrect site information by client	0.54	0.56	0.30	24
contractor	Wrong selection of type /capacity of equipment	0.52	0.57	0.29	25
Client	Poor communication and coordination by owner and other parties	0.58	0.49	0.28	26
contractor	Contractor's financial difficulties and liquidation	0.49	0.58	0.28	27
External	Unforeseen ground condition	0.54	0.50	0.27	28
contractor	In-proper technical study carried out during bidding stage	0.50	0.53	0.27	29
External	Complexity of project	0.49	0.54	0.27	30
Client	Delay to furnish and deliver the site to the contractor by client	0.49	0.54	0.26	31
External	Inflation and interest rate	0.51	0.46	0.23	32
Government	Government-related delays include delays in obtaining permit from local authorities	0.50	0.43	0.21	33
Government	Government law and regulations	0.49	0.43	0.21	34
External	Overall price fluctuations	0.49	0.42	0.21	35
Client	Unrealistically estimation of contract period given by client	0.43	0.47	0.20	36
Client	Suspension of work by owner cause delay.	0.49	0.41	0.20	37
Client	Delays in nomination of sub-contractors and suppliers by client	0.44	0.45	0.20	38
External	Lack of transparency with permit acquisition cost	0.44	0.45	0.20	39
contractor	Contractor's less experience	0.39	0.50	0.20	40
External	Political condition	0.44	0.44	0.20	41
Client	Lowest bid awarding by client	0.46	0.41	0.19	42
contractor	Bad decisions in regulating company's policy	0.39	0.44	0.17	43
contractor	Accidents during construction	0.37	0.40	0.15	44

Appendix – 9 Interview Results Analysis

Table A9-1 Interview results analysis for causes of delays

Rank	Party	Cause of Delay	MP	JD	UR	GK	LK	RII
1	Client	Client's slow decision making and improper planning	3	3	3	3	3	3.00
2	Client	Client initiated variations, additional & change orders	4	3	3	3	3	2.08
3	Consultant	Imperfect documents in the contract by consultant	3	2	3	3	3	2.00
4	contractor	Poor risk management and supervision	3	3	3	2	3	2.00
5	Client	Delay to furnish and deliver the site to the contractor by client	3	3	2	2	3	1.40
6	Client	Incorrect site information by client	3	3	2	2	3	1.40
7	contractor	Ineffective planning and scheduling of project	3	3	3	2	2	1.40
8	contractor	Insufficient labours on site and skilled labours	3	3	2	2	3	1.40
9	Consultant	Consultant delays for instructions, approvals	3	3	4	2	3	1.32
10	Consultant	Delay in approving design, shop drawings and sample materials by consultant	3	2	4	3	3	1.32
11	Consultant	Delay in issuing change orders	3	2	4	3	3	1.32
12	External	Bad weather conditions /natural disasters (flood, earthquake)	4	3	3	1	3	1.28
13	contractor	Contractor's poor site management	2	2	3	3	2	1.20
14	contractor	Delays from sub-contractors and nominated suppliers	2	2	3	3	2	1.20
15	contractor	Poor contract management	3	3	3	2	1	1.20
16	Client	Financial issue and payment delay by owners for completed work	4	3	2	2	4	1.08
17	Client	Lowest bid awarding by client	1	1	1	1	1	1.00
18	Client	Poor communication and coordination by owner and other parties	2	2	1	1	2	0.88
19	contractor	Contractor's low overall productivity	1	3	2	2	2	0.88
20	contractor	Inadequate technical performances	2	2	1	1	2	0.88
21	contractor	Mistakes by the contractor during construction	2	2	2	1	3	0.88
22	Consultant	Specification and drawing changes by consultant	1	1	3	3	1	0.84
23	contractor	Organization that lacks sufficient resources	2	3	1	3	2	0.84
24	External	Inadequacy of sub-contractors	3	0	2	2	2	0.84
25	External	Shortage in material, labour supply, equipment availability	2	3	2	3	0	0.80
26	Client	Delays in nomination of sub-contractors and suppliers by client	2	1	1	1	1	0.72
27	contractor	In-proper technical study carried out during bidding stage	1	1	1	2	2	0.68
28	contractor	Accidents during construction	1	0	1	1	1	0.64
29	Consultant	Long inspection procedures or late inspection by consultant	2	1	2	3	1	0.60
30	contractor	Rework due to errors during construction	2	3	2	1	1	0.60
31	contractor	Wrong selection of type /capacity of equipment	1	3	1	2	2	0.60
32	contractor	Contractor's less experience	1	1	1	0	2	0.44
33	Client	Suspension of work by owner cause delay.	1	0	1	0	1	0.36
34	contractor	Contractor's financial difficulties and liquidation	1	1	0	0	1	0.36
35	External	Complexity of project	1	3	0	1	0	0.28
36	Client	Unrealistically estimation of contract period given by client	1	0	0	0	1	0.16
37	contractor	Bad decisions in regulating company's policy	1	0	0	0	1	0.16
38	External	Lack of transparency with permit acquisition cost	0	0	0	1	1	0.16
39	External	Inflation and interest rate	1	2	0	0	0	0.12
40	External	Overall price fluctuations	0	0	0	0	2	0.08
41	External	Unforeseen ground condition	0	2	0	0	0	0.08
42	External	Political condition	0	0	0	0	0	0.00
43	Government	Government law and regulations	0	0	0	0	0	0.00
44	Government	Government-related delays include delays in obtaining permit from	0	0	0	0	0	0.00

