

**EVALUATING CLIENT RELATED BARRIERS TO
OPTIMIZE PERFORMANCE OF GOVERNMENT
FUNDED CONSTRUCTION PROJECTS
IN SRI LANKA**

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Degree of Master of Science

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Sri Lanka

January 2020

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This Dissertation was submitted to the Department of Civil Engineering of the University of Moratuwa in partial fulfillment of the requirement for the Degree of Master of Science.

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January 2020

DECLARATION

The work submitted in this dissertation is a result of my own investigation except where otherwise stated. It has not already been accepted for any degree and is also not being concurrently submitted for any other degree.

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Date:

The above candidate has carried out research for the dissertation under my supervision.
I endorse the declaration by the candidate.

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ACKNOWLEDGMENT

This work has been carried out at the Department of Civil Engineering, University of Moratuwa.

I would like to express my sincere gratitude to my supervisor Dr. Badrani Thoradeniya, Head, Division of Civil Engineering Technology, Institute of Technology for supporting and guiding me throughout the course of this research study and for many fruitful discussions and ideas that she shared.

I take this opportunity to extend my thanks to the Course Coordinator Prof. Asoka J. Perera and the staff of the Construction Project Management Unit for giving me the opportunity to read for my Master of Science in the Department of Civil Engineering, University of Moratuwa.

I would also like to thank senior engineers of Buildings Department, State Engineering Corporation and my organization, Central Engineering Consultancy Bureau (CECB) for their flexibility and greatly appreciate the support and encouragement extended to me by my family. Their understanding, motivation and patience towards the accomplishment of this exercise as well as my colleagues and friends who helped me in the compilation of this dissertation, will be remembered.

V. N. Kannangoda Arachchi

08 August 2019.

ABSTRACT

Performance of construction projects has been an important research area in the contemporary times. When the three main stakeholders of a project, viz. client, consultant and contractor are considered, majority of the research on performance improvements of the construction industry has mainly focused on contractors. However, the performance of clients is also important as any decision made by the client will too affect project success. Failures of clients on their role lead to many problems causing significant issues in successive stages of the project. This aspect seems to be inadequately investigated. As such, this research attempt to investigate into the client related barriers and their severity in the performance of Government funded construction projects in Sri Lanka.

The methodology included a literature survey to initiate a list of possible barriers faced by the clients. This was followed up with a questionnaire survey which was carried out among senior project consultants who have had worked with government clients such as Ministry of Health, Ministry of Higher Education, and Ministry of Justice etc. Further, a few key informant interviews were conducted to validate the results of the analyses. It was found out that delay by clients in paying the contractors progress claims is a major factor affecting the performance of contractors. The major variations are due to incomplete client's briefs and designs. Some clients do not have enough time or adequate staff to monitor and evaluate construction works. Finally, this research review opportunity available in guideline to overcome critical barriers. The outcomes of the study will help government sector clients as a guide to ensure better performances in their future state funded projects.

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LIST OF ACRONYMS & ABBREVIATIONS

LIST OF ACRONYMS

Acronyms	Description
ADB	Asian Development Bank
CECB	Central Engineering Consultancy Bureau
CIDA	Construction Industry Development Authority
EIA	Environmental Impact Assessment
EMS	Environmental Management System
EMP	Electrical, Mechanical and Plumbing
GDP	Gross Domestic Product
ICTAD	Institute for Construction Training and Development
GOSL	Government of Sri Lanka
JICA	Japan International Cooperation Agency
NPA	National Procurement Agency
PIP	Public Investment Programme
SEC	State Engineering Corporation
SPSS	Statistical Package for Social Science
UK	United Kingdom
UOM	University of Moratuwa
WB	World Bank

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Appendix	Description
Appendix - A	Sample Questionnaire
Appendix – B	Responses summary of the Questioner
Appendix – C	Data analysis summary

CHAPTER 1

INTRODUCTION

1.1 Background

Government of Sri Lanka (GOSL) annually allocates a large amount of public funds for national infrastructure development construction projects. However, it is a common phenomenon that most such projects experience delays, cost overruns and sometimes disputes as well. This situation has resulted in incurring additional costs, prolongation of negative social and environmental impacts during construction, depriving the general public of the use of infrastructure facilities for years and also underutilization of public funds (GPMCM, 2017).

In most parts of the world, the public sector is the major client of the construction industry (Construction Charter, 2006; Boyd and Chinyio, 2006). It plays a substantial role in providing funding for basic infrastructure which enhances economic activities, such as creation of jobs, and it provides affordable housing (Mbanjwa, 2003). However, in Sri Lanka; the public sector has been heavily criticized for its inadequacy in project delivery, leading to time and cost overruns.

Insufficient capacity of project management and lack of contract management skills of implementation staff have been identified as key contributory factors for this poor performance in public sector construction projects (GPMCM, 2017).

In order to remedy this situation, the government allocate funds for training programmes such as workshops and seminars, time to time (GPMCM, 2017). Such programmes are expected to enhance project management and contract management capacity of the staff engaged in implementation, execution, monitoring of national infrastructure development projects and also members of Procurement Committees, Technical Evaluation Committees and other staff in project management units.

Requirement of a new development or renovation of existing infrastructure is initially identified by the relevant government department. Therefore, the Head of the department becomes the Client of the construction project that will be formulated to address the requirement. For an example; in a hospital, construction of a new operation theatre is a decision of the Director in consultation with medical officers and staff. Then, as the Client the Director of the hospital should allocate either a technical person in-house or from outside in order to proceed with the work. Planning of work, preparation of preliminary budget and method of implementation are key activities at this initial stage. Once the project is approved by the Ministry of Health, the funds will be allocated by the Treasury. Most of the time initial budget is prepared by the client. Once the budget is approved, the Client is responsible to utilize the funds giving maximum benefit to the end user, within the target time. Therefore, playing an active role is a vital requirement as well as a major obligation of the client in order to succeed their project.

1.2 Research Question

Problem statement: Success of state funded public construction projects is very low due to inefficient clients' involvement (World Bank, 2003).

This research is aimed to answer the questions "What are the key client related barriers in state funded public construction projects in Sri Lanka and how to minimize them?"

1.3 Aim and Objectives

The aim of this research is to find key client related barriers and their relations to procurement method, time and cost overrun of the state funded construction projects in Sri Lanka, and assess the usage of available relevant guidelines.

In order to achieve the aim of the research, the following objectives are established:

1. Identify the client related barriers in public construction projects.
2. Analyze the severity of the identified barriers in GOSL funded construction projects and their relationships with procurement method, cost and time overrun.
3. Examine the adequacy of the available guidelines for GOSL clients to minimize barriers for project success.
4. Validate the severity analysis of the barriers in view of the existing construction industry environment.

1.4 Scope and Limitation

This research is limited to state funded public building construction projects in Sri Lanka which have been completed recently. The majority of respondents at data collection surveys are selected from the consultants of government organizations to the public projects. Hence findings are expressed in consultants' perspective.

1.5 Findings

Delay in contractor's progress payment, Incomplete Client's initial brief and Less Client's commitment to the needs of other stakeholders are found to be the three key client related barriers in the government funded construction projects in Sri Lanka. This research finding will be beneficial to the public sector clients to be of more concern regarding those factors in order to succeed their future construction projects.

This research also found provisions already available in guidelines for public sector clients in Sri Lanka to overcome those barriers. Also it will be helpful for public clients to apply most appropriate procurement method to Sri Lankan culture of state funded construction projects.

1.6. Structure of the report

The report is organized in the following order:

- Chapter 1** Chapter one covers the background of the study, aim and objectives, scope and limitation of the research, and the structure of the report.
- Chapter 2** Chapter two describes the client and his role, success factors of a construction project, procurement types available and their nature, barriers to the construction projects and relevant literature of the study area. It covers the existing knowledge on the set objectives of the research. The literature review delivers the background for identification of the research gap and the preparation of the research questions.
- Chapter 3** Chapter three elaborates the research methodology and techniques used for the study.
- Chapter 4** Chapter four present data collected through questionnaire survey and details of statistical analysis with explanation of the data.
- Chapter 5** Chapter five presents the expert interviews on barriers and guidelines. Three experts' comments on the findings are included in this chapter.
- Chapter 6** Chapter six presents the results and validation of the research.
- Chapter 7** Chapter seven presents the conclusions and recommendations of the research and recommendations for further research.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter presents a comprehensive summary of the previous researches relevant to this research topic.

The construction industry is a fast growing sector in Sri Lanka, similar to many other developing countries. Government of Sri Lanka (GOSL) annually allocates more than 40 % of state funds for infrastructure development (Central Bank of Sri Lanka, 2017). Accordingly, the government becomes a major client of the construction industry. Therefore, the various departments and agencies of the government, who are identified as public sector clients, are responsible to utilize the public money reasonably through their construction projects.

2.2 Clients of a Project

Clients are the most important construction industry stakeholders since they initiate the construction process (Lopes et al., 2011). A client is a person who takes the initiative to have a project designed and constructed, and in turn pays for the construction (Van Rijn, 2005; Bennett, 2003). Aiyetan (2010) defined a client as the project initiator who is responsible for the production of the project. A client is an organization or individual who commissions the services necessary to execute and complete a project in order to satisfy its needs and thereafter enters into contracts with other parties (Masterman, 2002).

2.2.1 Client Categories

Basically, clients can be categorized as public and private. A survey done by Newman et al. (1981) identified 18 client types, such as private commercial,

industrial, developers, leisure, education, hospitals etc. This clarification of the client type is helpful for professionals in the industry in order to take appropriate course of actions during their project phases (Tzortzopoulos et al., 2008, Alsolaiman, 2014).

2.2.2 Public Sector Clients

Public sector becomes a client when a construction is undertaken using public money either from local or state sources (Gould & Joyce, 2014). In Sri Lanka, clients are operated at different authorization levels such as national, provincial, divisional and Pradeshiya Sabhas. Boyd and Chinyio (2006) divided public sector into national and local.. The public sector construction process follows specific procedures and rigorous administrative and financial controls in an effort to eliminate the occurrence of fraud and corruption, and all procedures are subject to government audits.

Certain mechanisms are established for construction projects by the GOSL through the Treasury, the Central Bank, the Department of Public Enterprises, and the Project Monitoring Unit under the Ministry of Finance. Further, GOSL set out Construction Industry Development Authority (CIDA) (previously called Institute for Construction Training and Development- ICTAD) to enforce the procedures for ensuring that all public entities adhere to the standards and uniformity in construction procurement.

2.3 Government Funded Construction Project in Sri Lanka

In Sri Lanka, government funded public projects are initiated in few ways. Most projects are created as expansions of existing facilities within the same premises, such as hospital buildings, school buildings, university buildings etc., while some projects are initiated as new developments i.e. new services or expansions of existing services in new areas. Another project type is relocation or shifting of existing structures aiming better services for the public. Among these projects, a crucial type is the new constructions in the same place by demolishing existing functional structures. Planning

is very critical for these projects since the public and the staff will face severe grievances during the construction period.

2.3.1 Classification of Projects

Projects can be classified into Mega, Large, Medium, Small and Micro projects based on the Total Estimated Cost (TEC) of the project as follows.

Table 2.1: Classification of Projects

Type of Project	TEC (Rs. Mn)
Mega	More than 10,000
Large	1,000 - 10,000
Medium	100 - 1,000
Small	10 - 100
Micro	Less than 10

2.3.2 Formulation of GOSL Project

Government micro projects can be implemented with the approval of the Secretary of the relevant Line Ministry without obtaining the approval of the Department of National Planning (NPD), while Mega, Large, Medium and Small projects should follow the procedures laid down in “Guidelines for Submitting Development Project Proposals for Public Investment: Circular No. MNPEA-2019”. Both NPD and Department of National Budget (NBD) are involved in the approval process.

Once a public sector entity prepared, a project proposal, it will be evaluated by the Department of National Planning. Following are the responsibilities of the NPD.

- Preparation of Long Term / Medium Term Development Plans and the Investment Programme
- Development of the macroeconomic framework and strategies.
- Maintenance of accounting and financial analysis system for effective utilization of Foreign Aid and Accounting of Public Debt.

- Review of economic development policies.
- Strategies and programmes, Appraisal of project proposals submitted by line agencies.
- Provision of technical inputs to the preparation of the Capital Budget.
- Preparation and updating of the Project Pipe Line.
- Preparation of observations on Cabinet Memoranda.
- Implementation of special tasks assigned to the Department.

(Source: Official website of Department of National Planning)

2.4 Construction procurement

There are several procurement methods available for construction works. A client should select the most appropriate method evaluating the nature of the project, risk and the resources available. Some of the available procurement methods are;

- Traditional procurement system (Design Bid and Build)
- Design-build
- Construction management
- Management contract
- Turnkey
- Negotiated
- Cost-plus

2.4.1 Construction procurement methods commonly used in Sri Lanka

ICTAD (Now called CIDA) contracts are widely being used for domestic contracts while widely used form of International Contracts is referred to as FIDIC contracts. There are certain forms of contracts included within Standard Bidding Documents published by international funding agencies such as World Bank and Asian Development Bank (ADB), which are currently used for foreign funded projects. However, upon the enactment of the Construction Industry Development Act, No. 33 of 2014, it is mandatory to use ICTAD documents for any contract awarded in Sri Lanka, except for contracts between GOSL owned entities and foreign contractors.

The projects funded by the GOSL are executed only through traditional procurement system (Design Bid and Build), and Design and Build system to minimize the clients' responsibility.

- Construction Contracts (Design Bid & Build) - Traditional Method**

Construction contracts require a Contractor to execute works which are designed by the Employer or a Consultant appointed by him. It is also possible to allocate a Contractor to carry out a limited design scope under construction contracts. Payments in construction contracts are usually based on measure and pay where the Engineer certifies payments for works completed, after taking measurements. It is however, possible to include certain items of works within a construction contract, for which payments can be made on a lump sum basis: Standard forms available are ICTAD SBD/1 for medium scale works, SBD/2 for major scale works and SBD/3 for minor scale works (GPMCM, 2017).

Figure 2.1 illustrates relationships among parties for Traditional procurement while Figure 2.2 illustrates each party responsibilities of activities in this procurement method.

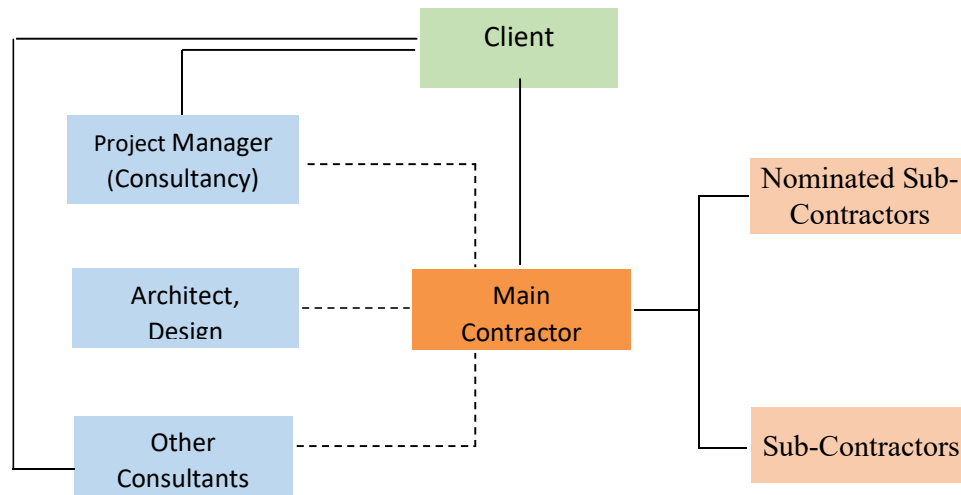


Figure 2.1: Relationships among parties for Traditional procurement (Source: Ashworth and Hogg, 2002)

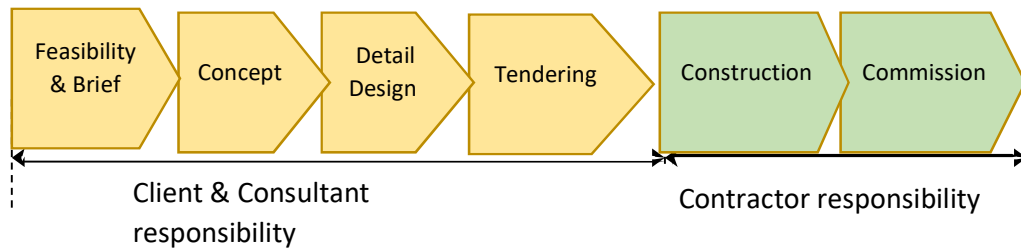


Figure 2.2: Responsibility of activities for Traditional method

(Adapted from Rashid et al., 2006)

- **Design and Build Contracts**

Design and Build contracts require the contractor to design and build the works. However, it is possible to include in the contract certain items of works which are not designed by the contractor but by the employer or a consultant appointed by him. Payments for work in Design and Build contracts is usually in lump sums although payment for certain items of works can be made on a measure and pay basis. Standard forms available are: ICTAD SBD/4 (GPMCM, 2017).

Figure 2.3 illustrates relationships among parties for Design and Build procurement while Figure 2.4 illustrates the responsibilities of each party for activities in the same procurement method.

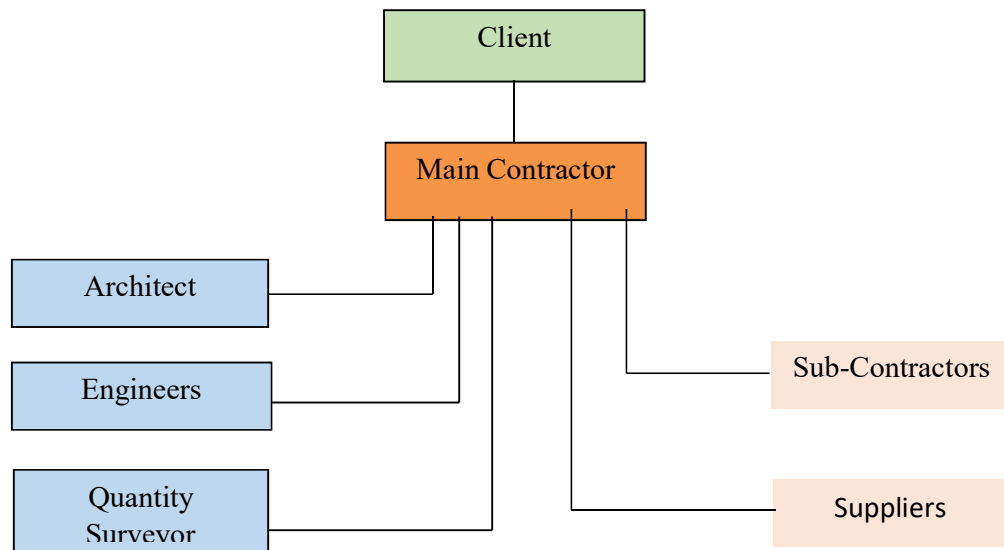


Figure 2-3: Relationships of parties for Design and Build procurement

(Source: Ashworth and Hogg, 2002)

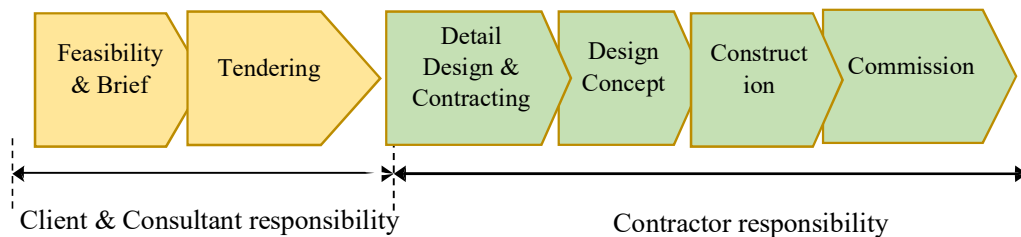


Figure 2.4: Responsibility of activities for Design and Build method

(Source: Rashid et al., 2006)

2.4.2 Guidelines available for Client for implementation public projects

GOSL has introduced few guidelines for public clients in order to perform in their projects. Public officers who are engaged in project management and implementation need to adhere following codes and guidelines (GPMCM, 2017).

