

**INVESTIGATION OF MAJOR DISPUTES IN
CONSTRUCTION OF URBAN DRINKING WATER
SUPPLY PROJECTS IN SRI LANKA**

W.M.M.S.K. Weerasooriya

(159174 D)

Master of Science in Construction Law and Dispute Resolution

Department of Building Economics

University of Moratuwa

Sri Lanka

March 2020

DECLARATION

I declare that, this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Also, I hereby grant to University of Moratuwa the non-exclusive right to reproduce and distribute my dissertation, in whole or in part in print, electronic or other medium. I retain the right to use this content in whole or part in future works such as articles or books.

Signature:

Date:

The above candidate has carried out research for the Dissertation under my supervision.

Name of the supervisor: Dr. (Mrs) Anuradha Waidyasekara

Signature of the supervisor:

Date:

ABSTRACT

Investigation of Disputes in Construction of Urban Drinking Water Supply Projects In Sri Lanka

Currently drinking water supply has become very prominent subject in the country as it becoming rare as the human activities has been amplified. Consummate organization in Sri Lanka, which supplying the pipe born drinking water to the nation is National Water Supply and Drainage Board (NWSDB). It gears up plenty of projects every year, which covers the whole island. While some of projects are implementing in highly urbanized areas and others are assigning to the rural areas to cover low income settlements. Hence timely and successful completion of projects are more important than others.

Disputes in the construction of water supply projects are deteriorate the successful completion while delaying projects. Urban water supply projects have high tendency of occurring disputes because of its nature. Hence this study is focused to investigate the disputes in construction of urban water supply projects in Sri Lanka. Accordingly, qualitative research methodology was adopted to have an in depth investigation on the subject. Carefully four projects were selected and semi structured interviews were conducted with the industry professionals who have been engaged in those specific projects.

After analysing the findings of the interviews it was found that there are several disputes in selected cases. Failure to offer possession of site, change of legislation, frequent design changes, ambiguities in the contracts, scope changes and delay payments are the major disputes as identified. Investigation works further extended to find causes of such disputes and mainly causes of disputes divided in to three categories as behavioural, contractual and technical in nature. As the mitigation measures are more important for future projects, finally, this study identified the measures to be adopted in preventing and/or resolving construction conflicts.

Keywords: *Conflicts, Disputes, Causes of disputes, urban water supply projects in Sri Lanka*

DEDICATION

This research dissertation is

Dedicated to

My Wife

Sons

& Daughter...

ACKNOWLEDGEMENT

This thesis would not have been possible without the support of so many people in so many ways. I owe a debt of gratitude to each one who spent their valuable time and effort and to all who shared their knowledge and professional experience.

First, I would like to extend my gratitude to my thesis supervisor Dr. (Mrs.) Anuradha Waidyasekara for her immense guidance and support given throughout this study. I also express my sincere gratitude to Prof. (Mrs.) Yasangika Sandanayake, Head of the Department of Building Economics and programme coordinator of MSc in Construction Law and Disputes Resolution degree programme, all the lecturers and other staff members of the Department of Building Economics for their assistance and support during this study and throughout my academic career.

Furthermore, I wish to express my greatest appreciation to the industry professionals, for their valuable advice and support, despite their busy schedule. They have been an inspiration and driving force for me.

Finally, I take this opportunity to thank my family and friends for their emotional and moral support.

Menaka Weerasooriya

CONTENTS

DECLARATION	i
ABSTRACT	ii
DEDICATION	iii
ACKNOWLEDGEMENT	iv
LIST OF TABLES.....	viii
LIST OF FIGURES.....	ix
ABBREVIATION.....	x
CHAPTER 1.....	1
1.0 INTRODUCTION	1
1.1 Background.....	1
1.2 Problem Statement.....	3
1.3 Aim of the Research	4
1.4 Objectives of the Study	4
1.5 Research Methodology.....	4
1.6 Scope and Limitations of the Research	4
1.7 Chapter Breakdown	5
CHAPTER 2.....	6
2.0 LITERATURE REVIEW	6
2.1 Introduction	6
2.2 Definition of Dispute	6
2.3 Causes of Disputes	7
2.4 Conflict causes due to behavioural problems	13
2.5 Conflict causes due to contractual problems	13
2.6 Conflict causes due to technical problems.....	14
2.7 Effects of Disputes	15
2.8 Chapter Summary.....	16
CHAPTER 3.....	17
3.0 RESEARCH METHODOLOGY	17
3.1 Introduction	17
3.2 Research Design.....	17

3.3 Research Approach	18
3.3.1 Qualitative Approach	18
3.3.2 Quantitative Approach	19
3.3.3 Mixed-Method Approach	19
3.3.4 Selection of the Suitable Research Approach	19
3.4 Research Strategy	20
3.4.1 Selection of the Research Strategy	21
3.4.2 Number of Cases	21
3.4.3 Case Boundary and Unit of Analysis	21
3.5 Research Methods	22
3.5.1 Data Collection Techniques	22
3.5.2 Data Analysis Techniques	23
3.5.3 Content Analysis	23
3.6 Validity and Reliability in Research Study	23
3.7 Research Process	25
3.8 Chapter Summary	26
CHAPTER 4	27
4.0 DATA ANALYSIS AND RESEARCH FINDINGS	27
4.1 Introduction	27
4.2 Details of the cases selected	27
4.2.1 Case study A	29
4.2.2 Case study B	30
4.2.3 Case study C	30
4.2.4 Case study D	31
4.3 Major Disputes in Urban Drinking Water Supply Projects	32
4.3.1 Major Disputes in Case A	32
4.3.2 Major Disputes in Case B	34
4.3.3 Major Disputes in Case C	35
4.3.4 Major Disputes in Case D	39
4.4 Summary of Major Disputes	40
4.5 Analysis of Causes of Disputes	41
4.6 Effects of Disputes in Urban Water Supply Projects	46
4.7 Remedies for Mitigating Disputes in Urban Water Supply Projects	48
4.7.1 Dispute 1: Failure to offer ‘possession of site’ to the contractor	48

4.7.2	Dispute 2: Changes of legislations	49
4.7.3	Dispute 3: Change of design due to third parties influence	49
4.7.4	Dispute 4: Additional works carried out by the contractor	50
4.7.5	Dispute 5: Frequent design changes to avoid existing utilities.....	50
4.7.6	Dispute 6: None payment for the performance bond	50
4.7.7	Dispute 7: None payment for joint protection materials, Imported soil, restrain Accessories.....	51
4.7.8	Dispute 8: Scope reduction in NRW management.....	51
4.7.9	Dispute 9: Delay payments	52
4.7.10	Dispute 10: Terrorist Attack (Force majeure)	52
4.7.11	Dispute 11: Unclear Definition of survey work	52
4.7.12	Dispute 12: Delay in third party approvals	53
4.8	Suggestions for Mitigating Behavioural, Contractual and Technical Disputes	56
4.8.1	Suggestions for Mitigating Behavioural Disputes	57
4.8.2	Suggestions for mitigating contractual disputes.....	57
4.8.3	Suggestions for mitigating technical disputes.....	58
4.9	Chapter Summary	58
 CHAPTER 5.....		59
5.0 CONCLUSIONS AND RECOMENDATIONS		59
5.1	Introduction	59
5.2	Conclusions under the research objectives	59
5.3	Limitations	61
5.4	Further research direction.....	61
 REFERENCES		62

LIST OF TABLES

	Page
Table 2. 1: Sources of Disputes	8
Table 3. 1: The Measures taken to ensure validity and reliability	24
Table 4. 1: Details of Selected Projects	27
Table 4. 2: Selection of the Interviewers	28
Table 4. 3: Causes of Disputes	45
Table 4. 4: Effects of Disputes	46
Table 4. 5: Effects of Identified Disputes	47
Table 4. 6: Summary of Remedies for Mitigating of Disputes	54

LIST OF FIGURES

	Page
Figure 3. 1: Unit of Analysis.....	22
Figure 3. 2: Research Process	25

ABBREVIATION

Abbreviation	Description
BOQ	Bill of Quantities
CEB	Ceylon Electricity Board
CMC	Colombo Municipal Council
DAB	Dispute Adjudication Board
DI	Ductile Iron
JV	Joint Venture
LS	Longitudinal Survey
NRW	None Revenue Water
NWSDB	National Water Supply and Drainage Board
PRDA	Provincial Road Development Authority
RDA	Road Development Authority
RFI	Request For Information
USD	United Stae Dollers
VAT	Value Added Tax

1.0 INTRODUCTION

1.1 Background

When the infrastructure development projects are concerned, water supply projects in rural and urban areas become very demanding projects among all other projects as the drinking water is considered as a basic human need. Worthington (1977) confirmed that people in any country have the basic right to the drinking water in terms of quantity and quality irrespective of their economical & social conditions.

Rauzana (2016) has stated that the construction industry is complex in nature which has competitive environment and various view points, skills & knowledge of stakeholders in completing the project. The author moreover stated that participants from various professions have their own goals and expects to make the most of their own benefits within this complex environment. When increase in the number of participants, there could be more business contacts, in contractual or social matters, which resulting in an amplify in the number of construction disputes. Carmichael (2002) says that disputes have the potential to convert an otherwise successful project into an unsuccessful one and disputes are something project personal will have to face many times during the life of a project and may continue long after a project has ostensibly finished.

Various reasons will lead to project delays and pave the path for disputes. Halwatura and Perera (2012) and Feyzbakhsh, Telvari and Lork (2017) have stated in their research that there are several influential factors causing delays in a water project as the majority of projects are taking place in public roads where special precautions are mandatory, high uncertainty could be associated as they are requisite excavation and trenching works in varied soil and site conditions, works are significantly dependent on equipment and machineries, which are vulnerable to repairs and need to get approvals from various type of authorities. Aditya, Douglass and Bhattacharya (2017) have identified that projects are delaying due to decision making, difficulties

in execution and failure of the contractor to perform. All the above facts are leading to delays and would probably create disputes when the claims are submitted and rejected. In the case of *Halki Shipping Corporation v Sopex Oils Ltd (1998)* mentioned that dispute does not exist until a claim has been submitted and rejected. As per the case, the claim is a request for compensation for damages incurred by any party to the contract.

Further, *Global Construction Dispute Report (2016)* also has identified five cases of disputes in the construction industry. Those cases have been identified as failure to manage the contract properly, inadequately drafted and unsubstantiated claims, curtailed design information or employer requirements, errors and omissions in the contract documents, and employer/contractor/subcontractor failing to understand and fulfil its contractual obligations. Similarly the research conducted by *Kumaraswamy and Yogeswaran (2001)* has established general sources of construction disputes which are enormously related to contractual issues, including variations, availability of information, extension of time, administration and management, payment, unrealistic client expectations, quality of the technical specification, and determination.

Denny and Kerry (2007) have discussed about the root causes of disputes in construction in detail. Further *Munaweera (2018)* have stated that disputes are the one of the major factors that prevents successful achievement of the construction project and additionally emphasise the importance of being sentient of the causes of disputes to complete the construction project in accepted time, budget and quality. *Cheung and Suen (2002)* stated that if the construction disputes are not appropriately managed, those factors will cause increase project costs, weaken team spirit, project delays, and harm business relationships. *Ayudhya (2011)* also has emphasized this view arguing that disputes are menacing and if not managed properly that frequently resulting in cost overrun, time overrun, weakening the quality of product to be delivered, decrement in investment profits, loss of productivity, and harm continues business relationships. Therefore it is evident that disputes are inevitable in the construction industry and there are various ways and means of emerging disputes.

1.2 Problem Statement

In Sri Lanka, the National Water Supply and Drainage Board (NWSDB) is the pioneer organization that supplies the pipe-borne drinking water to the nation. As Halwathura and Perera (2012) stated there is a massive demand for pipe drinking water all over the island due to the rapid growth of the population. Hence the Sri Lankan government has compelled to pump a significant amount from the national budget in every year (Halwathura and Perera, 2012). Due to the reasons, the National Water Supply and Drainage Board has hardly managed to provide pipe-borne water only for 35.1% of the country's population (Annual Report NWSDB, 2016). As the Annual Report of the NWSDB,(2016) revealed with the holistic vision of reaching 60% pipe-borne water coverage by the year 2020, it implements a large number of water supply infrastructure development projects all over the country while improving the existing facilities in urban areas to match with the future demands. Most of the projects implemented with the support of foreign funds and few of them with local funds.

Basically, water supply projects in Sri Lanka categorized into two types, namely rural and urban water supply projects, depending on their implementation area. Both Rural and urban projects are required to maintain the same quality standards irrespective of the area of implementing. As such, in urban water supply project needs to pay more attention and effort to maintain the quality standards while considering time limitations, materials availability, unknown underground structures and uninterrupted conditions of existing utilities. Hence the urban water supply projects have comparatively high risk towards the disputes rather than rural water supply projects.

Though most of the researchers have investigated the causes of disputes and their mitigation while considering the whole construction industry but only very few of them have investigated the causes of disputes arising out of urban drinking water supply projects (Elmarsafi, 2008). Hence this study attempts to investigate major disputes in the construction of urban water supply projects in Sri Lanka.

