IDENTIFYING FACTORS AFFECTING THE PROJECT SUCCESS OF PRIVATE SECTOR BUILDINGS IN SRI LANKA

MASTER OF SCIENCE

IN

CONSTRUCTION PROJECT MANAGEMENT

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August 2021

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"This dissertation was submitted to the Department of Civil Engineering of the University of Moratuwa in partial fulfilment of the requirement for the Master of Science in Construction Project Management"

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August 2021

Declaration

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Abstract

Building construction projects are inherently complex, dynamic, and involve challenges due to lots of uncertainties. It is difficult to produce a complete solution to manage such projects successfully. Therefore, to achieve project success in building construction of projects, recognising the most significant factors affecting project success is an emerging concern in the industry. Although there is abundant research conducted globally on project success factors, only a few have attempted to explore project success factors pertaining to Sri Lanka. Therefore, it is necessary to identify project success factors that particularly impact the private sector building projects in Sri Lanka which have been carried out in this research.

In this study, a literature survey was carried out to gather the project success factors identified in a global context out of which 115 factors were selected. The Delphi technique was adopted to collect data and to obtain expert opinions; two rounds of questionnaire surveys were conducted. An academically and professionally qualified panel of experts who are currently practising in Western Province, Sri Lanka participated in the survey.

In the first-round questionnaire, 66 project success factors were identified out of 115 factors as factors applicable to the Sri Lankan Context. Relative Importance Index formulae (RII) were utilized for data analysis, after which factors were ranked respectively. The second-round questionnaire survey was conducted to collect data to analyse the most significant factors affecting project success in Sri Lanka. Twenty-eight factors were identified as the most significant factors affecting project success in private sector building projects in Sri Lanka. Contractor's Cash flow, Contractor's Planning efforts, Easiness to reach to the site (Project Location) and Control of sub-contractors works are the most significant factors that received the ranking position of 1 to 4 respectively. The outcome of the research can be used as a guideline to achieve the project success of building construction projects in Sri Lanka. Further studies are required to create a conceptual framework, which shall be a benchmark to monitor project success in Sri Lanka.

Acknowledgment

This page is specifically written to extend my sincere gratitude to the people who have encouraged and supported me towards the successful completion of this research and dissertation. There are several personalities who have contributed their extensive and diverse knowledge and information for me to complete this research study and dissertation successfully.

First, I wish to thank the profound guidance and assistance of Prof. A.A.D.A. J. Perera; without his supervision and considerable advice, this research and dissertation would not have been completed agreeably.

I wish to thank all academic staff & non-academic staff of the Civil Engineering Department of the University of Moratuwa.

Further, I wish to express my special thanks and grateful appreciation to all my friends for their encouragement and support given to effectively fulfil the requirements of this dissertation.

Last but not least, I deeply express my heartfelt gratitude towards my loving wife Mrs Dhammika, and daughters; Githmi, Mihini, Methuli, and Vishmie Sachinthanee for their support, understanding, dedication, and the valuable backing, without which, it would have been impossible to complete this dissertation successfully.

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List of Abbreviations

CIDA – Construction Industry Development Authority

EOT – Extension of Time

FIDIC – International Federation of Consulting Engineers

ICTAD – Institute of Construction Training and Development

LEED – Leadership in Energy and Environment

RFC – Request for Clarification

RFI – Request for Information

SBD – Standard Bidding Documents

Chapter 1: Introduction

1 Introduction

The construction industry in Sri Lanka contributes to the country's economic development and amounts to 6.9% of the Gross Domestic Product (GDP) of the country. Sri Lanka's national economy was Rs 9,608,296 million in 2019 and it was Rs.9,404,093 million in 2018 (Central Bank of Sri Lanka /Annual Report, 2019). The Sri Lankan Construction Industry has grown since the post-war era due to the government's attention to commence developments and the investment of private and public sectors in the industry on large-scale projects such as apartment towers, high-rise buildings, roads, highways, airports, ports, land reclamation projects. Private sector building projects are the main contributors to the construction industry in the Western Province in Sri Lanka and projects such as mixed-use developments, office buildings, hotels, and apartment towers.

However, the construction industry is continuously facing difficulties and significant challenges both on a global and local level. Some of the challenges and difficulties are inimitable to a specific industry as well as specific to its context. The construction industry is at high risk, high value, more complex, and, competitive while the construction industry business is generally project-oriented. Around the globe, failures of construction projects are continuously reported and construction project success is tremendously becoming challenging and difficult to achieve in the current turbulent environment (Silva et al., 2016). Project success is widely researched by researchers but still interpretation and prediction of project success is a much more complex problem. Project success is much more than the achievement of the traditional time-cost-quality triangle included in the majority of the project success definitions. In addition to the time-cost-quality triangle, stakeholders perception, human-related factors, financial related factors such as clients, contractors, creditors, consultants, and sub-contractors for financial returns for their activities of the projects and other procurement related factors also impact project success. For a long period, experts and researchers have been trying to determine a response for project success or project failure, however have failed to achieve this until the present time (Sebestyen, 2017; The Delphi Technique: A case study of its application in school administration, 1985).

This research study is conducted to identify factors affecting Private Sector Building Project Success in Sri Lanka. . In this research, through different literature reviews, 115 factors under 15 categories impacting project success globally were identified (Bhangle, 2016; Babu, 2015; Melba et al.,2015; Sugumaran & Lavanya, 2014; Gunathilaka et al., 2013; Chan et al., 2004). This study is to adopts the Relative Importance Index (RII) formula to identify RII values for each factor and its ranking position. This will be analysed through a ranking position to identify the most significant factors affecting the success of private sector building projects in Sri Lanka.

1.1 Background

The construction industry continuously evolves due to its nature, development of modern technologies, and increasing uncertainties, complexity, budgets, and involvement of different stakeholders. Building projects are much more complex and are becoming difficult due to increasing uncertainties. Project success is defined by different researchers in different ways. There are several factors affecting project success and project success factors are identified in various ways according to different areas. Projects are complex and dynamic and it is difficult to comprehend the concept of project success (Chan et al., 2004). There is no clear globally accepted definition established for project success, however, it is fundamental to identify factors affecting project success (Nguyen & Chovichien, 2013).

1.2 Problem Statement

The project teams are facing many challenges and difficulties to achieve project success. There are several factors affecting project success and project success factors identified related to different areas (Nguyen & Chovichien, 2013), where Chan et al., (2004) identified 44 project success factors. The concept of project success is very difficult due to the complexity of the projects and their dynamic nature. There is no universally accepted definition of project success. The definition of project success is variable when applied to different industries and according to the different points of view of individuals and project teams (Parfitt & Sanvido, 1993). It is variable between stakeholders, project size, the scope of services, and the time required (Shenhar et al., 1997).

According to Bhangale (2016), 75 factors under twelve different groups were identified, which are; cost group, time group, quality group, client satisfaction group, people group, health and safety group, innovation and learning factor group, environment group, project-related group, project manager and team-related group, organisation group, and external environment group. Babu (2015) identified that 60 factors affected construction project success and those factors are grouped into 10 different groups. In terms of the Sri Lankan context, Gunasekara (2009) identified 30 factors impacting project success within the construction industry. Apart from the research conducted by Gunasekara (2009) and Silva et al., (2016), there is very little research carried out in Sri Lanka to determine factors influencing project success in the construction industry.

1.3 Aim of Research

This research aims to identify factors affecting project success unique to private sector building projects in Sri Lanka. The identified factors will then be ranked to recognise the most significant factors affecting the private sector building projects success in Western Province in Sri Lanka.

1.4 Objectives of Research

1) To identify factors affecting Project Success globally.

2) To identify and evaluate the factors affecting Project Success of private sector buildings in the Sri Lankan Context.

3) To identify, analyse and establish the most significant factors affecting the Project Success of private sector buildings in Western Province, Sri Lanka based on the accumulative knowledge and opinion of experts in the construction industry in Sri Lanka.

4) To provide recommendations & suggestions to achieve project success of the private sector buildings in Western Province, Sri Lanka.

1.5 Research Methodology

The purpose of this research is to identify factors that are affecting the project success of private sector building projects that are unique to Sri Lanka. To achieve research objectives, a 10-step approach will be adopted as a road map (Figure 1) which will be described in detail under chapter 3 of this report. A comprehensive literature survey followed by a Delphi method questionnaire survey comprising, Two Round Questionnaire Surveys were conducted to obtain expert opinions from a panel of experts from the construction industry in Western Province, Sri Lanka. Heterogeneous purposive sampling method, which is one of the non-probability sampling techniques is selected as the most suitable sampling technique to achieve research objectives which was described in detail in Chapter 3 of this report. According to Saunders, et al., (2012, p283), for a heterogeneous population sample size is between twelve to thirty (12-30), and accordingly, it was planned to deploy two-third of the maximum sample size, which is equal to twenty experts for this research. However, due to time constraints and the busy schedule of high-calibre professional practitioners in the Western Province construction industry, only fifteen experts were deployed for this research. A panel of experts from the construction industry in Western Province, Sri Lanka was selected based on the established criterion to provide opinions on project success factors. The expert panel is selected through an initial study conducted based on their qualifications, disciplines, experiences, and their understanding of the research topic and demonstrates an interest in the outcome of this research study.

The expert panel selection criterion was as follows: Practitioners within Western Province, Sri Lanka, who has more than fifteen years of experience in the Sri Lankan building construction industry and who are academically and professionally qualified. The profession pool was, Engineers, Project Managers, and Architects who satisfied academic qualifications either through a Bachelor's Degree (BSc) or Master's Degree (MSc) and Chartered Membership from relevant recognised institutions. This was the main research method utilized for this research study.

Road Map to Research Methodology

Step 1	Comprehensive Literature Survey.
Step 2	Identifying factors affecting Project Success globally.
Step 3	Developing the Questionnaire.
Step 4	Selection of Expert Panel from the Construction Industry who is practicing in the Western Province, Sri Lanka. Criterion was established professionals having more than 15 years experience with academic and professional qualifications.
Step 5	Delphi method survey, 1st round questionnaire was sent to a panel of 15 experts and requested based on their experience to indicate; importance level of each selected 115 factors on a Five-point Likert scale as very low importance - 1, low importance - 2, medium importance - 3, high importance - 4, and very high importance - 5.
Step 6	On receipt expert opinions (Responses) the questionnaire was analyzed using ranking method. Relative importance index was used to determine the relative significance and ranking of the factors. RII - Relative Importance Index was calculated using below mentioned formula. $RII = \frac{\sum W}{A \times N}$ Where; W - Weightage given to each factor by the experts, A - Highest weightage given and N - Total number of respondents.
Step 7	Based on the analysis using RII, factors nearest RII lower value to the mean of the RII values and an overall ranking relevant to that nearest RII lower value and above ranking received factors have been selected from the 1st round in Sri Lankan context to consider for the second round questionnaire.
Step 8	Delphi Survey 2nd round questionnaire was sent to the same panel of experts to indicate a Five-point Likert scale again as per Step 5 above to identify most significant factors affecting project success in Western Province of Sri Lanka.
Step 9	On receipt of the responses, 2nd round questionnaire was analyzed using the same method and formula.
Step 10	Based on the above analysis and ranking, the most significant factors were identified which affect private sector building project success in Western Province of Sri Lanka. Discussion and results with recommendation was provided for the construction of private sector building projects in Western Province of Sri Lanka.

Figure 1: Research methodology

Research Methodology includes the following 10 steps to carry out the process of research and to achieve the above-mentioned research objectives:

Step 1: Comprehensive literature survey.

Step 2: Identifying factors affecting project success in a global context through a literature survey.

Step 3: Developing the questionnaire survey which includes several factors under various categories

Step 4: Selection of Expert Panel from the Construction Industry who is practising in the Western Province, Sri Lanka. The criterion was professionals having more than 15 years of experience with academic and professional qualifications.

Step 5: Delphi Survey Round 01 - The questionnaire was distributed to 15 Panel of Experts practising within Western Province, Sri Lanka who is having more than fifteen (15) years of experience in the Sri Lankan building construction industry with academically and professionally qualified professionals, selecting from Engineers, Architects, Project Managers of Contractor's Organisations, Consultants, Project Management Consultants, and Clients. Respondents were advised to rank the question from Likert Scale 1 to 5 as per their preference of importance level considering factors affecting the project success of the private sector building projects in Sri Lanka, as follows; very low, low, medium, high, and very high. The responses were collected for analysis.

Step: 6 Responses of the round 01 questionnaires were analysed through the application of the Relative Importance Index (RII) Formula to calculate the ranking for each of the factors. RII was used to determine the overall ranking for each factor as well as a ranking of each factor under each category. RII was calculated using the formula mentioned below:

$RII = \sum W / (A*N)$

Where, W = Weightage given to each factor by the respondent

A = Highest weightage given

N = Total number of respondents

Step: 7 Based on the analysis using RII, factors nearest RII lower value to the RII mean value and an overall ranking relevant to that nearest RII lower value and above ranking received factors have been selected from the 1st round to consider in Sri Lankan context for the second-round questionnaire.

Step: 8 The Delphi Survey 2nd round questionnaire was sent to the same panel of experts to indicate the Five Point Likert scale same as step 5 as mentioned above to obtain an expert opinion to identify what are the most significant factors affecting project success in Western Province, Sri Lanka.

Step: 9 On receipt of the expert opinion through questionnaire 2, analysis and ranking will be done using the same RII formulae.

Step 10: Based on the above analysis and ranking the most significant factors were identified which affect private sector building project success in Western Province, Sri Lanka. Discussion and results with recommendation were provided for the construction of private sector building projects in Western Province, Sri Lanka.

1.6 Conclusion and findings

One hundred and fifteen factors under 15 different categories for the Construction Project Success were identified in a global context through a literature survey followed by Delphi Techniques Two Round Questionnaire Survey to obtain data through heterogeneous purposive sampling method to obtain expert opinions. Relative Importance Index (RII) formulae were adopted to carry out data analysis for this research study. Having analysed and ranked responses from the Panel of Experts for the first-round questionnaire, it was identified that 66 factors received overall ranking position 1 to 15 under 13 different categories which are significant project success factors in Sri Lankan Context out of the 115 factors. The 66 factors identified under 13 categories were used to prepare the Delphi survey second-round questionnaire for the same expert panel and the questionnaire was handed over to Experts individually. On receipt of responses to Delphi Techniques second-round questionnaire, data analysis was carried out using the RII formula and calculated Relative Importance Index value for all 66 factors, the mean value of all 66 factors RII values. Based on the RII value for each factor, appropriate ranking positions were given to each factor. Criteria were established to identify the most significant factors. Factors that had a higher RII value than the RII mean value were the factors that were selected as those that had the most significant impact on project success for Private Sectors Buildings in Western Province, Sri Lanka. As a conclusion, the four most significant project success factors are Contractor' cash flow, Contractors planning effort, Easiness to reach to site (Project Location) and Control of sub-contractors works out of twenty-eight significant factors which commonly affect project success in Western Province, Sri Lanka. Further studies are required to create a conceptual framework, which shall be a benchmark to monitor project success in Sri Lanka.