Table A9-2 Interview results analysis for the frequency of happening identified causes of delay

Rank	Party	Cause of Delay	MP	JD	UR	GK	LK	RII
1	Client	Client initiated variations, additional & change orders	3	3	3	3	3	3.00
2	Client	Client's slow decision making and improper planning	3	3	3	2	3	2.00
3	Consultant	Consultant delays for instructions, approvals	3	2	3	3	3	2.00
4	Consultant	Delay in issuing change orders	3	2	3	3	3	2.00
5	contractor	Contractor's poor site management	2	2	2	2	2	2.00
6	contractor	Delays from sub-contractors and nominated suppliers	2	2	2	2	2	2.00
7	External	Shortage in material, labour supply, equipment availability	2	2	2	2	2	2.00
8	Consultant	Delay in approving design, shop drawings and sample materials by consultant	3	1	3	3	3	1.96
9	Client	Financial issue and payment delay by owners for completed works	3	3	2	2	3	1.40
10	Consultant	Imperfect documents in the contract by consultant	3	2	2	3	3	1.40
11	Client	Incorrect site information by client	2	2	2	1	2	1.32
12	External	Inadequacy of sub-contractors	2	0	2	2	2	1.28
13	Client	Delay to furnish and deliver the site to the contractor by client	3	3	2	2	2	1.20
14	contractor	Insufficient labours on site and skilled labours	2	3	2	2	3	1.20
15	contractor	Poor risk management and supervision	3	3	2	1	3	1.20
16	External	Bad weather conditions /natural disasters (flood, earthquake)	3	3	3	1	2	1.20
17	Client	Delays in nomination of sub-contractors and suppliers by client	1	1	1	1	1	1.00
18	Client	Lowest bid awarding by client	1	1	1	1	1	1.00
19	contractor	Contractor's low overall productivity	1	1	2	2	2	0.88
20	contractor	Organization that lacks sufficient resources	2	2	1	2	1	0.88
21	contractor	Wrong selection of type /capacity of equipment	1	2	1	2	2	0.88
22	Consultant	Specification and drawing changes by consultant	1	1	3	3	1	0.84
23	contractor	Ineffective planning and scheduling of project	3	3	2	1	1	0.72
24	contractor	Poor contract management	3	3	2	1	1	0.72
25	Client	Poor communication and coordination by owner and other parties	1	1	1	1	2	0.72
26	contractor	In-proper technical study carried out during bidding stage	1	1	1	2	1	0.72
27	Consultant	Long inspection procedures or late inspection by consultant	1	1	2	2	1	0.68
28	contractor	Inadequate technical performances	2	2	1	1	1	0.68
29	contractor	Accidents during construction	1	0	1	1	1	0.64
30	contractor	Contractor's less experience	1	1	1	0	1	0.64
31	contractor	Mistakes by the contractor during construction	2	2	1	1	3	0.60
32	contractor	Rework due to errors during construction	2	3	1	1	1	0.56
33	Client	Suspension of work by owner cause delay.	1	0	1	0	1	0.36
34	contractor	Contractor's financial difficulties and liquidation	1	1	0	0	1	0.36
35	External	Complexity of project	1	3	0	1	0	0.28
36	Client	Unrealistically estimation of contract period given by client	1	0	0	9	1	0.16
37	contractor	Bad decisions in regulating company's policy	1	0	0	0	1	0.16
38	External	Inflation and interest rate	1	2	0	0	0	0.12
39	External	Lack of transparency with permit acquisition cost	0	0	0	1	0	0.04
40	External	Overall price fluctuations	0	0	0	0	1	0.04
41	External	Political condition	0	0	0	0	0	0.00
42	External	Unforeseen ground condition	0	0	0	0	0	0.00
43	Government	Government law and regulations	0	0	0	0	0	0.00
44	Government	Government-related delays include delays in obtaining permit from local	0	0	0	0	0	0.00