1.3 Aim of the research

This research aims to investigate the disputes in Construction of Urban Drinking Water Supply Projects in Sri Lanka.

1.4 Objectives of the study

- a) Identify the major disputes in the construction of urban drinking water supply projects.
- b) Examine the causes and effects due to disputes.
- c) Suggestions for mitigating the disputes in construction of urban drinking water supply projects.

1.5 Research Methodology

In this research qualitative approach was adopted selecting case study strategy to explore the research topic with semi-structured interviews and accordingly

- a) A comprehensive literature survey was carried out in order to identify major disputes in the construction of water supply projects.
- b) Semi-structured interviews conducted with the selected professionals who were involved in urban water supply projects.

1.6 Scope and limitations of the research

The scope of this research was limited to the disputes in construction of urban drinking water supply projects in Sri Lanka and this limitation is proposed to facilitate an in-depth investigation of the proposed research area which will be advantageous for the professionals who are being engaged in similar projects.

1.7 Chapter Breakdown

Chapter 1 – Introduction

This chapter presents a general overview of the research consisting of the research background, the research aim and objectives, and the methodology to be adopted. It also gives a general guide to the contents of the study.

Chapter 2 – Literature review

This chapter reviews the literature on stages of a construction project, areas prone to disputes, causes of delays, causes of disputes, and possible disputes.

Chapter 3 - Research Methodology

It explains the process or the methodology adopted in carrying out the research, the reasons for adopting it, and how it facilitates the achievement of the research objectives.

Chapter 4 - Analysis of Research Findings

Under this chapter, research findings are analysed to identify the disputes in urban drinking water supply projects in Sri Lanka and also to identify mitigating measures.

Chapter 5 - Conclusions and Recommendations

The conclusions derived from the research findings, recommendations for mitigating the disputes and future research directions.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This chapter intends to provide a comprehensive elucidation about the research area utilizing existing information and resources. Accordingly, this literature review will deeply investigate the existing knowledge of the research area while defining the dispute. Further, this will analysis the causes and effects of disputes related to the construction projects while distinguishing behavioural problems, contractual and technical problems.

2.2 Definition of Dispute

Referring to Vorster (1993), a dispute is defined as an argument about an issue concerning project operations, usually resulting from a debate over differences in two or more parties' understanding of the situation. This statement supports another statement by Deutsch (1973) that defines conflict as incompatible activities; conflict occurs when the behaviour of one person is interfering or obstructing the actions of another.

According to Kumaraswamy and Yogeswaran (1998), a dispute can be said to exist when a claim or assertion made by one party is rejected by the other party and that rejection is not accepted. This demonstrates that disputes are more likely to occur when the conflicting party shows actions or arguments to a controversy.

Though there are plenty of definitions of a dispute exists depending on the occasions of its occurrence, according to Thomas (1992), there are three (03) major themes among the definitions of dispute or conflict. The first theme can be said as whether a dispute exists or not is being considered as perception issue. The professed discrepancy may not be real, but on the other hand, if the discrepancy is real but not professed, there is no conflict. The second theme is that there is interdependence amongst stakeholders (i.e. each has the prospective to interfere with the other). Third,

there are issues of blockage, opposition, and scarcity. As Robbins (1994) stated, resources like money, power and prestige are limited. The scarcity of such resources creates blocking behaviour. On the other hand, when one team blocks the means to a target or interest of another, then a condition of conflict exists.

Evidently these definitions establish various perspectives of researchers who are looking at the dispute from different angles. As depicted in the literature, there are differences between conflict and dispute and hence it is prudent to concern the differences. Moore (1989) in his research has been taken an effort to define these two terms in to a one term while mixing the definitions. However, previous researches define conflict and disputes as the same definition. It generally involves disagreement regarding interests or ideas. The same definition was adopted for this research. As mentioned by Higgins (1991), the critical issue is that both of the terms has historically been viewed as undesirable, something to be avoided.

2.3 Causes of Disputes

Propagation of disputes would solely depend on the actions taken to find the origins of the problems. Many researchers have investigated on disputes and conflicts while considering large numbers of variables. The Global Construction Dispute Report (2016) has identified five causes of disputes in the construction industry such as failure to manage the contract properly, inadequately drafted and unsubstantiated claims, curtailed design information or employer requirements, errors and omissions in the contract documents, and employer/contractor/subcontractor failing to understand and fulfil its contractual obligations.. In the research of Kumaraswamy and Yogeswaran (2001) has also established common sources of construction disputes, which are vastly related to contractual matters, including variations, extension of time, payment, quality of the technical specification, availability of information, administration and management, unrealistic client expectations and determination. Illankoon, Tam, Kohan and Ranadewa (2019) also have discussed causes of disputes relating to the Sri Lankan construction industry and Essam (2018) also has investigated the types, causes and severity of claims in construction projects in the UAE.

Denny and Kerry (2006) have discussed about the root causes of disputes in construction. Munweera (2018) also has stated that disputes can be considered as one of the major causes, which prevent successful achievement of the construction project and further emphasise the importance of being responsive of the reasons of disputes in order to full fill the construction project within stipulated time, budget and quality. Cheung and Suen (2002) stated that improper management of construction disputes may cause of the undermine team spirit, project delays, damage business relationships and increase project costs. similarly Ayudhya (2011) has highlighted that disputes need to be managed properly and if not they may frequently resulting in time overrun, deterioration of the quality of product to be delivered, cost overrun, loss of productivity, damage continues business relationships and reduction in investment profits. Therefore, this clearly evident that disputes are inevitable in the construction industry and there are various ways and means of emerging disputes.

McGeorge (2007) in his study has made a summary of the majority of researchers’ findings into one tabulation as presented in Table 2.1, which gives comprehensive details of the researchers’ suggestion in sources of disputes.

Table 2. 1: Sources of Disputes

Authors	Year	Sources of disputes
Waldron	2006	10 key issues in disputes: <ol style="list-style-type: none"> 1. Variations to scope 2. Contract interpretation 3. EOT claims 4. Site conditions 5. Late, incomplete or substandard information 6. NA / or didn’t know 7. Obtaining approvals 8. Site access 9. Quality of design 10. Availability of resources

Authors	Year	Sources of disputes
Cheung and Yui	2006	Three (03) areas: <ol style="list-style-type: none"> 1. Conflict: Task interdependency, differentiations, communication obstacles, tensions, personality traits 2. Triggering events: Non-performance, payment, time 3. Contract Provision
Yiu and Cheung	2004	33 dispute sources identified [literature] & were ranked under 2 categories: <ol style="list-style-type: none"> 1. Construction related: 24 items 2. Human behaviour related: 9 items
Kumaraswamy	1997	Research conducted in Hong Kong by selecting 61 projects has identified that 11 “Time claim” categories and 19 “Cost claim” categories giving rise to two main groupings of causes of disputes and claims as root causes and proximate causes
Conlin	1996	Research conducted in UK projects has identified six areas: <ol style="list-style-type: none"> 1. payment and budget 2. performance 3. delay and time 4. negligence 5. quality 6. administration
Sykes	1996	Two major groupings of claims and disputes: <ol style="list-style-type: none"> 1. misunderstandings [8 specific reasons/ examples] 2. unpredictability [with 17 specific reasons/ examples]

Authors	Year	Sources of disputes
Bristow and Vassilopoulos	1995	<p>Research conducted in Ontario, Canada has identified five primary causes of claims:</p> <ol style="list-style-type: none"> 1. unrealistic expectations by parties 2. ambiguous contract documents 3. poor communications between project participants 4. lack of team spirit 5. failure of participants to deal promptly with changes and unexpected outcomes
Diekman	1994	<p>Three areas:</p> <ol style="list-style-type: none"> 1. people 2. process 3. product
Heath	1994	<p>Case study conducted in UK selecting five cases and 28 quantity surveyors has been identified five main categories of claims and seven main types of disputes.</p> <p>Main categories of claims</p> <ol style="list-style-type: none"> 1. Extension of time 2. Variations in quantities 3. Variations in specifications 4. Drawing changes 5. others <p>Main types of disputes</p> <ol style="list-style-type: none"> 1. contract terms 2. payments 3. variations 4. extensions of time 5. nomination 6. re-nomination 7. availability of information

Authors	Year	Sources of disputes
Jones	1994	<p>General survey conducted in construction industry with the lawyers revealed ten factors in the development of disputes.</p> <ol style="list-style-type: none"> 1. Poor management 2. Adversarial culture 3. Poor communications 4. Inadequate design 5. Economic environment 6. Unrealistic tendering 7. Influence of lawyers 8. Unrealistic client expectations 9. Inadequate contract drafting 10. Poor workmanship
Semple, Hartman, and Jergeas,	1994	<p>Six commons categories of dispute claims:</p> <ol style="list-style-type: none"> 1. Premium time 2. Equipment costs 3. Financing costs 4. Loss of revenue 5. Loss of productivity 6. Site overhead <p>Four common causes of claims:</p> <ol style="list-style-type: none"> 1. acceleration; 2. restricted access; 3. weather/cold; 4. increase in scope
Watts and Scrivener	1992	<p>Study on 72 judgment of construction litigation cases in Australia has been revealed 59 categories of disputes and 117 ‘sources’ of disputes and accordingly has established most frequent sources of claims;</p> <ol style="list-style-type: none"> 1. variations 2. negligence in tort 3. delays

Authors	Year	Sources of disputes
Hewitt		<p>Six areas:</p> <ol style="list-style-type: none"> 1. change of scope; 2. change conditions; 3. delay; 4. disruption 5. acceleration; 6. termination
Diekmann and Nelson		<p>Most commons cause of contract claims:</p> <ol style="list-style-type: none"> 1. design errors [46%] 2. discretionary or mandatory changes [26%] 3. Other specific claims types [entitlement issues] included; 4. Differing site conditions 5. Weather 6. Strikes 7. Value engineering

Source: (McGeorge, 2007)

As depicted in Table 2.1, the causes of disputes categorized in previous studies have been considered different variables depending on their expertise or area of study. Even though most of the studies share the same variables, the causes still seem too large to be understandable or to be focused on. The categorization or root of causes identified by Williamson (1979) was based for this study. Conflict causes identified by the researchers have summarized into three (3) categories that caused due to behavioural, contractual and technical problems. Jaffar, Tharim and Shuib (2011) also have followed the same categories introduced by Williamson (1979) in their study, and categories are as follows;

1. Conflict causes due to behavioural problems
2. Conflict causes due to contractual problems
3. Conflict causes due to technical problems

2.4 Conflict causes due to behavioural problems

Modern construction projects involve three parties, the client, the contractor and the Engineer. Further, Jaffar, Tharimand Shuib (2011) described, behavioural problems include human interaction, personality, cultures and professional background among the project team. Other problems related to human performance such as dissatisfaction, individual's ambition, desire for growth, frustration, fraud, communication and level of power and faith are also considered as causes of disputes. It was well-known previously construction is not considered as a science; it is an art. Construction is really a combination of people, and the winning contract administration, or disputant to agreement interpretation or adverse incidences on a project, is well served to know a slight about persons involved. The herding nature is influential by same industry's people. All seek and require that sense of approval. They need to follow the leaders or the theory of the leaders of the profession. Carmicheal (2002) stated that words like, superiority, belonging, status imitation, recognition and loyalty are descriptive of the human rudiments of gregariousness. Try to make the other person feel as if he or she belongs to the crowd. Find out the group the other party feels essential. Show him how the resolution of the dispute will help him achieve or strengthen his membership in the group.

2.5 Conflict causes due to contractual problems

Despite the fact that the contract documents are drafted explicitly for a particular construction project, subsequently, it paves the path for disputes between the parties due to the unfitting nature of the particular work. In construction sector, almost ninety five percent of claims are closely linked to contractual relationships among the project stakeholders of the construction project. A contract can be defined as an agreement that illustrates the work to be carried out by the contractors and the remuneration for them by the client in construction sector. It clearly demonstrates the activities to be done by contractors or sub-contractors, payment, quality of work tasks of parties involved and , time for completion,. According to Kumaraswamy and Yogeswaran (1998), the basis of construction disputes are mostly related to contractual issues, which include quality of technical specifications, variation,

accessibility of information, extension of time, administration and management, payment, impractical client anticipation and determination.

Loke (2003) has mentioned that reasons of contractual issues are mostly due to misrepresentation of Contract Documents, Unclear payment terms and Errors and Omissions in the Contract Terms. As stated by Jaffar, Tharimand Shuib (2011), documents errors become the mistake of the designer when the decision of its peers and the tradition of the industry the errors to be considered gross and inexcusable. Moreover, the author's stipulated that documental errors become responsible when someone who has a right to rely on the professional is severely hurt or damaged.