1.7 Structure of Report

This report describes the study of research undertaken to identify the most significant factors affecting project success in private sector building projects in Western Province, Sri Lanka in detail. The report consists of five chapters followed by references and a list of appendices as demonstrated below:

Chapter One: This chapter provides an introduction and background of the subject matter, problem statement, aim of the research, objective of the research, research methodology, and conclusion and findings.

Chapter Two: This chapter provides details of the literature

Chapter Three: This chapter provides the research methodology followed for this study of research in detail including a selection of the expert panel, data collection method

Chapter Four: This chapter provides the analysis of the questionnaire and results in the presentation of findings and discussion on the results.

Chapter Five: This chapter provides the conclusion and recommendation to the Construction Industry in Sri Lanka derived from this study through research findings.

Chapter 2: Literature Survey

2 Literature Survey

2.1 Introduction

This chapter demonstrates the theoretical background, current knowledge, and issues relevant to the research topic. A critical analysis and evaluation are done to meet the requirements of the research objectives. Research findings of the global construction industry, the nature of the Sri Lankan Private Sector Buildings in the Construction Industry, and details of some of the research topics conducted in Sri Lanka are described to help identify the success factors affecting the project success.

"*Success means different things to different people*" (Shenhar, et al., 2001). Nonetheless, the literature review is given below explains what project success is through many different sources on the aforementioned topic.

2.2 Theoretical background

Project success is much more complex than completing the project on time, within budget and achieving performance specification. Client satisfaction is the result which deals with project success or failure (Pinto & Slevin, 1988). The concept of project success is very difficult due to the complexity of the projects and their dynamic nature. No definition of project success is universally accepted. The definition of project success is different for every industry and different points of view of individuals and project teams (Parfitt & Sanvido, 1993). A project is completed successfully if the project is completed and handed over to the client within budget, on time and according to the required quality specified at the beginning of the particular project (Chan & Kumaraswamy, 1996). In addition to the above, the client's satisfaction is necessary for a successful project, as well as all other stakeholders, should be satisfied if the project is completed successfully.

As this research study is focused on identifying the factors affecting project success, it is necessary and worth describing how other researchers have interpreted these terms such as Project, Project Success and Factor Affecting Project Success.

Project: There were several definitions of a project in its literature and the most suitable one offered by Tuman GJ states that *"A project is an organisation people dedicated to a specific purpose or objective. Projects generally involve large, expensive, unique, or high-risk undertakings which have to be completed by a certain dare, for a certain amount of money, within some expected level of performance. At a minimum, all projects need to have well-defined objectives and sufficient resources to carry out all the required task"* as cited by Pinto & Slevin (1988).

According to PMBOK 5th edition, Project is *"A temporary endeavour undertaken to create a unique product, services, or result".*

Project success: PMBOK 5th defined Project Success as *"Since projects are in temporary nature, the success of projects should be measured in terms of completing projects within the constraints of scope, time, cost, quality, resources and risk as approved between the project manager and senior management"*.

Verma (1995, 1996) stated that leadership, teamwork and communication are the most fundamental elements and are effective for human resource management of the project and these elements are necessary to achieve a successful project. "An architect may consider success in terms of aesthetic appearance, an engineer in terms of technical competence, an accountant in terms of dollars spent under budget, a human resource manager in terms of employee satisfaction chief executive officers rate their success in the stock market" depicts how different professionals view the definition of project success. They also identified that project success is mainly dependent on the technical competence, efficiency of execution, customer satisfaction, personal growth and manufacturability and business performance (Freeman & Beale 1992).

Project success is of different interest to different groups and according to the different views by the project managers employees, customers and other stakeholders. Project success factors affecting project success are factors related to project management, Procurement, project participant, and external factors. Factors related to the project include types of project type, size of the project such as number floor, nature of the project, project complexity and number of floors etc.(Stuckenbruck 1986; Chan, et al.2004).

Many researchers recognised the importance of procurement factors (Pocock et al.1997; Walker 1997; Kumaraswamy and Chan 1999; Walker and Vines, 2000). According to Dissanayake and Kumaraswamy (1999), the scope of "procurement as the framework within which construction is brought about, acquired or obtained". Based on the above, procurement should include procurement path and tendering procedures which are used to select a suitable contractor for the project. Project management factors and project management action are critical key elements of project success (Hubbard,1990). Project participants (stakeholders) of the projects are key players including clients, project directors, project managers, consultants, sub-consultants, contractors, subcontractors, manufactures and suppliers (Chua et al. 1999). As per Walker (1995), the client and client representative's influence is one of the significant factors for the performance of construction time which is connected with project success.

Client related factors include; characteristics of the client knowledge and experience of the client organisation, type of client, ability to financing the project, client's confidence, proper, clear and defined scope, ability to take a risk by the client and client management (Chan & Kumaraswamy, 1997; Songer & Molenaar, 1997; Dasanayake & Kumaraswamy. 1999). Similarly, design consultants are playing a vital role in project-related design works and its' completion. Main contractor and subcontractors are mainly involved in the construction stage and they utilize their experience related to site management and supervision of the works, liaise and coordinate with the sub-contractors, involvement of construction cost control system and cash flow management. (Chan & Kumaraswamy, 1997)

The project manager is one of the major key stakeholders in the project, and his or her competency level is critical to the project's success. The project manager's competency includes his experience related to project planning, communication, leading the team and monitoring and controlling of project cost within the approved budget. Construction is teamwork under good leadership and therefore construction projects require all teams to have commitment, dedication, competency, experience etc. (Belassi and Tukel 1996; Chua et. al, 1999).

All external factors concerning the environment can be classified as a political, economical, social, technological, physical and industrial related environment (Akinsola et al., 1997).

According to Shenhar, et al. (1997), project success is categorised under four different dimensions and those four are time dependant. The first period is during the project execution and soon after its completion. The second period is shortly afterwards when the project is handed over to the end-user. Subsequently followed by the third period which is after a significant level of sale requirements are met and the final period will be after 3 to 5 years following the project completion period.

Bhangale (2016) identified in his studies, 75 factors under twelve different groups such as, 15 factors in the cost group, 9 factors in the time group, 6 factors in the quality group, 5 factors in the client satisfaction group, 4 factors in the people group, 4 factors health and safety group, 5 factors in innovation and learning factor group, 4 factors in environment group, 5 factors in a project-related group, 7 factors in project manager and team related group, 4 factors in organisation group and 7 factors in external environment group. Table 1 given below depicts the top significant factors affecting the performance of the construction project.

Table 1: Top Ten Significant factors

Sr. No.	Factors	RII	Rank
1	Average delay because of closures and materials shortage	0.9667	1
2	Availability of personals with high experience and qualification	0.9667	1
3	Belonging to work	0.9667	1
4	Learning from best practice and experience of others	0.9667	1
5	Economic environment	0.9667	1
6	Cash flow of project	0.9333	2
7	Availability of resources as planned through project duration	0.9333	2
8	Application of Health and safety factors in organization	0.9333	2
9	Climate condition in the site	0.9333	2
10	The size and the value of the project	0.9333	2

Babu (2015) identified that there are 60 factors affecting construction project success and those factors are grouped into 10 groups such as cost, time, quality, productivity, client satisfaction, regular and community satisfaction, people, health and safety, innovation and learning, and environment. Melba, et al., (2015) considered 47 project success factors in their studies under nine different groups such as cost, time, quality, projectivity, client satisfaction, community satisfaction, environment, health and safety and innovation and learning areas. Sugumaran and Lavanya(2014) identified 31 critical success factors grouped under seven major categories such as project management factors, procurement-related factor, client-based factors, design team-related factors, contractors related factors, project manager related factors and business and work environment-related factors.

According to Gunathilaka et al. (2013), there are 21 project success factors explained in his studies which are effective in the formation of the project team, effective communication, top management support, sufficient resource allocation, clearly defined objectives and goals, the level of technology, adequate funding and financial stability, project managers competence, monitoring of the project and feed back, motivation and incentives, established budget and monitoring, client consultation and involvement, clear and detailed procurement process, managing project risk, project schedules and project plans, frequent progress meetings, commitment to the project, well defined technical specifications, proper quality assurance programme, political support and social support.

Chan et al. (2004) identified 44 project success factors under five main categories.

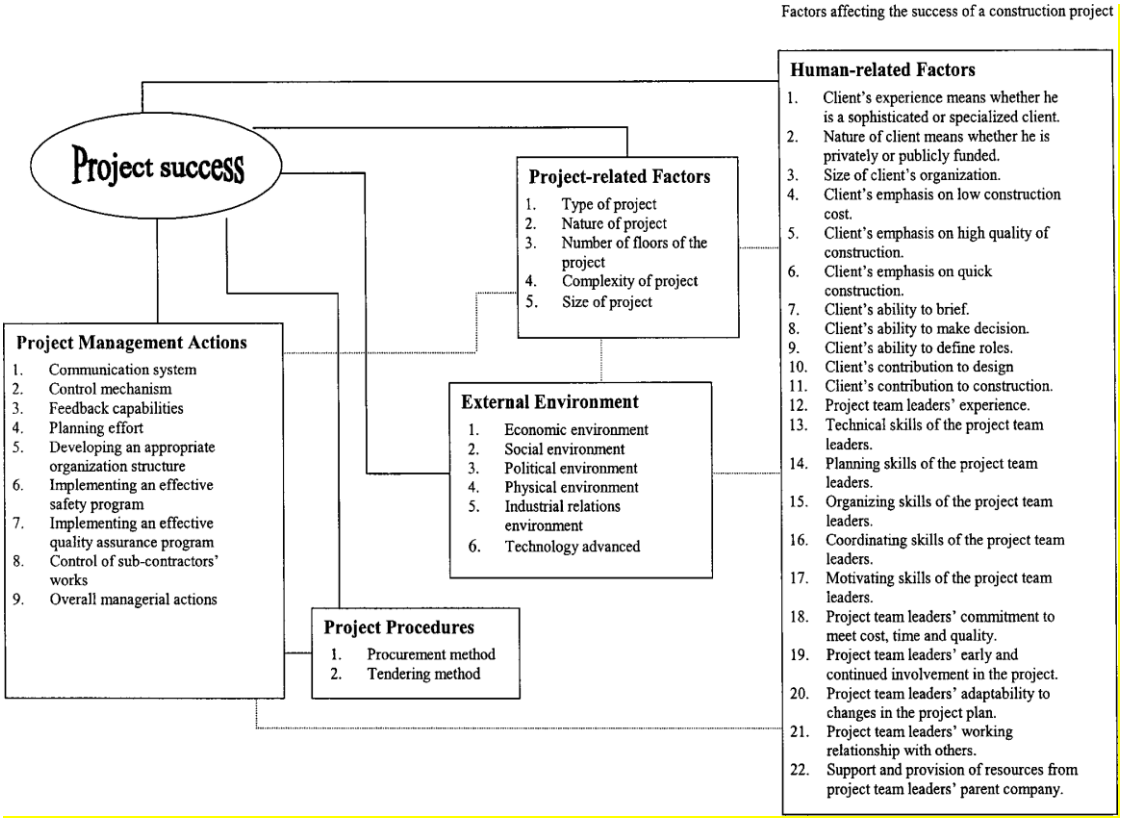

Figure 2 : New conceptual frame work for factors affecting project success by (Chan, et al., 2004)

Through research studies conducted, Chan and Chan (2004), recognized that project success depends on the following 4 major categories:

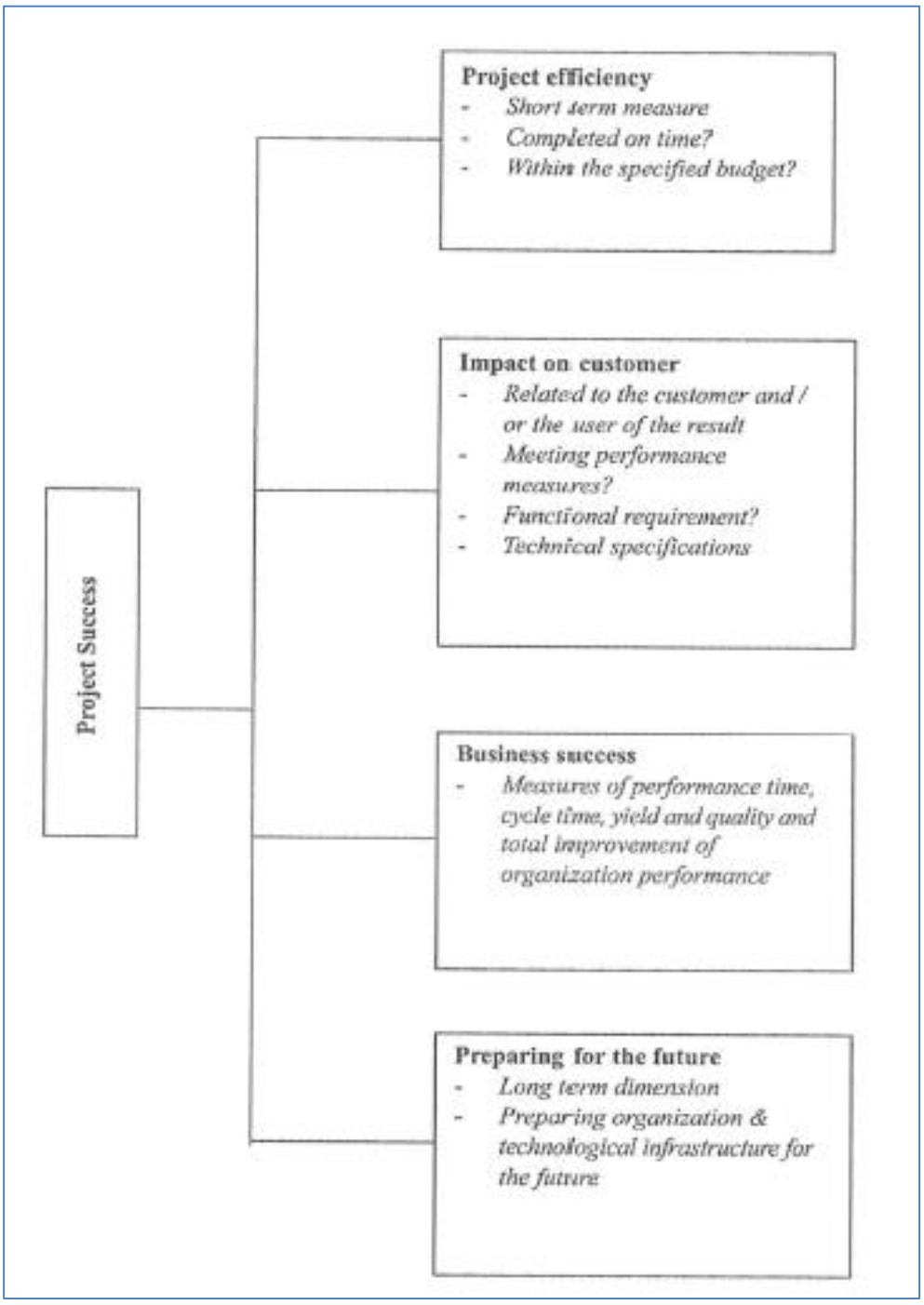

Figure 3: Project Success Categories by Chan (2004)

