STRATEGIES TO MINIMISE ERRORS IN CONTRACT DOCUMENTS TO MINIMISE DISPUTES IN BUILDING PROJECTS IN SRI LANKA

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ABSTRACT

Strategies to Minimise Errors in Contract Documents to Minimise Disputes in Building Projects in Sri Lanka

Disputes are not new feature to the construction industry and due to disputes; construction projects exceed the time, cost, and end with a poor quality product. Hence, avoiding disputes before it arises is vital to industry. Numerous causes for disputes have been investigated during last twenty years. Among them errors in contract documents has been identified as one of the key causes of disputes in the Sri Lankan construction industry. Therefore, strategies has to be investigated to minimise errors in contract documents to avoid disputes arise due to errors.

Accordingly, the aim of the research study is to develop a framework to minimise errors in contract documents to minimise disputes in the building projects. Multiple case study method was selected as the most suitable research method for this study. The reasons being, the study needed to focus on in-depth decisions and behavioural attitudes of construction professionals who involve in the construction projects. Furthermore, the primary source of data was collected through semi-structured interviews. Data were analysed adopting content analysis method.

The ultimate findings of the study were categorised based on the key documents, which comprises in the contract documents such as; BOQ, drawings, specifications and conditions of contracts. Strategies were investigated and which help to minimise errors in contract documents. Among them recruiting competent professional to the construction projects, allocating adequate time to prepare contract documents, work as a team, contractor's involvement from the beginning, educating consultants about contract documents, providing detailed information about the project from the beginning, were the key techniques to mitigate errors in the contract documents.

Keywords: *Contract documents, errors in contract documents, Disputes, Construction projects*

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LIST OF ABREVIATIONS

Abreviation	Description
FIDIC	Federation Internationale des Ingenieurs Conseils
ICTAD	Institute for Construction Training and Development (Now known as Construction Industry Development Authority (CIDA))
JCT	Joint Contracts Tribunal
RICS	Royal Institution of Chartered Surveyors
BOQ	Bills of Quantities

CHAPTER 1- INTRODUCTION

1.1 Background

In Sri Lankan economy, Construction is the fourth highest sector after services, manufacturing and agriculture, which accounts for 7.6% from GDP in Sri Lanka (Central Bank, 2016). Further, Increased investment expenditure, especially in the construction sector, drove economic growth during the year 2016 (Central Bank, 2016). Unlike other types of industries, constructing a building is extremely diverse and complex. It requires variety of skills and therefore, numerous specialist parties are involved in this complex process (Bertelsen, 2003). Also, the construction projects generally span for a long period (Wood, 2001). Owing to that, it has been necessarily identified that conflicts/disputes in construction projects are inherent and unavoidable, though disputes avoidance is crucial in completing a project successfully in terms of quality, time and cost (Fenn, 1997).

It has been evidently identified that the global construction industry suffers from many unexpected disputes which cost a lot. In the year of 2015, the estimated global average value of disputes was US$ 46 million (Arcadis, 2016). Accordingly, it is a significant loss to the construction industry.

A ‘dispute’ is a situation where two parties typically differ in the assertion of a contractual right, resulting in a decision being given under the contract (Arcadis, 2016). Similarly, Cheung and Yiu (2006) mention that dispute in construction is the conflict of interest among its participants. Apparently, it suggests that dispute is a disagreement between two or more parties related to a construction project.

A study conducted by Hohns (1979) has identified five major factors, which cause conflicts/disputes in construction projects. They are i) existence of errors; ii) failures in estimating cost at the beginning iii) reaction of consumer and people involved; iv) change in conditions and v) defects or omissions in the contract documents. Even though these causes have been identified about four decades ago, Arcadis (2016) confirms that they still exist in the current construction industry practices. According to the Global Construction Disputes Report (2016) the main five causes for the

construction disputes in year 2015 have been ranked as i) failure to properly administer the contract; ii) poorly drafted or incomplete and unsubstantiated claims; iii) errors and/or omissions in the contract documents; iv) incomplete design information or employer requirements and v) employer/contractor/subcontractor failing to understand and/or comply with its contractual obligations (Arcadis, 2016). Though it has been identified, the major reasons for construction disputes as such, the continuing emergence of disputes verify that further studies are needed to identify strategies to minimise them and minimise disputes correspondingly (Younis, Wood and Malak., 2008). However, errors and /or omissions in the contract documents have been identified as third cause among other priority causes. Many researches have been conducted to find minimisation strategies for first two priority causes such as failure to properly administer the contract and poorly drafted or incomplete and unsubstantiated claims (For examples Abeynayake, 2008; Cheung and Suen, 2002; Fawzy and El-adaway, 2012). Further, a study conducted by Gajaman (2015) identified that preparation of contract document without any lapses of information or ambiguity would be able to avoid disputes. Though she has identified the necessity of error free, contract documents to avoid disputes, none of researches were conducted to investigate how to minimise errors in contract documents to minimise disputes. Hence, this study is to develop a framework to minimise errors in contract document to minimise disputes in building projects in Sri Lanka.

1.2 Problem statement

Sri Lanka as a country in which the construction industry is rapidly growing at present also suffers from increasing number of construction disputes. According to Alwis (2005) contract document errors, omissions and misinterpretations are the main reasons for claims and disputes in Sri Lanka. Therefore, a necessity has arisen in Sri Lankan construction industry today to minimise errors in contract documents, in order to minimise construction disputes.

Typically, a construction contract comprises of several documents called "Contract Documents" and they include bidding documents, general conditions, working drawings, bills of quantities, specifications and schedules of work (Yelton, 2014).

Notwithstanding the type of a construction project, formulating a solid contract with relevant contract documents is one of the key steps towards the success of a project. Therefore, it is very important for the construction professionals who involve in preparing the contract documents to pay sufficient attention and have a thorough knowledge and understanding on what they prepare; otherwise manifestation of errors and omissions in contract documents is unavoidable (Sunday and Afolarin, 2013). Further, a large proportion of rework and non-conformance costs are due to deficiencies in documentation (Darwish, 2007; Love and Josephson, 2004).

In existing literature, many researchers such as Palaneeswaran, Ramanathan and Tam, (2007); Love, Edwards and Han, (1999) ; Love, Mandal, Smith , Georgiou and Shelton (1999); Cheng-Wing and Davey, (1998); Endsley (1999); Barkow (1995); Vrouwenvelder, Holicky and Sykora (2009); Long (2011); Love and Josephson (2004) and Love, Mandal, , Smith, and Li (2000) have carried out researches to identify the types of errors and omissions in contracts documents around the world. Further, a research conducted by Gajaman (2015) specifically mentions the major errors and omissions that can be seen in contract documents in Sri Lanka.

In view of those findings, this research focuses on identifying the strategies to minimise the errors and omissions in the contract documents used in Sri Lankan Construction Industry.

Accordingly, having error free documents for the construction contracts could ultimately lead to a smooth flow of construction process. This should be a joint effort of all key stakeholders of the project during its pre and post contract periods. This would ultimately result in less disputes to execute the work, and complete the project magnificently.

1.3 Aim and Objectives

Aim

The aim of this research is to develop a framework to minimise errors in contract documents to minimise disputes in the building projects.

Objectives

In order to achieve the aim of the study the following objectives were formulated.

1. to identify causes of disputes in the building projects
2. to identify different types of errors in the contract documents
3. to identify causes for errors in contract documents
4. to investigate strategies to minimise errors in contract documents
5. to devise a mechanism to minimise errors in contract documents identifying the causes of errors and strategies to minimise disputes which arise due to errors in contract documents in the building projects

1.4 Research methodology

Initially, a comprehensive literature review was carried out in respect of understanding the general concept of contract documents, what is an error?, errors in contract documents , cases of disputes and how to minimise errors in contract documents by means of reviewing the books, journals, articles, conference proceedings, previous dissertations and websites. Subsequently, empirical study was conducted by adopting qualitative research approach. Case study approach has been selected as the most suitable research approach due to range of justifiable reasons. A case study is "an empirical inquiry that investigates a contemporary phenomenon in depth within its real-life context" (Yin, 2003). Four case studies have been selected for this study. Semi structured interviews were conducted among construction professionals who involved in cases, such as Architects, Engineers, Project Managers and Project Planners. Content analysis was used to analyse collected data through semi-structured interviews.

1.5 Scope and limitations

This study was focused on building construction projects having contract price over LKR 100 million projects owned by private sector. The reason for limiting the scope of the study to the building in construction industry is due to the complex nature of other civil engineering projects. Further, the study was focused on the commonly practice standard forms of contracts namely FIDIC and ICTAD conditions of

contracts. These two types are the most widely accepted Norms of Contracts in the Sri Lankan construction industry. Further the study was limited to key documents in the contract namely BOQ, Specifications, drawings and conditions of contract.

1.6 Chapter breakdown

Chapter 1 – Introduction: This chapter includes background of the research, problem statement, aim, objectives, scope, limitations and methodology to achieve the objectives of the research.

Chapter 2 – Literature synthesis: This chapter discusses the theoretical status and research issues through comprehensive literature review in order to understand and establish the significance of the research problem.

Chapter 3 – Research methodology: This chapter discusses research methodology of the study and explains the significance of the study, research settings, research approach, choice of research approach, data collection and process of data analysis.

Chapter 4 – Data analysis and findings: This chapter presents the data collected from case studies with analysed data persistently across cases, in detail. Furthermore, this includes development of strategies to minimise errors in contract documents to minimise disputes.

Chapter 5 - Conclusions and recommendations: This chapter concludes with the research findings, recommendations and directions for further research.

CHAPTER 2- LITERATURE REVIEW

2.1 Introduction

This chapter provides a comprehensive literature review and synthesis of key research areas pertaining to this study. The chapter includes disputes in the construction industry, relationship between disputes, conflicts and claims, causes of disputes. Further, it discussed about contract documents errors, types of errors, causes of errors and how errors in contract documents leads to disputes.

2.2 Disputes in the construction industry

The construction industry inherits several unique characteristics such as complexity, high human diversity and lengthy process of construction due to which the disputes will occur (Jaffar, Tharim, & Shuib, 2011). Construction disputes happen fairly often; they are a reality on every construction project and could happen at any point in time during the design or construction phase of the project. Construction disputes vary in nature, size and complexity, but they all have a common thread; they are costly both in terms of time and money and are often accompanied with the destruction of individual and good working relationships (Farooqui & Azhar, 2014). Further, construction disputes, when not resolved in a timely manner, become very expensive in terms of finances, personnel, time and opportunity costs (Farooqui & Azhar, 2014).

The definition of dispute is itself is “in disputes”. Different authors defined it differently. According to Hellard (1987), construction dispute is the opposition of interests, values or objectives, while Mururu (1991) described that dispute is the formation of a position to maintain in conflict. Further, Brown & Marriott (1999) suggested that dispute can be viewed as a class or kind of conflict that require resolution. However, according to the above definitions disputes referred in this research is opposition of interest and facts.

2.2.1 Relationship between conflicts, claims and disputes

There are misinterpretation among construction professionals about the differences between conflict and dispute, and these terms have been used interchangeably

especially in the construction industry (Acharya, Lee, & Kim, 2006). However, according to Collins (1995, p.96) Conflict is 'serious disagreement and argument about something important' and as 'a serious' difference between two or more beliefs, ideas or interests'. Further, according to Fenn et al. (1997) Conflict exists wherever there is mismatch of interest. Conflict can be managed, possibly to the extent of preventing a dispute resulting from the conflict (Rauzana, 2016). On the other hand, disputes are one of the main factors which prevent the successful completion of the construction project (Rauzana, 2016). Further, Semple, Hartman & Jergeas (1994) defined 'claim' as an 'assertion of the right to remedy, relief or property'. According to Kumaraswamy (1997, p.97), some construction claims are unavoidable and in fact necessary, to contractually accommodate unforeseen changes in project conditions or unavoidable changes in client's priorities. While such claims may be settled amicably, the prior presence of unhealthy conflict can trigger degeneration into unnecessary disputes. Such scenarios can in turn generate unnecessary and/or unreasonable claims that further escalate unhealthy conflicts and disputes. This possibility is also illustrated in Fig. 2.1.1, which sets out the basic relationships between conflicts, claims and disputes in construction scenarios. Disputes are taken to imply prolonged disagreements on unsettled claims and protracted unresolved/destructive conflict.