1. Client Guide-General, ICTAD publication No. ICTAD/CONSULT/02
2. Client Guide-Selection of Consultants, IACTAD publication No. ICTAD/CONSULT/03

3. Guidelines for Submitting Development Project Proposals for Public Investment: Circular No. MNPEA-2019
4. Guide to Project Management & Contract Management” published Ministry of Finance -2017
5. National Procurement Guidelines
6. Financial Regulations
7. Establishment Code
8. Bribery Act

2.4.3 Key areas for client consideration and decisions

As per the guideline “Client guide ICTAD/CONSULT/02” following factors are essential to be considered in implementing new construction projects.

- **Assessing the need for the construction project**

The need for a project should be established through client’s initial involvement, and commitment to the complete project development process. The client should explore all the options and alternative possibilities, and test and assess the feasibility which otherwise could lead to confusion and difficulties as the project develops. Therefore, the project feasibility, outlining the justification for the project should be prepared before a decision is taken to proceed.

- **Selection of site**

This is one of the major changes for a client. It is advisable to obtain assistance of consultants at this point. Suitability for the project, climate, topography, geology, soil conditions and environmental, sociological and economic aspects should be carefully evaluated when a site is selected.

- **Selection of consultants**

Guideline “ICTAD/CONSULT/01” dictates that a public sector client should appoint consultants. However, as the public sector clients are usually

unfamiliar with the appropriate method to be used in the selection of consultants, especially with regards to their professional discipline.. Guideline “ICTAD/CONSULT/04” published by CIDA provides the scope of consultancy services and adequate information in this regard.

- **Client’s brief**

A Client’s brief contains description of the client, general statement of, activities, schedule of spaces, flexibility/ expansion, services, quality, aesthetic factors, time limits, priorities (Economic/ Functional/ Aesthetic). The brief should specify the basis for the functional performance of the project and shall therefore be formulated with care and detail.

The final brief should be prepared in consultation with the consultant. The client should be able to explain the consultant the details of the project since a statement of objectives, list of priorities and constraints, preliminary budget, details of completion dates and indication of user requirements are the content of a brief. A realistic budget for the project including operational and maintenance costs are also needed to be calculated.

2.5 Construction Project Phases

2.5.1 Pre-Construction Phase (Design Phase)

- **Initial project brief and feasibility**

Every project is created with initial client brief and it contains the requirements of the client. The initial cost estimate is prepared based on this requirement such as function of the building, floor area or number of people who will be facilitated and facilities that are expected to be provided for end user etc. Therefore, clients should pay careful attention to the initial brief before the preparation of budget.

In order to ensure a successful selection of building procurement system the client's brief must be clear and comprehensive and contain not only the

aesthetic and technical criteria for the project, but of equal importance, the primary and secondary objectives in terms of functionality/quality, time and cost (NEDO., 1975). It has been recognized that these three objectives are inter-related and conflicting and that it is impractical to try and achieve all three. One or two will need to be sacrificed to some extent and individual clients need to weigh each of the criteria to suit their own organization's particular circumstances and the project's technical, commercial and other characteristics (Walker, 1989).

Once the dimensions of the three basic objectives have been determined and a compromise has been reached between them, there is a need to identify and take into account the secondary objectives. This group of objectives can, particularly in combination, have considerable influence on the selection of the most appropriate procurement system (Perry, 1985). The client's primary and secondary objectives can only be identified and determined by firstly establishing the client's needs relative to the characteristics of the project.

Client's activities in pre-construction phase are:

- Developing project brief
- Selecting consultant/professional team
- Providing the consultants with all the necessary information required for the project
- Construction planning
- Establishing the descriptions of the roles and responsibilities of the contractor and consultants
- Estimation and agreement of the project duration
- Estimation and approval of the project cost
- Preparation of schematic/preliminary designs
- Design development
- Preparation of construction drawings
- Review of drawings and specifications

- Monitor and guarantee design quality
- Selection of procurement strategy e.g. Traditional (Engineer led), Design and Build, etc.
- Documentation for both principal and sub-contract procurement
- Tendering (calling of tenders)
- Tender adjudication including clarification meetings
- Negotiation of tender prices
- Contractor appointment
- Appropriate changes on relevant document to form contract
- Preparation and application of health and safety requirements
- Studying the impact of the project on health and safety
- Preparation and application of environmental requirements Studying the impact of the project on the environment

(GPMCM, 2017)

2.5.2 Construction Phase

During the construction phase of the project, client involvement on projects generally declines as much of the responsibilities are transferred to consultants and the contractor (APUC, 2012). In contrast, a study conducted by Bubshaite and Al-musaid, 1992 cited in Alsolaiman, 2014, found that Client is mostly involved in construction phase of a project. The study went on to highlight the importance of defining all tasks during the construction project phases as clearer defined tasks contributed to the optimum level of client involvement.

Key activities of a client in construction phase:

- Management and inspection of the site
- Attending site handover meetings
- Attending progress meetings
- Attending technical meetings
- Interpretation and clarification of ambiguities in the contract documents and drawings.

- Giving input into the project program
- Making decisions quicker about design changes or variations
- Selection of materials
- Making payments to contractors for work done
- Monitoring health and safety principles during project Implementation
- Monitoring environmental management principles during project implementation
- Conducting quality checks
- Dispute resolution
- Sub-contractor appointments

(GPMCM, 2017)

Three important activities of the above list are further discussed below.

a) Attending to site meetings

The client will be responsible for regularly attending to site meetings. Adequate client involvement in attending site meetings will enable clients to promptly resolve any claims, monitor the work schedule and minimizing the occurrence of disputes and enhancing project success. Additionally, clients will tend to make prompt and necessary decisions while on site and this facilitates successful project delivery (Alsolaiman, 2014).

b) Making payments to contractor

One of the client's major roles in a construction project is making payments of the value of all work executed. In a study conducted by Aiyetan (2010), clients tend to delay such payments and the lack of prompt payment to contractors has negative consequences on the project, such as time and cost overruns. Late payments to contractors by clients may impede project success as such late payments may cripple the contractor's cash-flow.

c) Manage variation orders

Variation orders due to design changes are frequent in the construction phase and these modifications impacts the project budget (NOAA, 2010). To avoid time and cost overruns, decisions should be made quickly about design changes and variations (Aiyetan 2010). Aiyetan et al. (2013) argue that the clients' ability to contribute variation order ideas during construction can impact either positively or negatively on the construction project.

2.5.3 Post construction phases (Maintenance period)

• Taking over the project

The post-construction phase is a very important stage of the construction project cycle. This is the practical completion of all the construction including handover. Further, the client issues certification acknowledging completion of the works.

During the post construction stage client should ensure that all commissioning certificates, operating instructions and maintenance instructions are obtained (Australian Government, 2012). Documentation such as as-built drawings; operation manuals and maintenance of the facility and warranties and guarantees of the systems installed should be collected by the client.

Key activities during the post-contract phase are:

- Establishment of criteria for acceptance of completed project
- Contribute to compiling snagging or defects list
- Input into development of maintenance plan
- Final account settlement
- Monitoring the process of testing and commissioning of all
- systems, plant and equipment in the project
- Issuing of certification acknowledging completion of the works
- Input into project review and close out report
- Release of guarantees and securities
- Release of retentions where applicable

- Record the warranties and certificates information. (GPMCM, 2017)

2.6 Project Success

Each industry, project team or individual has its own definition of success.. Definitions of project success are dependent on project type, size and sophistication, project participants and experience of owners, etc.

Pariff and Sanvido (1993) consider success as an intangible perceptive feeling, which varies with different management expectations, among persons, and with the phases of project. Owners, designers, consultants, contractors, as well as sub-contractors have their own project objectives and criteria for measuring success. For example, architects often consider aesthetics over building cost as the main criterion for success. However, client may value other dimensions more such as cost, function ability, easy maintenance etc.

The Wood Report, (N.E.D.O., 1975), revealed a consistent demand by clients to meet the cost, time, quality, functionality and aesthetic criteria in order for a project to be considered to be successful. Further, Alarcon and Ashley (1996) defined effectiveness as a measure of how well the project was implemented or the degree to which targets of time and cost were met from the start-up phase to full production..

2.6.1 Critical Success Factors of a Project

Saeed, Reza, Hamed and Shankar (2017) has conducted a study on critical success factors (CSFs) for integration of sustainability into construction project management practices in developing countries. Their findings reveal that role of clients, knowledge management, high quality workmanship, strategic direction and health and safety protocols, project managers' knowledge, skills and abilities and tighter control over construction activities are the most influential CSFs. Figure 2.5 illustrates a framework by Atkinson (1999) to measure project success and Figure 2.6 illustrates a model proposed by Atkinson (1999) to measure project success.

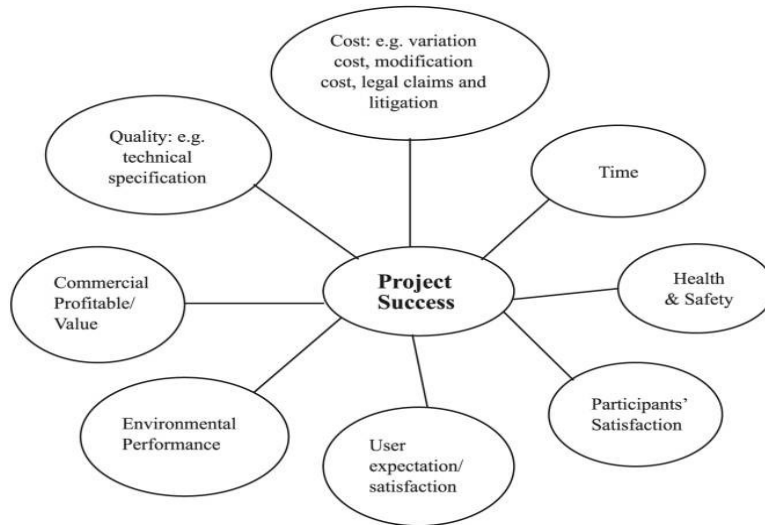
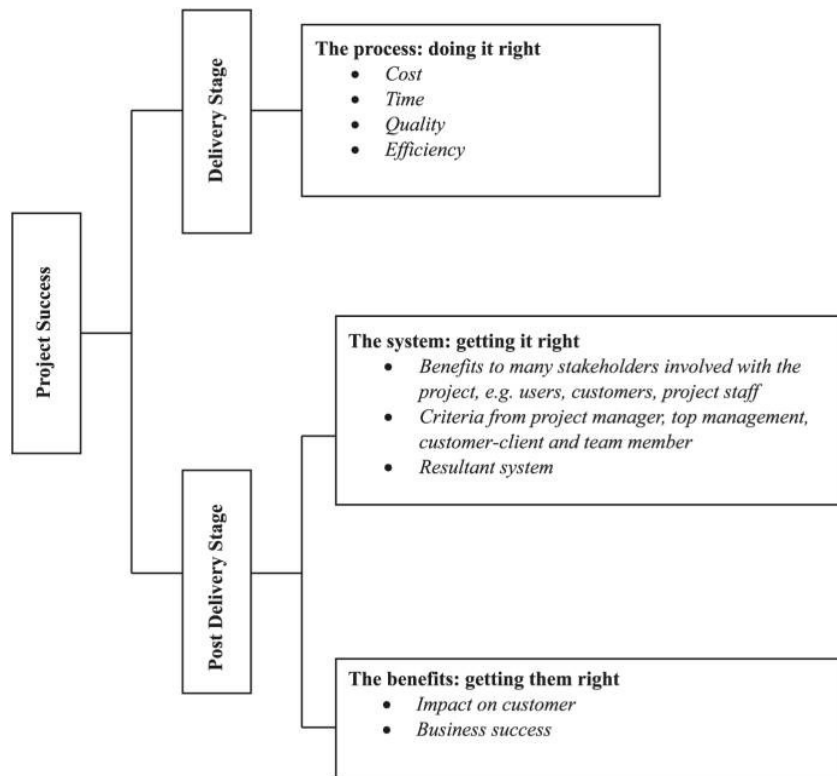


Figure 2.5: Consolidated framework for measuring project success
 (Source: Atkinson 1999)



Source: Atkinson (1999)

Figure 2.6: Atkinson’s model of measuring project success

- **Time**

Time refers to the duration for completing the project. It is scheduled to enable the building to be used by a date determined by the client's future plans (Hatush and Skitmore, 1997). Construction time is the absolute time that is calculated as the number of days/weeks from start on site to practical completion of the project.

- **Cost**

Cost is another important measure. Cost is defined as the degree to which the general conditions promote the completion of a project within the estimated budget (Bubashait and Almohawis, 1994). Cost is not only confined to the tender sum, it is the overall cost that a project incurs from inception to completion, which includes any costs arise from variations, modification during construction period and the cost arising from the legal claims, such as litigation and arbitration. Cost can be measured in terms of unit cost, percentage of net variation over final cost.

- **Quality**

Quality is another key criterion of a project that is repeatedly cited by researchers. In the construction industry, quality is defined as the totality of features required by a product or services to satisfy a given need; fitness for purpose (Parfitt and Sanvido, 1993). Quality is the guarantee of the products that convinces the customers or the end-users to purchase or use. The meeting of specification is proposed by Songer et al. (1996) and Wateridge (1995) as one way to measure quality. They defined specification as workmanship guidelines provided to contractors by clients or clients' representatives at the commencement of project execution.

- **Functionality**

Kometa et al. (1995) opine that there would be no point in undertaking a project if it does not fulfil its intended function at the end of the day. The importance of functionality is highlighted. This indicator correlates with expectations of project participant and can best be measured by the degree of conformance to all technical

performance specifications (Chan et al., 2002). Quality, technical performance, and functionality are closely related and are considered important to the owner, designer, and contractor.

- **User expectation and satisfaction**

Users are those who actually work or live in the final products. They are the ones who spend most of time in the constructed facilities. It is essential that the completed projects meet the users' expectation and satisfaction. Liu and Walker (1998) consider satisfaction as an attribute of success. Torbica and Stroh (2001) believe that if end-users are satisfied, the project can be considered being successfully completed in the long run.

- **Participants' Satisfaction**

Participants' satisfaction has been proposed as an important measure in the last decade (Cheung et al., 2000; Parfitt and Sanvido, 1993; Sanvido et al., 1992). Key participants in a typical construction project include: client, design team leader and construction team leader.

- **Health and Safety**

Health and safety are defined as the degrees to which the general conditions promote the completion of a project without major accidents or injuries (Bubshait and Almohawis, 1994). The issue of safety has been raised for a long time (Kometa et al., 1995; Parfitt and Sanvido, 1993; Sanvido et al., 1992) and cannot be overlooked. The measurement of safety is mainly focused on the construction period as most accidents occur during this stage.

- **Environmental Performance**

Construction industry has been regarded as a major contributor to environmental impacts. Construction projects affect the environment in numerous ways across their life cycle (Shen et al., 2000). Health & Safety and environment performance are directly relying on contractor but clients can emphasize consultant and contractor

regarding those concerns through an agreement with them. Government of Sri Lanka has now introduced green building concept for public building in order to encourage the sustainable construction.

2.7 Barriers in Construction Projects

A number of previous research studies have identified barriers in construction projects which results in time, cost overruns and other issues.

- a) Dolage and Perera (2009) described causes for delays in the pre-construction phase of state sector building projects. The ten most important causes of delays are due to non-adhering to the following activities:
- 1) Inclusion of detailed programme for design process
 - 2) Client studying the project brief
 - 3) Client's endorsement of architectural drawings prior to structural design phase
 - 4) Assessment of constraints in the client's brief
 - 5) Submission of alternative conceptual proposals
 - 6) Description of scope of work of consultants
 - 7) Indication of estimated cost in the final brief
 - 8) Submission of most suitable conceptual proposal
 - 9) Assessment of availability of services
 - 10) Concurrent preparation of structural and service drawings

These factors which affect the design process lead to significant delays in the design process. Further they propose that on receiving the endorsement of the client for the project brief, the consultant should submit alternate proposals through a pre-feasibility study. Detailed feasibility studies should consider site investigation, statutory requirements and views of the other specialist consultants and entails submission of a report containing the evaluation of alternative

proposals and recommendation of the most suitable proposal (Dolage and Perera, 2009).

- b) Odech and Batterainnch, (2002) found following causes for delays in traditional type contracts in Jordan.
 - 1) Finance and payment for completed works
 - 2) Owners interference
 - 3) Slow decision making by owner
 - 4) Unrealistic imposed contract duration

- c) Causes in project delays in large constrain projects in Saudi Arabia-Assaf and Al Hejji, 2006) ranked in top place that owner related factors. Further they identified that average time overrun between 10%-30% of its original contract period.

- d) In Nigeria, Frimpong et al. (2003) had identified 26 factors for project delays and ranked. Client related delay factors in this study are as follows:
 - 1) Monthly payment difficulties
 - 2) Poor contract management
 - 3) Planning and scheduling deficiencies
 - 4) Deficiencies in cost estimates
 - 5) Inadequate control procedures
 - 6) Delaying work approval
 - 7) Waiting for information
 - 8) Cash flow during construction
 - 9) Slow decision making

- e) Finding in Nigeria (Frimpong et al, 2003) are in line with that of Malaysian study (Sambasivan & Soon, 2006). According to both studies, financial problem is identified as the main cause for the project delays.

- f) Jawardana and Panditha (2003) identified 45 factors for project delays in construction industry of Sri Lanka. According to them, the 2nd major delaying

factor identified is design changes by the owners and consultants.

- g) Dolage and Rathnamali (2002) in their case study research found that delay in progress payment by clients and delay in approving extra work are the two major client generated delay factors which causes time overrun in construction phase of building projects at the Department of Engineering Services of Sabaragamuwa Provincial Council..
- h) A long-term study of a number of public works projects, which was conducted in the state of Nevada in the United States, showed the negative and costly impacts of time delays. The study investigated several design-bid-build state construction projects between the years of 1991 to 2008 and concluded that large size and long-duration projects had significantly higher cost and schedule overruns than smaller size and short-duration ones. The main factors for time delays and cost overruns are: 1) Scope definition, 2) Coordination of roles and responsibilities among involved parties, 3) Initial estimation and contingency planning, and 4) Monitoring and control systems (Shrestha, Burns and Shields, 2013).
- i) Most construction projects in developing countries are characterized by time delays (Sweis, 2013).
- j) The projects with extensive delays may end up losing their economic justification, which in turn may result in the termination of the project (Alavifar and Motamedi, 2014).
- k) Mahamid, (2011) identified the following complications due to delay increase in governmental projects: 1) Confusion regarding public development plans, 2) Disturbance of the budget execution plan, and 3) Public inconvenience resulting from project delays.
- l) The following major causes of construction delivery delays were reported by Alavifar and Motamedi (2014): 1) Insufficient data collection and survey before

design, 2) Higher than expected increase in costs due to inflation, and 3) Repair/reconstruction work due to errors during construction.

- m) The majority of cost overruns are encountered in lump sum contracts, fewer occur in unit-price contracts and even less in reimbursement contracts (Papadopoulou and Park, 2012). They reported the following causes of cost overruns: 1) Awarding contracts to the lowest bidder; 2) Site conditions; 3) Incompetent subcontractors and poor site management; and 4) Inaccurate estimates and Client-led change orders.