Additionally, according to Chan & Chan (2004), the following consolidated frame work has been proposed by many researchers for measuring project success for Construction projects shown the diagram below:

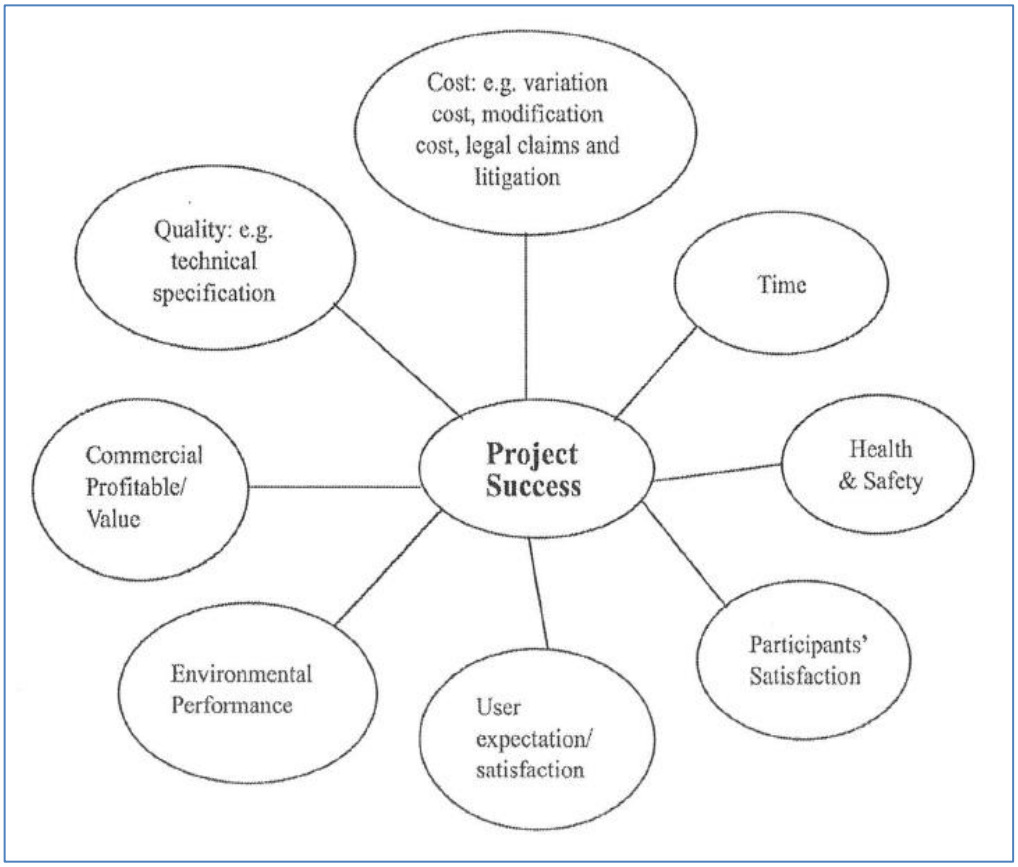

Figure 4:Consolidated frame work for measuring Project success

Aspects of project success were extended beyond time, cost and quality traditional triangle concept which were used for every definition in the construction industry. It was considered an industry standard. However, the current trend is not new and project success is much beyond time, cost and quality concept and requirement of project success can be given in many respects and can be shown as below (Sebestyen, 2017):

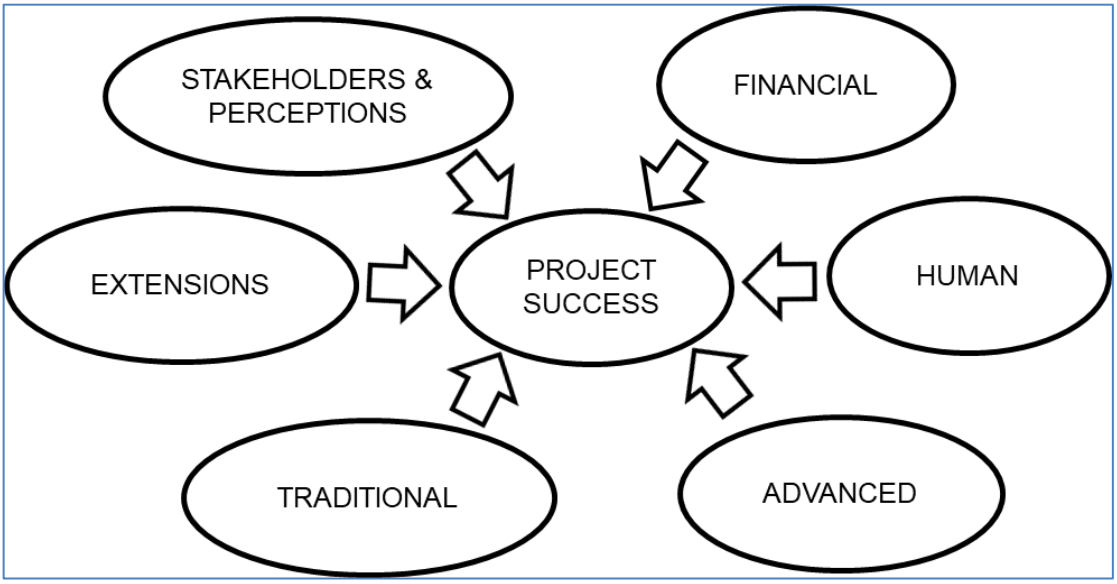

Figure 5: Project Success by Sebestyen (2017)

Based on, as shown above, various authors found various factors affecting the project success. A list of fifteen different categories of project success factors derived from various literature are given below:

- Project Category
- Organisation Category
- Project Management Category
- Contractor Category
- Stakeholders Category
- Procurement Category
- Design Team Category
- External Environment Category
- Cost Category
- Time Category

- Quality Category
- Productivity Category
- Client Satisfaction Category
- Health & Safety Category and
- Environmental Category

2.3 Major categories as per the literature review

2.3.1 Project Category

The project type/category plays a very critical role in the success of a project. Various authors identified in their studies the type of project, nature of the project, numbers of floors, complexity and size of project are influencing the project success as stated by Chan et al. (2004). A research study conducted by Bhangale (2016) identified 12 groups that impact project success. There were additional factors in addition to the four factors identified by Chan, et. Al. (2004), which are the uniqueness of project activities, urgency of project outcome, the density of project and project life cycle. However, the density of the project is almost similar to the complexity of the project while the project life cycle is beyond the control of construction which is an outcome of design requirements. Therefore, the life cycle cost is not relevant to this research and is excluded. There is always a difference between projects in terms of technology used, size, complexity, risk and other variables (Shenhar et al., 2001). However, a project is a project because of its uniqueness and different management style.

2.3.2 Organisation Category

In the global construction Industry, many organisation structures and activities are running on project-oriented and construction business are conducting based individual project programmes. While carrying out projects individually, the overall objective is to achieve the organisation goal as a whole (Olasupo et al., 2012). Organisations are performing based on profit, market share and related results. But nature and expectations are varied from project to project (Shenhar et al., 2001). Most organisations traditionally measure success using financial measures. Project organisation is heavily dependent on project success (Chan & Chan, 2004). High profit, open to a new market, new technology, reputations, etc is also influencing factors.The least priority is given to performing organisations expectations as per the case study Shenhar et al. (2001) wherein, organisation are focused on profits, market

share and other business-related results. Freeman & Beale (1992) found that managerial and organisational implications are impacting 43% of project success in which satisfaction of client, parent and end-user are key stakeholders.

2.3.3 Project Management Category

It is not sufficient enough to apply a conventional project management approach to achieve project success (Olasupo et al., 2012). Because of the complexity of the project, magnitude of investment, large stakeholders, high-quality standards, advancement of Information & communication technology etc. Communication system, control mechanism, feedback capabilities, planning effort, organisation structure strategy of safety, quality management, control of subcontractors and managerial actions are identified under factors affecting project management category (Chan, et al., 2004).

Due to complexity and its' magnitude, the construction management strategies are also considered as part of a key role in the success of the project. Even though cost, time and quality and efficiency are in delivery state factors, these are monitored by Project Management Consultant from the client perspective (Chan & Chan, 2004). Risk in a project also adversely impact the project success, therefore, it is important to properly identify associated risks and mitigate or transfer and/or reduce the risk level and retain for the successful delivery of the project (Hussein & Klakegg, 2014). A study by Long, Stephen et al., (2004) found that a survey from 109 professionals in which 42 respondents were in construction; gave entirely different factors which impact the project success, namely comfort, competence, commitment and communication.

2.3.4 Contractor Category

The study of Chan & Kumaraswamy (1997) shows contractor related factors are comprised under the four items state below:

- Planning and controlling experience
- Supervision and management of the site
- Extend of subcontracting
- Cash flow and financial capabilities.

Also, they found that shortage of labour, the skill level of labourers, less motivation and productivity levels are impacting the labour related factors which influence the

contractors' performance and it is related to contractors' success. Moreover, Rowe (1982) cited in Olasupo et al. (2012) that the organisation's ability to effectively mobilise resources is one of the key critical success factors.

Moreover, planning and controlling success is dependent on the resources in the market. In this, material factors play a major role including the impact of the project time and cost. Any shortages, or changes required in the materials in later stages, transporting impact the project success.

2.3.5 Stakeholders Category

In project success, stakeholders are providing paramount input (Dekkar & Qing, 2014). Also, the performance of the project team is dependent on support from top management, functional managers, customers, suppliers etc. According to Hussein & Klakegg (2014) competing and conflicting criteria due to the diversity of stakeholders including power and influence is another risk in project success.

As per the study conducted by Mortaheb et al. (2013), from various age group and mix of gender, the table below shows results.

Table 2 : Gender and Age group

Item		Frequency	Percentage (%)
Gender	Male	84	68.2
	Female	39	31.7
Age	20-30	54	43.9
(In years)	31-40	49	39.8
	41-50	12	9.8
	>51	8	6.5
Organization they work	Client	37	30.1
	Engineering	76	61.8
	Contractor	10	8.1

Chan, et al. (2004) identified twenty-two factors that are human-related that impact project success. Upon reviewing the factors, it was determined that they are stakeholders' relations and their capabilities, therefore, are covered under the above heading.

2.3.6 Procurement Category

The procurement method is directly impacting the project success and tendering methods (Chan et al., 2004). There are various types of procurement paths available in the construction industry such as the Traditional path, Management path and Design and build path. Management path can be Construction Management or Management Contracting.

Early bidding, Kwon and Kim (2004), allows trade contractors to implement the design know-how knowledge and ensures constructability.

2.3.7 Design Team Category

Four factors that are influencing the design goals are listed below (Chan & Chan, 2004):

- Functional specification
- Technical specifications
- Schedule goals
- Budget goals

As per Chan's study conducted with Kumaraswamy in 1997, it was inferred that the following three categories contribute to the success of a design team:

- Experience of the design team
- Complexity of design
- Design documents related to factors such as error and delays

2.3.8 External Environment Category

Chan, et al. (2004) identified six factors that impact the project success:

1. Economic environment
2. Social environment
3. Political environment
4. Physical environment
5. Industrial relations
6. Technology advantages

2.3.9 Cost Category

Cost category plays a major role in success in construction project. To achieve a very successful project, project cost should be managed within the allowable parameters without any additional scope creep. In some instances, there is a cost overrun because of other reasons like due to an extension of time. Therefore, to control the cost, it is essential to control other factors linked to cost.

A study by Bhangale (2016), analysed critical success factors for high rise buildings, thereby, found fifteen cost factors influencing the critical success of building project. The overall ranking and the factor ranking as per the study are shown below:

Table 3 : Cost factors

Sr. No.	Identified Factors	RII	overall rank	factor wise rank
	(1) Cost Factors			
1	Market share of organization	0.4333	16	8
2	Liquidity of organization	0.9	3	2
3	Cash flow of project	0.9333	2	1
4	Profit rate of project	0.6333	11	5
5	Overhead percentage of project	0.5333	13	6
6	Material and equipment cost	0.9333	2	1
7	Project design cost	0.4	17	9
8	Project labor cost	0.8333	5	3
9	Project overtime cost	0.5	14	7
10	Escalation of material prices	0.9	3	2
11	Cost control system	0.7	9	4
12	Regular project budget update	0.5333	13	6
13	Waste rate of materials	0.4	17	9
14	Cost of rework	0.3333	19	10
15	Cost of variation orders	0.5333	13	6

Based on the above study, material and equipment cost are at the top of the list on the project success while the liquidity of organisation become second priority. In the meantime, the least priority is given to the cost of re-work. On the other hand, the project design cost is also not given priority. In a traditionally designed project, the design is prepared by the employer therefore, the construction is only carried out by a contractor. Thereby, it makes sense that design cost is not a priority. But in a design and build project, the design is prepared by the contractor, therefore, it may impact the project success regardless of the role of the contractor.

The change order and experience level of the consultant contributes to more cost overruns which impact the project success. The life cycle cost also provides a significant success factor towards the project (Mortaheb et al., 2013; Olasupo et al., 2012).