2.6 Conflict causes due to technical problems

In project operation, the most general issue is technical problems, which arises due to the ambiguity of project activities. According to Galbraith (1973), ambiguity is the gap between the level of information necessary to do the activity and the level of information by now processed by the association. The level of information required depends on the activity complexity that is the number of various matters that have to be coordinated or performance desires such as time or funds constraints. The level of information processed relied on the efficiency of planning that is the compilation and explanation of information before the job. The ambiguity may lead to impracticable client expectations like overdesign, unrealistic project duration, insufficient site or soil investigation statement, late instructions from architect or engineer, error and imperfect technical specifications etc.

As mentioned by Jaffar, Tharimand Shuib (2011), technical disputes include engineering clarification that is a part of engineering pronouncement making processes. Request for information (RFI) is identified as successful method to illuminate differences in understanding the things during project operations. By utilizing those RFI, most unclarified issues are resolved on-site before they develop as a technical dispute and solve the problem of inadequate tracing mechanisms for request of information. These issues can be resolute by project recruits with the

suitable expertise. The engineering decision-making process is comparatively straightforward and sensibly acceptable for each member. If technical issues are unresolved, there are method to solve those issues in project management, not like the declaration of contractual issues during project operations. The design deficit, which leads to a key dispute, is usually beyond an error or omission. To be exact, the design error usually must alter the means, methods, environment, duration, or the conditions of the construction process. Any number of factors can influence this. The most common event of design errors are errors made in the foundations, in the construction of the frame and the enclosure, in the utilization of spaces such as method and materials and the required end result are specified, in project duration, and in connection with related performance by others on which the project in question must at some point relies on.

2.7 Effects of Disputes

As Aryal and Dahal (2018) disputes have to be resolved immediately before it gets worse as it results in project delays, leading to litigation. Some authors argue that conflicts always affect the productivity and effectiveness of a project. Construction history shows that all projects that experience variability and inefficiency fail to advance customer expectations and ultimately affect the time, cost and quality of projects. And many costs that lead to conflicts, financial difficulties and delays in financing projects. Sameer, Magar and Parker (2016) argue that human disputes are inevitable and that similar disputes cannot be prevented equally. It is difficult to imagine human society without a conflict of interest. Disputes should be resolved at least as much as possible by the costume both in terms of money and time, so that more time and resources can be saved. It simply means the direct effect of the arguments is costly and time-consuming and the rest of the outcome is closely related to the above direct effects. Further, Mashwama, Aigbovboa and Thwala (2015) mentioned that disputes in the construction project has an effect on all the stakeholders which probably lead to various inequitable project deliveries such as increased cost, loss of profit, reduced quality and level of service and further lists out the following effects of the disputes.

1. Loss of productivity
2. Loss of business viability
3. Loss of profitability Time delays
4. Loss of professional reputation
5. Break down in cooperation between parties
6. Cost overruns
7. Loss of company reputation
8. Diminution of respect between parties
9. Relocation of Equipment
10. Rework/ repetition of work
11. Relocation of Material
12. Additional Expense in administration
13. Relocation cost of workers/ labors
14. Additional Managers cost

Baloyi and Agumba, (2014) have studied about the effects of disputes in the construction industry and have found following effects.

1. Delay of the project
2. Cost overrun
3. Deterioration of relationships
4. Delay of information sharing within the parties
5. Neglecting client's needs

2.8 Chapter Summary

This chapter amalgamated the existing literature to capture the information and understanding of the disputes and causes of disputes. Causes of conflicts can summarize into three (3) categories as due to behavioural, contractual and technical problems. Many researchers have investigated the disputes in construction projects, however, very few of them have paid their attention to the subject area. As a result of that, currently many disputes are arising out of the water supply projects. Hence further investigation would be an added advantage in mitigation of such disputes, which induced losses on the contracted parties.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Introduction

The research methodology chapter is to elucidate the pathway of the researcher, which adopted to address the research problem. Brown (2006) defined methodology as the philosophical framework within which the research is conducted or the foundation upon which the research is based. This chapter describes research designs, approaches and methods in detail highlighting those used throughout the study, justifying the choice through describing advantages and disadvantages of each approach and design taking into account their practical applicability to the research. Further O'Leary (2004) describes the methodology as the framework, which is associated with a particular set of paradigmatic assumptions that will use to conduct a research. According to Allan and Randy (2005), two criteria should meet when conducting a research. Firstly, the methodology should be the most appropriate to achieve the objectives of the research. Secondly, it should be made possible to replicate the methodology used in other researches of the same nature. Accordingly, this chapter describes the research design, approaches and research strategy in detail highlighting those used throughout the study, justifying the choice while describing the advantages and disadvantages of each approach.

3.2 Research Design

The purpose of the design of the research is to provide an appropriate framework for research. Aaker, Kumar and George, (2000) state that an important decision in the research design process is to decide whether to move the research method because it determines how accurate the study information will be. The research design process involves many interrelated decisions.

This research involves a background study, a critical review of literature, data collection, data analysis and discussion of research findings and finally, conclusions and recommendations adopting appropriate research approach and research strategy.

3.3 Research Approach

Research methodology is an important part of any scientific study, regardless of the research area. This is the process to be adopted in the data collection of the research. Accrediting Smith, Zheng, Love and Edwards (2004), research approaches can assist in establishing research activities, including data collection, with research objectives. According to many authors, such as Yin (2009), Rudestam and Newton (2007) and Flick (2006), research approaches can be mainly divided into qualitative and quantitative approaches. Amaratunga, Baldry, and Sarshrand Newton (2002) have identified a research method which is a mixture of basic techniques. The weaknesses in the use of qualitative and quantitative methods have been overcome by adopting a mix-method approach.

3.3.1 Qualitative approach

As mentioned in the literature, relevant data collection methods are investigative in nature and have a significant impact on gaining an understanding and understanding of the underlying causes and motives. Measurement data collection methods emerged after it became known that traditional methods of data collection were unable to express people's feelings and emotions. Monette, Gullivan and Dejong's (2010) methods of acknowledging abstraction and general modification. Polanski and Waller (2011) distinguish vision, images, forms and structures from various media sources, as well as spoken and printed voice and audio recordings in data collection methods.

It is noteworthy that "behaviours are often viewed as providing rich data on real people's lives and situations and are able to make sense of behaviour and understand behaviour within its broader context (Monette, et al, 2010). However, many authors

have emphasized that relevant research is often criticized for lack of generalizability, because they rely heavily on the interpretations made by researchers and the inability to retaliate by subsequent investigators. ”

Well-known data collection methods used in scientific studies include interviews, focus groups, and observations and research conducted. In addition, established theory and document analysis can also be used as a means of collecting data from academic institutions.

3.3.2 Quantitative approach

Quantitative research is a way of examining test theory by examining the diversity of relationships within (Creswell, 2009). These variables can be estimated, typically in the tools, so that the calculated data can be analysed using mathematical procedures. The final written report contains a set of informational materials, literature and thought, methods, results, and discussion. As competent investigators, those involved in this type of inquiry are subject to theories of subjectivity, formulating anti-discriminatory safeguards, regulating other interpretations, and being able to make retrospectives.

3.3.3 Mixed-method approach

Mixed methods research is an approach to an inquiry involving collecting both quantitative and qualitative data. As stated by Creswell and Plano (2011), integrating the two forms of data, and using distinct designs that may involve philosophical assumptions and theoretical frameworks. Moreover, the authors stated that, combination of qualitative and quantitative approaches provides a more complete understanding of a research problem than either approach alone.

3.3.4 Selection of the suitable research approach

The purpose of the research is to investigate the major disputes in the construction of urban water supply projects in Sri Lanka which is why it needs to gather rich data on project disputes and an investigation will be undertaken to obtain available

information and information about the project. participants Mostly the estimation method is suitable for theoretical testing by examining the relationships between different variables but the quantitative method is supposed to provide rich data on people's real life, status and behaviour as described above. It can thus be assumed that the methodology provides flexibility in detecting project conflict. However, there may not be as many findings in the study as the surveyors investigating four (4) selected water supply projects but the selected projects oversee urban water supply projects and only represent urban water supply projects and it can be assumed that the results obtained will be improved within the framework of urban drinking water supply projects in Sri Lanka. For the above reasons the qualitative methodology indicates the validity of this investigation and hence the selection of the appropriate method

3.4 Research Strategy

Saunders, Lewis, and Thornhill, (2012) described the research strategy as "a general plan of how the researcher would move in response to research questions." In the same text, Bryman (2008) has identified research strategy as a "general ethical approach to research". According to Remenyi, Wiloms and Money (2003), the research strategy provides a framework for research including the process by which research is conducted. Specially Saunders et al (2012) suggested that appropriate research strategies should be selected based on research questions and objectives. In addition, the authors emphasize the extent to which information is available on the subject matter to be researched, the amount of time and resources, and the theoretical evidence to consider.

There are various research techniques with different features available that the researcher can choose, based on the above criteria. Both Yin (2003), and Saunders et al. (2012), conceded that although various research techniques exist, there is considerable overlap between them which is why the key assumption would be to choose the most profitable strategy for specific research. Some common research techniques used are experiments, surveys, case studies, action research, educational

theory, ethnography, archival research, low-level studies, longitudinal studies and participatory violence (Saunders et al., 2009).

3.4.1 Selection of the research strategy

This study investigates major disputes in construction of urban drinking water supply projects in Sri Lanka and makes suggestions for reducing conflicts in the construction of urban drinking water supply projects. Therefore, it is necessary to identify the major conflicts in the construction of urban drinking water projects, assess the causes and effects of conflicts and provide suggestions for reducing conflicts in the design of urban drinking water supply projects.

Thus, since case studies provide in-depth questions of the research problem and case studies can provide an opportunity for a holistic view of the research problem as described by Yin (2009), the case study approach is appropriate for this study and time availability is also the controlling factor for the case study method selection.

3.4.2 Number of cases

As Yin (2009) argues that the use of a single case study is preferred when research represents a sensitive, exaggerated or different case, a lawyer or a common case, a case of re-emergence or a far-flung case. However, this study uses multiple cases instead of one case as it has benefited from the study. Herriott and Firestone (1983), and emphasized that the collected evidence from multidisciplinary studies is often viewed as highly compelling, resulting in health and strong study. Therefore, four (4) cases were selected for this study to access the data acquisition and to obtain a comprehensive picture of the sources. In addition, time and resource limitations have also been an important factor in selecting the number of cases in this study.

3.4.3 Case boundary and unit of analysis

Identification of ‘case boundary’ and the ‘unit of analyses is a preliminary requirement of a research as described by Yin (2009). In this research, as the aim has

been set to investigate the disputes in construction of urban drinking water supply projects in Sri Lanka, unit of analysis is the “disputes during the construction” and accordingly the case boundary is to be “Urban drinking water supply projects” as illustrated in Figure 3.1.

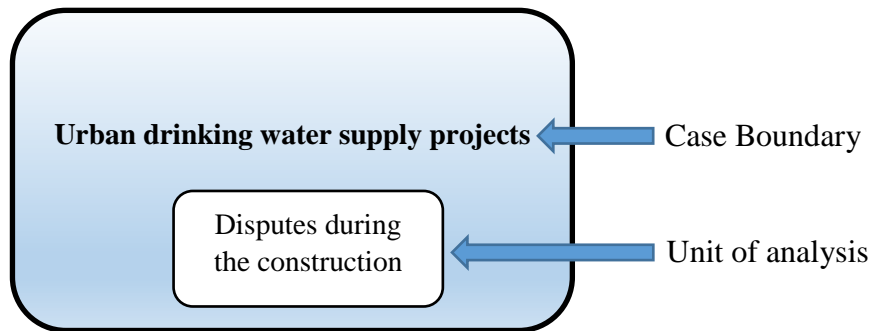


Figure 3. 1: Unit of Analysis

3.5 Research Methods

3.5.1 Data collection techniques

Yin (2011) introduced four (4) numbers of potential data collection activities as, Interviewing, Observing, Collecting and Examining and Feeling. Further, Robson (2002) stated that the data collection method, interviewing has four types, structured interviews, semi-structured interviews, unstructured interviews and non-directive interviews. The interviews provide more flexibility in selecting industry experts who are particularly engaged in specific projects and hence the information gathered was more comprehensive and more reliable.

As the qualitative approach is adopted to this research, semi-structured interviews were selected as the data collection technique, since it enabled the researcher to gather specific information that could be compared and at the same time allowed to remain flexible to gather any other important information that arose in the course of data collection.

3.5.2 Data analysis techniques

Yin (2009) has argued that many methods for analysing relevant data, such as pattern matching, definition construction, series analysis, Logic models, and case analysis. In particular, case studies often tend to produce large amounts of data that do not respond quickly to direct handling, analysis, and data reduction. With such a qualitative approach to data analysis of these concerns is the study's research focus. In accordance with this manual the content of the manual has been used to analyse the data and pattern of cases and this is discussed in subsequent sections.

3.5.3 Content analysis

Cristien and Petra (2017) stated that a common starting point for qualitative content analysis is often transcribed interview texts. The objective of qualitative content analysis is to systematically transform a large amount of text into a highly organized and concise summary of key results. Analysis of the raw data from precise transcribed interviews to form categories or themes is a process of further abstraction of data at each step of the analysis; from the manifest and literal content to latent meanings. Generally, content analysis is carrying out in the latter part of the research dissertation. Accordingly manual content analysis was carried out in this research to transform the heap of data gathered in the interviews.