Table A9-3 Interview results analysis for both causes and frequency combined**RII value**

Rank	Party	Cause of Delay	RII Course	RII Frequency	RII Combined
1	Client	Client initiated variations, additional & change orders	2.08	3.00	6.24
2	Client	Client's slow decision making and improper planning	3.00	2.00	6.00
3	Consultant	Imperfect documents in the contract by consultant	2.00	1.40	2.80
4	Consultant	Consultant delays for instructions, approvals	1.32	2.00	2.64
5	Consultant	Delay in issuing change orders	1.32	2.00	2.64
6	Consultant	Delay in approving design, shop drawings and sample materials by consultant	1.32	1.96	2.59
7	contractor	Poor risk management and supervision	2.00	1.20	2.40
8	contractor	Contractor's poor site management	1.20	2.00	2.40
9	contractor	Delays from sub-contractors and nominated suppliers	1.20	2.00	2.40
10	Client	Incorrect site information by client	1.40	1.32	1.85
11	Client	Delay to furnish and deliver the site to the contractor by client	1.40	1.20	1.68
12	contractor	Insufficient labours on site and skilled labours	1.40	1.20	1.68
13	External	Shortage in material, labour supply, equipment availability	0.80	2.00	1.60
14	External	Bad weather conditions /natural disasters (flood, earthquake)	1.28	1.20	1.54
15	Client	Financial issue and payment delay by owners for completed works	1.08	1.40	1.51
16	External	Inadequacy of sub-contractors	0.84	1.28	1.08
17	contractor	Ineffective planning and scheduling of project	1.40	0.72	1.01
18	Client	Lowest bid awarding by client	1.00	1.00	1.00
19	contractor	Poor contract management	1.20	0.72	0.86
20	contractor	Contractor's low overall productivity	0.88	0.88	0.77
21	contractor	Organization that lacks sufficient resources	0.84	0.88	0.74
22	Client	Delays in nomination of sub-contractors and suppliers by client	0.72	1.00	0.72
23	Consultant	Specification and drawing changes by consultant	0.84	0.84	0.71
24	Client	Poor communication and coordination by owner and other parties	0.88	0.72	0.63
25	contractor	Inadequate technical performances	0.88	0.68	0.60
26	contractor	Mistakes by the contractor during construction	0.88	0.60	0.53
27	contractor	Wrong selection of type /capacity of equipment	0.60	0.88	0.53
28	contractor	In-proper technical study carried out during bidding stage	0.68	0.72	0.49
29	contractor	Accidents during construction	0.64	0.64	0.41
30	Consultant	Long inspection procedures or late inspection by consultant	0.60	0.68	0.41
31	contractor	Rework due to errors during construction	0.60	0.56	0.34
32	contractor	Contractor's less experience	0.44	0.64	0.28
33	Client	Suspension of work by owner cause delay.	0.36	0.36	0.13
34	contractor	Contractor's financial difficulties and liquidation	0.36	0.36	0.13
35	External	Complexity of project	0.28	0.28	0.08
36	Client	Unrealistically estimation of contract period given by client	0.16	0.16	0.03
37	contractor	Bad decisions in regulating company's policy	0.16	0.16	0.03
38	External	Inflation and interest rate	0.12	0.12	0.01
39	External	Lack of transparency with permit acquisition cost	0.16	0.04	0.01
40	External	Overall price fluctuations	0.08	0.04	0.00
41	External	Unforeseen ground condition	0.08	0.00	0.00
42	External	Political condition	0.00	0.00	0.00
43	Government	Government law and regulations	0.00	0.00	0.00
44	Government	Government-related delays include delays in obtaining permit from local	0.00	0.00	0.00