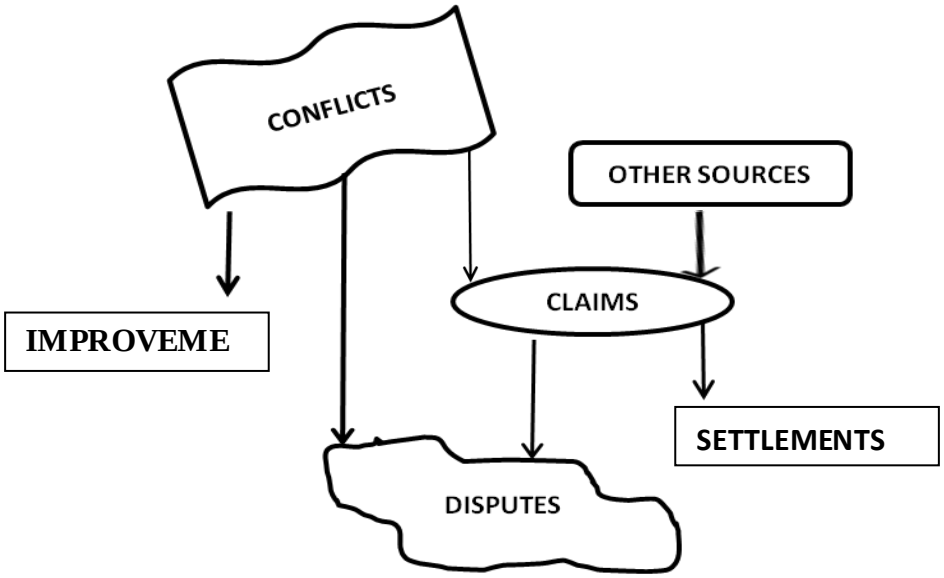

Figure 2-1: Basic relationships between conflicts, claims and disputes and potential outcomes (Source: Kumaraswamy, 1997, p.98)

2.2.2 Causes of disputes

A number of researchers introduced different causes of disputes. Yates (1998) argued that the main types of construction dispute arising from the contract document include variations, ambiguities in contract documents, inclement weather, late issue of design information/drawings, delayed possession of site, delay by other contractors employed by the client and postponement of part of the project. Further, Heath, Hills & Berry (1994) also catergorised causes of disputes into seven main subject matters of construction dispute;

1. contract terms;
2. payments;
3. variations;
4. extensions of time;
5. nomination;
6. re-nomination
7. availability of information

Moreover, Kumaraswamy (1997, p.105) catergorised causes for disputes occurrence into ten main sections;

1. variations due to site conditions;
2. variations due to client changes;
3. variations due to design errors;
4. unforeseen ground conditions;
5. ambiguities in contract documents;
6. variations due to external events;
7. interferences with utility lines;
8. exceptional inclement weather;
9. delayed design information
10. delayed site possession

Sykes (1996) elaborated that “construction disputes originate from two main interrelated sources; construction contracts and unexpected events”. In addition, Totterdill (1991) said that “construction contract disputes must have a contractual base”. Further Cheung and Pang (2014, p.19) suggested, “construction disputes are mostly contractual but can also be speculative where people factor is a major

trigger". Yate (1998) pinpointed that the main types of construction dispute arising from the contract documents include:

1. variations;
2. ambiguities in contract documents;
3. inclement weather;
4. late issue of design information/drawings;
5. delayed possession of site;
6. delay by other contractors employed by the client (e.g. utility companies);
7. postponement of part of the project

Based on the literature, the study has recognised that several causes have affected for individual disputes situations that can be commonly seen in the construction industry. All the identified cases of disputes situations are included in the categorisations provided in table 2.1. Among the literature contract related cause of disputes have been identified by many authors. Farooqui and Azhar (2014) illustrated that "Contract Clause Interpretations", "Breaches of Contract by the Project Participants", "Unjust and Untimely Presentation of Claims" and "Exaggerated Claims" are those causes that are occurring most frequently to contribute in the occurrence of disputes in the projects. On the other hand "Ambiguous Contract Language", "Unjust and Untimely Presentation of Claims", "Exaggerated Claims" and "Unrealistic Tender Pricing" are the most severe causes of disputes in the projects, described by all of the respondents. "Exculpatory Clauses" are moderately contributing in the projects in terms of their frequency and severity. According to Farooqui and Azhar (2014) it can be said that "Contract Clause Interpretations" is one of the causes that are occurring most frequently and "Ambiguous Contract Language" is one of the most severe causes of disputes in the projects which are directly due to deficiency in contract documents.

Table 2-1: Causes of Disputes

Causes of disputes		Author											
		Waldron (2006)	**Cheung and Yui (2006)**	**Killian (2003) ·**	**Mitropoulos and Howell (2001)**	**Kumaraswamy (1997)**	**Sykes (1996)**	**Bristow and Vasilopoulos (1995)**	**Heath et al. (1994)**	**Rhys Jones (1994)**	**Yates (1998)**	**Totterdill (1991)**	**Cheung and pang (2014)**
1	Variations	✓				✓		✓	✓		✓		
2	Ambiguities in contract documents					✓		✓			✓		
3	Contract terms and practicing	✓	✓	✓	✓		✓		✓	✓		✓	✓
4	Delayed design information					✓					✓		
5	Delayed site possession					✓					✓		
6	Delayed construction	✓							✓		✓		
7	Delay by other contractors employed by the client										✓		
8	Site conditions	✓				✓							
9	Site access	✓											
10	Site management			✓									
11	Late, incomplete or substandard information	✓							✓				
12	Quality of design	✓								✓			
13	Design errors			✓									
14	Exceptional inclement weather					✓					✓		
15	Unforeseen ground conditions					✓							
16	Unpredictable events						✓						
17	Project uncertainty				✓								
18	Poor communications between project participants							✓		✓			
19	Unrealistic expectations by parties							✓		✓			

Causes of disputes		Author											
		Waldron (2006)	Cheung and Yui (2006)	Killian (2003) ·	Mitropoulos and Howell (2001)	Kumaraswamy (1997)	Sykes (1996)	Bristow and Vasilopoulos (1995)	Heath et al. (1994)	Rhys Jones (1994)	Yates (1998)	Totterdill (1991)	Cheung and pang (2014)
20	Lack of team spirit							✓					
21	Poor management			✓						✓			
22	Adversarial culture									✓			
23	Bid development errors			✓						✓			
24	Availability of resources	✓											
25	Poor workmanship									✓			
26	Obtaining approvals	✓											
27	Conflict- Task interdependency, differentiations, communication obstacles, tensions, personality traits		✓										
28	Triggering events - Non-performance and time		✓										
29	Opportunistic behavior				✓								
30	Payments		✓						✓				
31	Nomination								✓				
32	Economic environment									✓			
33	Influence of lawyers									✓			

It is evident that errors in contract documents have critically affecting the disputes according to above table 2.1. It is further summarised and illustrated in Figure 2-2.

Figure 2-2: Factors contributing disputes-related to deficiency in contract documents

2.3 Construction disputes related to contract documents

Much of the current literature on construction industry pays extensive attention to the topic on contract documentation, which also acts as a key role of the quantity surveyor's job description (Ashworth, Hogg & Higgs, 2013). A contract document can be identified as a legal document which can be brought in front of a court as a binding document as evidence in of a written contract agreement (Hughes, Champion & Murdoch, 2015). There is a large volume of published studies describing the role of a contract document in the construction industry, which are mostly based on the contractual and legal aspirations. Contract document has been identified as a major

contributing factor for the legal and courts related matters simply due to the disputes occurred followed by the errors found in contract documents (Appleman & Holmes, 2016).

Lloyd-walker, Mills and Walker (2014) studied the effect of contract document in terms of developing a no-blame culture based on the Australian construction industry and have found that contract document has to be free of errors and ambiguity to minimise the number of disputes in the industry. Cakmak and Cakmak (2014) also draws our attention to the same incident where the contract document related ambiguities in terms of poor interpretation and room for giving different meanings become a basis of disputes. In the same vain, it is evidenced that both the parties involved in the contract document; the Contractor and the Employer along with the Engineer has to be responsible for the issues that are occurred in a practical scenario due to the errors which are found in contract documents (El-Sayegh & Mansour, 2015). The authors take part in the evaluation of the information based on the construction industry of United Arab Emirates which is an established country in terms of large-scale construction activities and also immense contractual documentation. Hence, it can be said that the lacck of proper contract documentation and the poor level of concentration and importance given during the contract document preparation stage has caused for most of the disputes that occur at the later stages of a construction project.

According to Cheung and Pang (2013), ambiguity, inconsistency, and defectiveness of contract incompleteness are the most significant dispute contributors. The occurrence likelihood evaluation at the factor group level showed that contract incompleteness is a pernicious structural problem in construction contracting. Opportunism is undesirable because it would trigger mistrust and drive irrational decisions. Their results indicated that incompleteness of the contract is the root cause of contractual dispute.

Cheung and Pang (2013, p.20) further elaborated Contract incompleteness as follows.

Contract incompleteness;

1. Ambiguity
    i. The scope of work is unclear
    ii. The specification is unclear
    iii. The rules to evaluate star rate are unclear

2. Deficiency
    i. The rules to evaluate substantial change in quantity of works are not addressed
    ii. The drawings provide insufficient details
3. Inconsistency
    i. The quantity of the same items in the contract bills are substantially different to the actual quantity
    ii. Some items are missing from the contract bills
    iii. The drawings contradict with the specification
4. Defectiveness
    i. The details in the drawings are inconsistent
    ii. The drawings are inconsistent with the contract bills

2.4 Contract documents errors

Many factors have been traced to poor project performance in terms of cost, time and quality however; prominent among them are errors in construction contract documents (Dosumu, Idoro and Onukwube, 2017). Further, Okuntade (2014) confirmed that errors in contract documents account for more than 82% of all construction errors committed. Ade-Ojo and Babalola (2013) and Mukuka, Aigbavboa & Thwala (2014) also noted that errors in contract documents are the major factors affecting the cost and time performance of building projects. As per the information revealed from many researches, it is a known fact that the lack of proper communication, not adhering to client's requirements, poor confidence levels shown by consultants who prepare contract documents have led to many errors in contract documents (Oluwaseun Sunday & Olumide Afolarin, 2013).

2.4.1 What is an error?

Since this study is investigation on contract documents errors, it is necessary to define and make clear about an error. According to Reason (1990) in its conventional sense, the term error relates to those occasions in which a planned sequence of mental or physical activities fails to achieve its intended outcome, and when these failures cannot be attributed to the intervention of some chance agency. However, Senders & Moray (1991) excluded non-indented errors from his definition, since they defined errors as "something that has been done, which was not intended by the author; not desired by a set of rules or an external observer; or that lead the task or system outside its acceptable limits". Accordingly, this particular study an error is defined as some mistake that has happened which was not intended to do so.

2.4.2 Types of contract documents errors

An error is a mistake done at the preparation stage of the contract document which maybe in the form of several factors (Farooqui, Azhar, & Umer, 2014). These factors may vary in the forms of human errors, arithmetical errors, omission of signatures, dates and reference numbers and even the included descriptions within the contract document that cause for the errors to be significant in any regard (Hughes, Champion, & Murdoch, 2015). However, one of the crucial tasks that is to be carried out by a professional in addressing these errors is to identify them at the primitive stage of the contract and come up with solutions at the earliest stages (Oluwaseun & Olumide, 2013).

The study carried out by Assah-Kissiedu, Fugar & Badu (2010) have identified different types of errors that are exist in the construction industry related important doucments. The authors have been able to identify these errors to be ineffective communication between parties of the contract, not having clear, complete and conscience numbers and descriptions in bill of quantities, and finally the failure of the contractor to read the contract document properly prior to the signing stage of the contract agreement. By drawing on the concept of Assah-Kissiedu et al., (2010), El-Sayegh & Mansour (2015) has also been able to show that the poor attention given

by consultants in preparation of contract document as a key reason to have errors in the documents that become contractually as well as legally binding.