3.6 Validity and Reliability in Research Study

Whichever method of study is inadequate without considering the fundamental issues relating to the review of the validity of any research outcomes (Malewana, 2009). Yin (2003), explained that, to confirm the validity of a research study and to pass specific design tests with regards to diverse levels of research validity, as explained below.

Accordingly, the measures that were taken to ensure the validity and reliability of this research under each of the above facts of validity are also specified in Table 3.1.

Table 3.1: The Measures taken to ensure validity and reliability

<i>Test</i>	<i>Achievement</i>	<i>Measures taken</i>
<i>Construct Validity</i>	Establishment of correct operational measures for the concepts being studied.	<ul style="list-style-type: none"> • Conducting semi-structured face-to-face interviews
<i>Internal Validity</i>	Establishment of casual relationships, whereby certain conditions are shown to lead the other conditions, as distinguishes from spurious relationships	<ul style="list-style-type: none"> • Developing the research problem in a reasonable manner based on a comprehensive literature review
<i>External Validity</i>	Establishment of a domain to which study's findings can be generalized	<ul style="list-style-type: none"> • Selecting four cases to investigate the problem • Adapting reasonable criteria for selecting cases
<i>Reliability</i>	Demonstrating that the operations of a study such as data collection procedures can be repeated with the same results	<ul style="list-style-type: none"> • Electronic recording and note-taking during the interview and developing interview transcripts to avoid losing data. • From every case, all the partners of Contractor and employer's representative were interviewed.

3.7 Research Process

Research process comprises of series of closely related activities and Figure 3.2 shows the steps outline of an effective strategy for finding solutions for the identified research problem. Accordingly the background investigation was the initial step of the study and subsequently comprehensive literature review was carried out. When conducting the literature survey, existing journals, articles and publications in the respective area were referred and accordingly interview guide lines were developed. Then the semi structured interviews were conducted with selected project participants. Gathered information were carefully analysed by using manual content analysis. Finally depending on the study findings conclusions and recommendations were made.

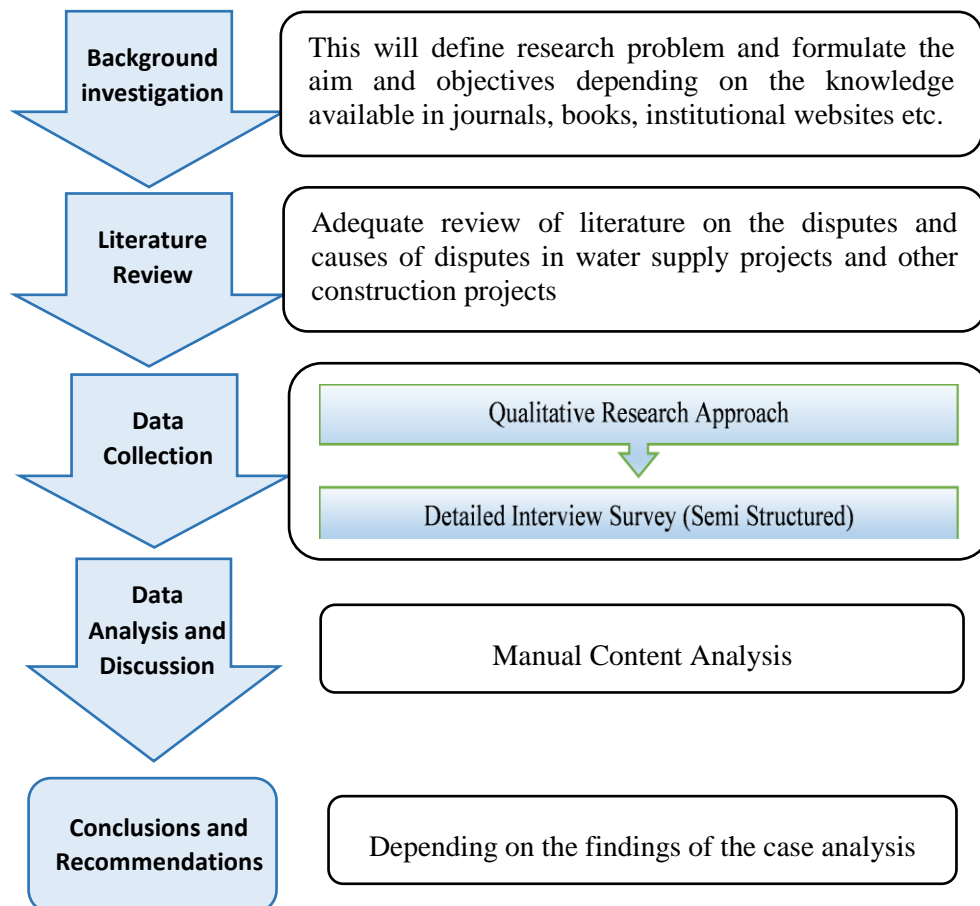


Figure 3. 2: Research Process

3.8 Chapter Summary

Benefits of research findings become more sharpen if the appropriate methodology is adopted. Hence the purpose and the aim of this chapter is to identify the most appropriate research methodology for this research. Accordingly in this chapter deeply described the research design, research approach, research strategy, research methods, data collection techniques, data analysis techniques, validity and reliability of research study and research process which were used to achieve the core aim and objectives of this research.

CHAPTER FOUR

4.0 DATA ANALYSIS AND RESEARCH FINDINGS

4.1 Introduction

This chapter elucidates data analysis and research findings of the investigation. At the outset, the selected cases have briefly introduced to have a better understanding of the background of each case. Then case analysis has been carried out to identify the disputes and causes of disputes in the selected cases pertaining to the interviewees' knowledge and experience. The analysis was followed by the manual content analysis to ascertain the interrelationships and differences between each case. At the end of this chapter, research findings are presented pertaining to the urban drinking water supply projects in Sri Lanka.

4.2 Details of the cases selected

Case selection is one of major important fact in succeeding the study and appropriate selection of cases will pave the way to deliver a richness conclusion. Accordingly, four (04) projects were selected depending on the current status of the projects. Two (02) projects out of four selected to represent the completed projects and the other two (02) projects are ongoing and Table 4.1 presents details of the projects selected.

Table 4. 1: Details of Selected Projects

Cases	Nature of the Project	Scope of the project	Contracted Sum (Billion LKR)	Duration (Months)	Location
A	Completed Project	Supply and laying of pipes	10.9	23	Kesbawa
B	Completed Project	Supply and laying of pipes	10	36	Homagama

Cases	Nature of the Project	Scope of the project	Contracted Sum (Billion LKR)	Duration (Months)	Location
C	Ongoing Project	Supply and laying of pipes and NRW management	7.2	42	Mattakkuliya
D	Ongoing Project	Supply and laying of pipes and NRW management	6.9	48	Nugegoda

In order to extract the information required three professionals were selected those who are thorough with the particular projects. Then the detailed semi-structured interviews were conducted with them and the selection criteria of the interviewees was based on the acquaintance of project and their proficiency in the field. In view of that, three (03) professionals were selected from each case which represents the high or middle management in each. Accordingly, 12 interviews were conducted and 30 to 45 minutes spent with each industry expert. Table 4.2 gives a brief description of the selected project professionals.

Table 4. 2: Selection of the Interviewers

Cases	Nature of the Project	Interviewee	Profession	Experience (yrs.)	
				Total	Water supply
A	Completed Project	A1	Chartered Civil Engineer	20	18
		A2	Chartered Civil Engineer	36	30
		A3	Quantity Surveyor	20	12

Cases	Nature of the Project	Interviewee	Profession	Experience (yrs.)	
				Total	Water supply
B	Completed Project	B1	Chartered Quantity Surveyor	10	7
		B2	Chartered Civil Engineer	17	12
		B3	Chartered Civil Engineer	20	10
C	Ongoing Project	C1	Chartered Quantity Surveyor	24	18
		C2	Civil Engineer	18	16
		C3	Civil Engineer	16	11
D	Ongoing Project	D1	Chartered Quantity Surveyor	12	8
		D2	Chartered Quantity Surveyor	21	17
		D3	Chartered Civil Engineer	25	23

4.2.1 Case study A

This project is an urban water supply improvement project, which was designed by the client with the intention of improving the capacity of the drinking water supply transmission main and to provide water connections to the new customers in the highly urbanised area located outside the Colombo city. The client of this project was a government organisation and a well-reputed company had been appointed as the Engineer. The contractor was also well experienced foreign contractor. The estimated project cost was USD 1000 million.

The contractor has selected adhering to the international bidding procedures and all the bidding documents were prepared by the client while referring to the FIDIC condition of contract. The contractual arrangement of interim payment was measure-and-pay method, which consists bulk of foreign materials supply and installation. The contractor had to undertake all civil works associated with the pipe laying works in highly congested and populated town areas.

4.2.2 Case study B

This case also a client designed project with the intention of providing the pipe-borne water to citizens. The project scope was to lay 400km of pipes with various diameters and provide house water connections to those who are living in the area. The client was a government organisation and they have appointed the Engineer internally. The Contractor also a well-reputed local company in Sri Lanka. This project had been implemented through the local bank funds which was arranged by the client and estimated contract amount of this project was LKR 10 billion.

Contract documents of this project had been prepared referring to the ICTAD condition of contract and the mode of payment has been a measure-and-pay. All most all the materials incorporated in the permanent works were foreign imported other materials associated with civil works were locally procured. In most cases, construction works have been carried out along highly congested roads with great difficulties.

4.2.3 Case study C

The Case C is a design & build project directed with a different angle of a rehabilitation project. The client of this project is a government organisation and the Engineer also appointed by the client but internally. The contractor is a Joint Venture (JV) and the leading party of the JV is a foreign body and the other party was a local contractor. This project is under the FIDIC conditions of contract. The main objective of this project is reducing of None Revenue Water (NRW) percentage while rehabilitation of the existing water supply network. It involved new technology

which is not familiar to the Sri Lankan water supply sector. Hence, the project has awarded to a foreign contractor who possesses vast experience related to construction activities involved. However, at the beginning of the project, the Engineer did not have such hands-on experience and it paved the way for disputes.

As per the initial contract, scope of the project is to lay 145km length of HDPE pipes to include DI pipes with 1200mm diameter about 1.2km length, along the congested roads. The next activity is to carry out the NRW management works to reduce non revenue water to 18% or lesser. Initial contract period is 42 months and it has been awarded the time extension of another 20 months as the scope is changed.

4.2.4 Case study D

Case D is also a design and built contract where the contractor had to undertake rehabilitation of the existing water supply network, which is more than 60 years old. Similar to the Case C, the client of this project is also a government organisation, and the Engineer also appointed by the client. The contractor is a foreign contractor. This project is under the FIDIC condition of contract similar to case C. The main objective of this project is also reducing of Non-Revenue Water (NRW) percentage in the water supply distribution system while rehabilitation of the existing water supply network. It involved new technology which is not familiar to the Sri Lankan water supply industry. Therefore, the project was awarded to a foreign contractor who possesses vast experience related to construction activities involved. However, in the beginning of the project, the Engineer did not have such hands-on experience and it paved the way for disputes. This project has a close relationship with the above case C as both the project has specified under the same category and the scope also bit similar.

Scope of the contract is to lay 170km of pipes along the congested roads and subsequently do the NRW management works. To accomplish the works specified, 48 month of time period has been allocated in the initial contract.

4.3 Major Disputes in Urban Drinking Water Supply Projects

As depicted in the literature survey, disputes in the construction of water supply projects are deteriorate the successful completion while delaying projects. Urban water supply projects have high tendency of occurring disputes because of its nature. Hence this study is focused to investigate the dispute in construction of urban water supply projects in Sri Lanka. Accordingly, this section describes the major disputes in the urban water supply projects identified through the interviews and findings are presented in each case separately.

4.3.1 Major Disputes in Case A

As reviled by the interviewers, as the result of the Engineer's failure to afford the site possession to the contractor prior to commencement of the project, disputes have arisen. As the Interviewee A1 stated, *“The Engineer had been failed to afford the possession to the contractor as the client does not possess the possession of site. For the reason that the pipe had to lay along the roads owned by the Road Development Authority (RDA) and Provincial Road Development Authority (PRDA) and permissions had to be obtained from them”* Interviewee A3 also confirmed the same and this is an utter failure of the client which created a dispute as the contractor incurred additional cost and time due to the delay of site possession. However, A2 stated *“the contract condition has amended and it says the right and possession shall not be exclusive to the contractor, but shall be subjected joint occupation with the right of use of site by the public, other utility organizations and other authorized entities to carry out their legitimate duties within the site.”*

As the interviewers revealed, this project had initiated with Value Added Tax (VAT) and the contractor had paid tax from the beginning. However, due to the change of legislation, the project was converted into a VAT exempted project when it is halfway completed. And then the client has refused to reimburse the VAT already been paid by the contractor. This situation has created a dispute and the case had referred to the Dispute Adjudication Board (DAB) as the Engineer failed to determine the case impartially and satisfactorily. Finally, DAB has given its decision in favour of the contractor.