2.3.10 Time Category

Time is a very important factor and tool used to measure project success. Site preparation time, time for completion, lead time to process the variation orders, lead time for material delivery, delay in claim approvals, delay in payment to the contractor, work during defect liability period including rectification of defects, availability of resources and shortage of materials are the affecting the success of the project (Bhangale, 2016). Upon analysing the above factors, some factors shall be managed by amending the contract by administrating the contract effectively. Specifically, the leads that process the variation shall be managed by issuing an instruction to process the work up the identification of scope change.

As per the case study by Shenhar et al. (2001), the priority (dimension) was the perception of respondents towards meeting time, then budget and other project requirements. Also, the majority of the project managers were targeting to complete the project on time and within the set budget. It is understood that if a project is completed on time, it is always within the budget unless there will be a productivity loss.

As per FIDIC (1987) Clause 44.1, there are five events that a contractor can get an Extension of Time for the completion of work and some instances cost and/ or plus profit as well. But those five events cover several Clauses in FIDIC 1987. The major five causes leading an extension of time are:

- Extra additional work
- Delay referred in the Conditions of Contract
- Exceptionally adverse climatic conditions
- Any delay by the Employer
- Other special circumstances – everything else other than above

Similarly, FIDIC 99 Clause 8.4 identified five causes that lead to the Extension of Time.

In addition to the above, CIDA SBD 01 Standard bidding document Section 2 – the condition of contracts Clause 44 identifies 12 events which the contractor shall be entitled to request for extension of time for the project, Similarly CIDA SBD 02 Condition of Contract Sub-Clause no. 8.4 provides provision for Extension of Time for completion, CIDA SBD 03 Condition of Contract Sub-Clause 6.3 and CIDA SBD 04

Condition of Contract Sub -Clause 8.4 provides for EOT provisions If the time is managed well by the Employer and/or by the Contractor, the project will be completed on time, therefore, the project will be a success. On the other hand, the project will be delayed because of the Employer's culpability, cost also shall overrun, wherein, there will be a double loss for the employer.

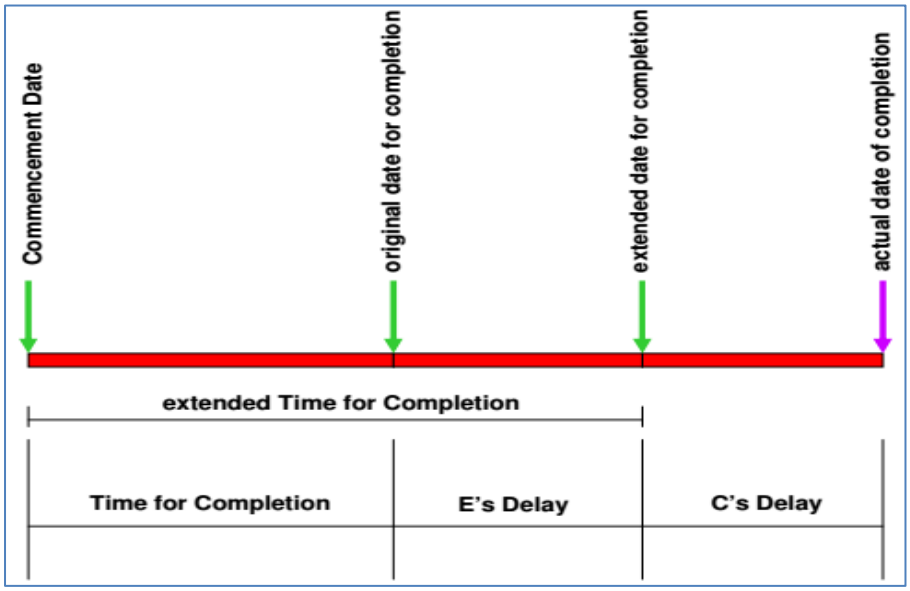

Figure 6: EOT

It is important to identify that the project will not be a success due to the delay that occurred as a result of either party. Therefore, in some instances, there may be cost over runs and on other occasions, it will be an additional burden to either the Contractor or Employer depending on the culpable delay as demonstrated in Figure (8).

Time is also dependent on planning requirements. Planning should be accurate or realistic to deliver the project success. As per Bhangale (2016), lack of planning in the pre-implementation stage as well as a failure of project delivery during execution is one of the most common problems that is experienced by developing countries. Moreover, a lack of methods and mechanisms to control and monitor projects leads to project failure. It is important to put regulation and monitor against it, inorder to closely monitor the project. Bhangale identified that weakness of the regulations, lack of standards, specification and data, absence of performance measurement systems, inadequate planning and strategies, poor projects awarding conditions and poor skills and unqualified managers and teamwork are the common reasons. Ultimately this will lead to citizen's dissatisfaction.

As per Hussein and Klakegg (2014) unrealistic target leads to the impact of project success.

The diagram below shows how factors are affecting in time schedule (Mortaheb et al., 2013).

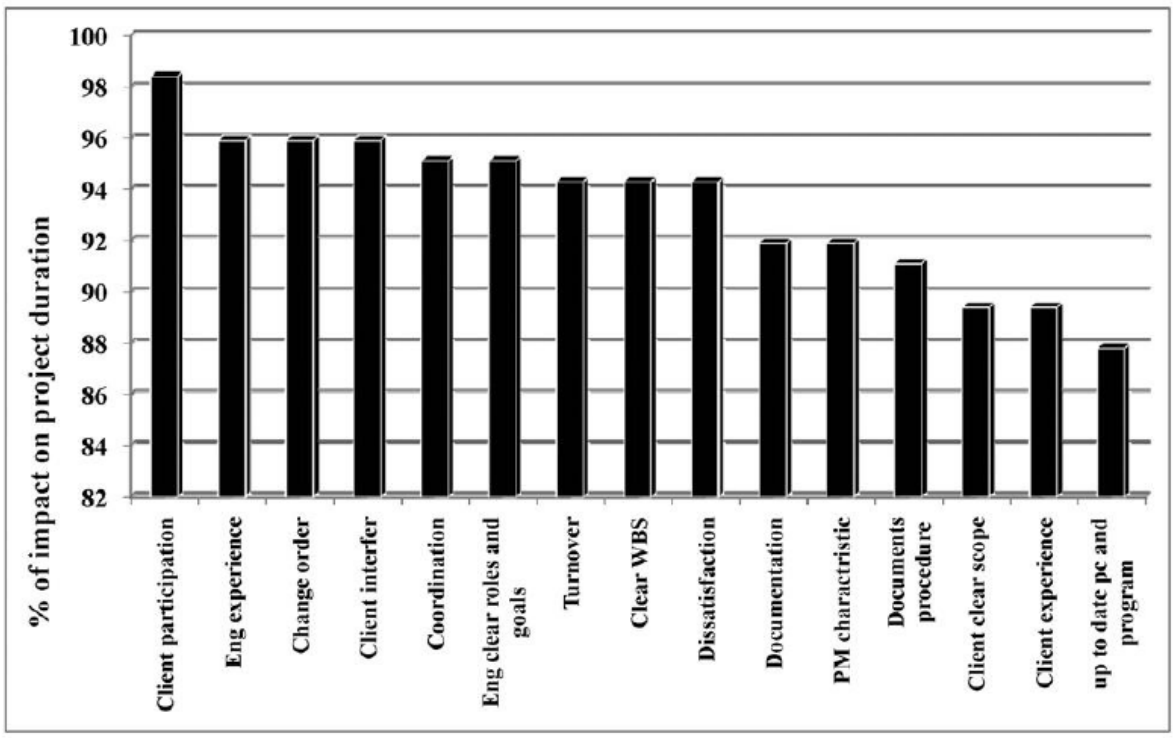

Figure 7: Factors are affecting in time schedule

The majority of the participants responded that significant time factors are contributed by the client but more than 50% of the participants with the aforesaid response of the same survey are working in non-client organisations.

2.3.11 Quality Category

The quality depends on the project requirements and sometimes relates to the minimum standards which are set by the authorities to maintain the standards in order to reduce the materials and labour wastage in redoing the works in a short time. Various standards are used in worldwide BS and ASTM and Sri Lanka CIDA (previously ICTAD) specification for the majority of the project together with specific project quality requirements. Also, there are quality standards to ISO to monitor and control the quality requirements.

As per the findings by Suma and Shubhamangala (2013), in order to achieve the quality requirements, there should be a process to be implemented.

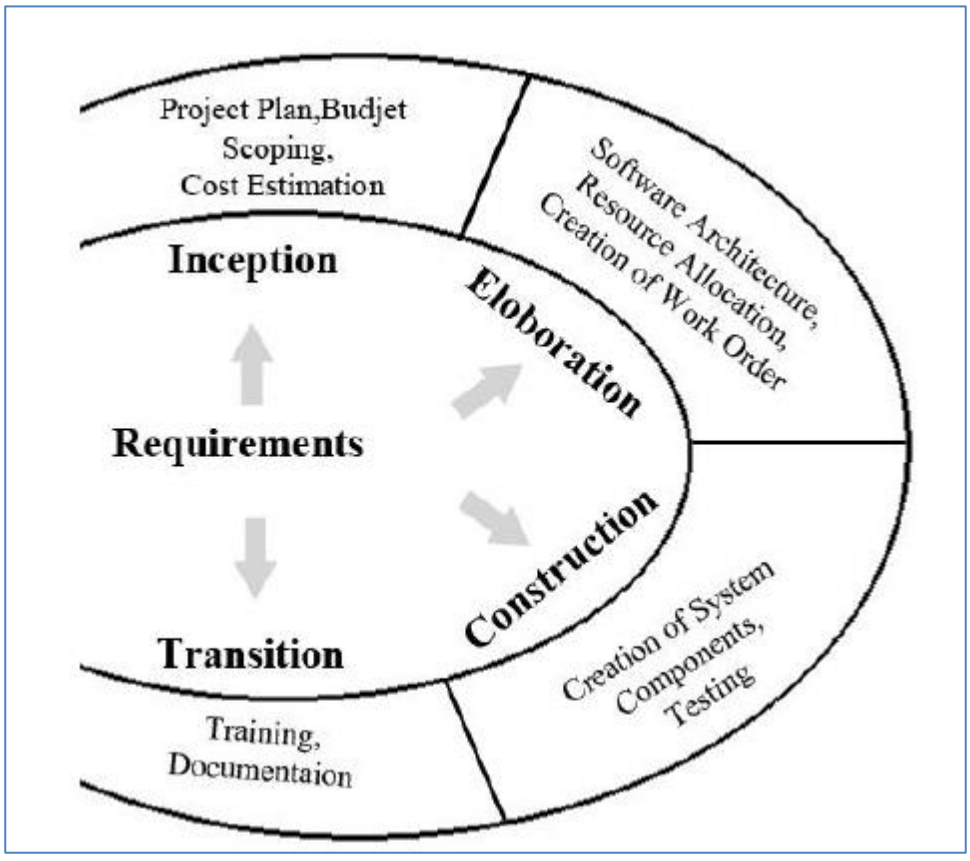

Figure 8: Quality Requirements

It is important that from inception to transition, there should be a proper follow-up and end up with providing quality training better, thus quality shall be achieved.

Project quality varies between the owner and the customer. Wherein, degree of conformance to the pregerminated standard and suitable sustainability certificate (Nguyen & Chovichien, 2013).

2.3.12 Productivity Category

Project success factors under the productivity category identified by Babu (2015) in his studies are Absenteeism rate throughout the project, Project complexity, Sequencing of work according to schedule and number of new projects for the organisation. Melba et al. (2015) analysed under productivity category in his studies relevant to Project success factors are similar factors identified by Babu (2015).

2.3.13 Client Satisfaction Category

Projects are customer-focused, therefore, there no requirement to respond to the internal organisational or external market opportunity (Olasupo et al., 2012). As per the case study Shenhar et al. (2001), the second priority (dimension) was the perception of respondents towards the benefit granted to the customer. The customer expected to meet their requirements with a standard solution at minimum cost whereby lower the longer-term maintenance, cleaning and less cooling/ heating expenses.

According to studies conducted by Bhangale (2016), it was identified that there are several critical success factors relevant to client satisfaction. These factors are Project Manager's leadership skill and Coordination between the Client other stakeholders. Project success factors analysed under the Client satisfaction category by Babu (2015) are Coordination between client and other stakeholders relevant project information, Leadership skills of project manager, number of abortive work incident, Speedy and reliability of service to the Client and disputes occurred between Client and other project participants.

2.3.14 Health & Safety Category

Studies carried out by Bhangale (2016) identified that there is a number of critical success factors relevant to the health and safety of the project. These factors are the accident rate reported in the project, an application of health and safety factors in the organisation and Project location. Project success factors analysed under Health and Safety category by studies carried out by Babu (2015) are, Project location is safe to reach, Reportable accident rate in the project, assurance rate of project and an application of health and safety factors in the organisation. However, it is recognised that the same factors are identified with different wordings by two others research. Safety is an important factor in project success. In the construction atmosphere accidents are usual but it is the Project stake holders' responsibility to take necessary mitigation measures to avoid such accidents. Any accidents that occur on the construction sites, the Client and Contractor may have a legal claim under the construction contracts which will result in project delays and additional costs to the project. This may have effects on project success (Chan, 2001).

2.3.15 Environmental Category

The use of locally manufactured materials should be used in order to reduce the impact of the environmental effect. Also, it will enhance the project success in a different way around by increasing the face value of the project (Olasupo et al., 2012). Shen et al. (2000) cited by Chan & Chan (2004), Environment is continuously impacting due to construction activities performed in the project and the impacts are in a number of ways throughout the project life cycle. According to Songer and Molenaar (1997), in Australia, approximately 44 million waste material released from the Construction Industry to the environment each year are primarily demolition waste material and have an immense impact on the environment. In the construction Industry, Environment Impact Assessment is the assessment which identifies impacts to the environment and pollution control is required from the project site. Air pollution, noise pollution, water pollution and waste disposal from the construction projects have a significant impact on the environment Wong and Chan (2004). According to Bhangale (2016), it was identified that there is a number of critical success factors relevant to the environmental category. These factors are Climatic condition in the site, air quality and noise level surrounding the site. The ultimate success of the project is also dependent on environmental consideration, design, procurement, supply and install of the product.

2.4 Identified factors affecting project success globally for this study

As described above, previous researchers have identified a large number of factors under different categories that are affecting construction project success for construction projects globally.