- n) Kasimu (2012) identified five major cause of cost overruns: 1) Market conditions, 2) Personal experience in the contract work, 3) Insufficient estimated time for construction items, 4) Material fluctuation and 5) Political situation.

- o) Chigangacha and Haupt (2017) researched on effectiveness of client involvement in construction projects and suggest 9 aspects of client role and involvement, 5 aspects of contractor perceptions, 7 aspects on procurement and 3 aspects on project stakeholder relation (Table 2.2).

Table 2.2: Statements on client involvement
(Source: Chigangacha and Haupt, 2017)

	Statement
A	Client roles and involvement
1	The lack of client understanding of the construction process contributes to unsuccessful project delivery.
2	Appropriate client involvement is beneficial to the project.
3	The lack of adequate client involvement in their projects leads to numerous problems encountered across the project lifecycle such as disputes, time and cost overruns, etc.
4	Dealing with experienced clients is better than dealing with those that are inexperienced.

5	The success of a project is linked to the extent of client involvement and client control in their projects.
6	Client interference is a hindrance to project success.
7	Expert and experienced clients play a more active role in their projects.
8	Clients experience more satisfaction and product quality when involved in their projects.
9	Construction clients understand their roles and responsibilities and adequately perform them.
B	Contractor perceptions
1	Delays in payments by clients contributes to negative project consequences.
2	Pre-qualification of contractors is essential to ensure project success.
3	Contractors strive to fulfill client satisfaction.
4	Client satisfaction is essential to securing client loyalty and retention.
5	Clients tend to delay payments due to the contractors.
C	Procurement
1	Clients tend to choose the procurement method which they are familiar with, which might not necessarily be the best.
2	It is fundamentally important for clients to obtain appropriate advice on the choice of procurement method.
3	Clients must retain authority to exercise maximum control of the procurement process.
4	The selection of an inappropriate procurement method can have a major impact on project success.
5	Clients should have the right to choose the procurement method they wish.
6	Clients' understanding of the procurement process influences the level of their involvement on construction projects.
7	Clients are adequately involved during the procurement stage.
D	Project stakeholder relations
1	Adequate client knowledge of construction projects influences teamwork and collaboration.

2	Trust, honesty and cooperation by clients is vital for successful project delivery.
3	Greater involvement of clients in their projects will change the current adversarial construction environment.

2.7 Summary

Literature review was carried out to study client role in construction projects, formulation of projects, methods of procurement, and guidelines available influencing factors to construction projects as well as success factors of a project.

There are 15 client related barriers identified and to be tested in this study. Those barriers are:

- 1) Feasibility issues such as identification of the project and its location etc.,
- 2) Lack of general understanding of client about the construction cost, quality and time
- 3) Lack of Client's ability to give complete initial brief & review client's requirements in designs drawings
- 4) Client's commitment to the needs of other stakeholders
- 5) Delays due to decision making issues at client
- 6) Political interest/support to the project
- 7) Bureaucracy in client's organization
- 8) Variations of scope by client
- 9) Delay in approving extra works and variations
- 10) Delay in contractor's progress payment
- 11) Lack of Client's commitment for monitoring & evaluation of the project
- 12) Lack of client's awareness of role of each party (client/consultant) and project management activities
- 13) Lack of Client's resources for monitoring the project such as supporting Staff & facilities
- 14) Less Client's involvement for project activities due to busy with work load

15) Delays of other connected separate contracts directly handled by client such as mechanical installations, water supply to the premises and sewer treatment plant

Client involvement and responsibility change according the procurement method applied for the project. Main procurement methods used by public projects in Sri Lanka are: 1) Traditional system, 2) Design and Build by the decision of cabinet, 3) Design and Build by national competitive bidding.

Cost of the project is also directly related with construction period. Construction period may depend on the project requirement. However, client's cash flow issues may be arisen with the absences of better coordination with funding agent in large construction projects with shorter period.

Nature of the project is also a considerable factor which decide the client's involvement.

The 15 client related barriers to be further tested with the above three factors in order to check the associations with each other.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter presents a comprehensive summary of the previous researches relevant to this research topic.

The construction industry is a fast growing sector in Sri Lanka, similar to many other developing countries. Government of Sri Lanka (GOSL) annually allocates more than 40 % of state funds for infrastructure development (Central Bank of Sri Lanka, 2017). Accordingly, the government becomes a major client of the construction industry. Therefore, the various departments and agencies of the government, who are identified as public sector clients, are responsible to utilize the public money reasonably through their construction projects.

2.2 Clients of a Project

Clients are the most important construction industry stakeholders since they initiate the construction process (Lopes et al., 2011). A client is a person who takes the initiative to have a project designed and constructed, and in turn pays for the construction (Van Rijn, 2005; Bennett, 2003). Aiyetan (2010) defined a client as the project initiator who is responsible for the production of the project. A client is an organization or individual who commissions the services necessary to execute and complete a project in order to satisfy its needs and thereafter enters into contracts with other parties (Masterman, 2002).

2.2.1 Client Categories

Basically, clients can be categorized as public and private. A survey done by Newman et al. (1981) identified 18 client types, such as private commercial,

industrial, developers, leisure, education, hospitals etc. This clarification of the client type is helpful for professionals in the industry in order to take appropriate course of actions during their project phases (Tzortzopoulos et al., 2008, Alsolaiman, 2014).

2.2.2 Public Sector Clients

Public sector becomes a client when a construction is undertaken using public money either from local or state sources (Gould & Joyce, 2014). In Sri Lanka, clients are operated at different authorization levels such as national, provincial, divisional and Pradeshiya Sabhas. Boyd and Chinyio (2006) divided public sector into national and local.. The public sector construction process follows specific procedures and rigorous administrative and financial controls in an effort to eliminate the occurrence of fraud and corruption, and all procedures are subject to government audits.

Certain mechanisms are established for construction projects by the GOSL through the Treasury, the Central Bank, the Department of Public Enterprises, and the Project Monitoring Unit under the Ministry of Finance. Further, GOSL set out Construction Industry Development Authority (CIDA) (previously called Institute for Construction Training and Development- ICTAD) to enforce the procedures for ensuring that all public entities adhere to the standards and uniformity in construction procurement.

2.3 Government Funded Construction Project in Sri Lanka

In Sri Lanka, government funded public projects are initiated in few ways. Most projects are created as expansions of existing facilities within the same premises, such as hospital buildings, school buildings, university buildings etc., while some projects are initiated as new developments i.e. new services or expansions of existing services in new areas. Another project type is relocation or shifting of existing structures aiming better services for the public. Among these projects, a crucial type is the new constructions in the same place by demolishing existing functional structures. Planning

is very critical for these projects since the public and the staff will face severe grievances during the construction period.

2.3.1 Classification of Projects

Projects can be classified into Mega, Large, Medium, Small and Micro projects based on the Total Estimated Cost (TEC) of the project as follows.

Table 2.1: Classification of Projects

Type of Project	TEC (Rs. Mn)
Mega	More than 10,000
Large	1,000 - 10,000
Medium	100 - 1,000
Small	10 - 100
Micro	Less than 10

2.3.2 Formulation of GOSL Project

Government micro projects can be implemented with the approval of the Secretary of the relevant Line Ministry without obtaining the approval of the Department of National Planning (NPD), while Mega, Large, Medium and Small projects should follow the procedures laid down in “Guidelines for Submitting Development Project Proposals for Public Investment: Circular No. MNPEA-2019”. Both NPD and Department of National Budget (NBD) are involved in the approval process.

Once a public sector entity prepared, a project proposal, it will be evaluated by the Department of National Planning. Following are the responsibilities of the NPD.

- Preparation of Long Term / Medium Term Development Plans and the Investment Programme
- Development of the macroeconomic framework and strategies.
- Maintenance of accounting and financial analysis system for effective utilization of Foreign Aid and Accounting of Public Debt.

- Review of economic development policies.
- Strategies and programmes, Appraisal of project proposals submitted by line agencies.
- Provision of technical inputs to the preparation of the Capital Budget.
- Preparation and updating of the Project Pipe Line.
- Preparation of observations on Cabinet Memoranda.
- Implementation of special tasks assigned to the Department.

(Source: Official website of Department of National Planning)

2.4 Construction procurement

There are several procurement methods available for construction works. A client should select the most appropriate method evaluating the nature of the project, risk and the resources available. Some of the available procurement methods are;

- Traditional procurement system (Design Bid and Build)
- Design-build
- Construction management
- Management contract
- Turnkey
- Negotiated
- Cost-plus

2.4.1 Construction procurement methods commonly used in Sri Lanka

ICTAD (Now called CIDA) contracts are widely being used for domestic contracts while widely used form of International Contracts is referred to as FIDIC contracts. There are certain forms of contracts included within Standard Bidding Documents published by international funding agencies such as World Bank and Asian Development Bank (ADB), which are currently used for foreign funded projects. However, upon the enactment of the Construction Industry Development Act, No. 33 of 2014, it is mandatory to use ICTAD documents for any contract awarded in Sri Lanka, except for contracts between GOSL owned entities and foreign contractors.

The projects funded by the GOSL are executed only through traditional procurement system (Design Bid and Build), and Design and Build system to minimize the clients' responsibility.

- **Construction Contracts (Design Bid & Build) - Traditional Method**

Construction contracts require a Contractor to execute works which are designed by the Employer or a Consultant appointed by him. It is also possible to allocate a Contractor to carry out a limited design scope under construction contracts. Payments in construction contracts are usually based on measure and pay where the Engineer certifies payments for works completed, after taking measurements. It is however, possible to include certain items of works within a construction contract, for which payments can be made on a lump sum basis: Standard forms available are ICTAD SBD/1 for medium scale works, SBD/2 for major scale works and SBD/3 for minor scale works (GPMCM, 2017).

Figure 2.1 illustrates relationships among parties for Traditional procurement while Figure 2.2 illustrates each party responsibilities of activities in this procurement method.

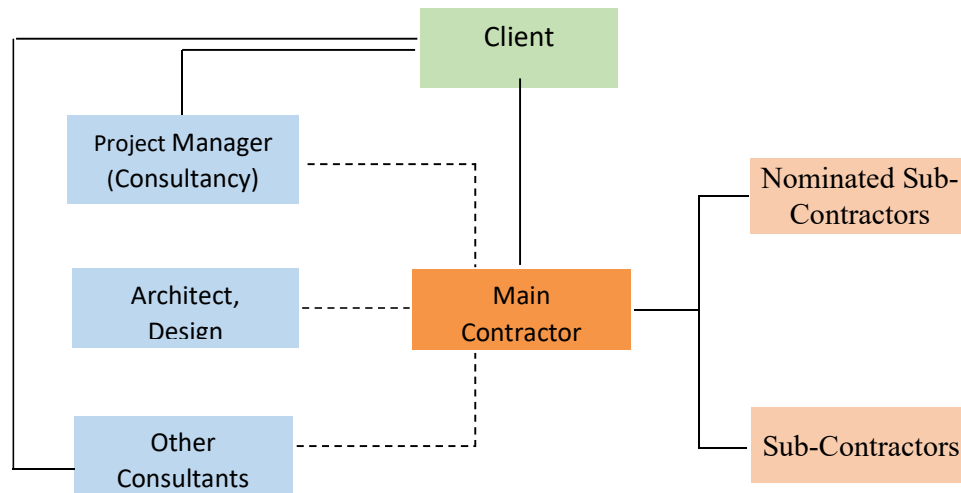


Figure 2.1: Relationships among parties for Traditional procurement (Source: Ashworth and Hogg, 2002)

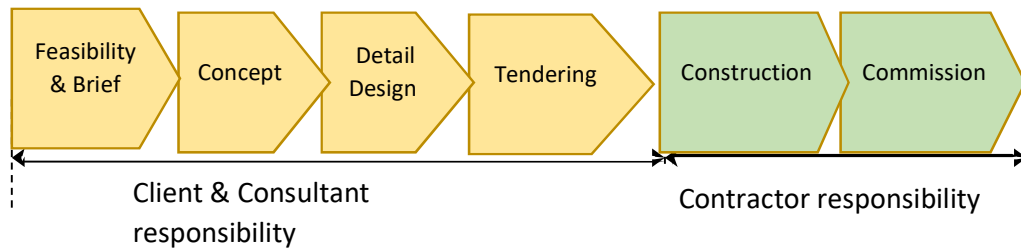


Figure 2.2: Responsibility of activities for Traditional method

(Adapted from Rashid et al., 2006)

- **Design and Build Contracts**

Design and Build contracts require the contractor to design and build the works. However, it is possible to include in the contract certain items of works which are not designed by the contractor but by the employer or a consultant appointed by him. Payments for work in Design and Build contracts is usually in lump sums although payment for certain items of works can be made on a measure and pay basis. Standard forms available are: ICTAD SBD/4 (GPMCM, 2017).

Figure 2.3 illustrates relationships among parties for Design and Build procurement while Figure 2.4 illustrates the responsibilities of each party for activities in the same procurement method.

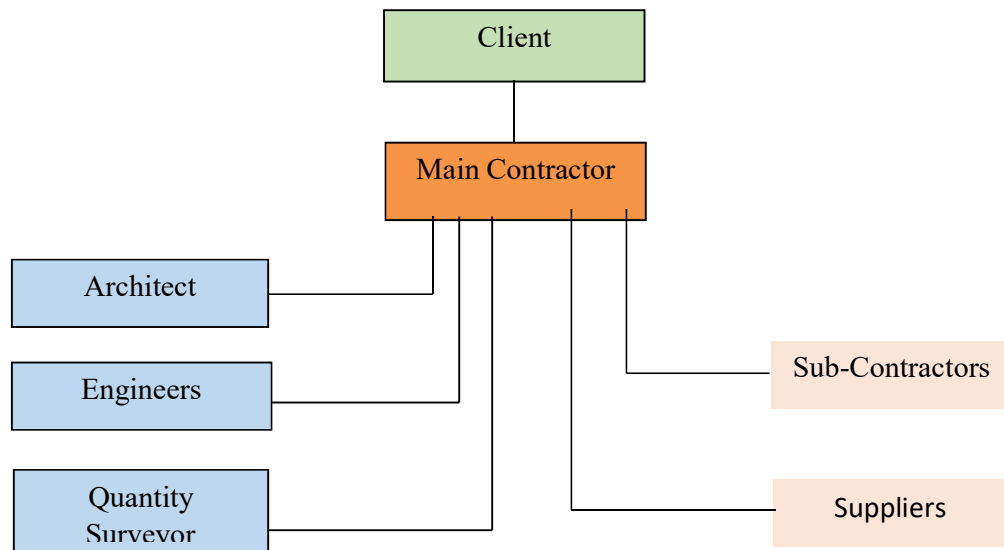


Figure 2-3: Relationships of parties for Design and Build procurement

(Source: Ashworth and Hogg, 2002)

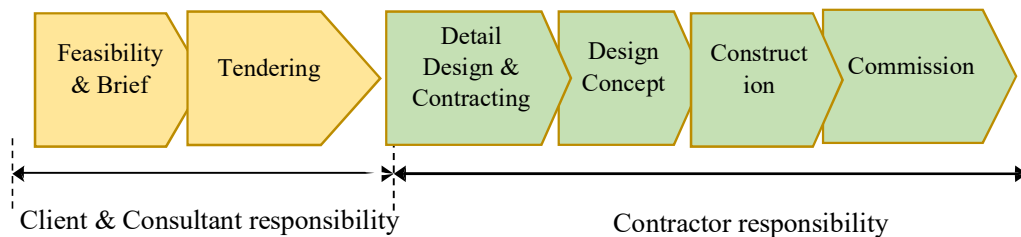


Figure 2.4: Responsibility of activities for Design and Build method

(Source: Rashid et al., 2006)

2.4.2 Guidelines available for Client for implementation public projects

GOSL has introduced few guidelines for public clients in order to perform in their projects. Public officers who are engaged in project management and implementation need to adhere following codes and guidelines (GPMCM, 2017).

1. Client Guide-General, ICTAD publication No. ICTAD/CONSULT/02
2. Client Guide-Selection of Consultants, IACTAD publication No. ICTAD/CONSULT/03

3. Guidelines for Submitting Development Project Proposals for Public Investment: Circular No. MNPEA-2019
4. Guide to Project Management & Contract Management” published Ministry of Finance -2017
5. National Procurement Guidelines
6. Financial Regulations
7. Establishment Code
8. Bribery Act

2.4.3 Key areas for client consideration and decisions

As per the guideline “Client guide ICTAD/CONSULT/02” following factors are essential to be considered in implementing new construction projects.

- **Assessing the need for the construction project**

The need for a project should be established through client’s initial involvement, and commitment to the complete project development process. The client should explore all the options and alternative possibilities, and test and assess the feasibility which otherwise could lead to confusion and difficulties as the project develops. Therefore, the project feasibility, outlining the justification for the project should be prepared before a decision is taken to proceed.

- **Selection of site**

This is one of the major changes for a client. It is advisable to obtain assistance of consultants at this point. Suitability for the project, climate, topography, geology, soil conditions and environmental, sociological and economic aspects should be carefully evaluated when a site is selected.

- **Selection of consultants**

Guideline “ICTAD/CONSULT/01” dictates that a public sector client should appoint consultants. However, as the public sector clients are usually

unfamiliar with the appropriate method to be used in the selection of consultants, especially with regards to their professional discipline.. Guideline “ICTAD/CONSULT/04” published by CIDA provides the scope of consultancy services and adequate information in this regard.

- **Client’s brief**

A Client’s brief contains description of the client, general statement of, activities, schedule of spaces, flexibility/ expansion, services, quality, aesthetic factors, time limits, priorities (Economic/ Functional/ Aesthetic). The brief should specify the basis for the functional performance of the project and shall therefore be formulated with care and detail.

The final brief should be prepared in consultation with the consultant. The client should be able to explain the consultant the details of the project since a statement of objectives, list of priorities and constraints, preliminary budget, details of completion dates and indication of user requirements are the content of a brief. A realistic budget for the project including operational and maintenance costs are also needed to be calculated.

2.5 Construction Project Phases

2.5.1 Pre-Construction Phase (Design Phase)

- **Initial project brief and feasibility**

Every project is created with initial client brief and it contains the requirements of the client. The initial cost estimate is prepared based on this requirement such as function of the building, floor area or number of people who will be facilitated and facilities that are expected to be provided for end user etc. Therefore, clients should pay careful attention to the initial brief before the preparation of budget.

In order to ensure a successful selection of building procurement system the client's brief must be clear and comprehensive and contain not only the

aesthetic and technical criteria for the project, but of equal importance, the primary and secondary objectives in terms of functionality/quality, time and cost (NEDO., 1975). It has been recognized that these three objectives are inter-related and conflicting and that it is impractical to try and achieve all three. One or two will need to be sacrificed to some extent and individual clients need to weigh each of the criteria to suit their own organization's particular circumstances and the project's technical, commercial and other characteristics (Walker, 1989).

Once the dimensions of the three basic objectives have been determined and a compromise has been reached between them, there is a need to identify and take into account the secondary objectives. This group of objectives can, particularly in combination, have considerable influence on the selection of the most appropriate procurement system (Perry, 1985). The client's primary and secondary objectives can only be identified and determined by firstly establishing the client's needs relative to the characteristics of the project.