Another dispute has occurred due to the over-excavation in culvert crossings of the pipeline. As pointed out by the A1, *“generally in water supply projects, when the pipe is required to cross an existing culvert or a bridge, in normal practice, culvert crossings are constructed with a separate steel structure rests on pre-casted concrete piles or in-situ casted concrete piles which are parallel to the culvert or with a simple support hang in the side wall of the culvert. However, in this particular project usual practice was altered. RDA officials, the owner of those culverts has requested cross the culverts by deep excavation which go beyond the silt level of the culverts. Accordingly, instruction has issued by the engineer and that instruction clearly constituted a variation. However, no payments were approved by the engineer stating that it is included in the contract and rates”*.

As stated by A3, *“additional works carried out by the contractor in road reinstatement works due to unforeseen underground soil condition also not approved and not paid to the contractor and it also had created a dispute.”* Moreover, interviewers A1 and A3 highlighted that, in the pipe laying contracts width of the pipe trench has defined referring to the diameter of the pipe used and would be paid accordingly for used materials in parallel to the CESMM codes specified. However when the underneath soil layers are more weaker, it has been very difficult to maintain specified trench widths as side walls were tend to collapse naturally. This scenario creates an additional requirement of backfilling materials and additional reinstatement of the top layer of the carriageway. This creates additional cost to the contractor and no contractor is willing to absorb such additional cost. Hence the contractor had requested additional payment but the engineer had refused such payment stating that it is a contractor’s obligation to include such costs into the rates and the contractor’s argument was such that it is an unforeseen ground condition where no contractor can predict without adequate investigation reports in pre-bidding stage to include in the rates.

Further as revealed by the A2 interviewee, frequent design changes also have created many disputes as design changes necessitate the additional materials. Most of the materials used in permanent works had to be manufactured and imported from

foreign suppliers. It consumed considerable time duration and led to the idling of resources. However, the contractor's request for Extension of Time (EOT) and cost have been disregarded by the engineer.

4.3.2 Major Disputes in Case B

During the data collection, it was observed that, the Case B has four (04) major disputes and some minor disputes when the value of the claim being considered. All the interviewees B1, B2 and B3 noted that a major dispute had initiated due to the non-payment for the performance bond. As stated by interviewee B2 *“As per the condition of contract, the contractor has to obtain performance bond at his own cost. However, there was a provision in the provisional sum for providing all bonds and guarantees. Hence the contractor has not been included any burden in his rates to provide the performance bond and finally, the payment was rejected by the client by creating a dispute. Hence it can be said that this is a contradiction of the contract document.”* Then the contractor has brought this case to the DAB and DAB has given their decision in favour of the contractor.

The next conflict was the supply of corrosion protection materials. As stated by the interviewers, there are several methods of pipe jointing in water supply pipes, depending on the materials of the pipe and location of the pipes. Among the above joints, there is a specific kind of joint called flange joint where it uses nut and bolts to joint two ductile iron pipes. After the installation of nuts and bolts in the joint it has to be covered with the joint with protection material to prevent corrosion. Payment for these materials had to be done in separate Bill of Quantity (BOQ) items provided in the contract for supply and installation. Payments have been made accordingly from the beginning of the project. However, contract preambles have specified the cost of supply of materials to be included in the pipe laying rates. When the engineer came across this information, suddenly the payment has suspended and all the paid amounts paid through the interim payments also withheld. Currently, the contractor is in quest of experts' opinions with the intension of referring the case to the DAB.

As found from the data collection, there had been another conflict regarding the materials used for bedding of the pipe. To prevent the possible lateral movements of the pipe during the construction and post-construction period it is required to provide self-compacting material as bedding and surrounding to the pipe as mechanical compaction is restricted to protect the pipe. This material is called as bedding type B and usually use graded quarry dust as it shows self-compacting behaviour in nature. In the BOQ there has been a separate item for bedding type B and the contractor had got paid accordingly. As the B3 interviewer stated, *“there had been a narration in the contract preambles stating that the cost of bedding and surrounding materials should be included backfilling materials rates”*. The interviewee B1, the contractor’s quantity surveyor stated *“the contractor has quoted separately for bedding type B following the BOQ and no burden has been added to the backfilling rates.”* the engineer had suspended the payments made for the bedding type B when they came to know that preambles have given the direction of payments for the bedding type B. Then the contractor had taken necessary action to refer the case to the DAB and DAB has given its decision favourable to the contractor.

There had been another similar conflict for imported soil also as it was provided a separate BOQ item while contract preambles stating that the cost of imported materials deemed to include in the backfilling rates.

4.3.3 Major Disputes in Case C

This is an ongoing project and when the Case C is considered there are five(05) most critical disputes currently under negotiation and three (03) of them are about to refer to the DAB. Moreover, C1 interviewer stated that there is a possibility of occurring some other disputes rather than identified disputes. The interviewers C1 and C2 noted that, first major dispute had initiated due to the non-payment for the performance bond similar to the Case B. As stated by interviewee C1, the condition of contract stated that, the contractor has to obtain the performance bond at his own cost. However, there is a provision in the provisional sum for providing all bonds and guarantees. As such the contractor is arguing that the contractor has not been

included any burden in his rates to provide the performance bond and the contractor is entitled for separate payment as the contractor has misled. However, this dispute is currently in the negotiation stream.

As the interviewee C3 stated the second significant conflict has been initiated due to non-payment for the part of materials imported by the contractor. Further, the interviewee C3 confirmed that the Ductile Iron (DI) pipes are mostly used for larger diameters in water supply pipes in Sri Lanka. If the pipes are laid in a straight line, normal socket and spigot pipes can be used. This type of pipe laying works are most appropriate in rural areas as there are no considerable underground utilities present. However, in the urban water supply projects, laying of pipes has to be undertaken with high concentration of existing utilities and structures. Then it necessitates additional bends and accessories to avoid such utilities. Technically, bends generate additional forces exerted on surrounds due to water hammer effects. To restrain such forces generally thrust blocks are constructed externally. Thrust blocks are constructed with mass concrete and comparatively these are larger structures and the size is become larger when the pipe diameter increased. Hence construction of thrust blocks needs larger space when compared with the other structures. When the pipes have laid with very limited ground spaces due to the presence of utilities, thrust blocks cannot be employed and then the contractor compelled to propose special arrangements of pipes. This system is called self-restrain pipes and this has comparatively high cost with the trust blocks. As stated by interviewee C1, *“There are DI Restrained Pipes in the Original design and the Bills of Quantities. As per contract provisions, restrained joint system shall be designed at the post bidding stage considering site conditions such as soil condition, the extent of existing underground utilities, space availability and change of pipe direction, etc. The joints in the pipe network at locations where the direction changes and potential settlements due to soil condition shall require restraint supports by means of:-*

- a) External support by providing thrust blocks or*
- b) Internal self -Restraining by built-in rubber ring – For smaller diameter pipes or*

- c) *External self-restraining system by providing Restrained self-anchoring Gland. A special Gland is manufactured with a special rib to keep pipes/valves/pipe specials in place without slipping.*

In normal situations, the internal Restraining system is applied for smaller diameter pipes, whereas for larger diameter pipes, a special gland is manufactured with a special rib to keep pipes/valves/pipe specials in place without slipping. In the Letter of Award, a supplier who manufactures an external Self-restrained system is approved for supply of DI Restrained Pipes. At Detailed Design/construction stage, it has found that there were no spaces for constructing thrust blocks of required sizes. Therefore, the only viable Joint Restrained System is the external Self-restrained system by providing a Restrained self-anchoring Gland. The Restrained self-anchoring Gland System comprises of; a) DI Gland b) DI Bolts & Nuts c) Rubber Gasket which is collectively named as “Restrained Accessories”.

A dispute has arisen regarding the cost of Restrained Accessories where the Contractor has requested additional payment stating that there is no BOQ item and the Engineer determination was such that the cost of Restrained Accessories shall be included within the BOQ rates.”

The next conflict has arisen due to the scope reduction on None Revenue Water (NRW) management works. As stated by the interviewee C3, NRW management is the process that reduces the percentage of none revenue water in the current pipe laying system and it involves a complex of activities to include the laying of new pipes. As per the contract, pre-identified limited length of pipes had to be replaced and then move to NRW management works. Then the contractor has to perform number of tests and investigations to confirm the present NRW percentage. The interviewee further stated *“the main intended scope of this project is for NRW reduction and management, and the Contractor expected to perform the following works under the scope of NRW management.*

- *Pressure zero test*
- *Initial flow measurement*
- *Flow measurement*
- *Step test*
- *House to house leak survey*
- *Leak detection by sounding*
- *Carry out leak repair work*

Now the contractor states that aforesaid initially contemplated construction methodology was drastically changed by the Engineer.”

The fourth (4) conflict has arisen due to the delayed payment made by the employer. As stated by the interviewee C1, the funding agent for this contract is the Asian Development Bank (ADB) and ADB is paying 72% form the interim payment. Balance 28% is providing with the local funds from Sri Lanka’s Treasury. Due to the failure of releasing the local portion to the contractor has claimed the interest for delayed payment and but the Engineer has not been approved yet.

Recent terrorist attack on Easter Friday (Force Majeure) had induced another dispute as the Employer has refused to accept the contractor’s request to consider idling resources and time extension. As the interviewee C2 stated, *“in recent past, multiple terrorists attacked took place in several places in the island wide including the area of this project. Just after the incident police curfew was imposed and continued for several days due to the security reasons. However, the investigation continued a little longer and during this period construction works along the roads were restricted. The contractor had duly notified the incident to the engineer and he had accepted to consider the losses on the contractor upon his due submission of incurred losses. However, the employer responding to the request made by the contractor had expressed his disagreement on paying losses to the contractor.”* This incident has created a dispute and the contractor has again requested an impartial determination from the employer.

4.3.4 Major Disputes in Case D

This case also shows similar characteristics with Case C and some disputes are identical with case C. As described, dispute regarding the payment for the performance bond, dispute in relation to the supply of foreign materials, drastic reduction in the NRW management scope and dispute arise due the non-payment for force majeure incident are very similar in occurrence in this project. However, as revealed in the interviews there are some other disputes in relation to the frequent design changes and incompetent instruction received from the Engineer, delay of construction approvals from Colombo Municipal Council (CMC) and Road Development Authority (RDA), unforeseeable site conditions and ambiguities in contract documents.

As the interviewee D3 stated ambiguities between drawings, specification and BOQ are very common which creates disputes. Further, D1 stated that the bedding type indicated in the tender drawings was different from the specification. When the clarifications raised by the contractor, the Engineers have instructed to carry out works as per the specification, which generates a variation to the original work. When the additional payment was requested by the contractor it has rejected without a proper determination. However, the case is still pending and the contractor is willing to refer the case to DAB.

Further, D1 stated that due to the unforeseeable existing utilities initially proposed pipe laying path changed without relocating the said utilities even though the BOQ provisions are available for utility relocation works. Such works are time-consuming and incurred additional costs on the contractor. Though no additional payment has been approved by the engineer and contractor is willing to bring this to DAB.

As interviewee D2 stated there has been a conflict in respect of the definition in the BOQ and actual work to be carried out in survey works. Further D2 stated *“it has clearly mentioned in the BOQ pay item as “Longitudinal Survey (LS)” but the specification has both the definition of LS survey and the TOPO graphic survey*

separately. However, both the survey work are required for design purpose and as-built drawings. But the Engineer's stand is such that the contractor has quoted for both the survey in above mentioned BOQ item." Hence it has created dispute and the contractor is requesting separate payment for TOPO graphic survey.

Further, interviewee D1 stated that granting approvals for construction works from other utility authorities such as CMC and RDA deliberately delayed and not sufficiently coordinated and facilitated by the engineer. Delay in acquiring permits had a direct impact on the progress of works and it has led to the idling of contractor's machinery and manpower which the Engineer failed to determine impartially.

4.4 Summary of Major Disputes

There are various disputes identified in all the cases and while some disputes identical to the projects and some are common. When Case A is considered, there are five (5) significant disputes. The first dispute is the failure to offer the site possession to the contractor and this dispute is a common dispute for all other cases. The next dispute is non-payment of the VAT paid by the contractor and this is identical to this project. The third dispute is the change of design to accommodate the requirement of a third party. The fourth dispute is the additional reinstatement works due to unforeseen ground conditions. The last dispute is frequent design changes to avoid the existing underground utilities. Accordingly identified disputes are,

- Failure to offer the site possession to the contractor
- Dispute is non-payment of the VAT paid by the contractor
- Change of design to accommodate the requirement of a third party
- Additional reinstatement works due to unforeseen ground conditions
- Frequent design changes to avoid the existing underground utilities.