Bhangale (2016) identified 75 construction project success factors in different twelve categories, Babu (2015) identified 60 project success factors in ten different categories, Melba et al.(2015) identified 47 project success factors in his studies under 9 different categories, Sugumaran and Lavanya (2014) identified 31 project success factors under 7 different areas, Gunathilaka et al., (2013) identified 21 factors and his study, Chan et al,(2004) identified a list of 44 factors under five different categories such as project management actions, project procedures, external environment, project-related and human-related and Gunesekara (2009) identified 30 project success factors under the responsibility of different stakeholders such as Client, Project Manager, consultant and contractors. Following the successful completion of this research study, it was

determined that it is impossible to summarize factors that impact construction project success stated by various researchers as the same factors may be described in multiple ways. Therefore. having carefully reviewed all the factors from the literature survey in this Chapter, 115 factors within 15 categories (Refer Appendix A) were selected from this study which affects the project success in the context of the global construction industry. Table 4 below shows fifteen categories with the number of factors under each category.

Table 4 : Identified Project Success factors Categories

No	Identified Categories	Identified Number of Factors
1.0	Project category	8
2.0	Organization Structure	4
3.0	Project Management	14
4.0	Contractor	6
5.0	Stakeholders	25
6.0	Procurement	3
7.0	Design Team	5
8.0	External Environment	6
9.0	Cost	15
10.0	Time	9
11.0	Quality	6
12.0	Productivity	4
13.0	Client Satisfaction	4
14.0	Health & Safety	3
15.0	Environmental	3
	Total identified factors	115

Chapter 3: Research Methodology

3 Research Methodology

3.1 Introduction

Research methodology is the most important part of the research as it ensures that readers understand the validity, reliability and strength of its findings. This chapter briefly describes the research methodology implemented in this research to achieve the aims and objectives of the research study.

This chapter illustrates in detail, various research methods, research approach, data collection techniques and method of data analysis conducted in this study.

3.2 Research Methodology

This study is focused on identifying factors affecting project success in Sri Lanka that are specifically unique to Private Sector Buildings in the Sri Lankan Construction Industry. Project success and factors of project success were extensively researched in different countries on a global scale. While reviewing literature for the research topic, it was evident that project success factors are similar to a certain extent in developing countries and some differences are found from country to country which was unique to each country. Although only a few researchers, namely Gunasekara (2009) and Silva et al., (2016) attempted to identify factors affecting project success in Sri Lanka, factors affecting the success of private sectors building projects are still not explored. Hence, more researchers are required to conduct studies on the selected topic. Specifically, private sector building projects increase in the Western Province, Sri Lanka due to post-war investment during the last decade.

3.2.1 Major Research Strategies

There are two major types of research strategies available for research such as quantitative and qualitative Naoum (2013, p39 & p40). In addition to the quantitative and qualitative strategies, Fellows & Liu (2008, p27&28) described triangulated research studies that employed two or more strategies to minimise disadvantages and increase the advantages of each research strategies. Quantitative and Qualitative

research types are further categorised by Dehlber and McCaaig (2010) as per the diagram below (Refer to Figure 9).

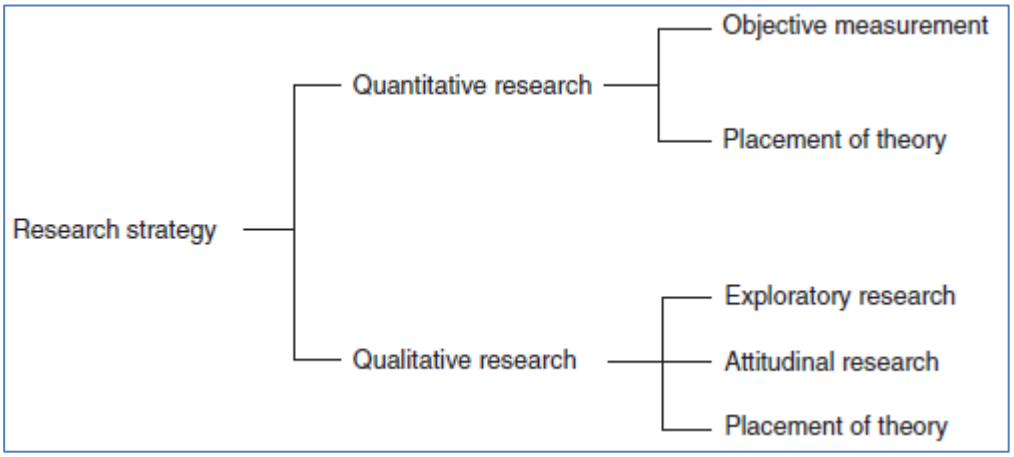

Figure 9 : Research Strategies

Objective measurement and placement of theory are under quantitative research strategy and exploratory, attitudinal and placement theory are covered under qualitative research strategy.

3.2.2 Quantitative research

Quantitative research is objective in nature and the process includes a detailed analysis of data provided by respondents and ultimately determine whether the result is true or false against the assumed hypothesis or the initial information had prior research. Quantitative research method can be chosen in the occurrences like if the research requirement is to find details of a theory/problem/attribute or when the accurate proof is required to recognise the relationship of facts in the interest of testing a theory or hypothesis according to Noaum (2013, p39).

As per Fellows and Liu (2008, p27), quantitative research leans towards positivism and seeks to collect factual data and studies to find out how those facts in relationships with theories and previously carried out research findings. This approach used scientific techniques to acquire measurements and quantified data. Data analysis is carried out to obtain the results and conclusions that relate to the theory and literature.

According to Creswell (1994, p4), quantitative research is commonly used to test theories and this is done by studying the relationship of variables. Generally, these

variables are measured are using instruments and taken numbers are analysed statistically to get the results.

3.2.3 Qualitative research:

As per Naoum (2013), qualitative researches are subjective and generally highlights certain meaning, experience or description etc. Data collected under qualitative research can be categorised into two, i.e., exploratory and attitudinal.

An exploratory type of research is done when the knowledge about the research matter is not adequate. These researches are generally carried out to obtain well defined and accurate details of an identified research problem (Naoum 2013, p41).

Attitudinal researches are done in order to assess a person's opinion or perspective concerning identified objects whereas the objects can be an attribute, elements, variables, factors or questions (Naoum 2013, p43).

As per Fellows and Liu (2008, p27), qualitative approaches to seeks perception of the group of people or from the individual. Through this research approach, investigation of people's opinions, views, beliefs and understating are carried out. Unstructured data is collected and those data are rich and detailed as per scope. As results, the objectivity of qualitative data is questioned. Qualitative data analysis is much more difficult than quantitative data analysis due to the requirement of sorting, filtering and some manipulations for the application of suitable analytical techniques.

According to Creswell (2009, p4), qualitative research is generally carried out to study and recognise the individual view towards the identified research problem. The research procedures consist of the research problem that occurred, data gathered from the participants, data analysis and the researcher's interpretation of collected data.

3.2.4 Comparison between Quantitative and qualitative Strategies

As shown below Figure 13, Naoum (2013, p44) illustrates a comparison between quantitative and qualitative research methods. This illustration shows fact wise as well as scope wise in terms of researches and it compares their role, relationship and scope of finding data.

Table 5: Comparison between Quantitative and Qualitative Research

		Quantitative	Qualitative
1	Role	Fact-finding based on evidence or records	Attitude measurement based on opinions, views and perceptions measurement
2	Relationship between researcher and subject	Distant	Close
3	Scope of findings	Nomothetic	Idiographic
4	Relationship between theory/ concepts and research	Testing/confirmation	Emergent/development
5	Nature of data	Hard and reliable	Rich and deep

3.2.5 Triangulation

As per Fellows and Liu (2008), triangulation research is to use two or more research strategies to investigate the same topic through several research methodologies. Application of combined qualitative and quantitative research strategies may be eliminated or minimised disadvantageous of each research strategy and to be increased advantageous of each strategy. This combined strategy uses a multidimensional view of the topic. It applies to obtain data using both strategies and the diagram below mentions various data collections, analysis, results and discussion leading to conclusion and recommendations.

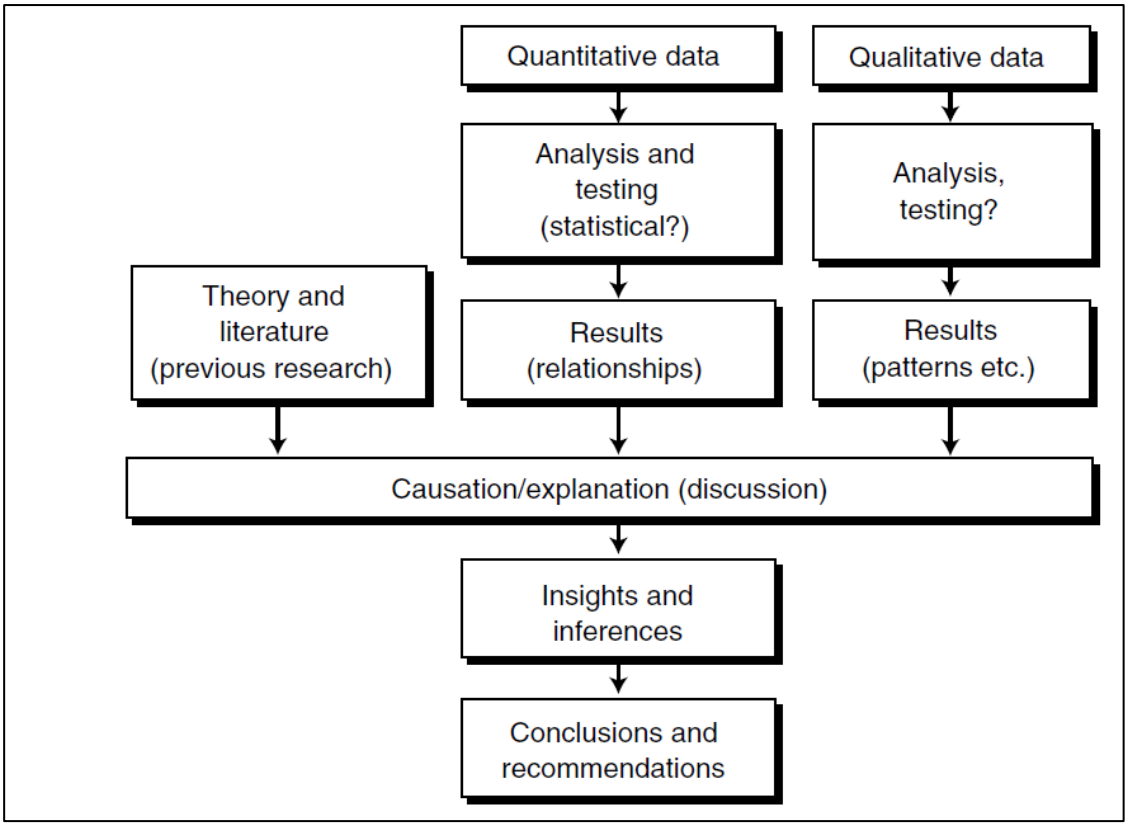

Figure 10: Triangulation of quantitative and qualitative data.

3.2.6 Other categories of research

According to Fellows and Liu (2008, p11), there is further categorisation based on the purpose of research as described below:

3.2.6.1 Instrumental

The instrumental method is used to develop research instruments, this can either be measuring equipment or tests like questionnaires, rating scales etc. As the construction of the instrument is a technological exercise, the method includes the assessment of the instrument and the measurement of data. Theoretical calculations are applied to evaluate the data.

3.2.6.2 Descriptive

This research method incorporates an identification process and records all the components of the selected phenomenon, process or system objectively and comprehensively. These kinds of research are carried out due to a specific purpose and in a certain perspective. This method is mainly applied where the requirements are to

categorise the subject matter. Either survey method or case study method can be adopted to do research.

3.2.6.3 Explanatory

The explanatory method is generally for finding a solution for a particular known or well-defined question or issue. In this method, a hypothesis is developed adopting a theory and test them.

3.2.6.4 Interpretive

This method can be adopted to fit research findings into an available model or framework where empirical testing cannot be applied. The models can be heuristic where variables are clustered as per assumptions that are close to reality as possible.

3.2.7 Data Collection Approaches

There are different types of data collection approaches available for research and it depends on the type of data required for investigation and availability of the information. According to Naoum (2013), there are two methods for data collection and those are fieldwork research for primary data and a desk study approach for secondary data through various publications. Fieldwork research can mainly be categorised into three approaches which show in the below Figure 15:

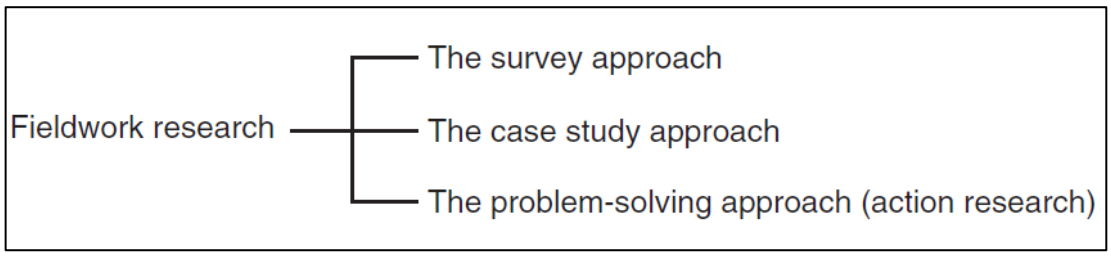

Figure 11 : Types of Data Collection

3.2.7.1 The Survey Approach:

A survey approach is used to obtain a large number of participants to provide relevant responses within a set out time frame. There are two types of survey approaches available and those are namely descriptive survey and analytical survey.

The descriptive survey approach is to obtain answers to questions such as When? Who? How much? Where? What is happening? (Naoum, 2013). It also deals with counting the number of participants with opinions or attitudes towards a specific object or tendency or demonstrate certainty.

The analytical survey is directed to establish relationship or connections and proposition between the characteristics/objectives of a questionnaire.

3.2.7.2 The Case Study Approach:

Case studies can be used to support the researcher's argument by carrying out an in-depth analysis of an organisation, a group of people or a person or a particular project. A case study is always trying to deal with one aspect of the research problem and reaching a conclusion that will not be in a general context, but specific to the problem. This does not mean that this approach has only limited value. This approach will give an in-depth analysis of one specific problem.

Case study approaches are designed in three types and they are descriptive case study, analytical case study and explanatory case study. This case study approach can be employed to limited projects and specific problem to identify a solution to that problem (Naoum, 2013).