2.4.3 Causes for contract document errors

Many studies have been written on dispute resolution resulting due to errors in contract documents have focused on the causes of such errors in their studies. The findings of these research works are very much similar in nature irrespective of the country nor the nature of the development level held by the country. Some examples taken from the Ghanaian construction industry, Pakistani construction industry and Indonesian construction industry by authors indicate how the causes are developed. Among the many reasons that become the root cause for errors in contract documents, the most common one is found to be the lack of concentration given by both parties in reading the contract document entirely, identify the key aspects and understand what is being required by each party (Appleman, Appleman, & Holmes, 2016). Much of the available literature on the topic questions on the fact that how the errors can be occurred even when an experienced Engineer or a Contractor takes part in the contract document preparation procedure. Therefore, it can be said that the reason for such errors is not the lack of knowledge, experience nor the technical know-how. It can be simply identified as the poor considerations given in reading and tailoring the contract document in a proper custom-made approach to each construction project (El-Sayegh & Mansour, 2015).

2.4.4 Effects of errors in contract documents on disputes

When it comes to the identification of effects of errors in contract documents, the most significant factor to be noted is that no error will cause for positive effects and will only lead to negative aspects that hinders the good name and the relationship between the parties of the contract agreement (Han, Love & Pena-Mora, 2013). This view is supported by many authors who engage in construction industry related research works indicating the disruptions made to the program as well as the quality of the construction works getting hindered (Marzouk & El-Rasas, 2014).

The errors in contract documents cause for the construction projects to face delays which cause for losses in both time and cost for the Employer (El-Sayegh &

Mansour, 2015). The authors focus on the facts which indicates how these disputes hinder the development of the country as well as the project itself. Once a dispute is established between the parties, it leads to poor contractual correspondence and a hostile situation causing all the later activities to be based on a complete adverse ground rather than mutually agreed friendly terms. Hence, the loss and the negative effects made by errors in contract documents causing for disputes in the projects are very much adverse and may hinder the overall progress of construction activities leading to the unfulfillment of initial plans and objectives of both parties of the contract agreement (Oluwaseun & Olumide, 2013).

2.5 Contract document errors minimisation strategies to minimise disputes

To better understand the mechanisms of minimising errors in contract documents, many authors' analysed ways that will make the parties adhere to an agreed common ground once the dispute is established. The alternative dispute resolution methods such as adjudication, arbitration, mediation and even litigation were initiated based on these factors (Wang, 2014). However, one of the most prominent error minimisation solutions provided by authors is to carry out proper pre-planning activities by having a clear and concise understanding about the exact nature, complexity, and scope of the project. If the Engineer who engages in contract document preparation is in a position to omit and eliminate human and arithmetic errors completely from the contract document, it becomes a major reason for reducing disputes in the construction industry as well (Cakmak & Cakmak, 2014).

2.6 Summary

The Chapter synthesised the existing literature to capture the knowledge and understanding of the causes of disputes, types of errors in contract documents, causes of errors in contract documents and effects of errors in contract documents on disputes. Disputes arise due to ambiguities, incompleteness, and inappropriate contractual provisions of the contract documents. From the literature review evident that the contract documentation plays a key role in the construction projects and errors in contract documents significantly affect the disputes in construction industry. Numerous researches were conducted in this area however; still problems are

happening in the industry due to errors in contract documents. Therefore, this highlighted that need for further investigation of how errors in contract documents could be minimised in order to minimise the disputes in the construction industry.

CHAPTER 3- RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research process in this study. The research process includes research design, Research approach, data collection and the data analysis methods.

3.2 Research process

Research process consists with series of close related activities. The following figure 3.1 shows the steps outline of an effective strategy for finding solutions for the identified research problem.

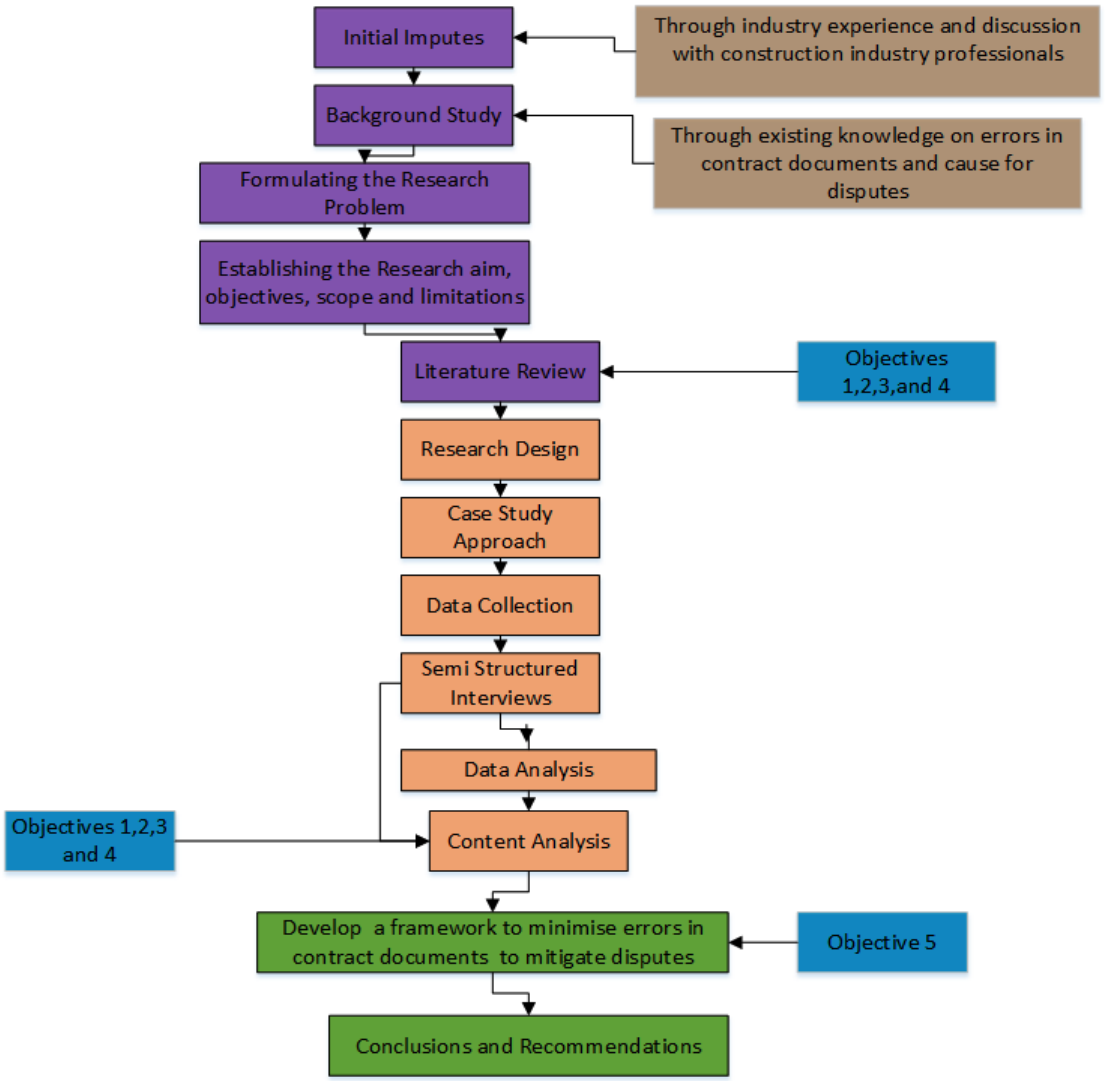

Figure 3-1: Research Process

3.3 Establishment of the research problem of the study

Research problem is vital to the success of a research effort. A research problem is a problem or an issue that leads to the need for a study. According to Creswell (2009) a research problem can originate from many potential sources such as it might arise from researcher's personal experience or workplace experience, that may come from an extensive debate that has appeared in the literature and it may develop from policy debates in government or among top executives. The research problem of the study was established from the initial imputes of the researcher having experience in the construction industry and discussion with industry professionals and literature review. The following sub-sections explain the process adopted in establishing the research problem of the study through the initial imputes, discussion with industry professionals and literature review.

3.3.1 Initial imputes of the researcher

The initial imputes for the study came from the experience in the construction industry working as a senior project manager and interests of the researcher. Accordingly, research area has been chosen as disputes minimisation through minimising errors in contract documents. The Section below explains how the initial imputes was supported with the literature review to arrive at the research problem appropriate to the study.

3.3.2 Literature review

The literature review as the basis for thorough empirical research used to identify the research gap and to develop research questions that address the gap in the knowledge (Eisenhardt and Graebner, 2007). As described in Section 3.3.1 the researcher's industry experience and own interest in the subject area, is disputes minimisation through minimising errors in contract documents. Hence, the exploration began with searching for the literature on "disputes minimisation". The initial literature review of research journal articles, books, web sites, conference publications, and various

institutional reports were of immense use in refining this broader area of study. The initial literature review helps to identify the causes of disputes. The numerous causes for disputes have been identified by many researches. Among them contract document errors is one of the important area many researches highlighted , accordingly research gap is identify as to develop strategies to minimise errors in contract documents to minimise disputes.

Having carried out a critical literature review on the above issues, the researcher was able to establish the research problem, the aim and the objectives of the study and the initial conceptual framework, which was further refined with the aid of semi structured interviews and documents review.

3.3.3 Formulating the research problem

As discussed in Sections 3.3.1 and 3.2.2, the researcher was able to establish the research problem for this study. Accordingly, the research problem of this study is to discover how to minimise errors in contract documents to minimise disputes in building projects in Sri Lanka. Consequently, the aim of the study is to develop a framework to minimise errors in contract documents to minimise disputes in the building projects.

The next Section describes how the research was designed to cater to the established research problem. The research design in essence describes the processes followed to answer the research questions in order to achieve the aim of the research.

3.4 Research design

Research design includes all issues involved in planning and implementing of a particular research from identifying the research problem to conclusion (Punch, 2005). Moreover, Dawson (2002) identified that it is the general principle which will guide the research and it is the overall approach to study the research area and includes issues need to be considered. Research approaches can be mainly categorised as quantitative, qualitative and mixed approaches. According to Fellows and Lui (2003) quantitative approach is inclined to relate to collect factual data and to study relationships between facts and how such facts and relationships with theories and the findings of any research executed previously. Further, qualitative

approaches are used to study whole population as individuals or groups and to identify beliefs, understandings, opinions and views of people (Fellows and Lui, 2003). The term "mixed methods" refers to an emergent methodology of research that advances the systematic integration, or "mixing," of quantitative and qualitative data within a single investigation or sustained program of inquiry (Creswell and Plano Clark, 2011). The aim of this study is to develop a framework to minimise errors in contract documents to minimise disputes in the building projects. This requires understanding the social phenomenon of mitigation of disputes through minimising contract documents errors. Qualitative approach will be the most suitable approach to use for this study for the reason that, it will allow the researcher to discover new variables and relationships, to reveal and understand complex processes in depth, and to illustrate the influence of the social context (Shah and Kevin, 2006). The case study, ethnography and action research are the three main research approaches that are used in qualitative researches. However, experiment and survey approaches are towards quantitative approach (Thomas, 2004).

3.5 Choice of the approach

The case study approach was selected as the most appropriate for this study as it delivers both the richness and depth of information usually offered by qualitative approaches, and also it has ability to capture many variables with the aim of identifying how a complex set of conditions come together to produce a particular manifestation (Hancock, 1998). Aim of this study is to develop a framework to minimise errors in contract documents to minimise disputes. Hence, it is necessity to enquire following issues from construction professionals who involved in selected projects to achieve the aim of the study.