As identified Case B has four (4) major disputes. Non-payment for the performance bond is the first dispute and it is common in Case C and Case D also. The second dispute is the payment for joint protection materials which was initiated due to

contradiction in the contract and BOQ. Third dispute was initiated due to the ambiguity in the contract with respect to the bedding type and fourth dispute also has raised due to a similar scenario concerning imported soil to be used in construction works and accordingly identified disputes are,

- Non-payment for the performance bond
- Payment for joint protection materials
- Ambiguities in the contract with respect to the bedding type
- Non-payment for the imported soil to be used in construction works

In the Case C and D have five (5) common disputes. Non-payment for the performance bond, disagreement for the payment for restraint accessories, scope reduction in NRW management, delay of releasing interim payments and Non-payments for the losses due to an unforeseeable event of a terrorist attack, which leads to force majeure situation. Apart from the above disputes there four disputes in the case Ambiguities in the specification and the drawings, enforceable underground utilities, survey works and delay granting of third party approvals for construction works. Thus identified disputes are as follows.

- Non-payment for the performance bond
- Disagreement for the payment for restraint accessories
- Scope reduction in NRW management
- Delay of releasing interim payments
- Payments for the losses due to an unforeseeable event of a terrorist attack

4.5 Analysis of Causes of Disputes

As identified in the literature survey, causes of disputes are basically in three types, behavioural problems, contractual problems and technical problems. Disputes identified in the urban water supply project also exhibit similar characteristics and

can be further analysed to distinguish the causes of disputes and it would be an added advantage in analysing strategies of mitigation of disputes.

Failure to offer the site possession to the contractor is the first dispute in the urban water supply projects as identified in the interviews had with industry professionals. The interviewees A1 and A3 stated that this dispute is occurring due to the failure of the employer to adhere the contractual obligations by the employer and the engineer and this is a contractual dispute. However, they further explained this scenario can only be avoided by improving proper coordination with relevant parties who keeps the administrative powers.

Legislation changes are the next most important matter to be considered as this creates critical disputes in the water supply projects. As the interviewee A1, project manager of the contractor stated, *“legislation changes are not very common but this is also a contractual dispute which cannot avoid when the contract is formed.”* If the engineer is very keen on the contract terms such disputes can efficiently mitigate. The next dispute is the design changes done to facilitate the third parties' requirements. If the proper and adequate investigations have been conducted in the pre-contract stage with proper coordination with the parties involved, this kind of dispute could easily be avoided. As same as dispute raised due to the additional works carried out by the contractor also could be avoided if the pre-investigation works carried out adequately. Further, A1 stated, *“if the project teams had proper communication skill and timely instruction from the engineer could have avoided this kind of disputes.”*

As the interviewee B3 stated, *“the dispute ascended owing none payment for performance bond also shows lack of experience and interpretation skill of the contract of the engineer and the employer.”* His indication further emphasised, when the DAB gave its decision in favourer of the contractor in this respect. This issue is a contractual dispute and personal behaviour also has a direct influence on this issue.

The disputes on joint protection materials, bedding type, imported soil and restrain accessories shows similar behaviour as the interviewees B2 and B3 emphasized. Interviewee B2 stated that, Lack of competency in contract interpretation and ambiguities in the contract documents are major causes of those disputes. At the first glance, those disputes have contractual background but when deeply investigate these disputes it was revealed that there is a slight contribution on behaviour of professionals has involved. For the reason, that particular disputes have been boosted up due to the competency of the interpretation of the contractual terms of both the engineer's and the contractor's personals and their communication skills.

Scope reduction in the NRW management works also a major dispute in the cases C and D as revealed by the interviewees C2 and D3. Interviewees further stated that this is due to the serious violation of procedures stipulated in the contract by the engineer. In order to succeed in the intended purpose, the engineer has tactfully driven the contractor without issuing proper instruction. Due to the lack of competence of the contractor to identify these drastic changes taking place they also have obeyed the engineer's instruction. However, at the end intended purpose of the employer is succeeding while the contractor pushing in to utter failure. When this case is deeply analysed it can be emphasized that this dispute has initiated due to the behavioural problems and it has been amplified by the ambiguities in the contract documents.

Delayed payment is the next dispute identified in all the Cases A, B, C and D have experienced delayed payments. As explained by the interviewees B1 and C2, delayed payment creates disputes when the contractor requests interest for delayed payment. The contractor's entitlement for additional financial chargers for delayed payment is well stipulated in the contracts. However, during the data collection it was identified when the contractor requests the interests, the engineer recommends to pay but the employer not willing to accept. It is keen that this is due to the behavioural problem of the employer's personals, not the contractual issue at all.

The terrorist attack on Easter Sunday is clearly a “Force Majeure” incident and the interviewee C2 further clarified that the contractor has clear entitlement for claiming incurred cost and time. However, the employer has disagreed without proper justification. Hence it is clearly a claim initiated due to the client’s behaviour.

Further the study found that, claim raised for the survey works has initiated due to the ambiguities in the contract documents and BOQ. Both the engineer and the contractor had failed to interpret the contract as it should be and nobody has accepted the interpretation of the other party. Furthermore, this case shows the behaviour of a dispute initiated by the contractual ambiguities but it has amplified by the behavioural problems.

As the interviewee C3 and D1 further stated, that the procedure which has been adopted in acquiring permits and approvals from the authorities was unacceptable and incurred delay. By the contract, all the obligation has been assigned to the contractor, but the engineer is required to provide reasonable assistance in acquiring such permits. Limits of reasonable assistance are not clearly demarcated and there is a question whether it is reasonable to pass the responsibility of acquiring permits to contractor instead of the owner of the property. This ambiguity has been created disputes between the contracted parties and this can be categorized as a contractual dispute as explained. All the above-discussed causes of identified disputes have tabulated in Table 4.3.

Table 4. 3: Analysis of Causes of Disputes

Dispute	Causes of Dispute		
	Behavioural	Contractual	Technical
Failure to offer possession of site to the contractor	✓	✓	
Change of legislations	✓	✓	
Change of designs due to third parties influence	✓		
Additional works carried out by the contractor		✓	✓
Frequent design changes to avoid existing utilities			✓
None payment for the performance bond	✓	✓	
None payment for joint protection materials	✓	✓	
None payment for bedding material	✓	✓	
None payment for imported soil	✓	✓	
None payment for restrain accessories (imported materials)	✓		
Scope reduction in NRW management	✓	✓	
Delay payments	✓	✓	
Terrorist attack(Force majeure)	✓		
Delay in third party approvals	✓	✓	
Ambiguities between drawings and specifications		✓	✓

4.6 Effects of Disputes in Urban Water Supply Projects

Disputes have various effects on the execution of urban water supply projects. According to the experts' opinion, effects of disputes in urban water supply projects have tabulated in Table 4.4.

Table 4. 4: Effects of Disputes

<i>Effects of disputes</i>		<i>Cases</i>											
		<i>A</i>			<i>B</i>			<i>C</i>			<i>D</i>		
		<i>A1</i>	<i>A2</i>	<i>A3</i>	<i>B1</i>	<i>B2</i>	<i>B3</i>	<i>C1</i>	<i>C2</i>	<i>C3</i>	<i>D1</i>	<i>D2</i>	<i>D3</i>
1	Time overrun	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓
2	Cost overrun	✓	✓	✓		✓	✓	✓	✓		✓	✓	
3	Abandonment							✓		✓		✓	✓
4	Negative social impact	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓
5	Idling resources	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓
6	Slow down growth of construction sector	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	
7	Loss of productivity	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓
8	reduction in investment profits	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓
9	damage continues business relationships	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

While referring Table 4.4 of common effects of disputes on the urban water supply projects, Table 4.5 differentiates the effects of the identified disputes in this specific area.

Table 4. 5: Effects of Identified Disputes

Dispute	Time overrun	Cost overrun	Abandonment	Negative social impact	Idling resources	Slow down growth of the construction sector	Loss of productivity	Reduction in investment profits	The damage continues business relationships
Failure to offer possession of site to the contractor	✓	✓			✓				✓
Change of legislation		✓						✓	✓
Change of design due third parties influence	✓	✓							
Additional work carried out by the contractor	✓	✓							
Frequent design changes to avoid existing utilities	✓	✓		✓	✓	✓	✓	✓	✓
None payment for the performance bond		✓				✓		✓	✓
None payment for joint protection materials	✓	✓					✓	✓	✓
None payment for bedding material		✓						✓	✓
None payment for imported soil		✓						✓	✓
None payment for restrain accessories (imported materials)		✓						✓	✓
Scope reduction in NRW management					✓			✓	✓

Dispute	Time overrun	Cost overrun	Abandonment	Negative social impact	Idling resources	Slow down growth of the construction sector	Loss of productivity	Reduction in investment profits	The damage continues business relationships
Delay payments	✓	✓		✓	✓	✓	✓	✓	✓
Terrorist attack(Force majeure)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Definition of survey work	✓	✓						✓	✓
Delay in third party approvals	✓	✓		✓	✓			✓	✓
Ambiguities between drawings and specifications	✓	✓			✓			✓	✓
Delay instructions	✓	✓	✓		✓		✓	✓	

4.7 Remedies for Mitigating Disputes in Urban Water Supply Projects

Referring to the opinion of the interviewees of Cases A, B, C and D in the above discussion, there are various suggestions to mitigate the identified major disputes in urban water supply projects and discussed in this section.

4.7.1 Dispute 1: Failure to offer ‘Possession of Site’ to the contractor

As discussed above site possession is the most crucial thing in a contract and timely handing over the site to the contractor without any constraint is the key success of the project. However, as stated by A1 and A2, due to the nature of the urban drinking water supply projects in Sri Lanka, the client is restricted to have full authority of the site as pipelines are laid through the existing roads. Therefore, offering possession of the site is not a straightforward process as the client need to seek other authority’s

approvals and permits. Those permits and approvals are keep delaying as other authorities have no obligation over the project success. As pointed out by the interviewee, A1 proper coordination with relevant authorities from the pre-contract period and change of legislation while making all parties responsible for the projects, are the remedial measures for this dispute.

4.7.2 Dispute 2: Changes of legislations

Legislation changes are inevitable in the construction contracts, as such decisions are solely depend on government decisions and no time frame is fixed for its occurrence. A1 and A3 stated such changes creating disputes in the contracts due to the disagreement over the interpretation made by contracted parties. The reason for unaccepting these changes is monetary value induced by such changes and while one party benefitted the other party incurs losses with the acceptance. In Case A also, same scenario has been taken place and there the employer has been the loser. Hence the employer has been refused to repay the VAT paid by the contractor and the dispute has referred to the DAB. Finally, the DAB has given its decision in favour of the contractor. The main issue of this dispute is the incompetence and lack of professionalism in the contracted parties. Hence appointing competent professionals in the engineer's team and facilitate them to keep their impartiality as they are the advisor of other contracted parties to the contract.

4.7.3 Dispute 3: Change of design due to third parties influence

Design changes in a project are followed by cost implications. As stated by A1 and A3, this dispute has induced due to a third party involvement and their request. However, the client of an urban water supply project has an obligation to adhere and accept the requests making other parties as most of the properties are under them. If these requests come in the early stages of the project, due consideration can be given in the design as well as the construction phase. Unfortunately, these requests arise in the construction phase when the construction works are halfway completed. As acknowledge by the A1 the occurrence of such disputes can only be minimized by improved early coordination and maintaining continuous communication when the

construction works are going on with relevant parties. Moreover, proper planning and implementation of the project also would help to mitigate such disputes.

4.7.4 Dispute 4: Additional works carried out by the contractor

As stated by the A1 when the contractor is doing the construction works, there may be possibility and requirement of undertaking additional works in order to complete construction works. However, these additional works should be carried out through a proper channel of instruction. Generally, these instructions are coming from the engineer in various forms and hence the contractor should be keen enough to get the confirmation from the engineer regarding the relevant information in particular, mode of payment. Disputes arise on additional works are mainly due to non-acceptance of instruction by the engineer's personals due to various reasons. These can be minimized by establishing a proper channel of communication and by establishing effective teamwork as stated by the A2.

4.7.5 Dispute 5: Frequent design changes to avoid existing utilities

As acknowledge by the interviewee A2, the reasons for the frequent design changes are lack of investigation in pre-design stage and none availability proper details of existing utilities and reliability of existing details with utility agents. Further, A2 stated that, comprehensive pre-investigation of site and incorporation of those details in to the designs would reduce the disputes arising due to frequent design changes. Additionally, A2 proposes to encourage the use of modern technologies to keep the actual records of utilities and share with all the utility agents in the country and to develop utility corridors in all over the country by a proper change in legislation.

4.7.6 Dispute 6: None payment for the performance bond

As identified during the data collection this is a very prominent dispute in the urban water supply projects in Sri Lanka. Same dispute could observe in Case B, C and D. It seems that the client also has failed to adopt a substantial remedial measure to the issue as the issue prolongs for an extended period in several contracts. However, in

Case B, as stated by the interviewee B2, the case had referred to DAB, and DAB decision had been given in favour of the contractor. Further B2 stated this elucidates the engineer's failure in determining a dispute impartially. Wittingly or unwittingly the Engineer has misused the delegated authority to determine the matters. Hence to mitigate this issue in the first instant, contract documents should be reviewed by a team of qualified professionals before the tendering process. Professionals with hand-on experience should be representing the engineer where the engineer can keep impartiality at any circumstances.