Table A9-4 Major Causes of delays comparison from Questionnaire and Interview analyzed results

Party	Cause of Delay	interview Rank (1)	Questionar Rank _(Combined) (2)
Client	Client initiated variations, additional & change orders	1	1
Client	Client's slow decision making and improper planning	2	2
contractor	Ineffective planning and scheduling of project	17	3
Consultant	Delay in issuing change orders	5	4
contractor	Poor contract management	19	5
contractor	Poor risk management and supervision	7	6
Consultant	Delay in approving design, shop drawings and sample materials by consultant	6	7
External	Bad weather conditions /natural disasters (flood, earthquake)	14	8
Client	Financial issue and payment delay by owners for completed works	15	9
Consultant	Specification and drawing changes by consultant	23	10
contractor	Contractor's poor site management	8	11
contractor	Mistakes by the contractor during construction	26	12
Consultant	Consultant delays for instructions, approvals	4	13
contractor	Insufficient labours on site and skilled labours	12	14
External	Inadequacy of sub-contractors	16	15
contractor	Delays from sub-contractors and nominated suppliers	9	16
contractor	Rework due to errors during construction	31	17
contractor	Contractor's low overall productivity	20	18
contractor	Organization that lacks sufficient resources	21	19
Consultant	Imperfect documents in the contract by consultant	3	20
contractor	Inadequate technical performances	25	21
External	Shortage in material, labour supply, equipment availability	13	22
Consultant	Long inspection procedures or late inspection by consultant	30	23
Client	Incorrect site information by client	10	24
contractor	Wrong selection of type /capacity of equipment	27	25
Client	Poor communication and coordination by owner and other parties	24	26
contractor	Contractor's financial difficulties and liquidation	34	27
External	Unforeseen ground condition	41	28
contractor	In-proper technical study carried out during bidding stage	28	29
External	Complexity of project	35	30
Client	Delay to furnish and deliver the site to the contractor by client	11	31
External	Inflation and interest rate	38	32
Government	Government-related delays include delays in obtaining permit from local	44	33
Government	Government law and regulations	43	34
External	Overall price fluctuations	40	35
Client	Unrealistically estimation of contract period given by client	36	36
Client	Suspension of work by owner cause delay.	33	37
Client	Delays in nomination of sub-contractors and suppliers by client	22	38
External	Lack of transparency with permit acquisition cost	39	39
contractor	Contractor's less experience	32	40
External	Political condition	42	41
Client	Lowest bid awarding by client	18	42
contractor	Bad decisions in regulating company's policy	37	43
contractor	Accidents during construction	29	44