- types of errors in contract documents
- causes of errors in contract documents
- investigate strategies to minimise errors in contract documents

Therefore, case study provide an in depth enquiry of the research problem. Furthermore, Yin (2009) found that case studies would provide an opportunity to

gain holistic view of the research problem, understanding and explaining a research problem or situation (Braxter and Jack, 2008). Further, Yin (1994) describe that generalisability of the research is very crucial when designing the research. However, it is adopted to design case study including identification of unit of analysis, criteria of sample selection and defining number of cases as described in sub section 3.5.2. Therefore, case study approach was selected as all the above requirements fit to the study.

3.5.1 Number of cases

The use of single case study is preferred when the study represents a critical case, extreme or a unique case, representative or typical case, revelatory case or a longitudinal case (Yin, 2003). This research does not fall under these categories, thus multiple case studies are preferred over a single case study. Further, Herriott and Firestone (1983) argue that the evidence gathered from multiple cases studies is often considered as more compelling which results in a healthier and a stronger study. Three cases were selected for this study in order to achieve data saturation and to get a broad picture of the sources. Further, the time and resource limitation were also a critical factor for selecting number of cases for this study.

3.5.2 Criteria for case selection

It is important to set criteria for selecting the cases in order to facilitate the exact selection due to the fact that the research is limited to building projects. In order to be precise on the selection, building projects with disputes due to errors in contract documents were selected as cases.

3.6 Data Collection

Literature review, semi structured interviews and document reviews were used to collect data. The following Sections expand each technique in details.

3.6.1 Literature review

The literature review has been conducted to collect secondary data for the study. It was conducted in two stages. First stage, literature review has been conducted to identify the research gap as discussed in chapter 1. Second stage, literature review

has been conducted to identify the "causes for disputes in building projects", "types of errors in contract documents", "causes of errors in contract documents "and "strategies to minimise errors in contract documents". Further, the researcher used the literature review and synthesis as the basis to build the initial conceptual framework.

3.6.2 Semi-structured interviews

Interviews are one of the most important data collection techniques used in the case study approach. Robson (2002) categorised interviews as structured interviews, semi-structured interviews, unstructured interviews and non-directive interviews. Semi-structured interviews are considered as ideal because it elicits more elaborative and purposeful answers from the respondents to the questions raised (Fernando, 2011). Moreover, semi-structured interviews allow the researcher to ask additional questions to follow up on any interesting or unexpected answers to the standard questions (Mitchell & Jolley, 2009). Corbetta (2003, p.270) explains, "Semi-structured interviews as the order in which the various topics are dealt with and the wording of the questions are left to the interviewer's discretion". Since this study is largely a combination of exploratory and explanatory type research, it is essential that the interviewee's knowledge related to the subject matter be extracted in great depth. Semi-structured interviews were conducted among construction professionals, who involved in the selected case study projects, as shown in Table 3.1.

Table 3-1: Profile of case study interviews

Case	Types of project	Respondent	Profile of respondent	Demographic information
A	Office Building for Finance Institution	RA1	Consultant Structural Engineer	40 years of experience in structural engineering, adjudication, and project management
		RA2	Cost Consultant	45 years of experience in quantity surveying,

Case	Types of project	Respondent	Profile of respondent	Demographic information
				cost advising to the several institute, arbitration and adjudication
		RA3	Contract Administrator of the Contractor	35 years of experience in quantity surveying and contract management
B	Additions and Alterations to Educational Institute	RB1	Consultant Structural Engineer	36 years of experience in structural engineering and project management
		RB2	Consultant Project Manager	15 years of experience in civil engineering, project management and project planning
		RB3	Cost Consultant	40 years of experience in quantity surveying and contract management
C	Multi Storey 5 Star grade Hotel Project	RC1	Consultant Project Manager	30 years of experience in civil engineering and project management
		RC2	Construction Project Manager	17 years of experience in civil engineering and project management
		RC3	Cost Consultant	44 years of experience in quantity surveying

3.7 Data analysis

Case studies generally tend to produce large amount of data that do not readily respond to mechanical handling, analysis and data reduction (Yin, 2003). This research follows within case study analysis and cross case analysis. Code-based

content analysis has been used to analyse data collected from semi structured interviews to capture significant findings from the interview transcripts. The manual content analysis has been used to analyse the qualitative data collected from semi-structured interviews.

3.8 Summary

This chapter has described and justified the research process and the research design adopted for the purpose of the research. Case study was selected as the most suitable research method for this study. The reasons being, the study needed to focus in-depth decisions and opinion of individuals and groups within and between selected building projects. Therefore, the most suitable source for primary data is considered to be the construction professionals' opinions. This study selected multiple cases, as it offers multiple sources of evidence and possible replication of findings. As such, semi-structured interviews were selected as the best because they elicit more elaborative and purposeful answers from the respondents, to the questions raised. Semi structured interviews were carried out among construction professionals in the case studies and content analysis was conducted to analyse the interviews. Contract documents were reviewed to identify the types of errors and content analysis used to analyse data collected from documents reviews.

CHAPTER 4- DATA ANALYSIS AND FINDINGS

4.1 Introduction

This chapter presents the data analysis of the three case studies. Data analysis was conducted using data collection from three construction professionals in each case. Accordingly, this Chapter is structured as follows:

- First, background details of three case studies are presented
- Second, cross case analysis is discussed in accordance with significant causes for disputes, types of errors in the contract documents, causes for errors in contract documents and strategies to minimise errors in contract.

4.2 Overview of the cases

Three cases were selected for collecting data as justified in Chapter 3. Three cases were building projects and projects have already been completed and had disputes mainly due to errors in the contract documentations. Table 4-1 demonstrates brief description about the selected cases.

Table 4-1: Description of cases

Case	Types of project	Respondent	Profile of respondent
A	Office Building for Finance Institution	RA1	Consultant Structural Engineer
		RA2	Cost Consultant
		RA3	Contract Administrator of the Contractor
B	Additions and Alterations to Educational Institute	RB1	Consultant Structural Engineer
		RB2	Consultant Project Manager
		RB3	Cost Consultant
C	Multi Storey 5 Star grade Hotel Project	RC1	Consultant Project Manager
		RC2	Construction Project Manager
		RC3	Cost Consultant

4.2.1 Case study A

Case study A is an office building for finance institution, which is located in Colombo. The project consists of a Basement, Lower Ground, Ground Floor, 6 Upper Floors and Roof Terrace, having a gross floor area of approximately 49,600 sq. ft. The construction cost of the Project is LKR 620.0 Mn (£ 3.2 Million). Scope of contract includes external work comprising boundary walls, improvements to existing boundary walls, open parking facilities etc. The specialised MEP services were entrusted to Nominated Sub Contractors, selected by the Employer and the Contractor was entitled to an attendance fee on the certified value of such Nominated Sub Contractor's work except Interior and furniture scope, which was handled directly by client.

Type of Contract is "Measure & Pay" and the Contract Price was not adjusted because of rise or fall of prices of materials, & fuel, plant hire, labour wages etc. Form of Contract is the Conditions of Contract No SBD / 02 (ICTAD Publication January 2007) together with the Contract Data. During the construction design changes occurred after the award of contract and mostly due to employer's request. The revisions of drawings were issued in several times. Three Hundred Variations orders were issued to the Contractor. The contractor submitted a claim for extension of time and claim for cost and expenses due to delay period from the original date of handing over of works. The total duration accepted by the Engineer was 146 days out of which 101 days were granted to the contractor as compensable and excusable delays and the Engineer to the Contract granted 45 days to the Contractor as excusable delay.

Respondents of the case study A have involved in the case study A in different professional capacities. Following Table 4-2 shows the profile of respondents.

Table 4-2: Profile of Respondents in Case Study A

Respondent	Demographic information
RA1-Consultant Structural Engineer	40 years of experience in structural engineering, adjudication, and project management
RA2-Cost Consultant	45 years of experience in quantity surveying, cost advising to several institutes, arbitration and adjudication
RA3- Contract Administrator of the Contractor	35 years of experience in quantity surveying and contract management

4.2.2 Case study B

Case Study B is well reputed local branch of Global Educational Institution, formed local operation as a non-governmental organisation in Sri Lanka, is a leading and popular destination for English Education and its library facilities. The facilities of the premises have been used by the students and readers belong to all ages and the average of 500 users was using the facilities on daily basis. The concept of the Project is to set up a new state of art Library, an Office Administration Building, upgrading and refurbishment of existing Colonial building without changing its heritage values. The Project consists of 3 phases and the cost was LKR 300. 0 Mn. The form of contract for this project is a combination of FIDIC and JCT 1998, amalgamated to suit Sri Lankan Standards.

The Furniture supplier and the installer was nominated subcontractor and following were direct specialised contractors appointed and handled by the client.

- Data & UPS System
- Access Control System
- Public Address System and Pipe Music System

Table 4-3: Profile of Respondents in Case Study B

Respondents	Demographic information
RB1-Consultant Structural Engineer	40 years of experience in structural engineering, adjudication, and project management
RB2- Consultant Project Manager	15 years of experience in civil engineering, project management and project planning
RB3- Cost Consultant	40 years of experience in quantity surveying and contract management

4.2.3 Case study C

Proposed Multi-storey hotel project, which is located in the highly commercialised location in the heart of Colombo. The project consists of more than 200 luxury room, banquette facilities, all day restaurant, pool and the bar facilities, including the back of house operation facilities.

As per the client's requirement, the overseas designers were appointed to carry out the design and a local reputed architect was appointed as the Local Architect and to design the building envelope of the project. In addition the client appointed reputed local Structural Engineering firm and Quantity Surveying firm for both Structural and Cost Consultancy works of the project.

The local consultant appointed for the project did not have prior experience on high-rise buildings and only an expert of low-rise projects. This made lot of issues from the start and the design was not very suitable for a high-rise building.

The piling commenced in early 2011 and completed the work by mid-2012 with delays. There was no proper supervision as well as construction management taken place at site. Many quality issues were identified subsequently.

Overseas Design team appointed were not properly coordinating with the client's representatives as well as local design team.

Rest of the construction started from early 2013 and expected completion was 30 months period. However, the project took additional 18 months due to various issues.

In the last quarter of 2012, only the Structural design was ready and the rest of the design was not completed. Therefore, the client appointed a PM at the late stage and the PM to look after the PM services and the construction management. In early 2013, the Client terminated the MEP Services consultant, who was an overseas consultant and requested the Consultant Project Manager's Service Consultant overlook Services Design, which was submitted by the overseas consultant.

Due to the lack of information, it was very difficult to finalise each contract. All Interior Decoration Contract and MEP Services contracts were only finalised at the latter part of the project and lots of issues related to coordination was taken place, which ended up with time and cost overruns. Total time overrun is 18 months. Total cost overrun is 75% , which was very difficult for client in terms of their operation.

Table 4-4: Profile of Respondents in Case Study C

Respondents	**Demographic information**
RC1- Consultant's Project Manager	30 years of experience in civil engineering and project management
RC2- Construction Project Manager	17 years of experience in civil engineering and project management
RC3- Cost Consultant	40 years of experience in quantity surveying

4.3 Cross case analysis

The data gathered from the semi -structured interviews were coded. The contents were divided into themes according to the objectives, and cross case analysis was carried out among three case studies. Below Figure 4-1 shows the structure of the themes.

Main themes/Sub themes

- Significant causes of disputes
- Types of errors in the contract documents
    - Errors in BOQ
    - Errors in Drawings
    - Errors in Specifications
    - Errors in Conditions of contracts
- Causes of errors in contract documents
    - BOQ
    - Drawings
    - Specifications
    - Conditions of contracts
- Strategies to minimise errors in contract documents
    - BOQ
    - Drawings
    - Specifications
    - Conditions of contracts

Figure 4-1: Structure of the themes

4.3.1 Significant causes of disputes

The interviewees in three cases have identified a number of significant causes of disputes. Further, this has been mapped against the literature findings and primary data findings.

Table 4-5 is illustrated the causes of disputes. Based on the interviewees' response significant causes were identified. When all respondents stated causes have been identified as significant causes. Further, this has been mapped against the literature findings and primary data findings.