3.2.7.3 Problem-solving Approach (Action research):

In this type of research, a researcher can interfere with the situation where the researcher can review the ongoing situation and recognise the problem and provide some input to do necessary changes to the current situation and carry out evaluation changes he made to the situation. Problem-solving research (action research) are more suitable for practitioners in the industry and researcher who has a professional practice and problem identified from their work and willing to find out the solution for the identified problem. Solution and recommendation must be practical and original which can be implemented (Naoum, 2013).

3.2.8 Primary Data Collection

Primary data collection is the most reliable data collection method as it is collected by a researcher on a first-hand basis through fieldwork research using survey, case study

or problem-solving approaches. Primary data collection techniques are of high cost and more time-consuming in comparison to secondary data collection**.**

The major data collection techniques are available for researchers to collect data through Postal questionnaire and Personal Interviews. It is not necessary to strict one technique to collect data required for the research. It is a researcher to decide the requirement of necessary data to be collected through one technique or two technique. Based on the research requirement, data can be collected through a Case study and Postal Questionnaire or obtained data from respondents through Personal Interviews in addition to the Postal questionnaire. Questions can be a qualitative form or quantitative form or a combination of both to collect information /data which is required to achieve the objective of the research study (Naoum, 2013).

3.2.8.1 Postal Questionnaire:

According to Naoum (2013), Postal questionnaires is one of the main techniques to use data/information collection purpose through conducting a questionnaire survey. This questionnaire can be used either descriptive type of questionnaire survey or analytical type of questionnaire survey to obtain information, opinions, facts and views of the respondents. All postal questionnaire mostly has a closed-ended question to obtain answer like “yes” or “no” or Likert scale or ranking to have the importance of the particular factor.

There are some major advantages of the Postal questionnaire:

A postal questionnaire survey is most economical because it can cover a large geographical area and a wider population for the collection of required data.

It is a faster method to conduct a questionnaire survey and proper administration of the questionnaire is done, more responses will be received. Follow up will be provided on some of the late responses.

There are some disadvantages of the Postal Questionnaire survey

A questionnaire survey is generally suitable when questions are straightforward, properly worded and simple. Questions should not be prepared with any ambiguity or difficult questions.

The questionnaire survey is inflexible because responses should be treated as final response and no opportunity to have any discussion with respondents for any clarification for unclear responses.

There is a doubtfulness for the correct person is responding to the questionnaire as the questionnaire stated that the questionnaire should be completed by Chief Engineer, Projects Manager, Chief Architect and Technical Director etc, there is no assurance for the correct person is answering the questionnaire.

3.2.8.2 Personal interview:

According to Naoum (2013), personal interviews are another data collection technique that has been used to collect information and opinions from the respondents. Personal Interviews can be face to face interview or telephone interview.

Telephone interviews are similar in nature to face-to-face interviews in terms of rules and techniques which are used to apply for telephone interviews and will be quick but not cost-effective (Nachmais and Nachmais, 1996, as cited in Naoum (2013).

Personal interviews are mainly three types of interviews such as un-structured interviews, semi-structured Interviews and structured interviews.

3.2.8.3 Unstructured interviews

Questions for unstructured interviews are generally open or open-ended questions and the questionnaire will be very general level. Unstructured interviews can be conducted for qualitative type research or at the very early stage of the research and the researcher is having little knowledge about the research topic. Unstructured interviews do not contain any planned schedule or no any systematically prepared or worded questions and generally not questioning the same information from different interviewees or participants.

3.2.8.4 Semi-Structured interview

Semi-structured interviews are open and closed-ended questions but do not have any set-out schedule and this type of interviews are much formal than unstructured interviews. The researcher is not asking questions in a systematic order and however

through this semi-structured interviews covering all possible questions prevalent to the research topic. Merton and Kendai (1946) cited by Naoum (2013) highlights that four characteristics should be focused on in the interview:

- Interviewees should have experience in specific involvement of relevant subject matter.
- Proper analysis should be completed about the situation before the interview.
- Interview guideline should be specified related to hypotheses of the research topic
- The interviewee's experience should be the focus of the interview on the relevant topic.

In this type of interview, researchers have full freedom to focus on various areas and pose specific questions during the interview.

3.2.8.5 Structured Interview

Structured interviews are conducted in a fully controlled manner, where the same questionnaire will be posed to all respondents and all questions are in the same wording. Questions in the structured interviews commence with open questions and end up with closed questions. Nachmais and Nachmais, 1996, as cited in Naoum (2013) mentioned that there are three assumptions considered in structured interviews'

1) For research objectives, each respondent should be able to understand and have the same understanding for each question.
2) All questions should be equally meaningful to every interviewee.
3) The context of the questions, sequence and meaning of the questions should be identical to every respondent.

Structured Interviews have the following major advantages:

- More accurate answers can be received.
- A high response rate is expected approximately 60-70 percent if the direct interviews are conducted.
- Responses can be more explored while clarifying the reasons for a given response to particular questions.

3.2.9 Secondary Data collection

Secondary data is collected by the researcher through desk study and are taken from other sources. Other sources are mainly primary sources and secondary sources. Secondary data collected from primary sources are mainly academic research papers, academic research journals, refereed conference papers, theses and dissertations, occasional papers/reports and Government publications. Secondary data is collected from secondary sources that are mainly from a text book, Trade Journals, newspapers and magazines. The diagram below shows primary sources and secondary sources. (Naoum, 2013). According to Stewart and Kamins (1993) cited by Naoum (2013, p49) stated that secondary data are having significant advantages over primary data in terms of time and cost. In general, using secondary data for carrying out primary research investigation is less expensive.

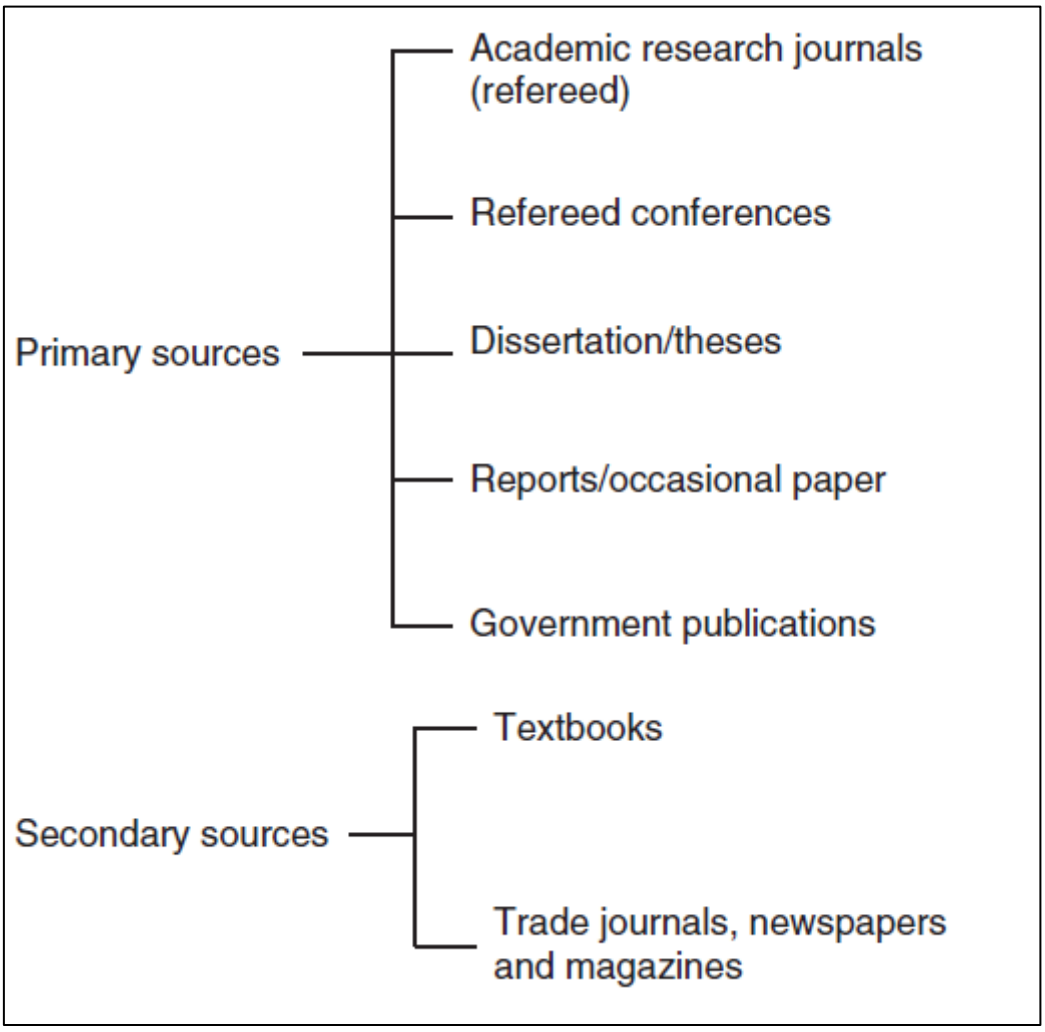

Figure 12: Primary sources and Secondary sources of Secondary Data

There are two formats used to store secondary data such as descriptive format and statistical format. Secondary data collection is of low cost and less time-consuming in contrast to primary data collection.

The secondary data is stored in two different formats such as statistical and descriptive documents which show in the diagram below.

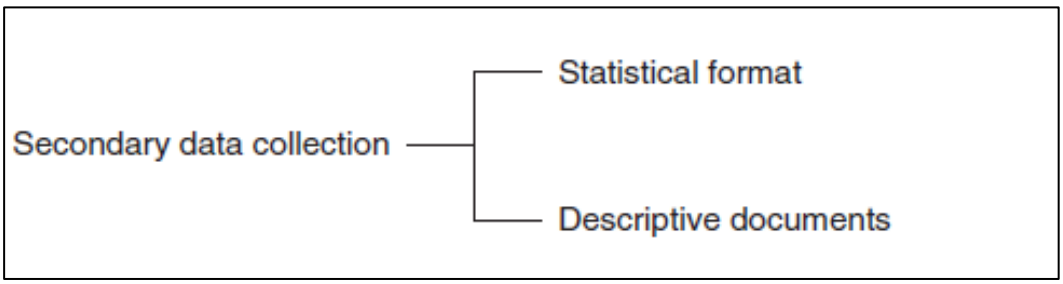

Figure 13 : Secondary data source

3.2.9.1 Statistical format

According to Naoum, (2013), secondary data stored in statistical format are available in university libraries and public libraries. These official statistics are generally collected by Government agencies.

3.2.9.2 Descriptive documents

Secondary data stored in descriptive documents are archival documents. Critically apprising past literature, newspapers and diaries can be included in this section (Naoum, 2013).

The above are the primary and secondary data collection methods available.
However, a Desk study approach was adopted for the collection of secondary data to identify the factors affecting project success in a global context through a comprehensive literature survey which were carried due to the non-availability of any other data collection method to identify factors affecting a global context.

The questionnaire survey is used as the primary data collection method due to the following:

- To obtain primary data to have the importance level of the factors, the Likert scale has been adopted into closed-ended questions used in this research study.
- It is expected to obtain an expert opinion about factors affecting project success and therefore questionnaire survey has been selected as the primary data collection method for this research study.

3.2.10 Questionnaire Construction

3.2.10.1 When the construction of questions for any research the following should be carefully taken into consideration:

- Questions should be relevant to at least one or more objectives of the conducted research.
- Questions should be related to the aim of the research.
- Questions should be related to the hypothesis of the research, provided that the respective research is used to test a hypothesis
- Questions should also concern to determine if it is possible to take answers from other sources.

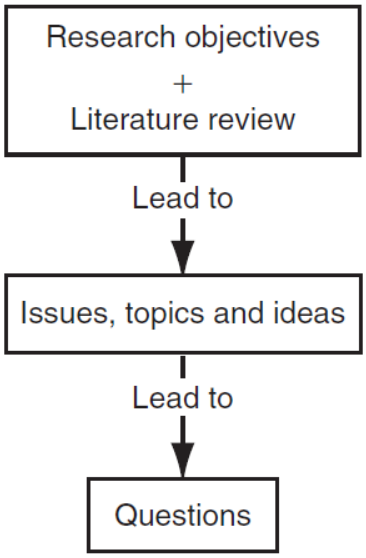

Figure 14: Questionnaire Construction

The above diagram shows in the research process, how the objectives of the research are transferring to questions.

According to Naoum (2013), two types of questions can be constructed for research such as open-ended questions form or unrestricted type and closed-ended question form or restricted type questions. While preparing the questionnaire, there are three fundamental stages to follow:

1) The first stage involves the process of identifying first thought questions.
2) The second stage is the construction of the final questionnaire.
3) The third stage involves the checking process to determine if the questions are worded properly.

Stage one is not hard and, in this stage, there will be an initial preparation list of questions and here properly wording is not a requirement. The questions will only be properly worded during stage three of the process.

In the second stage, there will be a final questionnaire preparation and it is required to introduce a few categories or sections for the questionnaire where first thought questions should be included under these categories or sections.

The third stage involves proper wording of the final questionnaire and those questionnaires should be comprehensive but short. All questions must have a logical sequence without any ambiguities. The questionnaire should be attractive in its appearance as well as to the respondents. The questionnaire should avoid any presumption and duplicating and not comprise any hypothetical questions.

There are a number of formats for questions such as factual questions and opinion questions. Based on the research requirement, a suitable format should be selected.

Factual questions are required to collect facts related to the data required for research. This will include descriptive type questions or analytical type questions. Information or data through a factual questionnaire can be asked based on all facts related questions as an example:

- What is the labour force available within the organisation?
- How many management experts exist within your organisation?

- What is the grade that your organisation is registered for?
- How many private sector building projects were carried in the last years?

Opinion questions can be prepared in a number of different formats like Check List format, Grid format, Rating scale, Likert Scale and Numerical rating scale.

The checklist format questionnaire contains a list of items where respondents are asked to tick in the given spaces and grid format questions are a further expansion of checklist formats.

Rating scale questionnaire formats are questions that are most common to questioning participants provide their opinions or views based on set pout rating scale criteria such as a strongly agree -5 points, Agree- 4 points, Neutral- 3 points, Disagree-2 points and Strongly disagree 1-points.

Likert Scale questionnaire format is similar to rating scale format with exception of attitudinal statements in the questions.

Numerical rating scale format is another most commonly used questionnaire format to questioning the rating of how much out of 100, 10 or out of 5.

In this research study, to obtain expert opinions, a questionnaire is prepared using Likers Likert Scale 1 to 5 as per their preference of importance considering effects on the project success of the private sector building projects in Sri Lanka. Refer to Appendix B & C for the First & Second Round Questionnaire.