Table A9-5 “rho” Value calculation for Questionnaire and Interview Ranks

Party	Cause of Delay	interview Rank (1)	Questionar Rank _(Combined) (2)	di (2) - (1)	di ²
Client	Client initiated variations, additional & change orders	1	1	-	-
Client	Client’s slow decision making and improper planning	2	2	-	-
contractor	Ineffective planning and scheduling of project	17	3	(14)	196
Consultant	Delay in issuing change orders	5	4	(1)	1
contractor	Poor contract management	19	5	(14)	196
contractor	Poor risk management and supervision	7	6	(1)	1
Consultant	Delay in approving design, shop drawings and sample materials by consultant	6	7	1	1
External	Bad weather conditions /natural disasters (flood, earthquake)	14	8	(6)	36
Client	Financial issue and payment delay by owners for completed works	15	9	(6)	36
Consultant	Specification and drawing changes by consultant	23	10	(13)	169
contractor	Contractor’s poor site management	8	11	3	9
contractor	Mistakes by the contractor during construction	26	12	(14)	196
Consultant	Consultant delays for instructions, approvals	4	13	9	81
contractor	Insufficient labours on site and skilled labours	12	14	2	4
External	Inadequacy of sub-contractors	16	15	(1)	1
contractor	Delays from sub-contractors and nominated suppliers	9	16	7	49
contractor	Rework due to errors during construction	31	17	(14)	196
contractor	Contractor’s low overall productivity	20	18	(2)	4
contractor	Organization that lacks sufficient resources	21	19	(2)	4
Consultant	Imperfect documents in the contract by consultant	3	20	17	289
contractor	Inadequate technical performances	25	21	(4)	16
External	Shortage in material, labour supply, equipment availability	13	22	9	81
Consultant	Long inspection procedures or late inspection by consultant	30	23	(7)	49
Client	Incorrect site information by client	10	24	14	196
contractor	Wrong selection of type /capacity of equipment	27	25	(2)	4
Client	Poor communication and coordination by owner and other parties	24	26	2	4
contractor	Contractor’s financial difficulties and liquidation	34	27	(7)	49
External	Unforeseen ground condition	41	28	(13)	169
contractor	In-proper technical study carried out during bidding stage	28	29	1	1
External	Complexity of project	35	30	(5)	25
Client	Delay to furnish and deliver the site to the contractor by client	11	31	20	400
External	Inflation and interest rate	38	32	(6)	36
Government	Government-related delays include delays in obtaining permit from local authorities	44	33	(11)	121
Government	Government law and regulations	43	34	(9)	81
External	Overall price fluctuations	40	35	(5)	25
Client	Unrealistically estimation of contract period given by client	36	36	-	-
Client	Suspension of work by owner cause delay.	33	37	4	16
Client	Delays in nomination of sub-contractors and suppliers by client	22	38	16	256
External	Lack of transparency with permit acquisition cost	39	39	-	-
contractor	Contractor’s less experience	32	40	8	64
External	Political condition	42	41	(1)	1
Client	Lowest bid awarding by client	18	42	24	576
contractor	Bad decisions in regulating company’s policy	37	43	6	36
contractor	Accidents during construction	29	44	15	225
				$\sum di^2$	3900
				N	44
				rho	0.725
					> 0.478

Table A9-6 Interview results for Remedies to each Professionals Practice

Responsible Party	Remedy	MP	JD	UR	GK	LK	RII	Rank
Client	On time payments to contractors	4	4	4	4	4	4.00	1
	Check resource availability before awarding the contracts for lowest bidders	4	3	3	3	3	2.08	2
	Proper in detailed site investigations to be carried out before finalising the drawings and award the tender	4	4	3	3	4	1.92	3
	Clients must make quick decisions to solve any problem during the execution and speed up approval procedures	4	4	4	3	3	1.92	4
	Speed up finalising claim until become course of delay	4	3	4	4	3	1.92	5
	Obtain necessary approval with allow sufficient fund for those approvals and improve the client's finance	3	4	4	3	3	1.72	6
	Adopt new procurement method like construction management and design-build	3	4	4	3	3	1.72	7
	Client to stick to original plans and to allocate adequate budget for any contract modifications	4	3	4	3	3	1.72	8
	Establish realistic project duration	2	2	3	2	2	1.40	9
	Close monitoring of the work progress	3	2	2	2	2	1.40	10
	While selecting the contractors are not selected based only on the lowest bid	4	2	3	4	3	1.20	11
	Allow sufficient time to do feasibility study and prepare comprehensive financial plan	2	3	2	2	3	1.20	12
	Allow sufficient time for tender preparation and submission	2	3	2	2	3	1.20	13
	Effective planning, scheduling and programme should prepared by qualified and experienced personnel	2	4	4	3	2	1.08	14
	Improve communication and the relationship between parties towards collaborative approach to minimise future delays	2	3	2	4	2	1.00	15
Responsible Party	Remedy	MP	JD	UR	GK	LK	RII	Rank
Contractor	Improve the skilled labour and productivity, well plan the finance	4	4	3	4	4	2.68	1
	Contractor's proper management & planning to be improved	4	4	4	4	3	2.68	2
	Recruit enough and well skilled staff	4	4	3	3	4	1.92	3
	Contractors must make sure they have a sound financial backing	3	4	3	4	3	1.72	4
	Identified potential risk with assess cost impact inform to client	3	2	3	2	3	1.40	5
	Improve communication and the relationship between parties towards collaborative approach to minimise future delays	3	2	3	3	2	1.40	6
	Introduce labour-intensive programmes	2	2	2	2	1	1.32	7
	The contractors would be efficient material procurement.	3	4	3	3	2	1.32	8
	Provide sufficient equipment	2	3	3	2	2	1.20	9
	Should plan the rainy days with other unaffected activities due to rain	1	2	1	2	1	0.68	10
Responsible Party	Remedy	MP	JD	UR	GK	LK	RII	Rank
Consultant	Provide comprehensive documents on time	4	3	4	3	4	1.92	1
	On-time approval of drawings and do inspection within appropriate time.	4	3	4	4	3	1.92	2
	Improve communication and the relationship between parties towards collaborative approach to minimise future delays	3	2	2	3	3	1.40	3
	To be flexible during evaluating the contractor's work	2	1	1	1	2	0.68	4