Table 4-5: Responses on causes of disputes

Causes of disputes	Literature findings	Case								
		A			B			C		
		RA1	RA2	RA3	RB1	RB2	RB3	RC1	RC2	RC3
Errors in documents	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lack of information when preparing tender documents	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lack coordination within design team	✓	✓			✓			✓	✓	✓
Issues associated with project management	✓	✓			✓					
Lack of authorities to project manager					✓				✓	
Lack of effective communication and lack of commitment	✓	✓			✓			✓		✓
Enforcing unreasonable conditions, which are not practicably enforceable in Sri Lanka		✓			✓	✓				
Lack of serious studies of insurance documentations		✓			✓					
Not achievable designs		✓			✓			✓	✓	
Lack adhering to government legislations			✓					✓	✓	
Changes of client's requirement	✓			✓	✓	✓		✓	✓	✓
Conceived projects (not adequately thought of)								✓	✓	✓
Lack of understanding of project time line	✓	✓	✓		✓			✓	✓	

Causes of disputes	Literature findings	Case								
		A			B			C		
		RA1	RA2	RA3	RB1	RB2	RB3	RC1	RC2	RC3
Lack of understanding of project budget		✓			✓			✓	✓	
Risk need to calculate in advance				✓				✓		
Contradictions between drawings and BOQ, or specifications and construction drawings				✓	✓			✓	✓	✓
Finance for the project not arranged by the client	✓					✓	✓	✓		✓
Delay of finance from Client	✓			✓			✓	✓		
Carelessness and negligence of professionals			✓		✓			✓	✓	✓
Insufficient funds to create quality documents				✓			✓			
Lack of understanding of standard documents					✓					
Inadequate time to prepare contract documents		✓	✓	✓	✓	✓	✓	✓	✓	✓
Lack of motivation among team	✓				✓				✓	✓
Selection of inappropriate procurement				✓				✓		
Attitude of client	✓						✓	✓	✓	
Long-time taken to Authority approval	✓				✓				✓	
Issues with professionalism		✓			✓				✓	
Lack of site investigation	✓	✓		✓	✓		✓		✓	

Interviewees' responses demonstrate that there are three significant causes for disputes based on their professional experience. This is shown in the However, literature findings have identified two common causes such as "errors in documents" and "Lack of information when preparing tender documents". Hence, "inadequate time to prepare contract documents" has been a unique finding from the study.

Table *4-6*. Based on the interview findings all respondents have identified "errors in documents", "Lack of information when preparing tender documents" and "Inadequate time to prepare contract documents" as significant causes of disputes. However, literature findings have identified two common causes such as "errors in documents" and "Lack of information when preparing tender documents". Hence, "inadequate time to prepare contract documents" has been a unique finding from the study.

Table 4-6: Significant causes of disputes identified by respondents

Significant causes of disputes	**Case**								
	A			**B**			**C**		
	RA1	**RA2**	**RA3**	**RB1**	**RB2**	**RB3**	**RC1**	**RC2**	**RC3**
Errors in documents	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lack of information when preparing tender documents	✓	✓	✓	✓	✓	✓	✓	✓	✓
Inadequate time to prepare contract documents	✓	✓	✓	✓	✓	✓	✓	✓	✓

Interview results demonstrated that errors in documents have been identified as the major causes of disputes in all projects. As RA2 highlighted that "*Contract documents should perfectly cover all the aspects of the contract, safeguard the rights and obligations of all aspects otherwise it is disputes*". Further RB3 pointed out that errors in documents sometimes misleading the parties as "*Errors in documents, especially Interpretations, When there are two parties they try to justify their interpretations. Sometimes both can be right*." It is essential to view the project broadly in a bigger picture, when preparing the contract documents. According to RC1 visiting construction site before preparing the contract is vital. It is further stated that "*Some consultant's prepare contract documents without checking the Site*

which can lead to disputes later as the information provided may not be correct or accurate". Further, respondents identified that inadequate time to prepare contract documents as another significant cause for disputes. As identified by respondents inadequate time to prepare contract document lead to errors in contract documents. Those two causes can be linked each other and lead to disputes in the construction projects.

Lack of information when preparing tender documents has been identified by all respondents as one of the main causes for disputes in the construction industry. As identified by RC1 "*Some information may not have been included in the tender documents and later issues can be arisen when client aware about it, then disputes starts.*" When contractors price the tender BOQ, they will not consider future changes and sometime they will not allocate risk based on the future requirements, hence disputes starts.

4.3.2 Types of errors in the contract documents

According to Farooqui et al. (2014), an error is a mistake done at the preparation stage of the contract document which maybe in the form of several factors. The

Table 4-7 shows the types of errors in the contract documents identified by respondents in the three cases. Types of errors have been identified as errors in Bills of quantities, errors in drawings, errors in specification and errors in conditions of contracts.

Table 4-7: Types of errors in contract documents

Types of errors in contract documents	**Cases**								
	A			**B**			**C**		
	RA1	**RA2**	**RA3**	**RB1**	**RB2**	**RB3**	**RC1**	**RC2**	**RC3**
Bills of quantities									
Inaccurate descriptions of items	✓	✓	✓	✓	✓	✓	✓	✓	✓
The item is omitted in the bills of	✓	✓	✓	✓	✓	✓	✓	✓	✓

Types of errors in contract documents	Cases								
	A			B			C		
	RA1	RA2	RA3	RB1	RB2	RB3	RC1	RC2	RC3
quantities									
Incorrect measurement	✓	✓	✓	✓	✓	✓	✓	✓	✓
Incorrect unit of measurement	✓	✓	✓	✓	✓	✓	✓	✓	✓
Arithmetic errors	✓	✓	✓	✓	✓	✓	✓	✓	✓
Inaccurate quantities of items	✓	✓	✓	✓	✓	✓	✓	✓	✓
Irrelevant preliminaries/ omitted preliminaries items	✓	✓	✓	✓	✓	✓	✓	✓	✓
Approximation errors	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ambiguity in item description	✓	✓	✓	✓	✓	✓	✓	✓	✓
Not applying proper pricing guide to the bidder	✓	✓	✓	✓	✓	✓	✓	✓	✓
Drawings									
Inaccuracy of details	✓	✓	✓	✓	✓	✓	✓	✓	✓
Design errors	✓		✓		✓		✓	✓	✓
Omissions in details	✓	✓	✓		✓		✓	✓	✓
Dimensional errors	✓	✓	✓		✓		✓	✓	✓

Types of errors in contract documents	Cases								
	A			B			C		
	RA1	RA2	RA3	RB1	RB2	RB3	RC1	RC2	RC3
Missing information	✓		✓		✓		✓	✓	✓
Symbol and abbreviation errors	✓		✓		✓		✓	✓	✓
Specification									
Missing items in the specification	✓	✓	✓	✓	✓	✓	✓	✓	✓
Items included in the drawings but not in the specification or vice versa		✓				✓	✓	✓	✓
Not reflecting specifications properly in drawings based on local standards.	✓	✓	✓	✓	✓	✓	✓	✓	✓
Items do not conform to client / discipline criteria	✓	✓	✓		✓	✓	✓	✓	
Abbreviation / symbol errors			✓		✓		✓		✓
Condition of contracts									
Ambiguity of clauses	✓	✓	✓	✓	✓	✓	✓	✓	✓
Documents does not conform to regulations		✓		✓	✓		✓	✓	✓

Types of errors in BOQ

According to the semi- structured interview findings, all respondents identified ten types of errors in the BOQ. They all identified the BOQ errors are common in the construction industry and it leads to disputes in the construction process. As

identified by RA 2 "*Very often design consultants prepare set of drawings and issue to the Quantity surveyors for the preparation of BOQ. Most of the times these set of drawings does not really match with the construction set of drawings. Its call preliminary set only for preparation of BOQ. They ignore preference and documents forming bidding documents. Contract starts with bidding documents. That's the starting point of disputes."* Lack of information of the BOQ description was identified as one of the errors in the BOQ. According to RB3 "Not *elaborating items correctly, which will lead to disputes at the end*". Further, he mentioned about lack of description of the BOQ items, which has a negative impact when contractors are pricing BOQs. Different contractors make variety of assumptions based on the given brief description. This includes not providing descriptions of standard materials in the BOQ.

Types of errors in drawings

Interviewees identified six types of errors in drawings. Among them inaccuracy of details in the drawing was identified by all nine respondents. Further, RC1 highlighted that "*Tender drawings are not sufficient as when you come to the construction phase the quantities will differ*." Six respondents among three cases have identified design errors. As stated by RA1 " *some tender drawings are not achievable designs… when considering design it should be able to practically implement in Sri Lanka… some drawings are having lot of errors*".

Types of errors in specification

Interviewees have identified five types of errors in specification. Among them, all respondents in the semi-structured interviews identified "missing items in the specification" and "not reflecting specifications properly in drawings based on local standards". They identified this as major issue during the construction process. RA2 stated that "*Most of our designers and consultants are not aware that there are about 25 materials have been declared by the government as materials requiring compulsory SLS marking. That has been gazetted. It has become a law of the land and as statutory… e.g. Cement SLS 107, Steel 305 etc.*".

Types of errors in condition of contracts

"Ambiguity of clauses" and "documents do not conform to regulations" were two types of errors identified in the contract documents. All respondents identified "ambiguity of clauses" as a major error, leads towards disputes in the construction process. RC1 identified that "*...Interpretation of conditions of contract clauses are always the problem, Interpretation is subjective because everybody's personal opinions involved. As example, BOI document is not clear and changing from project to project. Negative list is the wrong thing, which is assuming everything in negative list is not in positive list, which is not correct always…"*

4.3.3 Causes of errors in contract documents

Table 4-8 shows the causes of errors in contract documents which comprising BOQ, drawings, specification, and conditions of contracts. Following sections analyse interviewees' responses on causes of errors in each document.

Table 4-8: Causes of errors in contract documents

Causes of errors in contract documents	Cases								
	A			B			C		
	RA1	RA2	RA3	RB1	RB2	RB3	RC1	RC2	RC3
Bills of quantities									
Lack of adequate information about project	✓		✓			✓	✓		✓
Poor communication between the professionals and the client	✓		✓			✓	✓		✓
Negligence of the professional	✓		✓			✓	✓		✓
Limited time to prepare BOQ			✓		✓			✓	
Lack of knowledge of standard method of measurement	✓	✓	✓	✓	✓	✓	✓	✓	✓

Causes of errors in contract documents	Cases								
	A			B			C		
	RA1	RA2	RA3	RB1	RB2	RB3	RC1	RC2	RC3
Original drawing changes in the construction stage	✓	✓	✓	✓	✓	✓	✓	✓	✓
Improper selection of method of measurement	✓	✓	✓	✓	✓	✓	✓	✓	✓
Drawings									
Egos of client and design team			✓		✓			✓	
Lack of information about project	✓	✓	✓	✓	✓	✓	✓	✓	✓
Poor communication between the professionals and the client	✓		✓		✓		✓		✓
Original drawing changes in the construction stage	✓	✓	✓	✓	✓	✓	✓	✓	✓
Not having proper records of weather reports	✓	✓	✓	✓	✓		✓	✓	
Upgrade with new technology			✓					✓	✓
Client is not aware about the budget in the initial stage	✓		✓		✓			✓	
Cultural issues			✓					✓	✓
Way of contracting		✓	✓						
Insufficient Planning and design work	✓		✓		✓			✓	✓

Causes of errors in contract documents	Cases								
	A			B			C		
	RA1	RA2	RA3	RB1	RB2	RB3	RC1	RC2	RC3
Lack of experience in designing	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lack of coordination skills	✓	✓	✓	✓	✓	✓	✓	✓	✓
Client's change of mine	✓	✓	✓	✓	✓	✓	✓	✓	✓
Scope of the project is not clear from the beginning	✓	✓	✓	✓	✓	✓	✓	✓	✓
Before design not attending site visits	✓	✓	✓	✓	✓	✓	✓	✓	✓
Not conducting preliminary and feasibility study	✓								✓
Limited time to do design	✓	✓	✓	✓	✓	✓	✓	✓	✓
Specification									
Changes to specification time to time	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lack of knowledge about specifications	✓	✓	✓		✓	✓		✓	
Incorrect drawings	✓		✓	✓	✓				
Insufficient planning and design work	✓				✓	✓		✓	✓
Designer's experience		✓	✓	✓	✓	✓	✓		

Causes of errors in contract documents	Cases								
	A			B			C		
	RA1	RA2	RA3	RB1	RB2	RB3	RC1	RC2	RC3
Conditions of Contracts									
Not consulting legal professionals when writing Special Conditions of Contracts	✓	✓	✓	✓	✓		✓	✓	✓
unavailability of detailed information	✓			✓			✓		✓
Inclusion of unnecessary Conditions of Contracts		✓	✓	✓	✓				
Poor communication between the professionals and the client	✓		✓			✓	✓		
Negligence of the professional	✓	✓		✓		✓		✓	

Causes of errors in BOQ

Interviewees identified seven major causes of errors in the BOQ, which may lead towards disputes in the construction projects. Inaccurate selection of the standard method of measurement when preparing the BOQ was identified by all respondents as the main problem causing for disputes in construction process. According to RA2 "*SLS 573 is a national standard, you need to follow this. In UK there are national standards as SMM 7 and other publications."* In Sri Lanka, national standard for preparation of the BOQ is SLS 573. *"These standards stated in the contract documents. It has become a part of the contract. Some Quantity surveyors are ignorant of this and do not know the importance of this; they don't follow this and it leads to disputes at the end"* (RA3). Further, this will provide the instruction to

contractors, who will be pricing BOQ. As stated by RB3 "*BOQ says what prices to be included in the rates. When pricing, contractors need to follow this".* Further, all interviewees identified that not adhering to SLS 573 or appropriate standard method of measurement when preparing BOQ is due to lack of knowledge.