4.7.7 Dispute 7: None payment for joint protection materials, Imported soil, restrain Accessories

As majority of the interviewers emphasised, the causes for these disputes are similar and appointing qualified personals who can adequately interpret the contracts would be the immediate remedial measure to mitigate such disputes. In addition, B2 stated that, to avoid the recurrence of similar disputes in contracts, contract documents shall be reviewed by an experienced team of professionals trained on contract administration, in the pre-tendering stage. Additionally, improvement of the communication skill of project participants also would potentially reduce the tendency of such disputes.

4.7.8 Dispute 8: Scope reduction in NRW management

As identified during the data collection, scope reduction in the NRW management works has been accomplished without prior notice to the contractor. The contractor also failed to understand the deviation of the project from the original scope. C1 stated this shows the impartiality of the engineer's staff and the lack of competency of the contractor's personals about the contract. Hence C2 mentioned that, the tendency of such disputes will be reduced by assigning experienced professionals who act impartially, assigning competent personnel as the contractor's representative who can interpret the contract and efficient communication with the relevant parties.

4.7.9 Dispute 9: Delay payments

As identified in the data collection, in Case C and Case D employers none acceptance of the payment of interest on delayed payment has created a dispute. C1 stated that most of the urban water supply projects are executing under the NWSDB of Sri Lanka with the assistance of local or foreign banks. However, a percentage of the project cost would be borne by the government as a rule. The portion borne by the government is unduly delaying and leading to disputes. To avoid such delays, interviewees C1, C2 and D1 emphasised that before the commencement of the project the contractor should inquire about the client's financial capacity in releasing payments. Although the contractor's right to know the client's financial stability is well stipulated in the contract conditions, due to the prevailing circumstances, such guarantees have become insignificant. Hence, C1, D2 stated such disputes can only be avoided by assigning professionals in all the parties to the contract who can interpret the contract and act accordingly.

4.7.10 Dispute 10: Terrorist Attack (Force majeure)

The contractor's request for additional time and cost incurred due to the force majeure incident had declined by the client by his own judgment irrespective of contractual provisions as stated by the C1, C2 and D2. Hence it seems to be a severe breach of contract by the employer. This situation has paved the way for a dispute, and it could be avoided if the employer seeks the Engineer's opinion or adheres to the contractual provisions as acknowledged by C2 and D2. The engineer also has failed to provide proper justification to the client and to mitigate this kind of disputes, the engineer has a vital role to play and hence, the engineer's staff have to have consisted of professionals who can work impartially. Employer's team also has to have consisted of professionals who can interpret the contract properly.

4.7.11 Dispute 11: Unclear Definition of survey work

The definition of the survey work, which the contractor to be undertaken was not clear as BOQ and specification define a different scope as stated by C1 and D2. However, D2 stated that the engineer and the contractor have failed to reach an

agreement depending on their self-interpretation and on the other hand, this shows the inability to understand contract documents of both the parties. This problem could have been amicably settled if the engineer and the contractor had technically sound professionals during the project execution. As stated by the C1 this type of contract ambiguities should have identified in the pre-contract period phase and it was suggested to have an expert team for contract document reviewing to expel this kind of ambiguities from the contract documents. Furthermore, D2 mentioned that improving a positive attitude in the negotiation of conflict has a vital advantage in resolving such disputes prior to DAB or arbitration.

4.7.12 Dispute 12: Delay in third party approvals

Delay in third party approvals is also a common issue in the urban water supply projects as identified by the study and C3 emphasises that it can be mitigated by improvement of coordination of involving parties. The coordination should be initiated at early stage of the project to identify their requirements project scope and relevant information shall be share with them. Improvement of communication among the parties and respect and understand their ideas and proposals. In addition proper project planning and implementation would be an added advantages on avoiding such disputes.

As the interviewee C3 and D1 further stated, the procedure which has adopted in acquiring permits and approvals from the authorities is unacceptable and incurred delay. By the contract all the obligation has been assigned to the contractor, but the engineer is required to provide reasonable assistance in acquiring such permits. D1 acknowledge that the limits of reasonable assistance are not clearly demarcated in the contract and stated that there is a question of whether the contractor's liabilities are strong enough to acquire such permits by himself. This ambiguity has been created disputes between the contracted parties, and this can be categorized as a contractual dispute, as explained.

All the above-discussed remedial measures for identified disputes have tabulated in Table 4.6.

Table 4. 6: Summary of Remedies for Mitigating of Disputes

Dispute	Remedial Measures
Failure to offer ‘possession of site’ to the contractor	<ul style="list-style-type: none"> • Improve the coordination among project participants. • Change of legislation while making all the parties responsible for the project • proper planning and implementation of the project
Change of legislation	<ul style="list-style-type: none"> • Appointment of real professionals in the engineer's team and facilitate them to keep their impartiality.
Change of design due to third parties influence	<ul style="list-style-type: none"> • Improved early coordination • Maintaining continuous communication when the construction works are going on with relevant parties.
Additional work carried out by the contractor	<ul style="list-style-type: none"> • Establishing a proper channel of communication • Establishing effective teamwork.
Frequent design changes to avoid existing utilities	<ul style="list-style-type: none"> • Comprehensive pre-investigation of site and incorporation of those details into the designs • Encourage the use of modern technology to keep the actual records of utilities and share with all the utility agents in the country • Develop utility corridors in all over the country by a proper change in legislation.
None payment for the performance bond	<ul style="list-style-type: none"> • A team should review contract documents consisted of qualified professionals before the tendering • The engineer’s team should consist of well-experienced Professionals.

Dispute	Remedial Measures
	<ul style="list-style-type: none"> • The engineer should keep the impartiality in any circumstances.
None payment for joint protection materials	<ul style="list-style-type: none"> • Contract Documents shall be reviewed by a team of professionals in the pre tendering stage • Project staff shall be trained on contract administration. • Improvement of the communication skill of the project participants also would potentially reduce the tendency of such disputes.
None payment for bedding material	
None payment for imported soil	
None payment for restrain accessories (imported materials)	
Scope reduction in NRW management	
Delay payments	<ul style="list-style-type: none"> • Inquire about the client's financial capacity in releasing payments before commencing the works. • Assigning professionals in all the parties to the contract who can interpret the contract and act accordingly.
Terrorist attack (Force majeure)	<ul style="list-style-type: none"> • The engineer's staff has to consist of professionals who can work impartially. • Employer's team also has to consist of professionals who can interpret the contract terms clearly.

Dispute	Remedial Measures
Unclear Definition of survey work	<ul style="list-style-type: none"> • Appointment of technically and contractually sound professionals in the project execution. • Appointment of a team of professional pre-contract phase to review the contract documents in avoiding this kind of ambiguities. • Improvement of positive thinking attitude in the contracted parties in the negotiation of conflicts.
Delay in third party approvals	<ul style="list-style-type: none"> • Improvement of coordination of involved parties. • Coordination should be initiated at the early stage of the project to identify their requirements. • Project scope and relevant information shall be shared with them. • Effective communication among the parties and respect and understand their ideas and proposals. • Proper project planning and implementation would be an added advantage in avoiding such disputes.
Ambiguities between drawings and specifications	<ul style="list-style-type: none"> • In depth evaluation of contract documents in pre tendering stage for their compatibility. • Improvement of positive thinking attitude in the contracted parties in the negotiation of conflicts.

4.8 Suggestions for Mitigating Behavioural, Contractual and Technical Disputes

As identified in the case studies there are three distinct categories of disputes, Behavioural, Contractual and Technical depending on their occurrence. Mitigation measures also can be categorized referring to the said categories.

4.8.1 Suggestions for Mitigating Behavioural Disputes

- Improve the coordination among project participants.
- Employer's team should consist of competent professionals who can interpret the contract.
- Assigning competent persons as the Engineer and the contractor's representative who can interpret the contract and efficiently communicate with the relevant parties.
- Appointment of competent professionals in the engineer's team and facilitate them to keep the impartiality.
- Maintaining continuous communication among project participants while construction works are in progress.
- Arrange training programs to improve the skills of contract administration of all project participants.
- Improvement of positive thinking attitude in the contracted parties in negotiation of conflicts.

4.8.2 Suggestions for mitigating contractual disputes

- Change of legislations while making all the parties responsible for the project execution.
- Review of contract documents in pre tendering stage by a team of competent professionals.
- The engineer's team should consist of well-experienced professionals.
- The engineer should keep the impartiality in any circumstances.
- Contract Documents shall be reviewed by a team of professionals in the pre tendering stage
- Inquire about the client's financial capacity in releasing payments before commencing the works.
- Appointment of a team of professional pre-contract phase to review the contract documents in avoiding this kind of ambiguities.

4.8.3 Suggestions for mitigating technical disputes

- Proper planning and implementation of the project.
- Comprehensive pre-investigation of site and incorporation of those details into the designs
- Encourage the use of modern technologies to keep the actual records of utilities and share with all the utility agents in the country
- Develop utility corridors in all over the country by a proper change in legislation.

4.9 Chapter Summary

Analysis of the research findings while addressing pre-determined aims and objectives of a research would be the most important mission in a research. Hence this chapter was dedicated to explained and analysis of research findings. Accordingly, carefully analysed the finding of four (04) cases while identifying major disputes. Subsequently deeply analysed the causes of disputes and their effects pertaining to the urban drinking water supply projects in Sri Lanka. At the end of this chapter, remedies for above identified disputes have discussed relating to the disputes occurred due to behavioural, contractual and technical nature with the intension of mitigating such disputes in future contracts.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMENDATIONS

5.1 Introduction

The main purpose of this chapter is to deliver conclusions and recommendations on the findings of the multiple case analysis, which was carried out in the previous chapter. Several recommendations to minimize disputes in the urban water supply projects in the construction industry in Sri Lanka is discussed in this chapter. Further, limitations of the research and further research directions are also discussed at the end of this chapter.

5.2 Conclusions under the research objectives

The aim of the research is to “investigate the major disputes in construction of urban drinking water supply projects in Sri Lanka.” In order to achieve the prescribed aim, the researcher analysed four (04) cases of urban water supply projects in Sri Lanka under three research objectives.

5.2.1 Identify the major disputes in the construction of urban drinking water supply projects.

The first and foremost objective was to “identify major disputes in construction of urban water supply projects in Sri Lanka.” Accordingly, the researcher had employed the best endeavours to identify disputes in the construction industry relating to the urban water supply projects. As identified major disputes are,

- Failure to offer ‘possession of site’ to the contractor
- Changes of legislations
- Changes of designs due to third parties influence
- Additional works carried out by the contractor
- Frequent design changes to avoid existing utilities
- None payment for the performance bond

- None payment for joint protection materials
- None payment for bedding material
- None payment for imported soil
- None payment for restraint accessories (imported materials)
- Scope reduction in NRW management
- Delay payments
- Terrorist attack (Force majeure)
- Unclear definition of survey work
- Delay in third party approvals
- Ambiguities between drawings and specifications
- Delay instructions

5.2.2 Examine the causes and effects of disputes

The second objective of the research was set to examine the causes of identified disputes and to examine the effects of such disputes. As identified in the literature survey, causes of disputes divided into three major categories, behavioural, contractual and technical. Accordingly, the causes for disputes were categorized as tabulated in Table 4.2. Further, in this research, the effects of disputes also investigated.

In the literature review there are various effects were identified pertaining to the construction projects and as identified in this research, the effects of disputes identified are time overrun, cost overrun, negative social impact, idling resources, slow down the growth of the construction sector, loss of productivity, reduction in investment profit and damage the continuous business relationship in relation to the urban water supply projects in Sri Lanka. At the end of the study, effects of each dispute were discussed. (Refer to Table 4.5)

5.2.3 Suggestions for mitigating the disputes in construction of urban drinking water supply projects

Third and final objective of the research was to propose suggestions for mitigating the disputes arising out of urban drinking water supply projects in Sri Lanka. According to the research findings suggestions for remedial measures for each dispute were discussed (Refer to Table 4.6) and those suggestions would be more important in minimising disputes in urban water supply projects in Sri Lanka.

5.3 Limitations

Since the scope of this research was limited to the disputes in the construction of urban drinking water supply projects in Sri Lanka, in-depth investigations were carried out by selecting only the four samples from urban water supply projects in Sri Lanka. In order to collect the data required, interviews were conducted only with the project participants. Hence it has been limited to the disputes had arisen in selected projects.

5.4 Further research direction

As recognized, the following suggestions would be more valuable in further research, which emerged out of the study carried out.

- A research on causes of disputes in the construction of rural water supply projects in Sri Lanka
- A research on applicable dispute resolution methods for minimising disputes in the water supply projects in Sri Lankan context.