Likert scale as follows:

1 - Very low importance

2 - Low importance

3 - Medium importance

4 - High importance

5 - Very high importance

3.2.11 Selecting Sample techniques for the research

In general, for most researchers, it is hardly possible to gather data from every person in the target population because of practical limitations as well as time and budget constraints. Instead, the researcher selects a suitable sample to collect data. A sample is a group of individuals who truly participate in the research representing the entire target population.

A sample frame is the list of all the individuals that the sample is chosen from, generally, it is the total population of the research. Sample size can be expressed as a number of individuals considered to be included in the sample depending on the target population of the research. Sample size can be expressed as the number of individuals considered to be included in the sample depending on the target population of research.

According to Saunders *et al*., (2012, p261) sampling techniques can be divided into two; i.e., probability sampling and non-probability sampling. Below figure 15 illustrates sampling techniques.

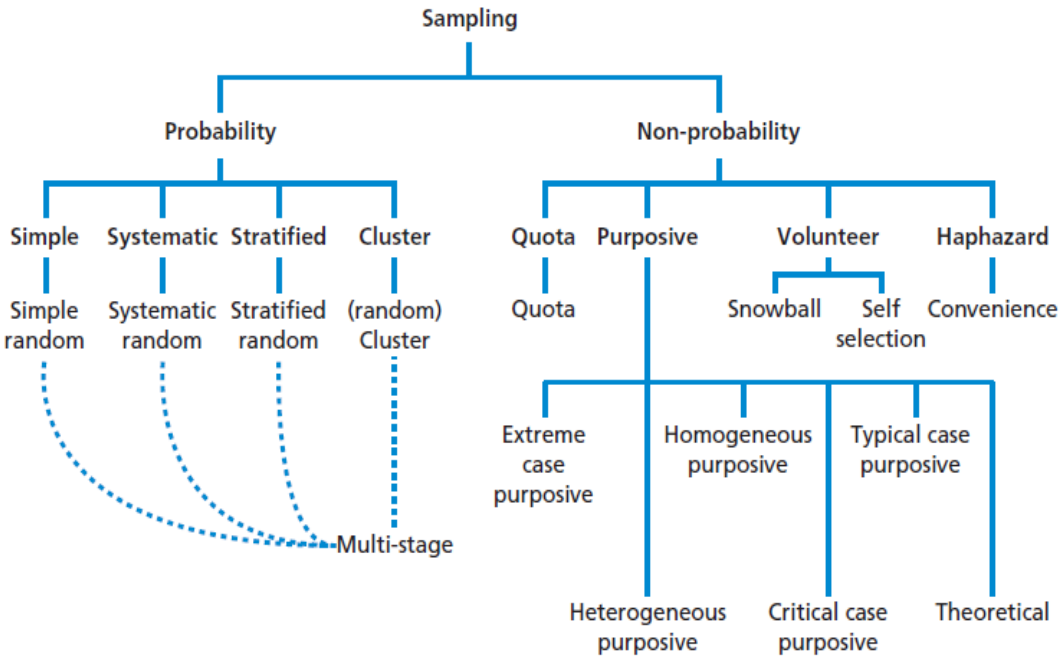

Figure 15 : Sampling Techniques

3.2.11.1 Probability Sampling

In probability sampling, each person in the target population gets an equal opportunity to be included in the sample. Saunders *et al*., (2012) state that the most important aspect of probability sampling is that it represents the total population. Further, Saunders *et al*., (2012) describe that when the sample size is determined, a researcher should be confident about the certainty that collected data represent the characteristics of the total population, the margin of error the researcher can tolerate within the research and the method of analysis.

Saunders *et al*., (2012) outlines five types of probability sampling techniques as described below;

3.2.11.2 Simple random sampling

This sampling method involves choosing the sample randomly from random number tables or computer. This is an unbiased method to select the sample, hence, the sample can represent the total population. A simple random sampling technique can be applied when an accurate and accessible list of an entire population is available.

3.2.11.3 Systematic Random Sampling

This is a method of gathering the sample from fixed intervals of the sample, therefore the sample is equally spread in the population.

3.2.11.4 Stratified random sampling

In this method, the population is divided into one or more subpopulations (strata) based on their attributes and random samples are selected from each stratum.

3.2.11.5 Cluster sampling

In cluster sampling, the entire population is separated into discrete clusters and can be collected from each cluster randomly. Each cluster has similar characteristics to the entire population.

3.2.11.6 Multi-stage sampling

This can be identified as a development to cluster sampling. In this method, the population is divided into a cluster and those clusters are grouped again according to their similar characteristics using a stratified random sampling technique.

3.2.11.7 Non-probability Sampling

In non-probability sampling techniques, participants are selected based on non-random criteria due to the reason that the entire population is unknown, therefore each individual in the population is not getting a chance to be included in the sample.

Saunders *et al*., (2012) state that in non-probability sampling, a researcher can apply sampling techniques based on subjective judgment. Furthermore, the researcher has to undertake a detailed study of suitable respondents from the entire population. The researcher can decide the sample size depending on the focus of the research problem.

Saunders *et al*., (2012) describes a number of non-probability sampling techniques as discussed below;

3.2.11.8 Quota Sampling

The quota sampling method is totally non-random and generally applied for structured interviews. In this method, the population is divided into groups and then, a quota is calculated for each group as per available data. Data collection can be carried out through interviews based on the number in each quota.

3.2.11.9 Purposive Sampling (Judgmental sampling)

In the purposive sampling method, respondents who are suitable for answering the research questions are selected by the researcher through subjective judgement. As per Saunders *et al*., (2012), there are several purposive sampling methods available as described below:

3.2.11.10 Extreme Case Sampling (Deviant sampling)

This sampling method emphasises selecting special or uncommon cases to the sample for the purpose of collecting unusual results which may enable the researcher to achieve research objectives effectively.

3.2.11.11 Heterogeneous Sampling (Maximum Variation Sampling)

The heterogeneous sampling method allows the researcher to choose participants that have diverse characteristics, hence various possible answers can be expected in the data collection in order to find out a solution for the research problem well.

3.2.11.12 Critical case sampling

In this sampling method, most critical cases are chosen for the sample based on the concept that their responses might dramatically influence the research objective. The purpose of this kind of data collection is to understand the opinions of an extreme case.

3.2.11.13 Theoretical Sampling

This method is based on theories like grounded theory and analytical induction. First, the researchers decide from the sample to be taken and then participants are chosen as required for data collection.

3.2.11.14 Haphazard Sampling (Convenience Sampling)

In the haphazard sampling technique, samples are selected without any clear connection to the research problem. Hence, this is the most convenient type of sampling method. The researcher can choose available samples haphazard without much effort.

3.2.11.15 Heterogeneous Purposive Sampling Technique for the Research

For this research, the heterogeneous purposive sampling method, which is one of the non-probability sampling techniques is selected as the most suitable sampling technique to achieve research objectives.

As the sample for this research, a panel of experts from the construction industry is selected based on an established criterion, assuring that the sample represents the entire

target population of the research. The selected panel of experts is from extremely diverse disciplines in the construction industry within the research subject.

According to Saunders et al., (2012, p283), for a heterogeneous population sample size is between Twelve to Thirty (12-30) and accordingly, it was planned to deploy two-third of the maximum sample size which is equal to twenty experts for this research. However, due to time constraints and the busy schedule of high calibre professional practitioners in the Western province construction industry, only fifteen experts were deployed for this research from the construction industry who are currently participating in Western Province in Sri Lanka. This sample size of 15 is within the range minimum of 12 and maximum of 30 and acceptable sample size for this research study. The expert panel consists of academically and professionally qualified professionals from Engineers, Project Managers and Architects who understand research well and have an interest in the outcome of the research.

Delphi techniques used for the collection of data in this research as it is the best techniques to obtain expert opinion from the industry other than data collection like questionnaire survey representing larger population or personnel interviews.

3.2.12 Data Analysis Techniques

According to Naoum (2013), data analysis techniques is adopted in research to analyse collected data from the respondents. All collected data should be analysed and to be presented in highlighting major variances and trend in the most presentable manner. There are three types of data analysis methods commonly used to summarise the collected data

1) The exploratory method for data analysis mainly uses an open-ended type of questions.
2) Descriptive analysis method which includes normal and frequency distribution slandered deviation and Measure of central tendency
3) Inferential statistical analysis method which includes Chi-square, t-test, Spearman ranking correlation – coefficient and Pearson product-moment correlation coefficient.

There are different software packages used for researches to carry out data analysis which is less time taking and faster than manual calculation. It is the researcher's decision to adopt a suitable data analysis method as per the requirement of the research study. By selecting an appropriate method of analysis and tabulating available information with graph, bar chats and or pie chart analysed data can be presented with confidence. In this way, the results will be more attractive and accurate. There are more data analysis methods are available and these are namely factors analysis, path analysis and cluster analysis. The most commonly use data analysis method to find is mean, median, mode, Relative Importance Index, normal curve and frequency distribution of the collected data. The Relative Importance Index is used to identify the rating or ranking position of the results.

In this research study, a panel of expert was requested to scale factors affecting project success as per the Likert scale is 1 - Very low importance, 2 - Low importance, 3 - Medium importance, 4 - High importance, 5 - Very high importance and Relative Importance Index (RII) formulae were adopted to analyse data from the panel of expert is as follows:

$RII = \sum W / (A*N)$

Where W = Weightage given to each factor by the respondent.

A = highest weightage given by respondents

N = total number of respondents.

Based on the RII values for each factor, the mean of RII was calculated using the formulae mentioned below:

Mean of $RII = \sum RII / n$

Where, n = total number of RII factor values.

Previous researchers in different countries used Relative Importance Index (RII) formulae for similar type their research studies for data analysis. Bhangale, (2016) used RII formulae for data analysis for his study for "*Analysis of Critical Success Factors for High Rise Building*, Babu, (2015) used RII formulae for data analysis for his studies for *"Factors Affecting Success of Construction Project",* Patil & Bhangale, (2016) used RII formulae for data analysis in their studies for "*Investigation of Factors Influencing Cost Overrun in High-Rise Building Constructions"*,

3.3 Research Design

This study was conducted to focus on identifying factors affecting project success unique to private sector building projects in Sri Lanka. The Delphi technique was applied to determine the most significant factors and rank them.

After establishing research questions, research aim and objectives; a number of research studies were reviewed to achieve similar nature of aims and objectives to identify the most suitable research methods. Accordingly, the research mentioned below was designed to collect data and analysis of data to achieve research objectives.

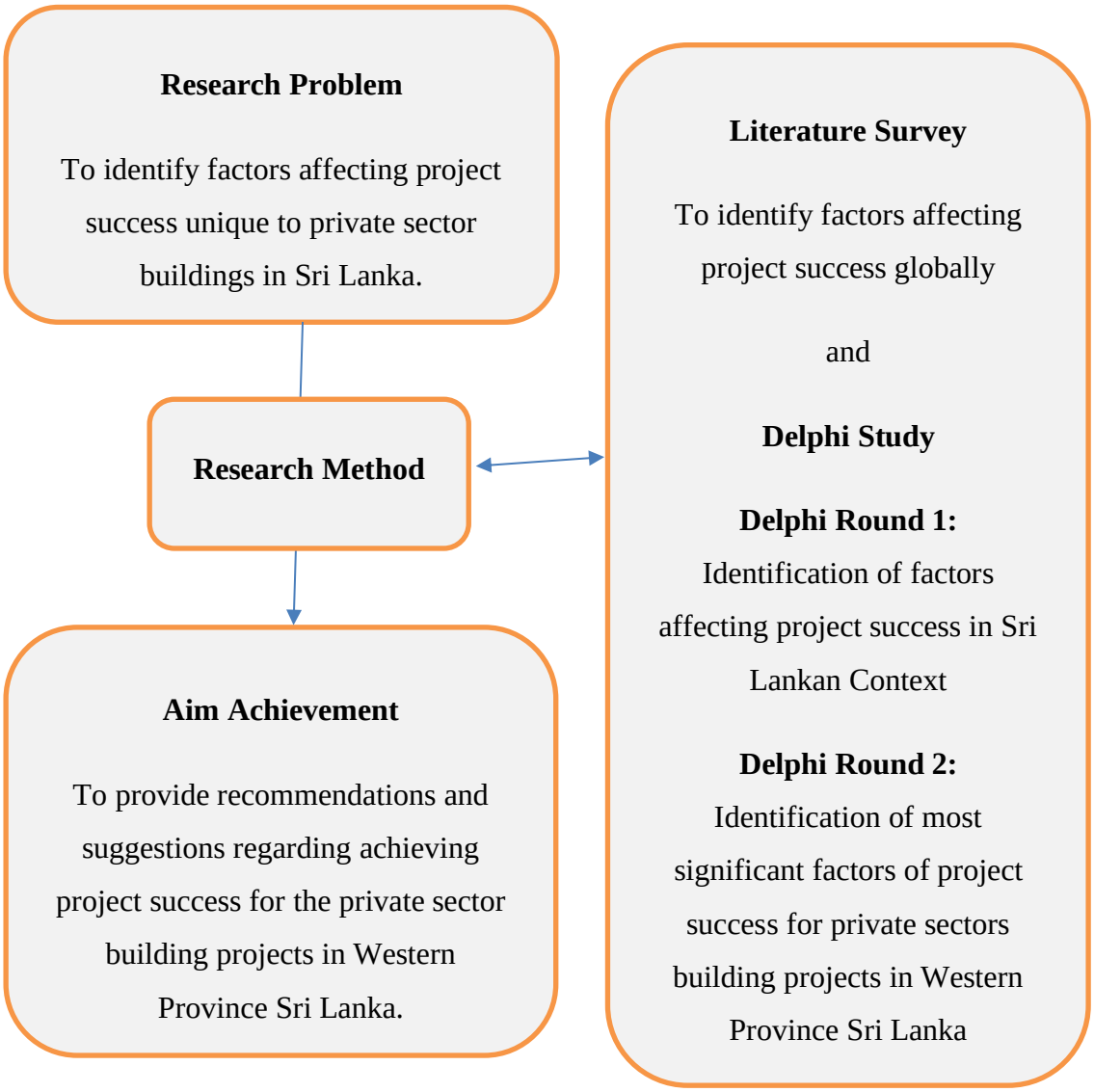

Figure 16 : Outline of the Research Design

3.4 Research Method

Having completed the road map research methodology and research design is completed the following data collection. Additionally, data analysis techniques were recognised which is suitable for this research.