All interviewees have identified that changes of tender drawings in the construction stage is another major causes for disputes in building projects. Further, this is strength by RA1 "*Quantities are not being right to design changes - When you go for tender you have basic set of documentations."* When the actual construction commenced at the site many things those are not in the initial drawing when preparing BOQs were identified. Hence, "*Quantity surveyor picks the quantities from tender drawings. Tender drawings are not sufficient as when you come to the construction phase the quantities will differ. In a larger project when you give a ratio, some contactors do redesign before pricing"* (RC1).

Lack of information of pricing guide in the BOQ also has been identified as another error in the BOQ. As stated by RB3 "*Not applying proper pricing guide the bidder will not get proper idea*". Further, five respondents identified professional negligence is another causes of errors in BOQ. Due to time limitation for preparation of BOQ re checking quantities and descriptions are limited.

Causes of errors in drawings

Interviewees identified eighteen causes for errors in drawings. All respondents identified following common causes for errors in drawings as "Lack of information about project", "Original drawing changes in the construction stage", "Lack of experience in designing"," Lack of coordination skills", "Client's change of mind", "Scope of the project is not clear from the beginning", "Before design not attending site visits" and "Limited time to do design".

Original drawing changes in the construction stage have been identified as one of the reasons for disputes in the construction process. As identified by interviewee RB3 "*Drawings at Tender stage can be differed when release construction drawings".*

When the drawings are different from tender stage to construction stage and less details of drawings will causes for disputes. As stated by RA1 *"Site situation is different to original drawing. Boundaries are different, joining buildings are different, boundary lines are different. You design without considering joining building and boundary lines. As example boundaries defined in survey plan is different to boundaries defined in the deed. Deed has larger plan than the survey plan*". Hence, having clear understanding of the scope of the project and conducting preliminary site visit before designing is very important. However due to lack of awareness and limited time for the design team to prepare design developments, tender drawings are with lack of information. This is further heighted by RB3 "*Drawings are with lack of information or not having important information*". This was further strengthened by RA3 "*If the drawings and documents are perfect, if it is covering all aspects of the contract there are lesser chances of variations. If the variations occur it's an additional cost and time."* Further, RC1 stated about the limited time to do design, as *"Client is also responsible for these errors in some way. In order to prepare completed set of drawings with more details it takes longer time. Client do not wait longer period to start the project*".

Causes for errors in specifications

Findings of the interviews show that five causes have been identified for errors in specification. Among the findings changes of specification time to time has been identified by all respondents. Based on the priority of documents in the contract documents, specifications will be priority document even before BOQs. Hence, accurate and in detailed description of specification is very important, contractors price the tender documents based on the specifications. Due to changing the specification time to time to reach perfect specification will lead towards disputes. Many interviewees in three cases highlighted this. Further, highlighted by RB3 "*Not reflecting specifications properly in drawings based on local standards. You need to do particular specifications by referring standards (ICTAD)".* There are three main specifications, such as performance specification, outright specification and vendor orient specification. Performance specification is a document that specifies the operational requirements of a component or installation. Simply put, a performance

specification tells the contractor what the final installed product must be capable of doing. As identified by RB3 "*In performance specification you need to mention the end result very clearly, customer's end requirement. Contractor needs to give ideas to meet those requirements specially when pricing."* Further, Outright specification conveys the requirements of a project through a detailed explanation of the materials that the contractor must use, and the means of installing those materials. Importance of outright specification was highlighted by RA3 "*You need to give the details how it should be and what are the materials to be used and exact way to be completed. It is easy to check and contractor knows how to do pricing"*. In addition, vendor orient specification provides specific brand, trade name, or supplier. As stated by RB3 "*consultants don't care about specifications, some are not aware about specifications. You need to be very specific in specification aspects. Everything has to be specified."* Further, RC2 identified that "*Some consultants when they build only they understand some materials or specified brands are not good or not appropriate."*

Causes of errors in Conditions of Contract

Interviewees have identified five causes of errors in conditions of contracts. Among them, a common cause of error was identified as "not consulting legal professional when writing the special Conditions of Contracts". As emphasis by RC2 " *better to always adhere to common clauses of conditions of contracts, otherwise if you need to change to the special conditions of contract always get the legal professional and construction professionals experience. Otherwise the clauses not properly interpreted will leads to disputes."*

4.3.4 Strategies to minimise errors in contract documents

Table 4-9 shows the interviewees' opinion on strategies that can be practised to minimise the errors in contract documents. Respondents have identified thirteen (13) strategies to minimise errors in contract documents. According to the findings many good practices have been identified, which can be used to minimise errors in BOQ, drawings, specification and Conditions of Contracts.

Table 4-9: Strategies to minimise errors in contract documents

Strategies to minimise errors in contract documents	Cases								
	A			B			C		
	RA1	RA2	RA3	RB1	RB2	RB3	RC1	RC2	RC3
Work as a team /partnering	✓		✓	✓			✓		
Contractor's involvement from the beginning				✓			✓		
Collaborative effort		✓		✓			✓		
There should be a mechanism to identify clauses that could be changed and could not be changed in the ICTAD or FIDIC documents			✓				✓		
Educate consultants about contract documents				✓			✓		
Provide adequate time to prepare the contract documents	✓	✓	✓	✓	✓			✓	
Pre- bid meetings for clarification	✓	✓	✓	✓					
Follow standard methods	✓	✓	✓	✓					
Good communication and coordination among team members	✓			✓	✓			✓	
Try to avoid additional unreasonable conditions in the contract clauses	✓	✓		✓	✓		✓	✓	✓
Provide detailed information about the project from beginning	✓			✓					

Strategies to minimise errors in contract documents	Cases								
	A			B			C		
	RA1	RA2	RA3	RB1	RB2	RB3	RC1	RC2	RC3
Conduct thorough site investigation	✓			✓			✓		
Recruiting competent professionals	✓			✓					

Work as a team /partnering

Work as a team / partnering has been identified by each respondent from each case. RA3 stated, "*You need to have a team work from the design stage. Structural and architectural drawings sometimes differ. All these should link together for a successful document*".

Contractor's involvement from the beginning

In addition to working as a team, RC1 identified involvement of contractors from the begging is important to minimise errors in contract documents. RC1 stated "*Where everybody's opinion taken. You need to involve contractor when doing documentation. Contactor's ideas need to be taken. It has become an Ego issue for client or consultant to take contractor's word. Good contractors are always right and their ideas will be important to minimise errors*".

Collaborative effort

Each respondent from each case has identified "collaborative effort" as an errors minimising strategy in contract documents. As identified by RC1" *Collaborative effort needs to be involved. Everybody has a contribution towards preparing the documents will able to minimise errors in contract documents".* Therefore, collectively has to find the solution rather than pointing finger at one person. RA2 stated the importance of collaborative effort as "*You shouldn't go towards destroying of a project because you want to satisfy your Ego". Collaborative effort brings many*

positive outcomes. It is happening in other countries. Why we can't practice in here. It's easy to adopt".

There should be a mechanism to identify clauses that could be changed and could not be changed in the ICTAD or FIDIC documents

RA3 and RC1 have identified in majority of projects use ICTAD and FIDIC conditions of contracts. However, there are conditions still can be changed based on the project circumstances. As identified by RC1 "*I think some of clauses are used indiscriminately. There should be some sort of a mechanism of what can be changed and what cannot be changed. It can tend to be unfair. As an example period to certify payments, which can be changed in, part two. There are certain things that should not change. Should be minimise what you change. No clause in ICTAD is independent*". Every clause in ICTAD is linked with some other clauses. Hence, Professional who prepares contract documents should be very cautious in changing clauses and try to avoid changing the standard documents as far as possible.

Educate consultants about contract documents

A group of people prepares contract documents with expertise knowledge by spending adequate time in formulating documents. It is an output of collective effort. As identified by RB1 "*Many people don't know even what is in the documents? We need to educate consultants. A decision that Architects takes also has a contractual legal repercussion. Commercial architects are aware of this. Some creative architects are not worried about the commercial contractual aspects, which leads to so many disputes*". This has been identified by RC1 and RB1.

Provide adequate time to prepare the contract documents

All respondents from case A and two respondents from case B and a respondent from case C identified that "Provide adequate time to prepare the contract documents" as good practice to minimise errors in contract documents. As stated by RA1 "*Reasonable time period should be included in bidding document/contract documents for preparation. It should be attainable*".

Pre- bid meetings for clarification

Pre-bid meeting could be an opportunity to discuss problems associated with contract documents. As identified by RA2 "*In pre-bid meetings that you have to discuss problems and if you observe any shortcomings of the documents you need to discuss, but this does not help at this stage, however it will help to negotiate*". This statement was further strengthened by RA3 "*pre-bid meeting can be conducted for clarification*."

Follow standard methods

Numerous errors occurred in the BOQ due to not following standard method of measurement. As interviewees have identified that following, standard method of measurement when preparing BOQ will minimise the errors in BOQ. In Sri Lanka standard method of measurement is SLS 573. As identified by RA2 "*These standards stated in the contract documents. It's become a part of the contract. Some Quantity surveyors are ignorant of this and do not know the importance of this*".

Good communication and coordination among team members

Main responsibility of compiling contract documents is with the consultant. When consultant is preparing the contract documents many professionals input are taken into considerations. Hence, communication and coordination among team members has to be effective. As stated by RB1 "*good Inter communication and coordination with various specialists is essential to minimise document errors*".

Try to avoid additional unreasonable conditions in the contract clauses

According to the findings, seven respondents identified that avoidance of additional clauses in the conditions of the contract is helpful to reduce errors in the conditions of contracts. Interviewees stated that adhering to standard conditions of contract would be ideal to minimise errors in conditions of contract documents rather than incorporating additional clauses.

Provide detailed information about the project from the beginning

Before producing tender documents detailed information about the project is vital. BOQ, specifications, drawings, and conditions of contracts are depended upon the available project information. Hence, Lack of information about the project result in errors in the BOQ, specifications, drawings, and conditions of contracts. As identified by interviewees providing detailed information about the project from the beginning is vital to minimise errors in contract documents.

Conduct thorough site investigation

Main issue associated with errors in drawings are lack of thorough site investigation. RB1 identified that before preparing drawings "*follow the proper site investigation on soil conditions, contours, flood levels, weather and any important items to minimise design detail errors…*". All other documents depend on designers' drawings. Minimising errors in drawings will facilitate to reduce errors in BOQ and specifications.