Client's activities in pre-construction phase are:

- Developing project brief
- Selecting consultant/professional team
- Providing the consultants with all the necessary information required for the project
- Construction planning
- Establishing the descriptions of the roles and responsibilities of the contractor and consultants
- Estimation and agreement of the project duration
- Estimation and approval of the project cost
- Preparation of schematic/preliminary designs
- Design development
- Preparation of construction drawings
- Review of drawings and specifications

- Monitor and guarantee design quality
- Selection of procurement strategy e.g. Traditional (Engineer led), Design and Build, etc.
- Documentation for both principal and sub-contract procurement
- Tendering (calling of tenders)
- Tender adjudication including clarification meetings
- Negotiation of tender prices
- Contractor appointment
- Appropriate changes on relevant document to form contract
- Preparation and application of health and safety requirements
- Studying the impact of the project on health and safety
- Preparation and application of environmental requirements Studying the impact of the project on the environment

(GPMCM, 2017)

2.5.2 Construction Phase

During the construction phase of the project, client involvement on projects generally declines as much of the responsibilities are transferred to consultants and the contractor (APUC, 2012). In contrast, a study conducted by Bubshaite and Al-musaid, 1992 cited in Alsolaiman, 2014, found that Client is mostly involved in construction phase of a project. The study went on to highlight the importance of defining all tasks during the construction project phases as clearer defined tasks contributed to the optimum level of client involvement.

Key activities of a client in construction phase:

- Management and inspection of the site
- Attending site handover meetings
- Attending progress meetings
- Attending technical meetings
- Interpretation and clarification of ambiguities in the contract documents and drawings.

- Giving input into the project program
- Making decisions quicker about design changes or variations
- Selection of materials
- Making payments to contractors for work done
- Monitoring health and safety principles during project Implementation
- Monitoring environmental management principles during project implementation
- Conducting quality checks
- Dispute resolution
- Sub-contractor appointments

(GPMCM, 2017)

Three important activities of the above list are further discussed below.

a) Attending to site meetings

The client will be responsible for regularly attending to site meetings. Adequate client involvement in attending site meetings will enable clients to promptly resolve any claims, monitor the work schedule and minimizing the occurrence of disputes and enhancing project success. Additionally, clients will tend to make prompt and necessary decisions while on site and this facilitates successful project delivery (Alsolaiman, 2014).

b) Making payments to contractor

One of the client's major roles in a construction project is making payments of the value of all work executed. In a study conducted by Aiyetan (2010), clients tend to delay such payments and the lack of prompt payment to contractors has negative consequences on the project, such as time and cost overruns. Late payments to contractors by clients may impede project success as such late payments may cripple the contractor's cash-flow.

c) Manage variation orders

Variation orders due to design changes are frequent in the construction phase and these modifications impacts the project budget (NOAA, 2010). To avoid time and cost overruns, decisions should be made quickly about design changes and variations (Aiyetan 2010). Aiyetan et al. (2013) argue that the clients' ability to contribute variation order ideas during construction can impact either positively or negatively on the construction project.

2.5.3 Post construction phases (Maintenance period)

• Taking over the project

The post-construction phase is a very important stage of the construction project cycle. This is the practical completion of all the construction including handover. Further, the client issues certification acknowledging completion of the works.

During the post construction stage client should ensure that all commissioning certificates, operating instructions and maintenance instructions are obtained (Australian Government, 2012). Documentation such as as-built drawings; operation manuals and maintenance of the facility and warranties and guarantees of the systems installed should be collected by the client.

Key activities during the post-contract phase are:

- Establishment of criteria for acceptance of completed project
- Contribute to compiling snagging or defects list
- Input into development of maintenance plan
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- Record the warranties and certificates information. (GPMCM, 2017)

2.6 Project Success

Each industry, project team or individual has its own definition of success.. Definitions of project success are dependent on project type, size and sophistication, project participants and experience of owners, etc.

Pariff and Sanvido (1993) consider success as an intangible perceptive feeling, which varies with different management expectations, among persons, and with the phases of project. Owners, designers, consultants, contractors, as well as sub-contractors have their own project objectives and criteria for measuring success. For example, architects often consider aesthetics over building cost as the main criterion for success. However, client may value other dimensions more such as cost, function ability, easy maintenance etc.

The Wood Report, (N.E.D.O., 1975), revealed a consistent demand by clients to meet the cost, time, quality, functionality and aesthetic criteria in order for a project to be considered to be successful. Further, Alarcon and Ashley (1996) defined effectiveness as a measure of how well the project was implemented or the degree to which targets of time and cost were met from the start-up phase to full production..

2.6.1 Critical Success Factors of a Project

Saeed, Reza, Hamed and Shankar (2017) has conducted a study on critical success factors (CSFs) for integration of sustainability into construction project management practices in developing countries. Their findings reveal that role of clients, knowledge management, high quality workmanship, strategic direction and health and safety protocols, project managers' knowledge, skills and abilities and tighter control over construction activities are the most influential CSFs. Figure 2.5 illustrates a framework by Atkinson (1999) to measure project success and Figure 2.6 illustrates a model proposed by Atkinson (1999) to measure project success.

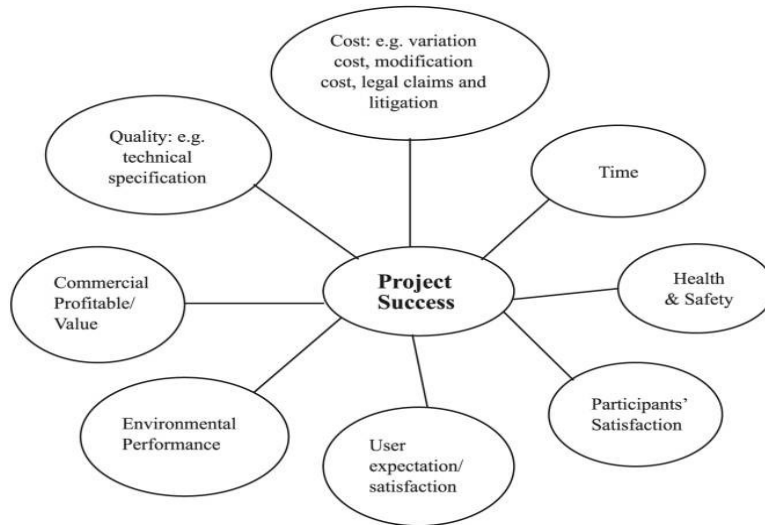
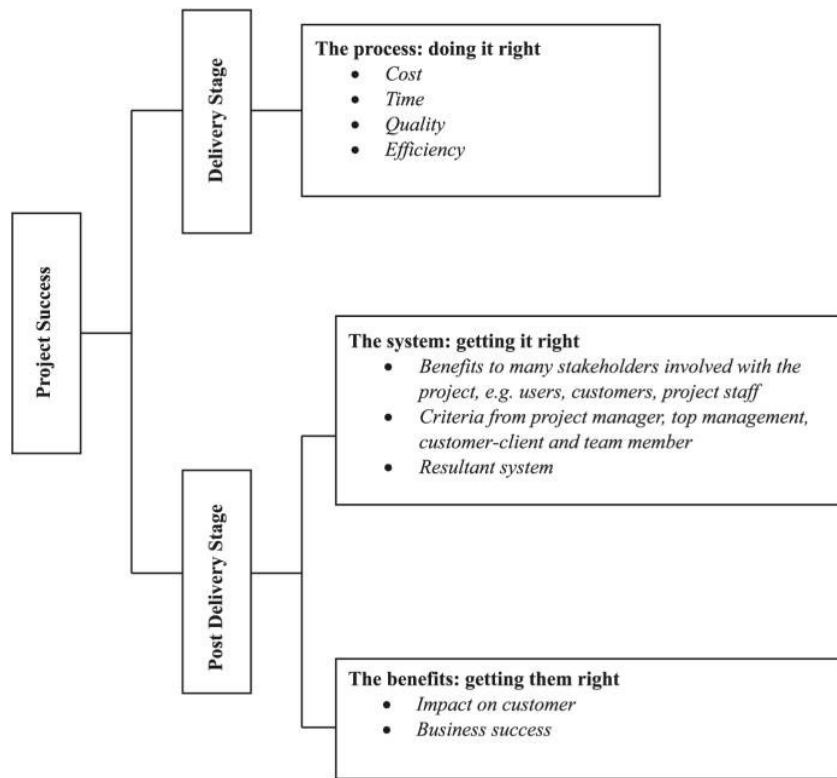


Figure 2.5: Consolidated framework for measuring project success
 (Source: Atkinson 1999)



Source: Atkinson (1999)

Figure 2.6: Atkinson’s model of measuring project success

- **Time**

Time refers to the duration for completing the project. It is scheduled to enable the building to be used by a date determined by the client's future plans (Hatush and Skitmore, 1997). Construction time is the absolute time that is calculated as the number of days/weeks from start on site to practical completion of the project.

- **Cost**

Cost is another important measure. Cost is defined as the degree to which the general conditions promote the completion of a project within the estimated budget (Bubashait and Almohawis, 1994). Cost is not only confined to the tender sum, it is the overall cost that a project incurs from inception to completion, which includes any costs arise from variations, modification during construction period and the cost arising from the legal claims, such as litigation and arbitration. Cost can be measured in terms of unit cost, percentage of net variation over final cost.

- **Quality**

Quality is another key criterion of a project that is repeatedly cited by researchers. In the construction industry, quality is defined as the totality of features required by a product or services to satisfy a given need; fitness for purpose (Parfitt and Sanvido, 1993). Quality is the guarantee of the products that convinces the customers or the end-users to purchase or use. The meeting of specification is proposed by Songer et al. (1996) and Wateridge (1995) as one way to measure quality. They defined specification as workmanship guidelines provided to contractors by clients or clients' representatives at the commencement of project execution.

- **Functionality**

Kometa et al. (1995) opine that there would be no point in undertaking a project if it does not fulfil its intended function at the end of the day. The importance of functionality is highlighted. This indicator correlates with expectations of project participant and can best be measured by the degree of conformance to all technical

performance specifications (Chan et al., 2002). Quality, technical performance, and functionality are closely related and are considered important to the owner, designer, and contractor.

- **User expectation and satisfaction**

Users are those who actually work or live in the final products. They are the ones who spend most of time in the constructed facilities. It is essential that the completed projects meet the users' expectation and satisfaction. Liu and Walker (1998) consider satisfaction as an attribute of success. Torbica and Stroh (2001) believe that if end-users are satisfied, the project can be considered being successfully completed in the long run.

- **Participants' Satisfaction**

Participants' satisfaction has been proposed as an important measure in the last decade (Cheung et al., 2000; Parfitt and Sanvido, 1993; Sanvido et al., 1992). Key participants in a typical construction project include: client, design team leader and construction team leader.

- **Health and Safety**

Health and safety are defined as the degrees to which the general conditions promote the completion of a project without major accidents or injuries (Bubshait and Almohawis, 1994). The issue of safety has been raised for a long time (Kometa et al., 1995; Parfitt and Sanvido, 1993; Sanvido et al., 1992) and cannot be overlooked. The measurement of safety is mainly focused on the construction period as most accidents occur during this stage.

- **Environmental Performance**

Construction industry has been regarded as a major contributor to environmental impacts. Construction projects affect the environment in numerous ways across their life cycle (Shen et al., 2000). Health & Safety and environment performance are directly relying on contractor but clients can emphasize consultant and contractor

regarding those concerns through an agreement with them. Government of Sri Lanka has now introduced green building concept for public building in order to encourage the sustainable construction.

2.7 Barriers in Construction Projects

A number of previous research studies have identified barriers in construction projects which results in time, cost overruns and other issues.

- a) Dolage and Perera (2009) described causes for delays in the pre-construction phase of state sector building projects. The ten most important causes of delays are due to non-adhering to the following activities:
- 1) Inclusion of detailed programme for design process
 - 2) Client studying the project brief
 - 3) Client's endorsement of architectural drawings prior to structural design phase
 - 4) Assessment of constraints in the client's brief
 - 5) Submission of alternative conceptual proposals
 - 6) Description of scope of work of consultants
 - 7) Indication of estimated cost in the final brief
 - 8) Submission of most suitable conceptual proposal
 - 9) Assessment of availability of services
 - 10) Concurrent preparation of structural and service drawings

These factors which affect the design process lead to significant delays in the design process. Further they propose that on receiving the endorsement of the client for the project brief, the consultant should submit alternate proposals through a pre-feasibility study. Detailed feasibility studies should consider site investigation, statutory requirements and views of the other specialist consultants and entails submission of a report containing the evaluation of alternative

proposals and recommendation of the most suitable proposal (Dolage and Perera, 2009).

- b) Odech and Batterainch, (2002) found following causes for delays in traditional type contracts in Jordan.
 - 1) Finance and payment for completed works
 - 2) Owners interference
 - 3) Slow decision making by owner
 - 4) Unrealistic imposed contract duration

- c) Causes in project delays in large constrain projects in Saudi Arabia-Assaf and Al Hejji, 2006) ranked in top place that owner related factors. Further they identified that average time overrun between 10%-30% of its original contract period.

- d) In Nigeria, Frimpong et al. (2003) had identified 26 factors for project delays and ranked. Client related delay factors in this study are as follows:
 - 1) Monthly payment difficulties
 - 2) Poor contract management
 - 3) Planning and scheduling deficiencies
 - 4) Deficiencies in cost estimates
 - 5) Inadequate control procedures
 - 6) Delaying work approval
 - 7) Waiting for information
 - 8) Cash flow during construction
 - 9) Slow decision making

- e) Finding in Nigeria (Frimpong et al, 2003) are in line with that of Malaysian study (Sambasivan & Soon, 2006). According to both studies, financial problem is identified as the main cause for the project delays.

- f) Jawardana and Panditha (2003) identified 45 factors for project delays in construction industry of Sri Lanka. According to them, the 2nd major delaying

factor identified is design changes by the owners and consultants.

- g) Dolage and Rathnamali (2002) in their case study research found that delay in progress payment by clients and delay in approving extra work are the two major client generated delay factors which causes time overrun in construction phase of building projects at the Department of Engineering Services of Sabaragamuwa Provincial Council..
- h) A long-term study of a number of public works projects, which was conducted in the state of Nevada in the United States, showed the negative and costly impacts of time delays. The study investigated several design-bid-build state construction projects between the years of 1991 to 2008 and concluded that large size and long-duration projects had significantly higher cost and schedule overruns than smaller size and short-duration ones. The main factors for time delays and cost overruns are: 1) Scope definition, 2) Coordination of roles and responsibilities among involved parties, 3) Initial estimation and contingency planning, and 4) Monitoring and control systems (Shrestha, Burns and Shields, 2013).
- i) Most construction projects in developing countries are characterized by time delays (Sweis, 2013).
- j) The projects with extensive delays may end up losing their economic justification, which in turn may result in the termination of the project (Alavifar and Motamedi, 2014).
- k) Mahamid, (2011) identified the following complications due to delay increase in governmental projects: 1) Confusion regarding public development plans, 2) Disturbance of the budget execution plan, and 3) Public inconvenience resulting from project delays.
- l) The following major causes of construction delivery delays were reported by Alavifar and Motamedi (2014): 1) Insufficient data collection and survey before

design, 2) Higher than expected increase in costs due to inflation, and 3) Repair/reconstruction work due to errors during construction.

- m) The majority of cost overruns are encountered in lump sum contracts, fewer occur in unit-price contracts and even less in reimbursement contracts (Papadopoulou and Park, 2012). They reported the following causes of cost overruns: 1) Awarding contracts to the lowest bidder; 2) Site conditions; 3) Incompetent subcontractors and poor site management; and 4) Inaccurate estimates and Client-led change orders.

- n) Kasimu (2012) identified five major cause of cost overruns: 1) Market conditions, 2) Personal experience in the contract work, 3) Insufficient estimated time for construction items, 4) Material fluctuation and 5) Political situation.

- o) Chigangacha and Haupt (2017) researched on effectiveness of client involvement in construction projects and suggest 9 aspects of client role and involvement, 5 aspects of contractor perceptions, 7 aspects on procurement and 3 aspects on project stakeholder relation (Table 2.2).

Table 2.2: Statements on client involvement
(Source: Chigangacha and Haupt, 2017)

	Statement
A	Client roles and involvement
1	The lack of client understanding of the construction process contributes to unsuccessful project delivery.
2	Appropriate client involvement is beneficial to the project.
3	The lack of adequate client involvement in their projects leads to numerous problems encountered across the project lifecycle such as disputes, time and cost overruns, etc.
4	Dealing with experienced clients is better than dealing with those that are inexperienced.

5	The success of a project is linked to the extent of client involvement and client control in their projects.
6	Client interference is a hindrance to project success.
7	Expert and experienced clients play a more active role in their projects.
8	Clients experience more satisfaction and product quality when involved in their projects.
9	Construction clients understand their roles and responsibilities and adequately perform them.
B	Contractor perceptions
1	Delays in payments by clients contributes to negative project consequences.
2	Pre-qualification of contractors is essential to ensure project success.
3	Contractors strive to fulfill client satisfaction.
4	Client satisfaction is essential to securing client loyalty and retention.
5	Clients tend to delay payments due to the contractors.
C	Procurement
1	Clients tend to choose the procurement method which they are familiar with, which might not necessarily be the best.
2	It is fundamentally important for clients to obtain appropriate advice on the choice of procurement method.
3	Clients must retain authority to exercise maximum control of the procurement process.
4	The selection of an inappropriate procurement method can have a major impact on project success.
5	Clients should have the right to choose the procurement method they wish.
6	Clients' understanding of the procurement process influences the level of their involvement on construction projects.
7	Clients are adequately involved during the procurement stage.
D	Project stakeholder relations
1	Adequate client knowledge of construction projects influences teamwork and collaboration.

2	Trust, honesty and cooperation by clients is vital for successful project delivery.
3	Greater involvement of clients in their projects will change the current adversarial construction environment.

2.7 Summary

Literature review was carried out to study client role in construction projects, formulation of projects, methods of procurement, and guidelines available influencing factors to construction projects as well as success factors of a project.

There are 15 client related barriers identified and to be tested in this study. Those barriers are:

- 1) Feasibility issues such as identification of the project and its location etc.,
- 2) Lack of general understanding of client about the construction cost, quality and time
- 3) Lack of Client's ability to give complete initial brief & review client's requirements in designs drawings
- 4) Client's commitment to the needs of other stakeholders
- 5) Delays due to decision making issues at client
- 6) Political interest/support to the project
- 7) Bureaucracy in client's organization
- 8) Variations of scope by client
- 9) Delay in approving extra works and variations
- 10) Delay in contractor's progress payment
- 11) Lack of Client's commitment for monitoring & evaluation of the project
- 12) Lack of client's awareness of role of each party (client/consultant) and project management activities
- 13) Lack of Client's resources for monitoring the project such as supporting Staff & facilities
- 14) Less Client's involvement for project activities due to busy with work load

15) Delays of other connected separate contracts directly handled by client such as mechanical installations, water supply to the premises and sewer treatment plant

Client involvement and responsibility change according the procurement method applied for the project. Main procurement methods used by public projects in Sri Lanka are: 1) Traditional system, 2) Design and Build by the decision of cabinet, 3) Design and Build by national competitive bidding.

Cost of the project is also directly related with construction period. Construction period may depend on the project requirement. However, client's cash flow issues may be arisen with the absences of better coordination with funding agent in large construction projects with shorter period.

Nature of the project is also a considerable factor which decide the client's involvement.

The 15 client related barriers to be further tested with the above three factors in order to check the associations with each other.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes research methods, research design and methodology used for this research including data and data collection methods. Research methodology is the systematic way of solving the research problem and also can be described as the ways of obtaining, organising and analysing data (Polit and Hungler, 2004). The Section 3.2 describes the general research methods while the selected research methods and methods of data analysis are described in Section 3.4.

3.2 Research Methods

Typically, there are three research methods; qualitative research, quantitative research and mixed research.