Table A9-7 Interview Overall results for Remedies to Professional Practice

Responsible Party	Remedy	MP	JD	UR	GK	LK	RII	Rank
Client	On time payments to contractors	4	4	4	4	4	4.00	1
Contractor	Improve the skilled labour and productivity, well plan the finance	4	4	3	4	4	2.68	2
Contractor	Contractor's proper management & planning to be improved	4	4	4	4	3	2.68	3
Client	Check resource availability before awarding the contracts for lowest bidders	4	3	3	3	3	2.08	4
Client	Proper in detailed site investigations to be carried out before finalising the drawings and award the tender	4	4	3	3	4	1.92	5
Client	Clients must make quick decisions to solve any problem during the execution and speed up approval procedures	4	4	4	3	3	1.92	6
Client	Speed up finalising claim until become course of delay	4	3	4	4	3	1.92	7
Contractor	Recruit enough and well skilled staff	4	4	3	3	4	1.92	8
Consultant	Provide comprehensive documents on time	4	3	4	3	4	1.92	9
Consultant	On-time approval of drawings and do inspection within appropriate time.	4	3	4	4	3	1.92	10
Client	Obtain necessary approval with allow sufficient fund for those approvals and improve the client's finance	3	4	4	3	3	1.72	11
Client	Adopt new procurement method like construction management and design-build	3	4	4	3	3	1.72	12
Client	Client to stick to original plans and to allocate adequate budget for any contract modifications	4	3	4	3	3	1.72	13
Contractor	Contractors must make sure they have a sound financial backing	3	4	3	4	3	1.72	14
Client	Establish realistic project duration	2	2	3	2	2	1.40	15
Client	Close monitoring of the work progress	3	2	2	2	2	1.40	16
Contractor	Identified potential risk with assess cost impact inform to client	3	2	3	2	3	1.40	17
Contractor	Improve communication and the relationship between parties towards collaborative approach to minimise future delays	3	2	3	3	2	1.40	18
Consultant	Improve communication and the relationship between parties towards collaborative approach to minimise future delays	3	2	2	3	3	1.40	19
Contractor	Introduce labour-intensive programmes	2	2	2	2	1	1.32	20
Contractor	The contractors would be efficient material procurement.	3	4	3	3	2	1.32	21
Client	While selecting the contractors are not selected based only on the lowest bid	4	2	3	4	3	1.20	22
Client	Allow sufficient time to do feasibility study and prepare comprehensive financial plan	2	3	2	2	3	1.20	23
Client	Allow sufficient time for tender preparation and submission	2	3	2	2	3	1.20	24
Contractor	Provide sufficient equipment	2	3	3	2	2	1.20	25
Client	Effective planning, scheduling and programme should prepared by qualified and experienced personnel	2	4	4	3	2	1.08	26
Client	Improve communication and the relationship between parties towards collaborative approach to minimise future delays	2	3	2	4	2	1.00	27
Contractor	Should plan the rainy days with other unaffected activities due to rain	1	2	1	2	1	0.68	28
Consultant	To be flexible during evaluating the contractor's work	2	1	1	1	2	0.68	29