Recruiting competent professionals

Contract documents are an important document in the construction industry. RA1 and RB1 identified that in order to minimise errors in contract documents recruiting competent personals who are capable of preparing documents are essential. Hence, RA1 stated that "*If you selected an incompetent person to prepare the bidding documents that also can be a reason for document errors*".

4.3.5 Categorisation of strategies to minimise errors in contract documents based on types of documents

Section 4.3.4 discussed the strategies to minimised errors in the contract documents. *Table 4-10* shows the minimisations strategies based on the types of documents. This was categorised based on the interview findings.

Table 4-10 : Strategies to minimise errors in contract documents based on types of documents

Strategies to minimise errors in contract documents	**Cases**								
	A			**B**			**C**		
	RA1	**RA2**	**RA3**	**RB1**	**RB2**	**RB3**	**RC1**	**RC2**	**RC3**
Bills of quantities									
Provide detailed information about the project from beginning	✓			✓					
Conduct thorough site investigation	✓			✓			✓		
Follow standard methods	✓	✓	✓	✓					
Good communication and coordination among team members	✓			✓	✓			✓	
Work as a team /partnering	✓		✓	✓			✓		
Pre- bid meetings for clarification	✓	✓	✓	✓					
Provide adequate time to prepare the contract documents	✓	✓	✓	✓	✓			✓	
Recruiting competent professionals	✓			✓					
Drawings									
Provide adequate time to prepare the contract documents	✓	✓	✓	✓	✓			✓	
Good communication and coordination among team members	✓			✓	✓			✓	

Strategies to minimise errors in contract documents	Cases								
	A			B			C		
	RA1	RA2	RA3	RB1	RB2	RB3	RC1	RC2	RC3
Work as a team /partnering	✓		✓	✓			✓		
Recruiting competent professionals	✓			✓					
Provide detailed information about the project from beginning	✓			✓					
Contractor's involvement from the beginning				✓			✓		
Collaborative effort		✓		✓			✓		
Specifications									
Provide adequate time to prepare the contract documents	✓	✓	✓	✓	✓			✓	
Recruiting competent professionals	✓			✓					
Contractor's involvement from the beginning				✓			✓		
Recruiting competent professionals	✓			✓					
Conditions of contracts									
There should be a mechanism to identify clauses that could be changed and could not be changed in the ICTAD or FIDIC documents			✓				✓		
Educate consultants about contract documents				✓			✓		
Try to avoid additional	✓	✓		✓	✓		✓	✓	✓

Strategies to minimise errors in contract documents	Cases								
	A			B			C		
	RA1	RA2	RA3	RB1	RB2	RB3	RC1	RC2	RC3
unreasonable conditions in the contract clauses									
Provide detailed information about the project from beginning	✓			✓					
Recruiting competent professionals	✓			✓					

4.4 Framework to minimise errors in contract documents to minimise disputes

The framework of the research study was developed by identifying types of errors in contract documents, causes of errors in contract documents and strategies to minimise errors in contract documents. BOQ, drawings, specifications, and conditions of contracts have been identified as documents in the contract document for the study. Different types of errors in each document were identified from the semi- structured interview findings. Next, the causes of errors in each document were identified in order to recognise the strategies to minimise errors. Finally, the strategies to minimise errors in contract documents were identified from interview findings. The developed framework is illustrated in the Figure 4.2.

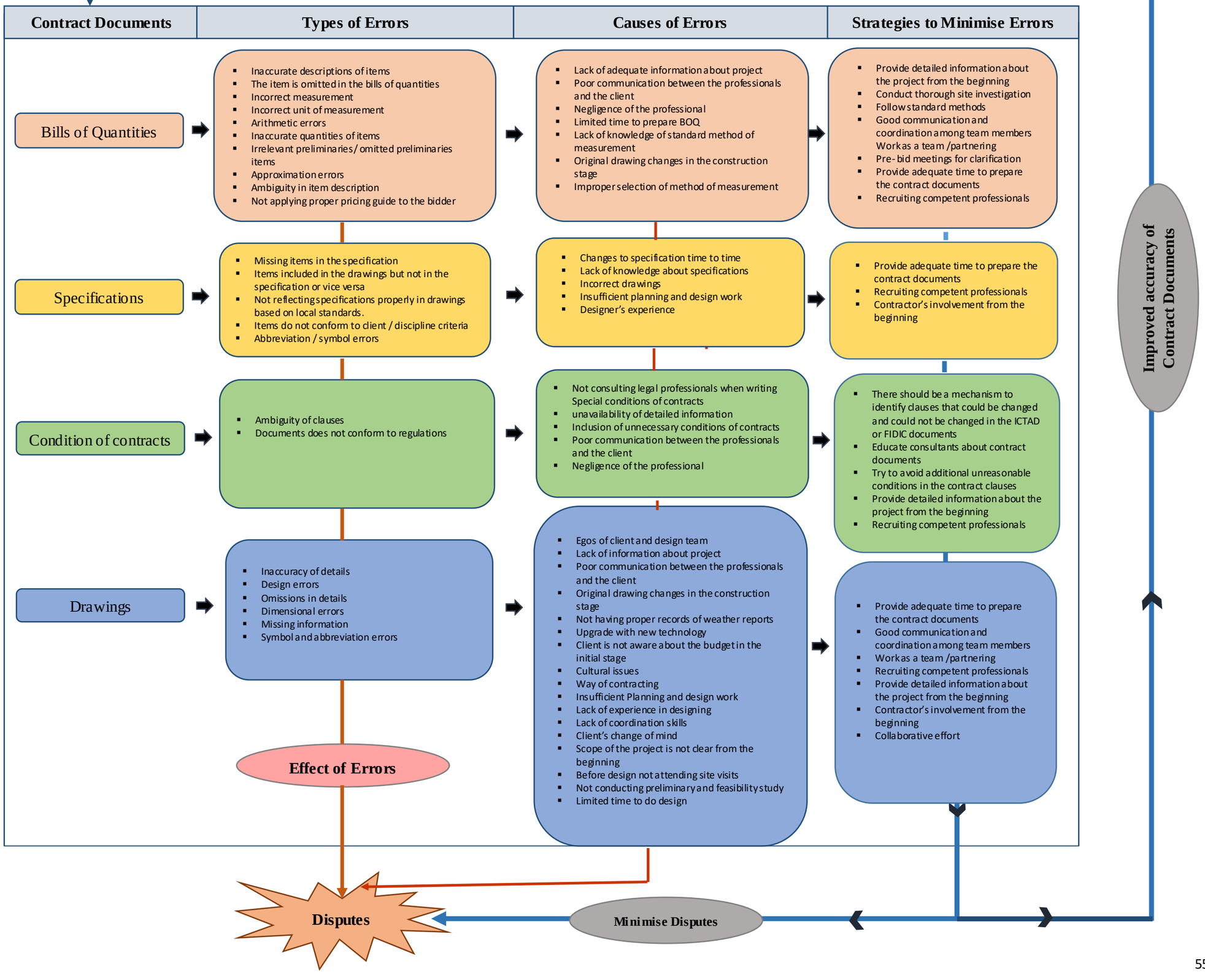

Figure 4-2: : Framework to minimise errors in contract documents to minimise disputes

4.5 Summary

This chapter explains the findings of the research in order to accomplish the key objectives of this research study. The analysis commenced with findings the causes of disputes in the construction industry. Findings revealed that errors in contract documents were one of the main causes of disputes in the construction industry. Subsequently, types of errors in contract documents were identified. The types of errors were discussed on BOQ, drawings, specifications and conditions of contracts. Also, causes for errors in contract documents were identified. Strategies to minimise errors in contract documents were identified to minimise errors. In order to overcome the aforementioned errors in contract documents, a framework was developed in cooperating types of errors, causes of errors and strategies to minimise errors, which is the ultimate goal of the study.

CHAPTER 5- CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Numerous causes have been identified for disputes in the construction industry. Among them errors in the contract documents have been identified as the one of the key causes for disputes in the construction projects. In order to minimise disputes, main causes of disputes have to be minimised from the inception of the construction project. The disputes should be avoided at the first instance it is foreseen. Thus, it will be a great benefit if they can be avoided before they arise. Hence, the causes of disputes should be minimised from the beginning of the project. The following Sections summarise and present the key findings and conclusions related to each research objective of the study.

Objective 1: to identify causes of disputes in the building projects

The objective 1 was achieved by way of a comprehensive literature review and supported by semi structured interviews. Different authors have categorised causes of disputes in different ways. As discussed in section 2.2.2 main causes of disputes are unrealistic expectations by parties, ambiguous contract documents, poor communications between project participants, lack of team spirit and failure of participants to deal promptly with changes and unexpected outcomes. Similarly, interview findings identified lack of information, when preparing tender documents and inadequate time to prepare contract documents were the significant causes of disputes.

Objective 2: to identify different types of errors in the contract documents

The objective 2 was addressed mainly through the literature review supported by case study interviews. According to the literature, it was found that human errors, arithmetical errors, omission of signatures, dates, and reference numbers, and the lapses in descriptions within the contract document were types of errors in the contract documents. According to the literature as common types of errors in the contract documents were considered as ambiguity, deficiency, inconsistency, and

defectiveness of contract documents. Case study interview findings revealed the types of errors based on the document types. Accordingly, types of errors in BOQ were identified as inaccurate descriptions of items; the item is omitted in the bills of quantities, incorrect measurement, incorrect unit of measurement, arithmetic errors, inaccurate quantities of items, irrelevant preliminaries/ omitted preliminaries items, approximation errors and ambiguity in item description. Further, types of errors in the drawings were inaccuracy of details, omissions in details, dimensional errors, design errors, missing information and symbol & abbreviation errors. Missing items in the specification were, items included in the drawings but not in the specification or vice versa, not reflecting specifications properly in drawings based on local standards, items do not conform to client / discipline criteria and Abbreviation / symbol errors. Types of errors in conditions of contracts were identified as ambiguity of clauses and documents do not conform to regulations.

Objective 3: to identify causes for errors in contract documents

Objective 3 in the study was addressed via the case studies findings supported by the literature review. The main reasons for errors in the contract documents are the lack of knowledge, experience, not allowing reasonable time to prepare documents and the lack of technical know-how. The poor considerations given in reading and tailoring the contract document in a proper custom-made approach to each construction project is essential. Lack of adequate information about project, poor communication between the professionals and the client, negligence of the professional, original drawing changes in the construction stage and improper selection of method of measurement were causes in the errors in BOQ. The main causes of errors in drawings as the inadequate weather reports, not upgrade with new technology, lack of awareness about the budget in the initial stage, client's changes of mind and before designing poor attendance to site. When client changes type of building materials time-to-time, complex designs with limited information and incorrect drawings causes the main reasons for errors in specifications. Conditions of contracts are an important document in the contract documents. Main causes for errors in contract document were changing the common conditions of contracts to special conditions of contract. Not consulting legal professionals when writing

Special conditions of contracts and inclusion of unnecessary conditions of contracts were common reasons for errors.

Objective 4: to investigate strategies to minimise errors in contract documents

Objective 4 was achieved by literature review and primary data collection from case studies interviews. Proper pre-planning activities by having a clear and concise understanding about the exact nature, complexity, and scope of the project is essential. The consultants who involve in contract documents preparation should be able to omit and eliminate human and arithmetic errors completely from the contract documents. It helps to reduce disputes in the construction industry as well. Besides above findings work as a team /partnering, contractor's involvement from the beginning, collaborative effort, identifying clauses that could be changed and could not be changed in the ICTAD or FIDIC documents, educating consultants about contract documents, providing adequate time to prepare the contract documents, organising pre- bid meetings to negotiate, following standard methods, good communication and coordination among team members, avoiding additional unreasonable conditions in the contract clauses, providing detailed information about the project from the beginning, conduct thorough site investigation and recruiting competent professionals were the techniques to minimise errors in the contract documents.