3.2.1 Qualitative Research

Qualitative research is a methodical and subjective approach which facilitates and makes it possible for the researcher to gain in-depth knowledge and status of the research participants' reality (Holloway, 2005). The qualities or attributes expected to be possessed by researchers using qualitative research methods include but are not limited to; being a good listener, non-judgmental, friendly, honest and flexible (Kothari, 2004). Qualitative research aims at answering the 'how' and 'why' of a given phenomenon thereby providing the necessary in-depth understanding of the process (Symon and Cassel, 1998).

3.2.2 Quantitative Research

Quantitative research is concerned with the measurement of quantity or amount and it is used when dealing with phenomena that can be expressed numerically (Kothari, 2004). Quantitative research answers the 'where', 'what', 'who' and 'when' questions

(Silverman, 2000). It is empirical in nature and is also sometimes referred to as scientific research (Atieno, 2009). A major limitation of quantitative research is that it focuses on numbers only and the results can be misleading as all other factors are ignored.

3.2.3 Mixed Research

Mixed methods research represents research that involves collecting, analysing, and interpreting quantitative and qualitative data in a single study or in a series of studies that investigate the same underlying phenomenon (Leech and Onwuegbuzie, 2008).

3.3 Data and Data Collection

All data can be categorized into two groups; primary data and secondary data. These data can be collected in various ways. The following section describes the data types and main data collection methods.

3.3.1 Primary Data and Secondary Data

- **Primary Data**

Primary data is the type of data which is original in nature as it is collected for the first time (Kothari, 2004; Creswell, 2009). Examples of primary data collection methods include observations, surveys, experiments and interviews (Driscoll, 2011).

- **Secondary Data**

Secondary data is the data that have been previously collected by someone else and had gone through statistical processes (Kothari, 2004). It can either be published or unpublished data. Examples of secondary data include but are not limited to journals, magazines, diaries, newspaper articles, reports prepared by academic scholars and existing databases. It is important that before the use of secondary data, the researcher ensures the reliability and adequacy of such data.

3.3.2 Methods of Data Collection

This section describes three prominent data collection methods relevant to this study.

- **Interviews**

Interviews often generate only verbal data and thus a prime candidate for the qualitative label. Generally, an interviewer asks respondents questions so as to obtain answers relevant to the research question. This method can be conducted either through personal interviews or telephone interviews.

- a) Personal Interviews: The interviewer asks questions generally in a face-to-face contact with the other person or persons
- b) Telephone Interviews: The interviewer collects information by contacting respondents on telephone.

Interviews can be structured or unstructured. Structured interviews consist of a set of predetermined questions that are asked in a prescribed order, and the interview follows a rigid procedure. On the other hand, unstructured interviews are more flexible, and do not follow a system of pre-determined questions and standardised techniques of recording information (Kothari, 2004).

- **Questionnaires**

Questionnaires take many forms and may be designed to obtain quantitative or qualitative data. This is a data collection technique conducted through asking questions from those who are thought to have the desired information (Bhattacharyya, 2006).

The advantages of using questionnaires include the ability to cover a wide geographical area, facilitates in the collection of relatively more data on a condensed basis, findings can be processed relatively easy and anonymity is maintained. The major disadvantages of using questionnaires are the relatively low response rate and that all the questions may not be answered (Popper, 2004).

- **Observations**

Information is acquired by observing the process at work (Bhattacharyya, 2006).

Observation can generate both quantitative and qualitative data and also take several forms. The observation method is used when collecting data on naturally occurring behaviours in their usual contexts. This method basically entails acquiring information by way of the researcher's own observation, without interviewing the respondents.

3.3.3 Sampling

Sampling is the process of selecting some individuals from a large population, and the outcome drawn from the sample is generalised to the whole population (Bhattacharyya, 2006). A good sample should be a true representative of the population as this will help in generalising the results to the whole population (Creswell, 2009). A population is the collection of units about which the researcher wants to study. In statistics, a population is the entire pool from which a statistical sample is drawn. A population may refer to an entire group of people, objects, events or measurements.

- **Sample frame**

A sample frame is a set of units that has non-zero probability of being selected and it is drawn from the population. A sample frame is the list of elements in the target population from which a sample of study may be drawn.

- **Sample Size**

The sample size is the selected number of people to be chosen to represent the population. The sample should be large enough to answer the research questions (Zikmund et al., 2010). A large sample size helps in minimizing 'sampling error' which is the discrepancy that may result from drawing conclusions on the basis of a small sample.

3.4 Research Design

A research design is the structure through which the researcher conducts the research (Bhattacharyya, 2006). It has also been described as the process that specifies all the assumptions of the research and the methods of data collection and analysis (Creswell,

2009). Leedy (1997) defines research design as a plan for a study, providing the overall framework for collecting data. Research design can be classified mainly as “exploratory” and “conclusive”. Conclusive type is further classified as “descriptive” and “causal”. As the name implies, the objective of descriptive research design is to provide comprehensive and detailed explanation of the phenomena under study.

The literature review process aimed at examining all issues as discussed by different authors in various sources. The use of secondary data through literature reviews was of very importance to this research as it identified barriers relating to the role of client in successful construction projects. Informal discussions were also conducted to understand the system practice in implementation of public construction projects in Sri Lanka.

A descriptive approach was adopted for this study on collecting data on barriers related to client on state funded construction projects, Sri Lanka. Three sources of data were identified for this study, namely interviews and a questionnaire which are referred to as primary sources of data, and a literature review as secondary data. Secondary data was used for the primary purpose of preparing the questionnaire.

3.4.1 Questionnaire Development and Survey

A questionnaire was used as the tool for data collection in this research. Such a tool is useful to quantify the information and it makes data analyses easier. The questionnaire was structured in a manner such that the respondent found it easy to understand and also to simplify the statistical process.

There are three sections in the questionnaire. The section A of the questionnaire is on personal information about the participants and the main focus is on the length of experience. Project information such as nature, procurement method, cost and time are obtained under the section B. The section C is the most important part of the study, which contained 15 numbers of questions relevant to the client related barriers. These 15 barriers are selected by having discussions with three senior engineers on a large number of barriers identified through the literature review of this study. The

discussions helped to identify the important issues and related barriers of public construction projects, procurement methods and usable guidelines.

A 5 point Likert scale was used to measure severity of each barrier. Respondents were requested to choose most appropriate answer for each barrier. The scale parameters are:

1= very low, 2= low, 3=Neutral, 4=high, 5=very high

Questionnaire used for survey is attached as Appendix A.

- **Pilot survey**

A pilot survey was carried out by having face to face interviews with three (03) respondents, who are well-known professionals in the construction industry. This stage is used to improve the clarity of the questionnaire. The pilot survey was conducted in March 2019.

- **Sample survey**

The sample included experienced individuals who have acquired a wide range of knowledge, understanding and application of the methods and techniques involved across the project cycle. Their experience is expected to impact positively in their judgement about client and other stakeholders in a project.

All respondents are professionally qualified engineers and possessed more than five years of experience in the field as well as with public clients. Therefore, they are likely to have a better understanding of clients and their responses possibly be more accurate indication of client related barriers. In addition, majority of respondents are selected from consultancy organizations since they practice as consultants to the public projects. Therefore, answers to questions are assumed as unbiased.

Follow-up telephone calls were given to the sample in order to increase the rate of response.

3.4.2 Expert Interviews

Discussions are conducted with two experts from the construction industry and one of the senior officers at the Treasury to validate the findings.

3.5 Data Analysis

Descriptive analysis is used to describe the basic features of the data in the study. They provide simple summaries about the sample, quantitative analysis of data together with simple graphical analysis. With descriptive analysis, one simply describes what the data shows. Description of data is needed to determine the normality of the distribution. According to Best and Kahn (2003), much simple action research involves descriptive analysis and provides valuable information about the nature of the particular group of individuals.

The descriptive analysis of data provides the following;

- The first estimates and summaries, arranged in tables and graphs, to meet the objectives.
- Information about the variability or uncertainty in the data.
- Indications of unexpected patterns and observations that need to be considered when doing formal analysis.

Statistical Package for Social Science (SPSS) is used for data analysis. Descriptive analysis of SPSS gives comprehensive results of the data analysis.

- **Mean**

The Mean or average is probably the most commonly used methods of describing a central tendency. The mean represents the centre of gravity of distribution. Each score in a distribution contributes to the determination of mean. It is also known as arithmetic average. Mean is the average of all values in a distribution (Krishnaswamy and Ranganathan, 2006).

- **Chi Square Test**

The Chi-Square test is used when trying to find a relationship between two variables. This test was mainly used to find a relationship between critical barriers and procurement methods.

3.6 Validity and Reliability

Validity and reliability are two essential characteristics of a good measurement tool (Groth-Marnat, 2003). Validation of questionnaire is attained by conducting pilot tests. Two desktop interviews were held with two senior project managers to check the questionnaire. They made good comments for the questionnaire and helped to realize that some answers were incorrect due to wrong understanding of the questions. Accordingly, revisions were made to the questionnaire incorporating sample answer for clarity.

Reliability can be thought of as consistency. This check is done for Likert scale data. The Cronbach's Alpha (α) is a widely used method to measure the reliability of a questionnaire used in a survey by measuring the internal consistency of a scale (Tavakol and Dennick, 2011). The Cronbach's alpha test was used to determine the consistency and reliability of the 5-point Likert scale and SPSS facilitates to find the Alpha Coefficients. Kline (2013) found that the Cronbach's alpha co-efficient value of 0.70 is regarded as the minimum for an adequate test and any value < 0.70 indicates poor reliability.

CHAPTER 4

DATA COLLECTION AND ANALYSES

4.1 Introduction

Details of data collection through the questionnaire survey and the analyses of the collected data are presented in this chapter. Both Microsoft Excel and Statistical Package for Social Sciences (SPSS) version 24 were used to tabulate and analyse data. Resulted frequency tables are attached as Appendix B. Descriptive statistics and cross table functions supported to derive relationships of data and describe information. Critical client related barriers in construction projects are ranked using the “mean” of the severity calculated from Likert data.

4.2 Data Collection

The third objective of this study is to analyze the severity of the identified barriers in GOSL funded construction projects and their relationships with procurement method, cost and time overrun.

4.2.1 Survey Population and the Sample

The population of this survey is the construction industry professionals. The sample of respondents for this study was selected through convenience sampling. This means, respondents were intentionally selected for the survey in order to maximise the rate of response and the accuracy.

The convenience sample consisted of 40 elements.

1. Consultants of Traditional Contracts
2. Project Managers of Design and Build Contracts awarded by cabinet
3. Project Managers of Design and Build Contracts awarded by Bidding

4.2.2 Respondents' Profile and rate of response

- **Response rate**

The response rate is the percentage of people who respond to the research survey. Responses for questionnaire were collected over a four-month period from March to July 2019. Only 31 responses were received out of 40 distributions. Table 4.1 shows the distribution of the sample and the number of responses received.

Table 4.1: Rate of Response to Questionnaire Survey

Respondent Category	Sample	No. of Responses	Percentage of Response
Consultants of Traditional Contracts	18	15	83.3%
Project Manager of Design and Build Contracts awarded by cabinet	18	14	77.8%%
Project Manager of Design and Build Contracts awarded by Bidding	04	02	50.0%
Total	40	31	77.5%

Out of 31 responses, 15 (48.4%) are from government and semi government consultancy organizations and those respondents represented the consultant role to the projects which were awarded through traditional procurement method. Fourteen respondents (45.2%) represented design and build projects which were awarded by cabinet decision while two (6.4%) respondents are from the private sector design and build contractors who obtained the project under Competitive Bidding procurement.

- **Experiences of Respondents**

All respondents are experienced engineers and their involvement in the survey improves the quality of research findings. Hence their experience was obtained in four ranges (Table 4.2)

Table 4.2: Respondents' Experience

Years of experience (Years)	Frequency	%
05-10	03	09.7
11-15	24	77.4
16-20	04	12.9
> 20	00	00.0
Total	31	100

Majority (90.3%) of respondents possess more than 10 years of experiences. Therefore, responses can be assumed as unbiased, accurate and hence represent the expected population.

4.3 Data Analyses

Statistical methods are used to analyse the sample data and to generalize the findings of the sample to the population wherever possible. The findings are presented in table format and discussion is created based on the findings. Once data has been entered into Excel and SPSS, preliminary data exploration is carried out to assess the expected trends of findings. Some new variables are also created for easy analysis.

4.3.1 5-Point “Likert” scale

In this study, the group interval coefficient value was calculated as $(5 - 1) / 5 = 0.80$ and the intervals indicated were taken as reference values in evaluating the responses obtained through the implementation of the 5-point scale (Table 4.3).

Respondents were requested to indicate the severity of client related barriers on their recently completed construction projects using the 5-point scale; where 1= very low, 2 = Low, 3 = Neutral, 4 = High, and 5 = very high.

Table 4.3: Numerical value range for responses

Range	Response
4.21 - 5.00	Very High
3.41 - 4.20	High
2.61 - 3.40	Neutral
1.81 - 2.60	Low
1.00 -1.80	Very Low

- **Reliability Test Using SPSS Statistics**

The Cronbach's Alpha (α) coefficient for Likert scale survey data was 0.750 and hence consistency is greater than 0.70 hence satisfy the reliability test (Table 4.4).

Table 4.4: Reliability Statistics from SPSS

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No of Items
0.750	0.734	15

4.3.2 Evaluation of Client Related Barriers

A number of barriers in construction projects are identified through the literature review and out of that fifteen (15) client related barriers have been selected for the questionnaire survey. Questionnaire carries 7 questions (from Q1 to Q7) which are relevant to the pre-construction (Design) phase while of the remaining 8 questions (From Q8 to Q15) are relevant to the construction phase.

Selected 15 client related barriers are systematically evaluated to establish their importance and to establish their associations with project characteristics.

- **Rank of Importance**

The responses obtained from the survey is used to rank the importance of client related barriers. The barriers are ranked by the means of Likert scale point (Table 4.5).

Table 4.5: Ranked client related barriers in construction projects

Q No.	Client's related Barriers in construction projects	Mean	Rank
10	Delay in contractor's progress payment	3.58	1
3	Incomplete Client's initial brief	3.55	2
4	Less Client's commitment to the needs of other stakeholders	3.48	3
8	Variations of scope by client	3.42	4
14	Less Client's involvement for project activities	3.13	5
13	Lack of Client's resources for monitoring the project (Staff & facilities)	3.10	6
7	Bureaucracy in client's organization	2.90	7
5	Delays due to decision making issues at client	2.87	8
9	Delay in approving extra works and variations	2.81	9
11	Lack of Client's commitment for monitoring & evaluation of the project.	2.81	10
15	Delays of other connected separate contracts/ responsibilities directly handled by client i.e. temporary arrangements, Water, electricity & other services etc.)	2.58	11
2	Understanding of Time, Cost, Quality	2.39	12
1	Feasibility Issues	2.26	13
6	Political interest/support to the project	1.84	14
12	Lack of client's awareness of role of each party (client/consultant) and project management activities.	1.81	15

4.3.3 Critical Client Related Barriers

The above descriptive statistic (Mean) analysis of the data (sample responses) enable to identify the most important barriers. Accordingly, the top three critical barriers are:

- 1) Delay in contractor's progress payment
- 2) Incomplete client's initial brief
- 3) Less Client's commitment to the needs of other stakeholders

Only the first three barriers are further analysed due to the limited time frame available for the research study.

1) Delay in contractor’s progress payment

From Table 4.5, it is evident that the respondents regarded the delay in contractor’s progress payment as the most critical barrier (mean 3.58) to perform public construction projects in Sri Lanka. Further severity of the impact of top barrier on the type of procurement was analysed (Figure 4.1 and Table 4.6).

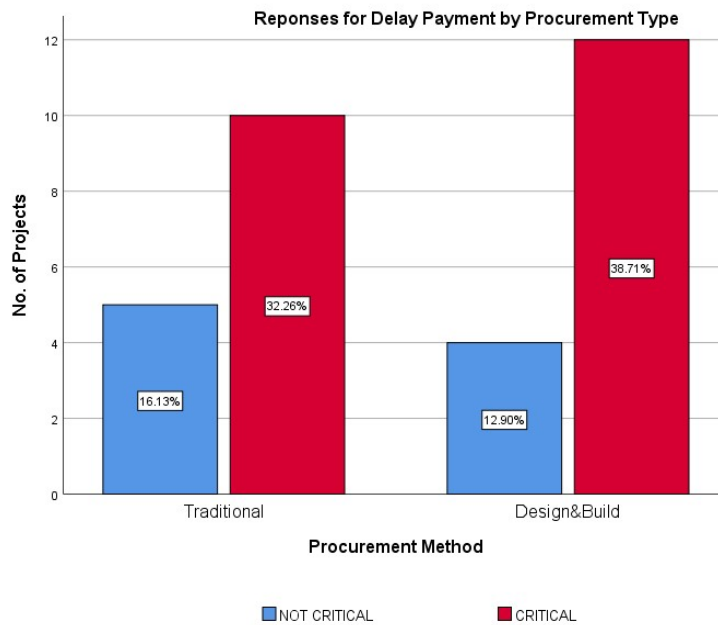


Figure 4.1: Responses for contractor’s payment delay by Procurement methods

Table 4.6: Responses for contractor’s payment delay by Procurement methods

		Responses for payment delays		Total
		Not Critical	Critical	
Procurement	Traditional	5	10	15
	Design & Build	4	12	16
Total		9	22	31

According to the Table 4.6 and Figure 4.1, both ‘traditional’ and ‘design & build’ projects have the issue of delaying contractor’s progress payments. Therefore, a chi-square test was performed to verify whether there is any significant association between this barrier and observed negative consequences of projects as experienced by the respondents. Chi-square test results are shown in Table 4.7.

Table 4.7: Chi-Square test results

	Value	df	Asymptotic Significance (2-sided).	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.261 ^a	1	.609	.704	.454
Continuity Correction ^b	.013	1	.908		
Likelihood Ratio	.261	1	.609		
Fisher's Exact Test					
Linear-by-Linear Association	.253	1	.615		
N of Valid Cases	31				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 4.35.

b. Computed only for a 2x2 table

Since the expected count is less than 5 for two cells, SPSS does not recommend to conclude the findings. Therefore, Pearson correlation analysis is carried out and Table 4.8 shows that procurement method is not related to payment delays.

Table 4.8: Correlation between Procurement Methods and Payments Delay

		Procurement	Payment Delay
Procurement	Pearson Correlation	1	.092
	Sig. (2-tailed)		.624
	N	31	31
Payment Delay	Pearson Correlation	.092	1
	Sig. (2-tailed)	.624	
	N	31	31

2) Incomplete client’s initial brief

Sample survey revealed incomplete client’s brief (mean 3.55) as the second critical barrier. Further severity of the impact of this barrier on the type of procurement was analysed (Figure 4.2 and Table 4.9).