REFERENCES

- Aaker A, Kumar VD, George S. (2000).Marketing Research. New York: John Wiley & Sons Inc.
- Aditya,A.K, Dougless,A.A & Bhattacharya,M.(2017). Urban Infrastructure Development of Works in India: Delay and Difficulties in Implementation with Reference to a Water Supply Project. Journal of the Institution of Engineers India.
- Allan, AJ, Randy, L.J.(2005), Writing the Winning Thesis or Dissertation. A Step-by-Step Guide, Corwin Press, California
- Amaratunga, D., Baldry, D., Sarshar, M. and Newton, R. (2002), "Quantitative and qualitative research in the built environment: application of "mixed" research approach", Work Study, Vol. 51 No. 1, pp. 17-31. <http://doi.org/10.1108/00438020210415488>
- Annual Report of National water Supply and Drainage Board (NWSDB) (2016) of Sri Lanka. Retrieved from <http://waterboard.lk>
- Aryal S. and Dahal R.K. (2018) Review of Causes and Effects of Dispute in the Construction Projects of Nepal Department of Civil Engineering, Lumbini International Academy of Science and Technology (LIASST), Nepal
- Ayudhya, B. I. N. (2011). Common disputes related to public work projects in Thailand. Songklanakarin Journal of Science and Technology, 33(5), 565-573. Retrieved from <http://www.doaj.org/doaj>
- Baloyi, M., & Agumba, J. N. (2014). Causes of disputes in construction projects in South Africa: a case of Gauteng province. Proceedings 8th Construction Industry Development Board (CIDB) Postgraduate Conference.
- Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and Implementation for novice researchers. The Qualitative Report, 13(4), 544-559.
- Brown RB, (2006), Doing Your Dissertation in Business and Management: The Reality of Research and Writing, Sage Publications

- Bryman, A. (2008) Social research methods, 4th edition, Oxford, Oxford University Press.
- Carmicheal, D. G. (2002). Disputes and international projects (2 ed.) Retrieved from <https://books.google.lk/books>
- Cheung, S., & Suen, H. C. (2002). A multi attribute utility model for dispute resolution Strategy selection. *Construction management and economics*, 20,557-568.
- Corbin, J., & Strauss, A. C. (2008). Basics of qualitative research: Techniques and procedures for developing grounded theory (3rd ed.). Beverly Hills, CA: Sage Publications, Inc.
- Cristien, E. & Petra B. (2017), A hands on guide to doing content Analysis, *African Journal of Emergency Medicine*.
- Creswell, J. W. (2009). Research design: Qualitative, quantitative, and mixed methods approaches. Los Angeles: Sage.
- Creswell, J. W., & Plano, C. V. L. (2011). Designing and conducting mixed methods research. Los Angeles: SAGE Publications.
- Creswell, J.W., (2009). Research design: Qualitative, quantitative, and mixed methods approaches.3rd ed. Los Angles: Sage.
- Denny, M. and Kerry,L.,(2007).Dispute Avoidance and Resolution, A Literature Review.
- Deutsch, M. (1973). The resolution of conflict constructive and destructive processes. New Haven: Yale University Press.
- Elmarsafi G, M (2008) Interorganisational collaboration: transformation strategies to reduce construction disputes in the construction industry, Capella University, United States.
- Essam K. Z (2018), investigating the types, causes and severity of claims in construction projects in the UAE, *International Journal of Construction Management*, DOI: 10.1080/15623599.2018.1484863

- Frimpong, Y., Oluwoye, & Crawford, L., (2003). Causes of delay and cost overruns in construction of ground water projects in developing countries: Ghana as a case study. *International Journal of Project Management*.
- Feyzbakhsh, Tevari and Lork. (2017), Investigating the Causes of Delay in Construction of Urban Water Supply and Wastewater Project in Tehran. *Civil Engineering Journal*. Retrieved from <https://www.civilejournal.org>.
- Halki Shipping Corporation v Sopex Oils Ltd, (1997) Retrieved from <https://www.swarb.co.uk/halki-shipping-corporation-v-sopex-oils-limited>.
- Hancock B., Windridge K., and Ockleford E. (2007). *An Introduction to Qualitative Research*. The NIHR RDS EM / YH, 2007
- Herriott, R.E., and Firestone, W.A. (1983). Multisite qualitative research optimizing description and generalizability. *Education Researcher*, 12, 14-19.
- Higgins, J. M. (1991). *The management challenge* (2nd Ed.). Basingstoke: Macmillan Publishing.
- Illankoon. I. M. C. S., Tam V.W. Y, Khoa N. Le & Ranadewa K. A. T. O. , (2019), Causes of disputes, factors affecting dispute resolution and effective alternative dispute resolution for Sri Lankan construction industry, *International Journal of Construction Management*, DOI: 10.1080/15623599.2019.1616415.
- Jaffar, N., Tharim, A.H.A., & Shuib, M.N. (2011). Factors of conflict in construction industry: A literature review. In *Proceedings of the 2nd International Building Control Conference 2011*, (pp. 193-202). Retrieved from <http://www.sciencedirect.com> [12 February 2017]
- Janice, M. Morse, Stern, P.N, Bowers, J.C.B. & Clarke, A.E. (2016). *Developing Grounded theory*, USA, New York, Routledge Taylor & Francis Group.
- Kumaraswamy, M.M. and Yogeswaran (2001). A Comparative Study of Causes of Time Overruns in Hong Kong Construction Projects. *International Journal of Project Management*, 15, 55-63. Retrieved from <https://doi.org>
- Kumaraswamy, M. M. (1997). Conflicts, claims and disputes in construction. *Engineering Construction and Architectural Management*, 95-111.
-

- Kumaraswamy, M., & Yogeswaran, K. (1998). Significant sources of construction claims. *International Construction Law Review*, 15 (1), 144-160.
- Ndekugri, I, & Russell V, (2006). Disputing the existence of a dispute as a strategy for avoiding construction adjudication. *Engineering, Construction and Architectural Management*. (11ed) <http://doi.org/10.1108/09699980610680180>.
- Malewana, M. V. G. C. (2009). Learning processes of construction project teams in Sri Lanka. (Unpublished Dissertation). University of Moratuwa, Sri Lanka.
- Mashwama, N. X, Aigbovboa, C and Thwala, D (2015) Evaluating the impact of construction dispute and the use of ADR in the Swaziland construction industry, Department of Construction Management & Quantity Surveying / Faculty of Engineering & the Built Environment / University of Johannesburg, South Africa.
- Mike, A. (2016). Global construction Disputes report 2016. Retrieved from <http://www.arcadis.com>
- Moore, C. (1989). *The mediation process*. San Francisco: Jossey Bass.
- Monette, D.R., Gullivan, T.J. & DeJong, C.R. (2010) “Applied Social Research: A Tool for the Human Resources” Cengage Learning
- Munaweera C.J,(2018)Minimizing Disputes in Construction Industry in Sri Lanka, Department of Building Economic, Moratuwa University of Sri Lanka
- O’Leary Z. 2004 “The essential guide to doing research”. Sage.
- Perry, C., 1998. Processes of a case study methodology for postgraduate research in marketing. *European Journal of Marketing*, 32(9/10), 785-802.
- Perera, W.D.A. & Halwatura. R.U., (2012) Causes and Effects of Delays in Construction of Medium Scale Drinking Water Supply Projects in Sri Lanka. *Annual Transactions of the Institution of Engineers, Sri Lanka*, 151-159.

- Perera W.D.A, (2010), Causes and effects of delays in construction of water supply projects, Department of Civil Engineering, University of Moratuwa, Sri Lanka.
- Polonsky, M., J. & Waller, D., S. (2011). Designing and managing a research project. (2ndEd), Los Angeles, California; Sage
- Rausana A, (2016), Causes of Conflicts and Disputes in Construction Projects, Department of Civil Engineering, Syiah Kuala University, J.I.Syech Abdur Rauf, Banda Aceh, Aceh Province, Indonesia.
- Robson, C. (2002). Real World Research: A Resource for Social Scientists and Practitioner-Researchers (2nd ed.). Oxford: Blackwell Publishers Ltd.
- Remenyi, D., Williams, B., Money, A. & Swartz, E. (2003) Doing research in business and management: An introduction to process and method, London, SAGE Publications.
- Rudestam, K. E. & Newton, R. R. (2007) Surviving your dissertation (London, Sage).
- Sameer S.S.K, Magar R.B and Parker F.(2016) Claims and Disputes in Construction Projects, International Journal for Research in Applied Science & Engineering Technology (IJRASET)
- Saunders, M., Lewis, P. and Thornhill, A. (2012) "Research Methods for Business Students" 6th edition, Pearson Education Limited.
- Semple, C., Hartman, F., and Jergeas, G. (1994). Construction claims and disputes: causes and cost/time overruns. ASCE Journal of Construction, Engineering and Management, 120(4), pp.785-795.
- Smith, F., Zheng, B., Love, P.E.D. and Edwards, D.F. (2004). Procurement of construction facilities in Guangdong Province, China: Factors Influencing the Choice of Procurement Method, 22(5/6), 141-148. DOI 10.1108/02632770410540351.
- Thomas, K. (1992). Overview of conflict and conflict management. Journal of Organizational Behavior, 13(3), 263-274.
-

- Vorster, M. C. (1993). *Dispute prevention and resolution*. Austin, Texas: Construction Industry Institute (CII).
- Worthington, E. (1977). United Nations Water Conference, held at Mar del Plata, Argentina, 14–25 March 1977. *Environmental Conservation*, 4(2), 153-154.
- Walliman, N. S. & Walliman N. (2011) “Research methods: the basics” Taylor and Francis
Yin, R. K. (2009). *Case research design: design and methods*. (4th ed.). London: SAGE publications.
- Yin, R. K. (2003). *Case study research: design and methods*. (3rd ed.). London: SAGE publications.
- Yin, R. K. (1994). *Case study research: Design and methods*, 2nd ed. Newbury Park, CA: Sage.
- Yamagata,L. (2010).Activity System analysis methods,(2010), Retrieved from: <http://books.google.lk/books>
- Younis, G., Wood, G., and Malak, M.A.A., (2008) Minimizing construction disputes: the relationship between risk allocation and behavioural attitudes. In *Proceedings of International Conference on Building Education and Research (BEAR)*. pp. 728-740. Retrieved from: <http://www.irbnet.de/daten/iconda/CIB11538.pdf>.

ANNEXURE

A. Interview guidelines

INVESTIGATION OF DISPUTES IN CONSTRUCTION OF URBAN DRINKING WATER SUPPLY PROJECTS IN SRI LANKA

Dear Sir/Madam

*Request for obtaining information for the thesis on “Investigation of Disputes in
Construction of Urban Drinking Water Supply Projects in Sri Lanka”*

I’m a postgraduate student of the Department of Building Economics, University of Moratuwa following MSc. in Construction Law and Dispute Resolution. As a part of the degree course, I’m conducting a research on the topic of “Investigation of Disputes in Construction of Urban Drinking Water Supply Projects in Sri Lanka”

I would like to thank you for dedicating your valuable time to have an interview and the information you can provide would be greatly appreciated. This interview will only take few minutes to complete.

All the information gathered from this interview will be kept strictly confidential and this research is intended for educational purpose only, and not for any commercial or other purposes.

*Thank you
yours Faithfully
Researcher*

Menaka Weerasooriya

Section – A

General Information of the Respondent	
Name (Optional)	
Organization	
Type of Organization (Please tick X in relevant box)	Contractor <input type="checkbox"/> Client <input type="checkbox"/> Consultant <input type="checkbox"/>
Profession / Designation	
Working Experience in the construction Industry	
Working Experience in the construction urban water supply projects	

General Information of the Project	
Project Name	
Project Location	
Scope of the project	
Client	
Engineer	
Contractor	
Funding agent	

General Information of the Project	
Contracted amount	
Original contract period	
Contract finished in the original time	
Extension of time granted	
EOT with cost or not	
LD imposed or not	

Section- B

Please answer the following questions relating to your project.

- 1) What the disputes are as identified in this project?
- 2) Were there any disputes due to the client's behaviour?
- 3) Were there any disputes due to the Engineer's behaviour?
- 4) Were there any disputes due to the Contractor's behaviour?
- 5) Were there any disputes due to the other parties influence?
- 6) What are the other factors induced disputes in this project?
- 7) Any of those disputes related to
 - (a) Human behaviour
 - (b) Contractual behaviour
 - (c) Technical behaviour

- 8) In which stage the disputes were settled or resolved
(DAB , Arbitration and Litigation)
- 9) What are the dispute resolution methods adopted in this contract.
- 10) Did you implemented the proper procedures in resolving the disputes
- 11) Were there any disputes which amicably settled
- 12) What are the common effects of disputes in urban water supply projects in Sri Lanka?

Common effects of Disputes	Remarks “√” or “x”
Time overrun	
Cost overrun	
Abandonment	
Negative social impact	
Idling resources	
Slow down growth of construction sector	
Loss of productivity	
Reduction in investment profits	
Damage continues business relationships	

- 13) What are the effects due to the identified disputes?
- 14) What are the suggestions or remedies that you can propose to mitigate such disputes?
- 15) How would you categorize such measures identified above according to the mitigating of behavioural, contractual and technical disputes?

Remedial Measures	Behavioural	Contractual	Technical