Objective 5: to devise a framework to minimise errors in contract document to minimise disputes which arise due to errors in contract documents in the building projects

This section presents the theoretical framework developed through the empirical investigation of the study. Through a comprehensive literature review, the main concepts of the study and their interrelationships were identified. The framework indicates types of errors in contract documents, causes of errors in contract documents and strategies to minimise errors in contract documents. Further, the framework shows the findings based on four documents namely BOQ, drawings, specifications and conditions of contracts. It argues that types of documents errors help to identify the causes of errors and causes of errors help to identify the strategies

to minimise errors in contract documents. Minimising errors in the contract documents will help to minimise disputes. Moreover, the developed framework could be used by consultants, contractors and client organisations to minimise disputes taking proactive actions before disputes arise because of errors in contract documents.

5.2 Recommendations

The research findings found out errors in contract documents was one of the key causes of disputes. Therefore, this research strongly recommends Sri Lankan construction industry practitioners to practice the proposed framework to avoid disputes, which can occur at the construction stage of the building construction project because of errors in contract documents. Specifically, construction professionals should make clients aware about the causes of errors in contract documents during the construction stage. Because some causes were aroused by client's unawareness, such as client's change of mind, scope of the project is not clear from the beginning and lack of awareness about the budget in the initial stage. As the research has identified strategies to minimise errors in contract documents, this research recommends that recruiting competent professionals, allocate adequate time to prepare the contract documents and contractor's involvement from the beginning. The clients should have been educated about those strategies by consultants. Further, a client should be able to recruit competent professionals to the projects based on past records of accomplishment.

5.3 Limitations of the study

Due to time and resource limitations associated with a typical master research, interviews were conducted only with nine construction professionals in three case studies, which comprises consultant structural engineer , cost consultant, contract administrator of the contractor and consultant project manager. Consequently, there are possibilities where their personal opinions might not be eliciting the organisational point of view. In order to increase the validity, number of cases should have been increased. Furthermore, three cases represent buildings from the Colombo area. Therefore, the results can be generalised to similar types of cases.

Further, the framework that has been developed based on this study has not been tested and implemented in the industry. Due to time limitation for the study, the framework has only been developed as a guideline for construction professionals in the industry. Testing and implementing of this framework could be conducted as part of further research.

5.4 Further Research Directions

Different avenues for further research are identified to enable researchers to explore the study area.

5.4.1 Minimise errors in contract documents to minimise disputes in developed countries

This study was based on Sri Lankan construction industry and this could be conducted in developed countries with different cultural settings as a further study. There would then be a possibility to compare the findings of Sri Lanka as a developing country and with a developed country, which would provide the basis to investigate how different countries and cultural setting affects the findings.

5.4.2 The same study can be conducted for the projects which are procured under another procurement method

This study was based on the traditionally procurement projects. Another research can be conducted to minimise errors in contract documents to the projects, which are procured under other procurement methods such as design and built method.

5.4.3 Testing and implementing the framework developed through the study

One of the limitations of the study is non-testing and non-implementation of the framework in construction industry. Thus, as further research the developed framework can be tested and implemented within construction industry.

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APPENDIX A-INTERVIEW GUIDELINE

RESEARCH BRIEF

Dear Sir/Madam,

I am R.P.H.S. Bandara, postgraduate student pursuing MSc/PG Dip. in Construction Law and Dispute Resolution programme at University of Moratuwa. As a fulfilment of a degree, I'm currently conducting a research on the topic of "**strategies to minimise errors in contract documents to minimise construction disputes in building projects in sri lanka**". Research aim and objectives are as follows.

Aim

Aim of the research is to develop a framework to minimise errors in contract documents to mitigate disputes in the building projects.

Objectives

In order to achieve the aim of the study the following objectives were formulated.

- to identify causes of disputes in the building projects
- to identify different types of errors in the contract documents
- to identify causes for errors in contract documents
- to investigate strategies to minimise errors in contract documents
- to devise a framework to minimise errors in contract document to mitigate disputes which arise due to errors in contract documents in the building projects

In order to collect the data for aforementioned research, I am conducting interviews among construction professionals who are currently involving in and had experiences in the dispute resolution in construction industry. Therefore, I kindly request your assistance by allowing me to conduct interviews for the aforementioned research. The interview guideline is attached herewith.

The interview will least for approximately one hour. The data will be collected through tape recording and note taking in order to increase the accuracy of data.

The collected information will remain confidential and will be used for the sole purpose of this study. The subsequent reports and research papers written based on

this study will be structured in such a way that no individual and organisation can be identified. Comments will not be attributed to any single person of the case study. Thank you in advance for participating in this study. If you have any queries, do not hesitate to contact me.

Thanking you

R.P.H.S. Bandara
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Law and Dispute Resolution
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Interview Guidelines

Strategies To Minimise Errors In Contract Documents To Minimise Construction Disputes In Building Projects In Sri Lanka

Section A

1. General Information about the Respondent

- Current Position:
- Experience in Construction Industry:
- Authorities, duties and responsibilities related to position:

Section B

1. Causes of disputes

- What are causes of disputes in building projects?

2. Types of errors in the contract documents

- What type of contract documentation errors you have come across? (Bills of Quantities, drawings, specifications, form of contracts, schedules of rates etc.)
- What are the common type of contract documentation errors, which lead towards the construction disputes?

3. Causes for errors in contract documents

- What are the causes for errors in contract documents?

4. Strategies to minimise errors in contract documents

- How to minimise errors in contract documents?

5. Minimise errors in order to mitigate disputes

- Your view in best provisions in the contract documents to minimise the disputes.

- The standard documents available (ICTAD/FIDIC documents) in the industry have every relevant provision to minimise the disputes.
- What are new provisions can be introduced to minimise the disputes?

Thanking you

APPENDIX B- SAMPLE OF INTERVIEW TRANSCRIPT

RESEARCH BRIEF

Dear Sir/Madam,

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Interview Guidelines

Strategies To Minimise Errors In Contract Documents To Minimise Construction Disputes In Building Projects In Sri Lanka

Section A

1. General Information about the Respondent

- Current Position:
- Experience in Construction Industry:
- Authorities, duties and responsibilities related to position:

Answer

Consultant Structural Designer, Project Manager, Adjudicator who has 41 years experience in the industry

Section B

1. Causes of disputes

- What are causes of disputes in building projects?

Answer

Daily communication with client. Providing wrong or lack of information can be a reason for dispute.

There has to be some clear milestones and data with related so many things. Client need to be aware of financial aspects, scope of the project. The scope should be clearly defined. The more scope is defined the more finance aspects defined client have a clear idea. This is very important to do in the initial stage. The dispute can be arising due to lack of information and lack of information will result in weak outputs.

From the initial site investigation, preliminary site investigation there are things can be missed out. If you don't give these information to client dispute can arise. Good project manager will extract cleverly what are the disputes. Questions need to be

asked from the client in a manner that you get answers. Project manager need to be clever to ask simple question to get proper answer. Client should be able to understand questions. If you ask difficult questions they might not give proper answers.

If you do not conduct a geo technical investigation some problems may not identified. At every stage of planning and design phase, project manager needs to make sure that maximum possible information made available to bidders. So bidders will not complain.

Not informing Archaeological issues to client can be a reason for disputes later. There might be unforeseen things. You need to go to archaeological department and check. As an example if we are doing a project in Trico you need to talk to Navy. We need to avoid shocks and surprises. Both parties need to discuss financial factors; clients own expectations need to be discussed. We need to know what client's project expectations. Project deliverable and time lines need to be discussed and agreed. You need take more time for a project that you need to inform client. Taking more time is better than spending time to solve disputes later. We need to make the client aware of these things. At Project design and design development stage there should be more time allowed than what is usually done in Sri Lanka. Because of client's demand and having said rather arbitrary deadlines the design team don't have time to do all the research of adequate of materials, availability of materials, check on importations etc. All these can be impact finally.

2. Types of errors in the contract documents

What type of contract documentation errors you have come across?
(Bills of Quantities, drawings, specifications, form of contracts, schedules of rates etc.)

Answer

Poor Documentation

Quantity Surveyor should be a clever person who must be able to view the project broadly in a bigger picture. It's not only looking the drawing and takes quantities. Generally need to cover all potential aspects. That is very important. Documentation part is very important. It's not only BOQ. They need to properly aware of the project and provide details. Some Quantity Surveyors prepare documents without checking the Site which can be lead to disputes later as the information provided may not correct or accurate.

Finally entire contracts signed based on drawing and bidding documents. Therefore Drawing and bidding documentation, specifications are very important. Reasonable time period should be included in bidding document/contract documents. It should be attainable.

Designs *– not achievable designs*

When considering designs it should be able to practically do in Sri Lanka. Dispute can arise due to lack of proper planning, practical consideration and lack of knowledge.

- What are the common types of contract documentation errors, which lead towards the construction disputes?

Answer

- *Oversight is one issue*
- *Not responding at adequate time and appropriate time.*
- *Variations*
- *Lack of information on documents*

When there is lack of information QS need to reply to the client explaining the situation to avoid future issues.

There are lot of documents that is not mentioned overhead cost and profit margin not mentioned.

Disputes can occur as Quantity Surveyor did not take proper documentary measures to return the documents with errors at right time and not keeping clear records. Where there is lack of information in bills quantity surveyor keeps the bill without checking or without informing the client. Once the QS get the bill they need to check it and if there any inadequate information the bill need to return and should request for a resubmissions with all the corrections. Not doing this can be result in client complaining in delay of payment certificate. When Quantity surveyor do not have enough details to check variations client need to be informed and make it resubmitted to avoid unnecessary disputes.

Another big reason for dispute is Project manager doesn't dedicate authority correctly at the beginning. Project manager needs to establish proper communication methods and need to build proper hierarchy. To avoid issues there has to be clear image of dedicated powers. Staffs needs to be aware who are empowered for each task and to whom they need to report. Then there will be no matters arise later.

Another dispute is contradictions between drawings and BOQ, or specifications and construction drawings.

Drawings are with lack of information or not having important information.

If you selected incompetent person to prepare the bidding documents that also can be reason for a document errors.

Poor Inter communication and coordination with various specialists is major reason for document errors.

6. Causes for errors in contract documents

- What are the causes for errors in contract documents?

Answer

Lack of coordination within the design team can be another reason for disputes.

Lack of efficient of project management is another reason.

Lack of effective communication and lack of commitment is another reason.

There should be an effective communication and coordination within the team.

Dispute can occur by trying to put unreasonable conditions which are not practicably enforceable in Sri Lanka.

Dispute can be occurred due to lack of serious studies of insurance documentations. We need to check exclusions. And need to check whether we need to add any additional inclusions.

7. Strategies to minimise errors in contract documents

- How to minimise errors in contract documents?

Answer

- *Regular meetings need to be conducted with key stake holders*
- *Need to have Staff with good communications skills should be appointed for work.*
- *Decision making person should come to meetings from all parties. This should include consultants, client, contractor and the nominated sub contractors as well*
- *Need to mention all the required conditions in contracts.*
- *Quantity Surveyors need to have a practical knowledge about the site and prepare the document after visiting the site.*

- *Investigate properly, specially the preliminary investigation, weather, past as well predict the future u[to greater extend, soil conditions, flood levels, any important items……*
- *Have to do Preliminary feasibility studies. This is important.*
- *More Information should be made available at the first stage or early stage of the project*
- *Geophysical investigation need to be done. Not only soil investigation, sometimes surface profile, hydrology study, etc.*
- *Need to check weather, rain falls intensity is very important. But it should not be limited to rain fall, it is important to have date on humidity levels, wind velocity, etc.*
- *Discuss and make aware about the client expectations in the beginning.*

8. **Minimise errors in order to mitigate disputes**
    - Your view in best provisions in the contract documents to minimise the disputes.
        - The standard documents available (ICTAD/FIDIC documents) in the industry have every relevant provision to minimise the disputes.
        - What are new provisions can be introduced to minimise the disputes?

Answer

Make aware the client about documentation and content of it.

Always use standard forms with minimum changes,

If changes required please ensure to do changes that you have already done

If you want to do new changes then need to get expert opinion

Thanking you