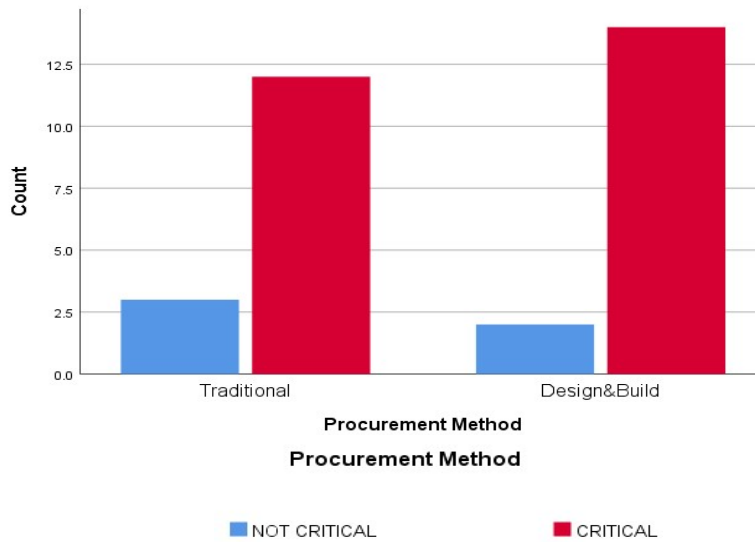


Figure 4.2: Responses for Incomplete Client’s initial brief by Procurement Methods

Table 4.9: Responses for Incomplete Client’s initial brief by Procurement Methods

	REDEFINED Q3		Total
	Not Critical	Critical	
Procurement Traditional	3	12	15
Design & Build	2	14	16
Total	5	26	31

Table 4.9 and Figure 4.2 indicate, that both ‘traditional’ and ‘design & build’ projects are critically affected by incomplete client’s initial brief.

Correlation test is conducted to check the relation between incomplete Client’s brief and procurement method. Table 4.10 indicates that there is no significant relationship exists between the impact from client’s incomplete briefs and procurement method.

Table 4.10: Correlation between Incomplete Client’s initial brief by Procurement Methods

		Procurement	Incomplete Brief
Procurement	Pearson Correlation	1	.102
	Sig. (2-tailed)		.585
	N	31	31
Incomplete Brief	Pearson Correlation	.102	1
	Sig. (2-tailed)	.585	
	N	31	31

3) Commitment to the needs of other stakeholders

According to Table 4.5, Clients’ low commitment to the needs of other stakeholders is the third critical barrier.

Tables 4.11 and 4.12 gives the cross tabulation of data and the correlation analysis for the third critical barrier.

Table 4.11: Cross tabulation between Low Commitment for Stakeholders needs and Procurement Methods

		Low Commitment for Stakeholders		Total
		Not Critical	Critical	
Procurement	Traditional	5	10	15
	Design & Build	0	16	16
Total		5	26	31

Table 4.12 Correlation between Low Commitment for Stakeholders and Procurement Methods

		Procurement	Low Commitment for Stakeholders
Procurement	Pearson Correlation	1	.453*
	Sig. (2-tailed)		.011
	N	31	31
Low Commitment	Pearson Correlation	.453*	1
	Sig. (2-tailed)	.011	
	N	31	31

*. Correlation is significant at the 0.05 level (2-tailed).

Accordingly, a correlation exists between client’s low commitments to the stakeholders and the procurement method at 95% confidence level. All respondents noted that this barrier is critical in design and build projects (Table 4.11).

4.4 Further Analysis with Procurement Method, Cost Overrun, Time Overrun and Project Phases

Questions contain in the questionnaire can be further divided into the two project phases as design phase and construction phase. Accordingly, questions 1 to 7 are related to design phase while questions 8 to 15 are related to construction phase. Average mean of responses for above two categories are 3.0 and 2.9 respectively. Therefore, it is evident that client related barriers in the design phase are more critical than the barriers in construction phase.

When considering design phase, incomplete client’s initial brief is the most critical barrier while delay in contractor’s progress payments is most critical in construction phase. Further, design & building contractors who obtained projects through the competitive bidding; has responded that the incomplete initial client’s brief as a significantly high barrier.

4.4.1 Procurement methods in public construction projects

Number of different project types on procurement methods, considered in the survey sample and their frequency analysis are given in Table 4.13.

Table 4.13: Procurement methods

Procurement method	Frequency	
	N	%
Traditional	15	48.4
Design and build by cabinet decision	14	45.2
Design and build by tender	2	06.4
Total	31	100.0

According to the informal discussions with clients, traditional method is the most widely used method in public sector for procurement of construction works. This is true for both local and international scenarios as per the literature. Since the key objective of this research is to find the client related barriers in public construction projects, relevant variable was not tested. Hence, Table 4.13 gives only a characteristic of the sample and not the reality of population.

Informal discussion with client representatives revealed that they prefer design and build procurement model through national competitive bidding process.

In Sri Lanka selecting a design and build contractor through competitive bidding process is a new experience for public clients. Therefore, completed projects of this nature are very few. Only two such projects are included in this survey.

4.4.2 Evaluation of Cost Overrun

Figure 4.3 shows that the design and build projects have a low cost overrun percentage. This is because design and build projects are approved by the cabinet and procedure for extra budget is a long procedure. According to the expert’s comment, contractors of design and build projects are very careful not to exceed the budget. Therefore, chances to major scope variations are also limited.

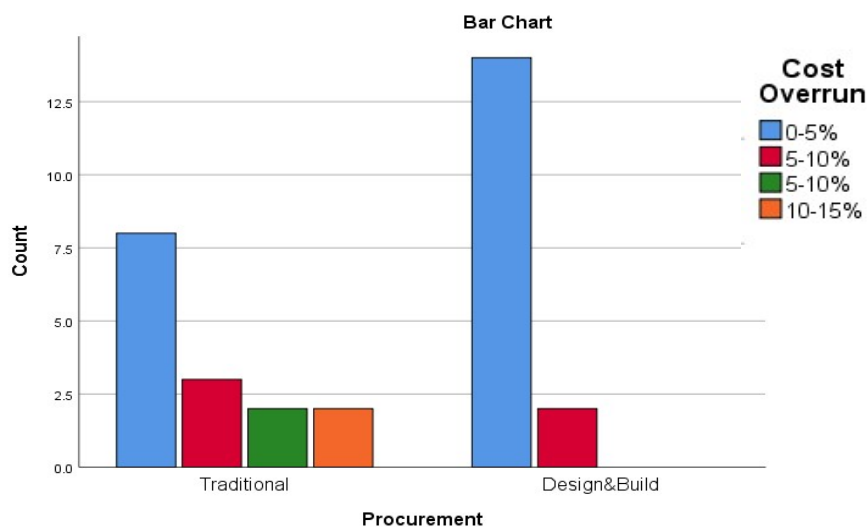


Figure 4.3: SPSS analysis for cost overrun vs. procurement type

4.4.3 Evaluation of Time Overrun

The time overruns of the considered projects are analysed against the project cost. Table 4.14 shows the magnitude of projects delays.

Table 4.14: Analysis of time overrun

Time Overrun vs. Project amount			
Project Value	Time Overrun < 50%	Time Overrun > 50%	Total
50-150	1	7	8
150-300	2	8	10
300-600	5	4	9
600-3000	1	3	4
Total	9	22	31
	30%	70%	

Accordingly, 70% of public sector projects are delayed at least 50% of its original time period.

4.5 Rank of Barriers according to the procurement type

Respondents experiences can be categorised mainly into two types based on procurement type of the project they considered in responding to the survey: Traditional, and Design & Build. Fifteen numbers of respondents considered traditional type of projects while sixteen numbers represented design & build type projects. Table 4.6 shows the final ranking of client related barriers according to the procurement type of projects.

Table 4.15: Client related barriers ranked by procurement type

Q No.	Client's related Barriers in construction projects	Ranked by Traditional Projects	Ranked by Design & Build Projects
10	Delay in contractor's progress payment	1	2
3	Incomplete Client's initial brief	9	1
4	Less Client's commitment to needs of other stakeholders	2	3
8	Variations of scope by client	3	4
14	Less Client's involvement for project activities	5	5
13	Lack of Client's resources for monitoring the project (Staff & facilities)	4	6
7	Bureaucracy in client's organization	6	9
5	Delays due to decision making issues at client	7	8
9	Delay in approving extra works and variations	8	10
11	Lack of Client's commitment for monitoring & evaluation of the project.	11	7
15	Delays of other connected separate contracts/ responsibilities directly handled by client i.e. temporary arrangements, Water, electricity & other services etc.)	13	11
2	Understanding of Time, Cost, Quality	12	12
1	Feasibility Issues	10	13
6	Political interest/support to the project	15	14
12	Lack of client's awareness of role of each party (client/consultant) and project management activities.	14	15

The results of the above analysis show that the overall ranking is slightly different to ranking with procurement type. "Incomplete client's initial brief" is the most critical factor for design and build procurement project but in the traditional procurement projects; it falls to the 9th place.

CHAPTER 4

DATA COLLECTION AND ANALYSES

4.1 Introduction

Details of data collection through the questionnaire survey and the analyses of the collected data are presented in this chapter. Both Microsoft Excel and Statistical Package for Social Sciences (SPSS) version 24 were used to tabulate and analyse data. Resulted frequency tables are attached as Appendix B. Descriptive statistics and cross table functions supported to derive relationships of data and describe information. Critical client related barriers in construction projects are ranked using the “mean” of the severity calculated from Likert data.

4.2 Data Collection

The third objective of this study is to analyze the severity of the identified barriers in GOSL funded construction projects and their relationships with procurement method, cost and time overrun.

4.2.1 Survey Population and the Sample

The population of this survey is the construction industry professionals. The sample of respondents for this study was selected through convenience sampling. This means, respondents were intentionally selected for the survey in order to maximise the rate of response and the accuracy.

The convenience sample consisted of 40 elements.

1. Consultants of Traditional Contracts
2. Project Managers of Design and Build Contracts awarded by cabinet
3. Project Managers of Design and Build Contracts awarded by Bidding

4.2.2 Respondents' Profile and rate of response

- **Response rate**

The response rate is the percentage of people who respond to the research survey. Responses for questionnaire were collected over a four-month period from March to July 2019. Only 31 responses were received out of 40 distributions. Table 4.1 shows the distribution of the sample and the number of responses received.

Table 4.1: Rate of Response to Questionnaire Survey

Respondent Category	Sample	No. of Responses	Percentage of Response
Consultants of Traditional Contracts	18	15	83.3%
Project Manager of Design and Build Contracts awarded by cabinet	18	14	77.8%%
Project Manager of Design and Build Contracts awarded by Bidding	04	02	50.0%
Total	40	31	77.5%

Out of 31 responses, 15 (48.4%) are from government and semi government consultancy organizations and those respondents represented the consultant role to the projects which were awarded through traditional procurement method. Fourteen respondents (45.2%) represented design and build projects which were awarded by cabinet decision while two (6.4%) respondents are from the private sector design and build contractors who obtained the project under Competitive Bidding procurement.

- **Experiences of Respondents**

All respondents are experienced engineers and their involvement in the survey improves the quality of research findings. Hence their experience was obtained in four ranges (Table 4.2)

Table 4.2: Respondents' Experience

Years of experience (Years)	Frequency	%
05-10	03	09.7
11-15	24	77.4
16-20	04	12.9
> 20	00	00.0
Total	31	100

Majority (90.3%) of respondents possess more than 10 years of experiences. Therefore, responses can be assumed as unbiased, accurate and hence represent the expected population.

4.3 Data Analyses

Statistical methods are used to analyse the sample data and to generalize the findings of the sample to the population wherever possible. The findings are presented in table format and discussion is created based on the findings. Once data has been entered into Excel and SPSS, preliminary data exploration is carried out to assess the expected trends of findings. Some new variables are also created for easy analysis.

4.3.1 5-Point “Likert” scale

In this study, the group interval coefficient value was calculated as $(5 - 1) / 5 = 0.80$ and the intervals indicated were taken as reference values in evaluating the responses obtained through the implementation of the 5-point scale (Table 4.3).

Respondents were requested to indicate the severity of client related barriers on their recently completed construction projects using the 5-point scale; where 1= very low, 2 = Low, 3 = Neutral, 4 = High, and 5 = very high.

Table 4.3: Numerical value range for responses

Range	Response
4.21 - 5.00	Very High
3.41 - 4.20	High
2.61 - 3.40	Neutral
1.81 - 2.60	Low
1.00 -1.80	Very Low

- **Reliability Test Using SPSS Statistics**

The Cronbach's Alpha (α) coefficient for Likert scale survey data was 0.750 and hence consistency is greater than 0.70 hence satisfy the reliability test (Table 4.4).

Table 4.4: Reliability Statistics from SPSS

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No of Items
0.750	0.734	15

4.3.2 Evaluation of Client Related Barriers

A number of barriers in construction projects are identified through the literature review and out of that fifteen (15) client related barriers have been selected for the questionnaire survey. Questionnaire carries 7 questions (from Q1 to Q7) which are relevant to the pre-construction (Design) phase while of the remaining 8 questions (From Q8 to Q15) are relevant to the construction phase.

Selected 15 client related barriers are systematically evaluated to establish their importance and to establish their associations with project characteristics.

- **Rank of Importance**

The responses obtained from the survey is used to rank the importance of client related barriers. The barriers are ranked by the means of Likert scale point (Table 4.5).

Table 4.5: Ranked client related barriers in construction projects

Q No.	Client's related Barriers in construction projects	Mean	Rank
10	Delay in contractor's progress payment	3.58	1
3	Incomplete Client's initial brief	3.55	2
4	Less Client's commitment to the needs of other stakeholders	3.48	3
8	Variations of scope by client	3.42	4
14	Less Client's involvement for project activities	3.13	5
13	Lack of Client's resources for monitoring the project (Staff & facilities)	3.10	6
7	Bureaucracy in client's organization	2.90	7
5	Delays due to decision making issues at client	2.87	8
9	Delay in approving extra works and variations	2.81	9
11	Lack of Client's commitment for monitoring & evaluation of the project.	2.81	10
15	Delays of other connected separate contracts/ responsibilities directly handled by client i.e. temporary arrangements, Water, electricity & other services etc.)	2.58	11
2	Understanding of Time, Cost, Quality	2.39	12
1	Feasibility Issues	2.26	13
6	Political interest/support to the project	1.84	14
12	Lack of client's awareness of role of each party (client/consultant) and project management activities.	1.81	15

4.3.3 Critical Client Related Barriers

The above descriptive statistic (Mean) analysis of the data (sample responses) enable to identify the most important barriers. Accordingly, the top three critical barriers are:

- 1) Delay in contractor's progress payment
- 2) Incomplete client's initial brief
- 3) Less Client's commitment to the needs of other stakeholders

Only the first three barriers are further analysed due to the limited time frame available for the research study.

1) Delay in contractor’s progress payment

From Table 4.5, it is evident that the respondents regarded the delay in contractor’s progress payment as the most critical barrier (mean 3.58) to perform public construction projects in Sri Lanka. Further severity of the impact of top barrier on the type of procurement was analysed (Figure 4.1 and Table 4.6).

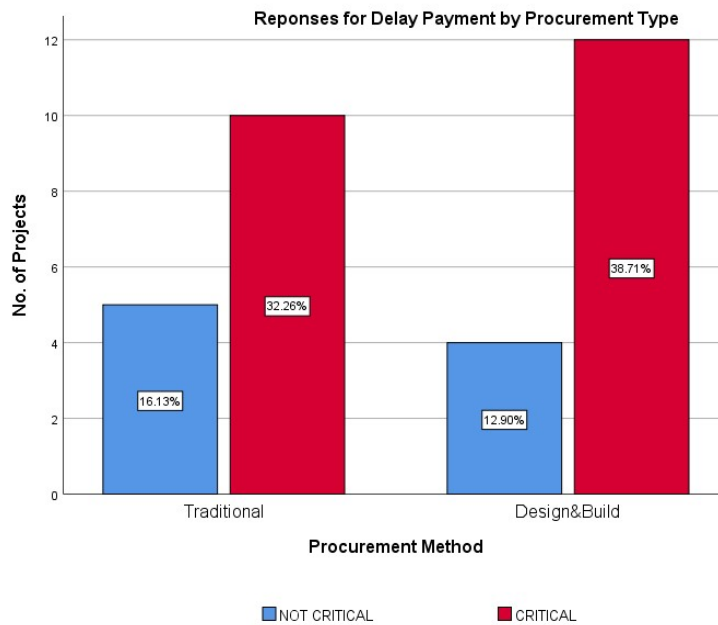


Figure 4.1: Responses for contractor’s payment delay by Procurement methods

Table 4.6: Responses for contractor’s payment delay by Procurement methods

		Responses for payment delays		Total
		Not Critical	Critical	
Procurement	Traditional	5	10	15
	Design & Build	4	12	16
Total		9	22	31

According to the Table 4.6 and Figure 4.1, both ‘traditional’ and ‘design & build’ projects have the issue of delaying contractor’s progress payments. Therefore, a chi-square test was performed to verify whether there is any significant association between this barrier and observed negative consequences of projects as experienced by the respondents. Chi-square test results are shown in Table 4.7.

Table 4.7: Chi-Square test results

	Value	df	Asymptotic Significance (2-sided).	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.261 ^a	1	.609	.704	.454
Continuity Correction ^b	.013	1	.908		
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Linear-by-Linear Association	.253	1	.615		
N of Valid Cases	31				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 4.35.

b. Computed only for a 2x2 table

Since the expected count is less than 5 for two cells, SPSS does not recommend to conclude the findings. Therefore, Pearson correlation analysis is carried out and Table 4.8 shows that procurement method is not related to payment delays.

Table 4.8: Correlation between Procurement Methods and Payments Delay

		Procurement	Payment Delay
Procurement	Pearson Correlation	1	.092
	Sig. (2-tailed)		.624
	N	31	31
Payment Delay	Pearson Correlation	.092	1
	Sig. (2-tailed)	.624	
	N	31	31

2) Incomplete client’s initial brief

Sample survey revealed incomplete client’s brief (mean 3.55) as the second critical barrier. Further severity of the impact of this barrier on the type of procurement was analysed (Figure 4.2 and Table 4.9).

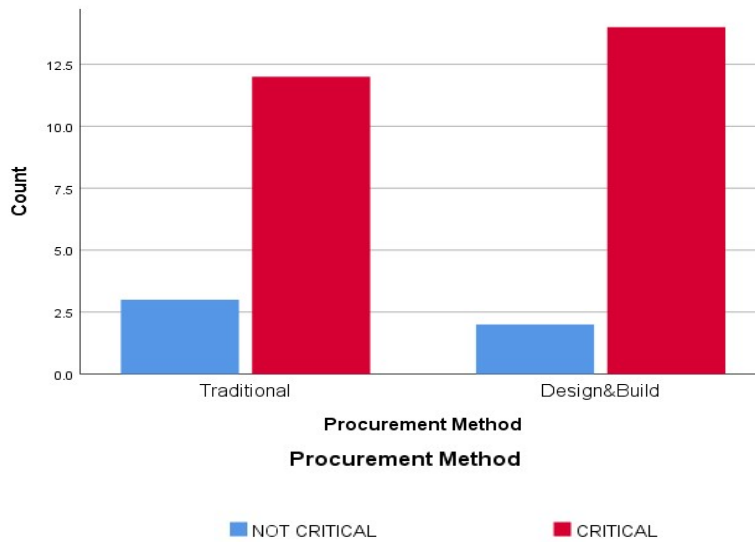


Figure 4.2: Responses for Incomplete Client’s initial brief by Procurement Methods

Table 4.9: Responses for Incomplete Client’s initial brief by Procurement Methods

	REDEFINED Q3		Total
	Not Critical	Critical	
Procurement Traditional	3	12	15
Design & Build	2	14	16
Total	5	26	31

Table 4.9 and Figure 4.2 indicate, that both ‘traditional’ and ‘design & build’ projects are critically affected by incomplete client’s initial brief.

Correlation test is conducted to check the relation between incomplete Client’s brief and procurement method. Table 4.10 indicates that there is no significant relationship exists between the impact from client’s incomplete briefs and procurement method.

Table 4.10: Correlation between Incomplete Client’s initial brief by Procurement Methods

		Procurement	Incomplete Brief
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	Sig. (2-tailed)		.585
	N	31	31
Incomplete Brief	Pearson Correlation	.102	1
	Sig. (2-tailed)	.585	
	N	31	31

3) Commitment to the needs of other stakeholders

According to Table 4.5, Clients’ low commitment to the needs of other stakeholders is the third critical barrier.

Tables 4.11 and 4.12 gives the cross tabulation of data and the correlation analysis for the third critical barrier.

Table 4.11: Cross tabulation between Low Commitment for Stakeholders needs and Procurement Methods

		Low Commitment for Stakeholders		Total
		Not Critical	Critical	
Procurement	Traditional	5	10	15
	Design & Build	0	16	16
Total		5	26	31

Table 4.12 Correlation between Low Commitment for Stakeholders and Procurement Methods

		Procurement	Low Commitment for Stakeholders
Procurement	Pearson Correlation	1	.453*
	Sig. (2-tailed)		.011
	N	31	31
Low Commitment	Pearson Correlation	.453*	1
	Sig. (2-tailed)	.011	
	N	31	31

*. Correlation is significant at the 0.05 level (2-tailed).

Accordingly, a correlation exists between client’s low commitments to the stakeholders and the procurement method at 95% confidence level. All respondents noted that this barrier is critical in design and build projects (Table 4.11).

4.4 Further Analysis with Procurement Method, Cost Overrun, Time Overrun and Project Phases

Questions contain in the questionnaire can be further divided into the two project phases as design phase and construction phase. Accordingly, questions 1 to 7 are related to design phase while questions 8 to 15 are related to construction phase. Average mean of responses for above two categories are 3.0 and 2.9 respectively. Therefore, it is evident that client related barriers in the design phase are more critical than the barriers in construction phase.

When considering design phase, incomplete client’s initial brief is the most critical barrier while delay in contractor’s progress payments is most critical in construction phase. Further, design & building contractors who obtained projects through the competitive bidding; has responded that the incomplete initial client’s brief as a significantly high barrier.

4.4.1 Procurement methods in public construction projects

Number of different project types on procurement methods, considered in the survey sample and their frequency analysis are given in Table 4.13.

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Procurement method	Frequency	
	N	%
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Design and build by tender	2	06.4
Total	31	100.0

According to the informal discussions with clients, traditional method is the most widely used method in public sector for procurement of construction works. This is true for both local and international scenarios as per the literature. Since the key objective of this research is to find the client related barriers in public construction projects, relevant variable was not tested. Hence, Table 4.13 gives only a characteristic of the sample and not the reality of population.

Informal discussion with client representatives revealed that they prefer design and build procurement model through national competitive bidding process.

In Sri Lanka selecting a design and build contractor through competitive bidding process is a new experience for public clients. Therefore, completed projects of this nature are very few. Only two such projects are included in this survey.

4.4.2 Evaluation of Cost Overrun

Figure 4.3 shows that the design and build projects have a low cost overrun percentage. This is because design and build projects are approved by the cabinet and procedure for extra budget is a long procedure. According to the expert’s comment, contractors of design and build projects are very careful not to exceed the budget. Therefore, chances to major scope variations are also limited.

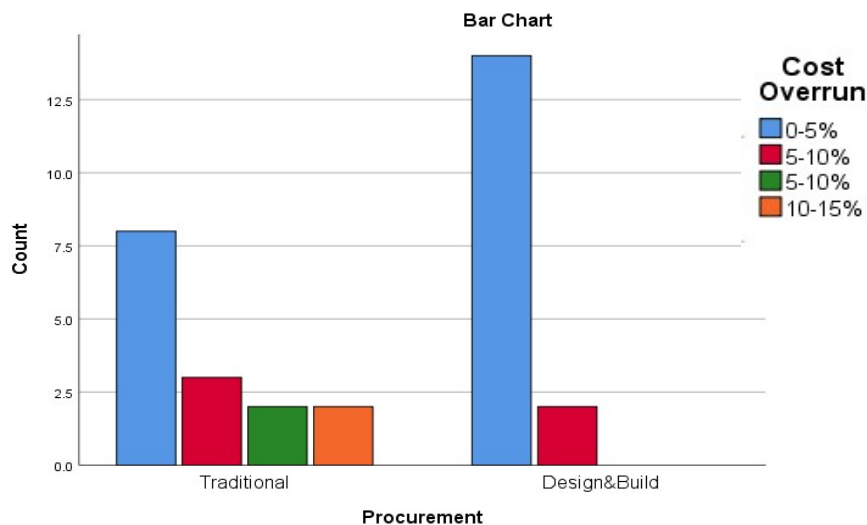


Figure 4.3: SPSS analysis for cost overrun vs. procurement type

4.4.3 Evaluation of Time Overrun

The time overruns of the considered projects are analysed against the project cost. Table 4.14 shows the magnitude of projects delays.

Table 4.14: Analysis of time overrun

Time Overrun vs. Project amount			
Project Value	Time Overrun < 50%	Time Overrun > 50%	Total
50-150	1	7	8
150-300	2	8	10
300-600	5	4	9
600-3000	1	3	4
Total	9	22	31
	30%	70%	

Accordingly, 70% of public sector projects are delayed at least 50% of its original time period.

4.5 Rank of Barriers according to the procurement type

Respondents experiences can be categorised mainly into two types based on procurement type of the project they considered in responding to the survey: Traditional, and Design & Build. Fifteen numbers of respondents considered traditional type of projects while sixteen numbers represented design & build type projects. Table 4.6 shows the final ranking of client related barriers according to the procurement type of projects.

Table 4.15: Client related barriers ranked by procurement type

Q No.	Client's related Barriers in construction projects	Ranked by Traditional Projects	Ranked by Design & Build Projects
10	Delay in contractor's progress payment	1	2
3	Incomplete Client's initial brief	9	1
4	Less Client's commitment to needs of other stakeholders	2	3
8	Variations of scope by client	3	4
14	Less Client's involvement for project activities	5	5
13	Lack of Client's resources for monitoring the project (Staff & facilities)	4	6
7	Bureaucracy in client's organization	6	9
5	Delays due to decision making issues at client	7	8
9	Delay in approving extra works and variations	8	10
11	Lack of Client's commitment for monitoring & evaluation of the project.	11	7
15	Delays of other connected separate contracts/ responsibilities directly handled by client i.e. temporary arrangements, Water, electricity & other services etc.)	13	11
2	Understanding of Time, Cost, Quality	12	12
1	Feasibility Issues	10	13
6	Political interest/support to the project	15	14
12	Lack of client's awareness of role of each party (client/consultant) and project management activities.	14	15

The results of the above analysis show that the overall ranking is slightly different to ranking with procurement type. "Incomplete client's initial brief" is the most critical factor for design and build procurement project but in the traditional procurement projects; it falls to the 9th place.

CHAPTER 5

EXPERT INTERVIEWS ON BARRIERS AND GUIDELINES

5.1 Introduction

The third objective of this study is to examine the guidelines available for GOSL clients to minimize barriers for construction project success. The objective is achieved through a review of available guidelines and interviews with experts. This chapter presents the sections of the guidelines which are important in view of the research aim and expert views obtained on both the barriers, guidelines and other related matters.

5.2 Guidelines for public sector clients in Sri Lanka

This study found several local guidelines available to the client when implementing public construction projects in Sri Lanka. There are general guidelines and technical guidelines. Establishment Code, Financial Regulations, Bribery Act and Doctrine of Public Trust are the general guidelines available for all government servants while the following technical guidelines are available for staff engaged in infrastructure development projects.

- a) National Procurement Guidelines. (2006)
- b) CIDA (ICTAD) Client's Guides (2007)
- c) Guide to Project Management & Contract Management for Infrastructure Development Projects (Works) Implemented by the GOSL (2017)
- d) Guidelines for Submitting Development Project Proposals for Public Investment: (2019)

The above four guidelines are reviewed and found clauses which are directly connected with barriers found to be critical from the analyses of the previous stages.

5.2.1 National Procurement Guidelines (2006)

National Procurement Guidelines 2006 as amended from time to time applies to the procurement of goods, service and works with public funds or any other source by government ministries, provincial councils, local authorities, government corporations, and government owned companies etc. The guidelines prohibit an officer engaged in a procurement action to abuse their powers to derive benefits for one's self, family or business associates and to derive personal gain from such a procurement action. Such officers are prohibited from accepting gifts or inducement which may impact or influence their decision making in an objective manner.

5.2.2 CIDA (ICTAD) Client's Guides (2007)

Construction Industry Development Authority (CIDA), formerly known as ICTAD developed a number of guidelines for the betterment of the construction industry to be used by involved personnel. This study found that amongst them the guidelines ICTAD/CONSULT/02 provides a comprehensive guidance to the public sector clients.

- Clause 4 of the “Client Guide- ICTAD/CONSULT/02” describes the process of selection of consultant.
- Scope of relevant consultancy services are also defined in the guideline Selection of Consultant ICTAD/CONSULT/03”
- Clause 7 of the guideline “Client Guide- ICTAD/CONSULT/02” advises client to organize management functions necessary for the proper implementation of the project. Guideline further advise clients, to establish a nucleus of a team within the organization to coordinate activities and accumulate more detailed information of the requirements.

5.2.3 Guide to Project Management & Contract Management (GPMCM) for Infrastructure Development Projects (Works) Implemented by the GOSL (2017)

The GPMCM intends to provide guidance to staff involved in the implementation and monitoring of infrastructure development projects; especially for ADB funded projects. However, this guideline is also useful for members of Procurement Committees and

Technical Evaluation Committees other staff in project management units in GOSL funded project since project management concepts and procedures are same. It has 3 three broader sections; (i) Introduction, Principles and Concepts of Contract Management; (ii) Contract Management Procedures; and (iii) forms, templates and specimen letters for each contract management action. The Guide is intended to serve as a first reference point to project staff to manage projects effectively and efficiently. The GPMCM was circulated within all government institutions by ministry of finance.

5.2.4 Guidelines for Submitting Development Project Proposals for Public Investment (2019) “Circular No. MNPEA 19/02/2019”

Ministry of National Policies and Economic Affairs issued a guideline in January 2019 aiming to re-assess development project proposals under Public Investment Programme (PIP).

5.3 Experts’ Views on the Barriers and Guidelines

Three discussions were held with experts in the industry in order to obtain their views on results of the analyses of data collected from the sample and the usage of the available guidelines by the public sector clients in general. Interestingly, they held different views and selected some of the bottom ranked barriers as having high impacts on the success of GOSL projects. The following sections present the expert views on the priority they placed on the ranked barriers.

5.3.1 Experts’ Views on the barriers

- **Barrier “Client’s involvement in public sector construction projects is not adequate” [Rank - 5]**

All three experts agreed with the statement of “Client’s involvement in public sector construction projects is not adequate”. Further, they believe that consultant of the project also can play a big role in order to minimize

the effect of this barrier and to achieve the success of a project.

- **Barrier “Delay in contractor’s progress payment” [Rank - 1]**

This is the most critical barrier according to the overall responses of the survey sample. Even though this is directly relevant to the client, experts highlighted that the responsibility of releasing funds falls under the Ministry of Finance, which is a separate entity. Therefore, they are of the view that it is not reasonable to identify the funding issue as a client’s barrier since it is beyond the control of public sector clients.

- **Barrier “Political interest/support to the project” [Rank - 14]**

The experts pointed out political interest on a project as a factor to receive the funds. Lack or absence of timely policy decisions allow politicians to prioritise projects as per their schedules and concerns. They disclosed of their experiences where political involvement had directly impacted with payment issues of certain projects.

- **Barrier “Incomplete client’s initial brief” [Rank - 2]**

This is the most critical barrier for design and build projects as per the analysis with survey data. All experts also accepted this as one of the critical barriers. Public sector clients prefer to choose design and build contracts because of less responsibility on them and also the resulting minimum disputes. However, they stressed the need for a proper evaluation system, if the method is to be used in the future.

- **Barrier “Lack of Client’s resources for monitoring projects” [Rank - 10]**

Experts believe that, should any public client has a well experienced engineer most problems can be effectively managed. Unfortunately, such professionals are very rear in public sector since they have a better demand in private sector with higher salaries. Correspondingly, it was revealed that less construction experience of public sector engineers is

also a factor that hinders the success when implementing construction projects.

- **Barrier “Less commitment to the needs of stakeholders’ requirements” and “Scope variations” [Ranks - 3 and 4]**

The experts are of the view that the absence of a good coordinator at client’s entity, to work with consultant, restricts the design by the capacity of consultant’s staff. Therefore, stakeholders’ representatives may not be satisfied with the project. Such a situation could create the potential to generate scope changes at the construction phase. This situation can be minimized by the appointing allied professionals in the construction industry as consultants to the project.

- **Usage of available Guidelines**

Clause 6.0 of ICTAD/CONSULT/02, provides a comprehensive guidance to the client. However, in response to the usage of guidelines the experts claimed that usually client’s representative does prepare a brief summary including budget requirements without obtaining any assistance from consultants. This is mainly because of the busy schedules of responsible officers with their routine works such as minor constructions and maintenance works directly handled by the client. Further, at this point of a project usually the consultants are not appointed. Once the approval is obtained for the budget from the relevant authority, it will take a long time for any revision needed, leading to time overruns of the project.

5.3.2 Experts’ Views on the Guidelines

Regarding the effectiveness of available guidelines, experts stated that all guidelines are very important and they were developed and circulated as a result of long term need in the society. However, adhering to those guidelines is not at a satisfactory level. Therefore, experts suggested to assess process of project planning with the direction stated in the guidelines before executing physical construction. Though the clients are requested to submit their infrastructure requirements to the Treasury and department of national planning; assessment process may not be strong enough.

Generally, consultant to the project will be appointed by the client after the approval of the same. Therefore, consultant has no opportunity to involve in initial planning and budget preparation work. Under this situation, people who involve in project initiation stage should have broad knowledge and awareness regarding national planning. Experts has despondency as political authority violate and change the national policies in time to time. Further, they are in the opinion that the Department of National Planning should be made more powerful.

5.4 Design and Build Contracts

Experts highlighted the benefits and drawbacks of Design and Build Contracts.

5.4.1 Benefits of Design and Build method

Design and Build method brings following significant benefits to the project client:

- **Minimizes risk**

This method helps to minimize risks for the client because it reduces the number of contacts. The client does not take the risk but design and build contractor take major responsibility.

- **Saves time**

This method reduces the delivery schedule by overlapping the design and construction phases of a project. Contractor has freedom to carry out detailed designs while executing construction activities. Any delay in design drawings will be borne by him.

- **Saves money**

This method also saves money for the client. With only one entity to hire, there are fewer overhead costs to bear, simpler and fewer legal and managerial responsibilities, and a decreased possibility of litigation and with fewer parties.

- **Encourage innovation and a more holistic approach to construction**

Design and Build method also encourages the contractor to take more innovative and best value approaches to design and construct the building. This is possible because both designer and the contractor come together early in the process to address potential issues that may arise in the future. This also reduces the risk of design errors, which take more time and money to rectify later on. Moreover, since the contractor is also the designer, the design can be easily customized to suit the actual site conditions.

- **Lack of expertise**

There is a possibility that, the entity no longer specializes in either designing or construction, but has to be proficient at both, this may compromise the level of expertise of the design and build contractor. If the contractor is primarily a builder rather than a designer, he may not be able to achieve complex designs or push himself to the limit of the project's design potential.

- **Quality issues of the Project**

Another potential drawback of the Design and Build approach is that the client may lose out, in terms of quality with ultimate outcome. In traditional method, the designer and contractor represent different perspectives in the construction process, where the designer usually interprets the project owner's vision through the design. When the designer and contractor become same person, they no longer operate as counterweights to each other, and the architect's vision could appear to favour the contractor. Therefore, client may require to assign technical expertise in order to assist him in overseeing the project.

5.4.2 Shortcomings and Limitations in procuring Design and Build contract

As per the experts' views some shortcomings and limitations exist in design and build contracts. Two main such issues are discussed below.

- **Evaluation of technical proposal**

Generally, a Design and Build bid has two parts as ‘technical’ and ‘financial’ which are evaluated separately. Final marks of those two parts are calculated using a pre-decided proportion (E. g. 60% for technical and 40% for financial proposal). This proportion is decided by the client. Expert clearly expressed their disagreement about the evaluation process of technical proposals. Their major concerns are the marking scheme and the members who involve in the evaluation of the technical proposal. If a comprehensive marking scheme is not available, evaluator has the freedom to award more marks in favour of the aesthetic views of the building projects at the expense of other important factors that must have been evaluated. Therefore, there should be a guidance to evaluate the bidders’ technical proposal considering all factors such as functional ability, easy maintenance, durability, low running cost and environmental sustainability.

Further, experts proposed to obtain the services of qualified teams encompassing Architects, Structural Engineers and Mechanical-Electrical-Plumbing consultants to evaluate the design proposal as per the function of the building.

- **Simultaneous occurrence of design and construction phases**

It may not produce expected result because the design and construction phase occur simultaneously, there is no fixed design to refer to at the start of the project. Thus, the ultimate outcome may differ from what the client has in mind, especially if the employer’s requirements and contractor’s proposal are not sufficiently precise to make sure that both project owner and design-builder can have a good mutual understanding. However, this can be dealt with by slightly modifying the Design and Build method – the project-owner can develop a more detailed preliminary project design beforehand, so that the contractor has a clearer idea of what the project-owner wants.

CHAPTER 6

RESULTS AND VALIDATION

6.1 Introduction

The aim of the study is to investigate the role and responsibility of public sector client for better performance in their construction projects. This aim has been systematically achieved by attaining the first three objectives of the study. This chapter presents a discussion on the results obtained in the data analyses and validation of such results in view of the existing construction industry environment, which is the last objective of this study.

6.2 Client related barriers

Client is the project initiator. Therefore, clients have to carefully evaluate all possible options at the beginning of a project proposal. In addition to the three critical success factors time, cost and quality, satisfaction of stakeholders, functionality, environmental performance and safety are also expected in a construction project.

In view of the above requirements of construction projects, this research study identified client related barriers by reviewing available research literature and through discussions with senior professional in the industry. Fifteen (15) important barriers were identified as follows:

- i. Feasibility issues (Identification of the project and its Location)
- ii. Lack of Client's ability to review client's requirements in designs drawings.
- iii. Variations of scope by client
- iv. Delay in approving extra works and variations
- v. Delays due to decision making issues at client
- vi. Delay in contractor's progress payment
- vii. Lack of Client's commitment for monitoring & evaluation of the project.

- viii. Lack of client's awareness of role of each party (client/consultant) and project management activities.
- ix. Lack of general understanding of client about the construction cost, quality and time
- x. Lack of Client's resources for monitoring the project (Staff & facilities)
- xi. Political support to the project
- xii. Client's time to involve project activity (i.e. busy with work load)
- xiii. Client's commitment to the needs of other stakeholders
- xiv. Bureaucracy in client's organization
- xv. Delays of other connected separate contracts directly handled by client

6.2.1 Ranked critical client related barriers in the public projects

The overall analysis of the responses received on a Likert scale resulted the following five as the most important client related barriers which impacts the success of GOSL projects;

1. Delay in contractor's progress payment
2. Incomplete Client's initial brief
3. Less Commitment to the needs of other stakeholders
4. Variations of scope by client
5. Less Client's involvement for project activities

However, the ranks of the critical barriers shifted as given below, when the same 15 barriers are analysed based on the procurement type.

Client's related Barriers	Rank in Traditional	Rank in Design & Build
• Delay in contractor's progress payment	1	2
• Incomplete Client's initial brief	9	1
• Less Client's commitment to needs of other stakeholders	2	3
• Variations of scope by client	3	4
• Less Client's involvement for project activities	5	5
• Lack of Client's resources for monitoring the project (Staff & facilities)	4	6
• Bureaucracy in client's organization	6	9

Accordingly, the following conclusions can be drawn;

- a) Both 'traditional' and 'design & build' projects are severely affected by delaying contractor's progress payments.
- b) Incomplete client's initial brief has a significant impact on 'Design and Build' procurement.
- c) Bureaucracy in client's organization has a lower impact on projects with Design and Build' procurement method.

6.2.2 Impact of identified critical barriers on other factors

Association of barriers with other factors found this study;

- a) Client related barriers in design phase are critical than that of construction phase.
- b) Both traditional and design & build projects are affected by delaying contractor's progress payments.
- c) 70% of public sector projects are delay at least 50% of its original time period.
- d) Cost overrun possibility is comparatively low in design and build projects than traditionally procured projects.

6.3 Validation of the Results

The above rankings and impacts identified by the sample of experienced professionals in the construction industry is then validated in three steps. First, by obtaining opinions of three experts, second by an interview with a top official in the Treasury and third, by comparing with the clauses in the available guidelines for the public sector clients. The following sections presents the rationale for validation or invalidation of findings through the analysis of survey data in Chapter 4.

6.3.1 Delay in contractor's progress payments

This is the barrier ranked first on the list of given 15 client related barriers contributing to retardation of a successful completion of a public sector construction project. It also secured first and second ranks when analysed by the procurement type (Traditional or Design and Build) of project. Further analyses also did not show a significant relationship of this barrier on the procurement type. Hence, this study argues that the 'Delay in contractor's progress payments' as the most significant client related barrier negatively contributing to the successful completion of a construction project in the contemporary construction industry of Sri Lanka.

However, the three experts emphasized that the releasing of the funds for progress payments is a responsibility coming under the purview of the Ministry of Finance. The senior Treasury officer endorsed this view and further explained that the deficiency of consolidated fund is due to the increases of essential expenses of the country. He agreed that it could be a reason impacting cash flow of government funded projects resulting in delays of contractor's progress payment. Further, he disclosed that the Treasury is in the opinion that in the planning of new construction projects by the government, all projects should be re-assessed with the view of prioritizing them for implementation. Further, he expressed his concern on the existing system of initiation of construction projects by obtaining details directly from clients. He is of the view that the construction projects should be reviewed by National Planning Department and provide the details to the Treasury.

Therefore, delaying contractor's progress payment is not directly under the control of public sector clients. However, the client is responsible to; evaluate economic feasibility of the proposed project, allocate practical project duration, and follow guidelines stringently. Guideline issued by the Ministry of National Policies and Economic Affairs in January 2019 may address this issue in future up to some extent. Said guideline is "Guidelines for Submitting Development Project Proposals for Public Investment: Circular No. MNPEA 19/02/2019". The aim of this guideline is to re-assess development project proposals under Public Investment Programme (PIP).

6.3.2 Incomplete client' brief

The study found that the client can acquire a comprehensive guidance from Clause 6.0 of Client Guide- ICTAD/CONSULT/02. However, the three experts are of the view that in practice the clients do not search and practice this guideline and instead prepare only a small summary including budget requirements. The client is also not in a position to obtain assistance from a consultant as at this point of time, consultants are usually not appointed. Once the approval is obtained for such an incomplete budget from the relevant authority, it leads to time overruns of project with subsequent changes and corrections for omissions. Therefore, this study proposes that the appointment of consultants, at least one, should happen at the project initiation stage.

6.3.3 Commitment to stakeholder's requirements and scope variations

These two barriers scored 3rd and 4th ranks in the overall analysis. Hence, the opinions of the experts were sought on these barriers. Their opinions shed light to understand the inter-relationship existing between the two barriers.

The experts are of the view that a client needs to have a good coordinator who understands the needs of all stakeholders and should work with consultant to develop the design. Lack of a trained professional in this role limits the capacity of consultant's staff. As a result, at later stages especially in the construction phase, the unsatisfied stakeholders may request scope changes.

This situation can be minimized by the appointing allied professionals in the construction industry as consultant to the project. The selection of consultant is described in Clause 4 of the “Client Guide - ICTAD/CONSULT/02”. Scope relevant to the consultancy services are also defined in the guideline “Consultant ICTAD/CONSULT/03”.

6.3.3 Less client involvement in the project

This is the fifth ranked barrier. As described in literature Client involvement is required throughout the project. Clause 7 in the guideline “Client Guide-ICTAD/CONSULT/02” advises client to organize management functions necessary for the proper implementation of the project. Guideline further advise clients to establish a nucleus of a team within the organization to coordinate activities and accumulate more detailed information of the requirements.

6.3.4 Political interest/support to the project

The analysis of the responses received from the sample of professional resulted in placing this barrier at the 14th rank among the 15 barriers. However, both the experts and Treasury officer clearly explained how political manipulation is directly connected with funding in public projects. On the other hand, being a developing country, public sector infrastructure requirements are increasing day by day in Sri Lanka. In this situation, every government in SL have faced very crucial financial crisis during their administrative periods. Even current situation is also same in SL and sustainable solution through long term planning is a vital requirement.

The barrier “Incomplete client’s initial brief” is deeply discussed. This is also the most critical barrier for design and build projects. All experts accepted and confirmed it as one of critical barriers. The study also found that the public sector clients prefer to choose design and build contracts because of low responsibility and minimum disputes in such projects. However, the experts are in the opinion that there should be a proper evaluation system for the success of this type of projects.

Further, the new trend of selection of design and build contractors through competitive bidding was not accepted by the experts.

Under this scenario, if public clients wish to procure a design and build project, it is highly advisable to appoint expert team in order to prepare employers requirement and evaluation criterion. Also it is important to appoint supervisors for assuring the quality during the construction period.

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 Introduction

This chapter concludes the research study and recommends aspects which need further study.

7.2 Conclusions

This study identified the following critical client related barriers.

1. Delays in contractors' progress payments.
2. Incomplete client's initial brief.
3. Less commitment to the needs of stakeholders.
4. Variation of scope by client.

Further analyses on the associations of these barriers with factors such as procurement method, project cost, cost overrun and time overrun resulted in drawing the following conclusions;

- a) Both 'traditional' and 'design & build' projects are severely affected by delaying contractor's progress payments.
- b) Incomplete client's initial brief has a significant impact on 'Design and Build' procurement.
- c) Client related barriers in design phase are critical than that of construction phase.
- d) 70% of public sector projects are delayed at least 50% of its originally planned time period.
- e) Cost overrun possibility is comparatively low in design and build projects than traditionally procured projects.

Knowing this outcome is important for the public organizations in order to determine how their involvement should be developed. It is also important to the staff who provide consultations to the GOSL projects in order to keep more attentions with these critical factors and acknowledge the clients accordingly.

7.3 Recommendations for Public Clients

Based on the findings, the study recommends that public clients' representative should be more aware of their role and responsibility in construction projects. Specially following key point will help clients to minimize the critical barriers.

- 1) Should take contractors realistic cash flow for project and communicating with in-house relevant officers as well as the treasury in order to maintain uninterrupted payments to the contractor. If there are funding issues, then better to acknowledge consultant or contractor for re-planning activities as appropriately.
- 2) Specially, when constructing new buildings replacing the existing, funds should be available for temporary works, in addition to the cash flow availability in order to avoid any time delays.
- 3) Should listen to the experience consultant's advices rather bargaining technical and practical aspects.
- 4) Needs to take adequate care in preparing 'initial project brief' by discussing stakeholders to identify their requirements. Adhere strictly on the "Client Guide- ICTAD/CONSULT/02"
- 5) When dealing with non-technical stakeholders, use modern visualization techniques for better understanding of technical jargon.
- 6) Allocate sufficient time to design and estimate and review the designs before finalize the scope of work and budget.
- 7) Evaluate the team to be engaged to the projects i.e. experience of consultant's staff.
- 8) Pay adequate attention for feasibility of the project including geotechnical and environmental parameters as well as social & cultural aspects for

sustainable.

- 9) Need to take into account weather records and other anticipated events during the year and make necessary instructions to the contractor.
- 10) Should advise relevant parties for sufficient design review and estimates before finalizing the design.
- 11) Take approval from relevant authorities before awarding the project.
- 12) Should be vigilant in activities of both consultant contractors at site.
- 13) Participate in training programmes and obtain essential knowledge to handle the project.
- 14) Expedite the approval process and make decisions as early as possible.
- 15) Flexible to adopt the most suitable procurement method instead of relying on the traditional procurement method which might not necessarily be the most appropriate.
- 16) Recommend to refer:
 - a) “Guide to Project Management & Contract Management” published Ministry of Finance in February 2017.
 - b) “Client Guide-General”, IACTAD publication No. ICTAD/CONSULT/02
 - c) “Client Guide-Selection of Consultants”, IACTAD publication No. ICTAD/CONSULT/03

7.4 Recommendation for Future Research

Based on the findings of this research, the following are recommended for future research endeavours.

- 1) It would be worth to compare success between private and public sector clients’ involvements in construction projects. This would help in identifying the areas where the client involvement is efficient in construction projects. The investigation would also help in identifying possible methods for enhancing

client role and would be useful to extract new ideas that would improve the existing system of client involvement.

- 2) Since the study was done with consultants from few government sector organizations, similar studies could be conducted with sample populations from private sector consultants and contractors to determine whether the findings of this study are accurate and meaningful. This would help in ascertaining and getting a full understanding of the current state of client's behavior in public sector.
- 3) There is a need to investigate into the procurement methods (i.e. traditional or design and build etc.) to match the same with the nature of the project, cost estimation and required duration.
- 4) Since this study was limited to government funded project in Sri Lanka, it is worth to investigate the systems practiced by foreign funding agents such as World Bank, Asian Development Banks etc. in order to compare the similarities and differences.
- 5) It is highly recommended to collect adequate data for all above studies since construction projects are very complex and many influencing parties are involved.

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Appendix – A: Sample Questionnaire

Appendix – B: Responses summary of the Questioner

Appendix – C: Data analysis summary

**EVALUATING CLIENT'S RELATED BARRIERS TO PERFORM GOVERNMENT
FUNDED CONSTRUCTION PROJECTS IN SRI LANKA**

QUESTIONNAIRE

A. General Information

Name of the respondent :

Name of the organization :

Designation :

Working experience :

5 - 10 Years 11 - 15 Years 16 - 20 Years
 Above 25 Years

B. Project Information

Description	Answer
1. Name & Type of Project (Administrative/ Office Building, Hospital Building, University, School, Police station, New development etc.)	
2. Type of Contract a. Design Bid-Build (Traditional), b. Design & build (Competitive), c. Design & Build (Direct award by Cabinet), d. Other (Please specify)	
3. Project cost (Original)	
4. Cost at completion	
5. Construction period original	
6. Construction period actual	
7. Funding arrangement (Special vote, consolidated, Loan)	
8. Designation of Client's representative	
9. Time taken to function after completion	-
10. Reason for delay to function	

C. Status of barriers to the project

This part of the questionnaire will examine the client related barriers on construction projects. Various barriers identified from previous studies and the interviews with senior consultant are listed below and you are requested to put your view/ experience on To What Extent these barriers are faced in the projects.

Please use 1-5 Likert-scale for indicating your answer.

Barriers to the project (See the sample given at the end)	1 Very low	2 low	3 Neutral	4 High	5 Very high
1. Feasibility issues (Identification of the project and its Location etc.)					
Remarks:					
2. Lack of general understanding of client about the construction cost, quality and time					
Remarks:					
3. Lack of Client's ability to give complete initial brief & review client's requirements in designs drawings.					
Remarks:					
4. Client's commitment to the needs of other stakeholders					
Remarks:					
5. Delays due to decision making issues at client					
Remarks:					
6. Political interest/support to the project					
Remarks:					
7. Bureaucracy in client's organization					
Remarks:					
8. Variations of scope by client					
Remarks:					
9. Delay in approving extra works and variations					
Remarks:					

10. Delay in contractor's progress payment					
Remarks:					
11. Lack of Client's commitment for monitoring & evaluation of the project.					
Remarks:					
12. Lack of client's awareness of role of each party (client/consultant) and project management activities.					
Remarks:					
13. Lack of Client's resources for monitoring the project (Staff & facilities)					
Remarks:					
14. Less Client's involvement for project activities (i.e. busy with work load)					
Remarks:					
15. Delays of other connected separate contracts directly handled by client (i.e. MEP works)					
Remarks:					
16. Other Barrier 1 (Please specify)					
Remarks:					
17. Other Barrier 2 (Please specify)					

Note: Please recheck your answers of severity of barriers

Example: Barrier 2- "Lack of general understanding of client about the construction cost, quality and time" –
if client allocated unrealistic low budget for your project and caused severe delay to finalize scope of work then your answer should be 4 or 5.

A. Respondent's Details

1 Experience, Y1

Y1	1: (5-10); 2: (11-15); 3:(16-21) (Not a variable)
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B. Project Information

- 1 Nature of project, X1
- 2 Procurement Type, X2
- 3 Amount, X3
- 4 Cost Overrun, X4
- 5 Time Overrun, X5
- 6 Time to function after completion

X1	(1:Hospital, 2:University/school,3: Court, 4:Office, 5:Mix Develop,)
X2	(1:Traditional; 2: Design & Build Cabinet; 3: D&B Tender)
X3	1: 50m-150, 2:150-300, 3:300-600, 4: 600-1500, 5: >1500
X4	1: 0-5%; 2: 5-10%; 3: 10-15%; 4: >15%
X5	1: 0-25%; 2: 25-50%; 3: 50-75%; 4: 75-100%; 5:100%>
X6	1: <3M; 2:3-6M; 3:6-12M; 4:>12M

C. Status of barriers to the project

Res	Nature X1	Procurement Type, X2	Amount, X3	Cost Overrun, X4	Time Overrun, X5	Design Phase (Pre-construction)							Construction Phase							
						Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
1	4	1	4	1	1	3	3	3	2	3	3	3	4	4	4	3	3	3	4	4
2	3	1	3	1	1	2	3	4	3	2	3	4	3	3	3	2	2	3	3	4
3	3	2	3	2	2	3	1	4	2	2	2	3	5	4	3	2	1	3	2	4
4	4	1	3	1	2	4	3	2	4	1	1	3	2	2	2	4	2	3	4	1
5	3	1	1	4	5	5	3	4	3	2	3	3	4	2	3	2	2	3	4	3
6	2	1	3	3	5	2	3	3	1	1	1	2	4	3	2	1	3	1	1	1
7	2	2	3	1	4	1	1	3	4	2	1	3	2	1	4	1	1	2	1	1
8	1	2	4	2	5	2	3	4	3	4	4	1	4	3	5	4	2	5	5	1
9	5	1	1	1	3	3	2	1	3	2	1	5	2	2	3	4	4	3	2	1
10	1	2	2	1	4	1	3	5	4	4	1	4	4	3	4	3	2	5	5	4
11	5	1	1	2	3	1	4	4	2	3	1	4	3	4	2	2	3	4	4	1
12	2	1	1	3	5	1	2	3	4	4	1	3	3	4	5	4	2	4	3	3
13	1	2	2	1	5	1	1	5	4	5	1	3	3	5	5	5	2	4	4	5
14	5	2	2	1	5	4	3	4	3	4	4	2	3	4	5	4	3	4	3	5
15	4	1	1	1	4	1	2	3	4	4	1	4	4	4	5	2	3	3	2	4

Res	Nature X1	Procurement Type, X2	Amount, X3	Cost Overrun,X4	Time Overrun, X5	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
16	5	1	1	1	5	1	1	1	4	3	1	1	1	2	2	1	1	2	3	1
17	4	1	5	1	5	1	4	4	3	5	3	3	1	1	4	1	1	2	2	5
18	5	1	2	4	5	5	3	1	4	3	4	1	5	3	5	4	1	4	4	1
19	5	2	3	1	4	4	3	4	4	2	1	1	2	2	2	3	1	4	3	1
20	2	1	3	2	2	1	1	1	4	1	1	3	2	3	2	1	1	3	3	1
21	5	1	2	1	5	5	2	5	3	5	3	4	4	3	5	4	1	4	3	1
22	2	3	3	1	2	1	1	5	5	2	1	4	4	2	1	1	2	2	3	1
23	5	2	2	1	5	1	4	5	4	2	2	3	5	4	5	5	1	4	3	3
24	1	2	3	1	5	1	1	4	4	3	1	3	4	2	5	4	1	4	5	3
25	5	4	2	2	5	5	2	3	4	3	2	1	5	2	5	4	1	4	4	4
26	5	2	1	1	3	2	3	4	5	4	4	2	4	3	4	3	2	2	2	3
27	2	3	2	1	1	1	1	5	4	2	1	3	4	2	2	1	3	3	3	1
28	1	2	2	1	4	1	2	3	4	4	1	3	4	2	5	5	1	3	4	3
29	4	2	4	1	5	4	3	5	4	3	1	5	3	4	5	4	1	3	4	5
30	4	2	1	1	2	2	3	4	4	3	2	4	4	2	4	1	1	1	2	4
31	5	2	2	1	1	1	3	4	2	1	1	2	4	2	2	2	2	1	2	1
32																				
						70	74	110	108	89	57	90	106	87	113	87	56	96	97	80

Check association of Procurement type (X2) with 1 to 3 critical Questions (Q10, Q3, Q4)

Correlations

		Procurement	REDEFINED Q10
Procurement	Pearson Correlation	1	.092
	Sig. (2-tailed)		.624
	N	31	31
REDEFINED Q10	Pearson Correlation	.092	1
	Sig. (2-tailed)	.624	
	N	31	31

Correlations

			Procurement	REDEFINED Q3
Spearman's rho	Procurement	Correlation Coefficient	1.000	.102
		Sig. (2-tailed)	.	.585
		N	31	31
	REDEFINED Q3	Correlation Coefficient	.102	1.000
		Sig. (2-tailed)	.585	.
		N	31	31

Correlations

		Procurement	REDEFINED Q4
Procurement	Pearson Correlation	1	.453*
	Sig. (2-tailed)		.011
	N	31	31
REDEFINED Q4	Pearson Correlation	.453*	1
	Sig. (2-tailed)	.011	
	N	31	31

*. Correlation is significant at the 0.05 level (2-tailed).

Check association of Project cost (X3) with Critical Questions

Correlations			
		Amount	REDEFINED Q3
Spearman's rho	Correlation Coefficient	1.000	-.138
	Amount Sig. (2-tailed)	.	.460
	N	31	31
	Correlation Coefficient	-.138	1.000
	REDEFINED Q3 Sig. (2-tailed)	.460	.
	N	31	31

Check association of Cost Overrun (X4) with Critical Questions

Correlations			
		Cost Overrun	REDEFINED Q3
Spearman's rho	Correlation Coefficient	1.000	-.264
	Cost Overrun Sig. (2-tailed)	.	.152
	N	31	31
	Correlation Coefficient	-.264	1.000
	REDEFINED Q3 Sig. (2-tailed)	.152	.
	N	31	31

Check association with Procurement type and Time Overrun

Correlations			TimeOverrun	Procurement
Spearman's rho		Correlation Coefficient	1.000	-.091
	TimeOverrun	Sig. (2-tailed)	.	.625
		N	31	31
		Correlation Coefficient	-.091	1.000
	Procurement	Sig. (2-tailed)	.625	.
		N	31	31

Check association with Procurement type and Cost Overrun

Correlations			Procurement	Cost Overrun
Spearman's rho		Correlation Coefficient	1.000	-.406*
	Procurement	Sig. (2-tailed)	.	.023
		N	31	31
		Correlation Coefficient	-.406*	1.000
	Cost Overrun	Sig. (2-tailed)	.023	.
		N	31	31

*. Correlation is significant at the 0.05 level (2-tailed).