3.4.1 The Delphi Technique for the Research

In the early 1950s, the Delphi techniques were developed by Olaf Helmer & his associates when they were doing defence research at the Rand Corporation (Yousuf, 2007). The Delphi method is basically gathering opinions on a research issue from a panel of experts who are anonymous to each other. The collective responses are subjected to a process improvement, through another round of questionnaires and a controlled feedback process. Delphi techniques can be described as commonly used and an established method to collect data from participants whose has the relevant expertise. The design of the technique allows accomplishing a convergence of perspectives of experts regarding research matter (Hsu & Sandford, 2007)

According to Linstone and Turoff (1975) cited by Hsu and Sandford (2007), the Delphi technique can be applied and organise data from a panel of experts on a complicated research problem and develop an effective solution.

Delphi questionnaire is designed and circulated among a group of individuals and when the questionnaire is returned, the researcher summarises responses and develop another questionnaire for the same respondents. In general, respondents gets to re-evaluate their responses after examining the group response. (Linstone & Turoff,1975)

Delbecq, Van de and Gutafson (1975) cited by Hsu and Sandford (2007) specified that the Delphi Tectechniques can be employed to achieve the objectives mentioned below:

- To establish feasible programme alternatives.
- To provide judgment regarding a matter by studying certain data or assumption
- To develop a consensus by analysing data from a group of participants
- To correlate different conclusions on a certain matter in a range of disciplines.
- To educate participants of the research on various and inter-connected parts of the research.

Originally, the Delphi technique is developed for forecasting and planning purpose. According to Ngor (1985), the first relatively large Delphi project has seven experts, five questionnaire and weekly basis feedback procedures. Further, the process of Delphi underwent modifications but its major characteristics remained unchanged.

3.4.1.1 Characteristics of Delphi Techniques

In most of the application, Delphi techniques have certain common characteristics. Dalkey 1972 cited by Hsu and Sandford (2007) stated that several characteristics of the Delphi method as below:

- By employing the Delphi method, specifically researcher can use iterations to achieve a consensus compared to other data collecting methods available.

- Another major characteristic is that the Delphi method provides the ability to offer anonymity to research participants, a proper feedback procedure, and the allowance of various data analysis methods to interpret gathered data.

- Due to the anonymity nature of the method, the researcher can minimise the effect of common problems arising when collecting data from a group of individuals.

- The process of the Delphi method is designed in a way that the effect of noise is minimal. Noise is one of the major problems in collecting data from a group of individuals and it distorts the data because individual interest can be appeared rather than focusing on research matter.

- As the data is analysed statistically, the Delphi technique further limits the possible pressure among respondents regarding conformity. In addition, opinions can be properly represented in final iteration when it is calculated by statistical analyses.

3.4.1.2 Delphi Process

The procedures of Delphi often vary based upon its application. In general, the process begins with the assumption that the research problem must be clearly defined before gathering information for forecasting or decision making. However, Pfeiffer, 1968 (cited by Yousuf, 2007) outlines the fundamental steps of the Delphi process as shown below;

- A questionnaire is distributed to the panel of experts and them to provide their opinions according to their experiences.

- In the second round, a summary of the responses is sent back to experts and ask the panel of experts to rate each item of the questionnaire according to the scale provided for the criterion of importance.

- Through the third round of the questionnaire, the researcher includes the analysed summary, rating and the analysed consensus and ask experts to re-evaluate their opinion if required or review the reasons for not matching with the of the group.

3.4.1.3 Selection of the Delphi Method

Linstone and Turoff (2002) stated that in order to use the Delphi technique in research one or more of the below-mentioned properties are to be applicable;

- When the particular research problem is not addressed properly in history and there is an expert individual who can share their knowledge for the research study by contributing to the problem in various backgrounds of experience and expertise.
- When the requirement of a number of experts to gather information is high to explore the research problem effectively, face-to-face interviews cannot be applicable.
- When the repeated meeting with experts may incur infeasible cost and money.

- When the disagreement among participants is served, assuring anonymity is an essential matter, the researcher ensures referred communication and assured anonymity.
- When it is a must for the requirement to preserve the heterogeneity of individuals in order to assure the validity of gathered data.
- When a proper straight forward analytical technique cannot be applied to the research problem, but collective data possibly leads to a reasonable subjective judgment.

Accordingly, for the study of this research, Delphi techniques are employed as the method to (congregate) data from 15 experts in two rounds of questionnaires. Throughout this research process, major characteristics of Delphi are maintained, those are anonymity, controlled feedback procedure, statistical analysis and expert input.

3.4.1.4 Limitation of Delphi Method

Delphi Techniques are not possible without limitations and the consensus reached through Delphi techniques may not be the true consensus. It may be a product of inaccurate or influenced agreement or outcome. Delphi seems to be a straightforward method to researching concern areas of forecasting and building consensus. At first glance, researchers may think the Delphi technique is a very simple technique that can easily be done. The problems associated with Delphi techniques must be considered very carefully before designing the Delphi study (Yousuf, 2007).

Linstone and Turoff (2002) stated that Delphi is a very simple concept and Delphi techniques can easily be applied to the research. Therefore, many people have tried this procedure without taking into consideration the problems that can be involved while carrying out the exercise. As Linstone and Turoff (2002, p6) emphasize that failure of Delphi techniques is due to the following common reasons:

- Strong enforcement of the researcher's presumptions and views of a problem to a respondent group through a thorough explanation of the Delphi techniques whilst overlooking other perspectives relevant to the specific problem.
- Expectations for the Delphi techniques to be a replacement of all other forms of communication methods in any given scenario.

- Use of insufficient summarisation techniques when presenting participant responses with the inclusion of a common and basic understanding of evaluation scales within the exercise.
- Disregarding any negative views others may have about this technique in order to establish an artificial positive outlook about the technique.
- Misjudging the demand in introducing the technique to respondents and not considering the impact this may have on their time management when incorporating Delphi whilst fulfilling the roles of their job.

However, Delphi limitations are not having any impact on this research study as all experts responded to two Delphi round questionnaires.

3.4.1.5 Selection of Expert Panel

The selection of the panel of experts must be carried out with proper care and consideration. In this research, a heterogeneous purposive sampling approach is adopted because sound and extensive expert knowledge from different disciplines is mandatory to gather accurate information.

A panel of experts from the construction industry in Western Province, Sri Lanka is selected based on the established criterion to provide opinions on project success factors. The Expert Panel is selected through an initial study about their qualifications, disciplines, experiences and they are well understanding the research topic and their interest in the outcome of this research study.

- Qualified experienced professionals who are currently practising in the construction industry in Western Province, Sri Lanka.
- Directly involved in the management of building construction projects.
- Having a sound and extensive knowledge of building construction in Sri Lanka including a considerable period as a practitioner.
- Having understood the research problem and its importance to the industry.
- Having the great interest in the outcome of this research study and inspiration to actively participate in the questionnaire rounds

Accordingly, in this research study, 15 experts have been selected in order to obtain expert's opinion and to make heterogeneous respondents with reliable and accurate

consensus from the Delphi method. These (15) fifteen experts were deployed from the construction industry in Western Province in Sri Lanka based on the below-mentioned criterion;

Expert panel selection criterion: Practitioners within Western Province, Sri Lanka who has more than fifteen (15) years experience in the Sri Lankan building construction industry with academically and professionally qualified professionals, selected from a pool of Engineers, Project Managers and Architects with academic qualifications either Bachelor Degree (BSc) or Master Degree (MSc) and Chartered Membership from relevant recognise Institutions.

3.4.1.6 Data Collected from Expert panel from First Round Questionnaire

Table 6: Data Collected from Expert panel from First Round Questionnaire

Ref	Identified Factors	1 - Very low importance	2 - Low importance	3 - Medium importance	4 - High importance	5 - Very high importance	RII (Relative Importance Index)	Overall Rank	Category-wise Rank
1.0	**Project Category**								
1.1	Type of project	2	1	7	5	0	0.750	19	5
1.2	Nature of project	0	2	11	2	0	0.750	19	5
1.3	Number of floors of the project	0	1	6	6	2	0.720	21	6
1.4	**Complexity of project**	0	1	0	5	9	0.893	5	1
1.5	**Size and value of project**	0	1	2	5	7	0.840	11	3
1.6	Uniqueness of project activities	0	2	6	4	3	0.707	22	7
1.7	**Urgency of project outcome**	0	0	4	5	6	0.827	13	4
1.8	**Clearly defined project goals / objectives**	0	0	4	3	8	0.853	9	2
2.0	**Organisation Structure Category**								
2.1	**Project organisation structure**	0	0	3	7	5	0.827	13	4
2.2	**Effective project team formation**	0	0	0	6	9	0.920	3	1
2.3	**Top management support**	0	0	1	5	9	0.907	4	2
2.4	**Functional manager's support**	0	0	2	8	5	0.840	11	3
	Factors which were under categories 3 to 13 were omitted in the table for clarity and for full details for data collected in the Appendix D								
14.0	**Health & Safety Category**								
14.1	Application of health and safety factors in organisation	0	1	2	10	1	0.773	17	2
14.2	**Easiness to reach to the site (Project Location)**	0	0	7	8	0	0.883	6	1
14.3	Reportable accidents rate in project	0	1	7	5	2	0.707	22	3
15.0	**Environmental Category**								
15.1	Air quality noise level	1	1	4	8	1	0.693	23	2
15.2	Waste around the site	0	2	5	7	1	0.693	23	2
15.3	Climate condition in the site	0	0	6	7	2	0.747	20	1

3.4.1.7 Data Collected from Expert panel from Second Round Questionnaire

Table 7: Data Collected from Expert panel from Second Round Questionnaire

Ref	Identified Factors	1 - Very low importance	2 - Low importance	3 - Medium importance	4 - High importance	5 - Very high importance	RII (Relative Importance Index)	Overall Rank	Category-wise Rank
1.0	**Project Category**								
1.1	Complexity of project	0	0	4	7	4	0.800	10	1
1.2	Size and value of project	1	0	3	6	5	0.787	11	2
1.3	Urgency of project outcome	0	2	4	4	5	0.760	13	3
1.4	Clearly defined project goals / objectives	1	0	3	6	5	0.787	11	2
2.0	**Organisation Structure Category**								
2.1	Project organisation structure	0	0	6	6	3	0.760	13	4
2.2	Effective project team formation	1	0	2	7	5	0.800	10	3
2.3	**Top management support**	1	0	2	3	9	0.853	6	1
2.4	**Functional manager's support**	0	2	1	6	6	0.813	9	2
Factors which were under categories 3 to 10 were omitted in the table for clarity and full details for data collected in Appendix E									
11.0	**Productivity Category**								
11.1	Laborer's skills and experience	1	0	1	12	1	0.760	13	3
11.2	Management-labor relationship	0	2	0	9	4	0.800	10	2
11.3	**Sequencing of work according to schedule**	0	2	0	8	5	0.813	9	1
12.0	**Client Satisfaction Category**								
12.1	**Leadership skills for project manager**	1	0	0	8	6	0.840	7	1
13.0	**Health & Safety Category**								
13.1	**Easiness to reach to the site (Project Location)**	0	0	7	8	0	0.883	3	1

3.5 Strength and weakness of the Delphi technique.

3.5.1 Strength of Delphi Technique

Delphi technique can avoid many of the weaknesses common to more conventional interviews and discussions type research studies. Many researchers have pointed out many strengths of the Delphi method. The Delphi technique claims to have the following strengths cited by Nogr, 1985 (Nash, 1978; Ibid, Helmer, 1966; Pill,1977; Rabiega,1982; Riggs, 1983; Dalkey,1966; Pill, 1971; Stenberg, 1979; Battersby, 1979; Cyphert & Gant, 1970; Weaver, 1972):

- As the Delphi technique is not technically comparatively to other methods, it is suitable to use with an individual who is not familiar with research methods.
- Delphi is relatively low-cost, quick and can be applied with much less effort. The researcher can obtain data by mailing a properly designed questionnaire to a large number of participants.
- There is evidence that group consensus is more accurate and reliable in the Delphi technique compared to other methods.
- In uncertain or intangible circumstances, the researcher can use the Delphi technique for forecasting and planning purpose.
- Because of the systematic nature of the Delphi method, the research outcome becomes objective.
- When the Delphi study is managed properly, respondents become motivational and tend to provide a higher commitment to the research.
- Respondents get equal opportunity to contribute to the final output due to the features like anonymity, feedback procedure and statistical analysis methods etc;
- Participants' friendliness or hostility among each other is lessened and one cannot judge other's response
- Delphi study accommodates updated feedback to respondents and this reduces the need of overlooking opposing views among participants.

3.5.2 Weaknesses of Delphi Technique

There is a lack of guidance and standard principles on how to interpret the results and the non-availability of globally established definitions of consensus and method to select sample. In addition to methodological limitations., According to Preble (1983), Rabioga (1982) and Tuneroff (1971) cited by Ngor (1985), mentioned below are some of the weaknesses of Delphi techniques.

- Administrative works in the Delphi study is more complex and time-consuming and therefore, the required time maybe a week or months or more than that to have final output.
- Selection criteria of the expert panel may lead to losing an application of sampling techniques into the research study which is required to measure the readability of the research. Therefore, this may arise some doubts about the effectiveness and representative ability of experts.
- In certain researches, members of the expert panel are well-known to each other and therefore, responses may not fully independent.
- Misunderstanding of communication may occur if the questionnaire is not properly designed, if so, the consensus becomes unreliable.
- Delphi techniques are having difficulties determining long-range accuracy however techniques have reasonable forecast about its accuracy.
- The researchers are relying on Delphi analysis to make recommendations rather than taking consensus as an information-gathering tool.

Chapter 4: Analysis

4 Analysis and discussion of the results

4.1 Introduction

This chapter explains and describes an analysis of the data received from the expert panel through a two-round Delphi method questionnaire survey and its results. This describes in two steps to identify and evaluate the factors affecting private sector building project success in Sri Lankan Context and the most significant factors affecting private sector building project success in Western Province, Sri Lanka.

4.2 Composition of Expert Panel from Construction Industry in the Western Province of Sri Lanka.

The expert panel consists of 15 professional practitioners of those who are representing the following organisations.

Table 8: Composition of the expert panel

From Client Organisation	2
From Project Management companies	1
From Engineering consultancy firms	5
From Architectural consultancy firms	5
From Contracting companies	2
Total Number of Experts in the Panel	**15**

From First Round Data Analysis for 115 Factors with RII value and Ranking Positions

Table 9: First Round Data Analysis Results for 115 factors with RII Value and Ranking Positions

Ref	Identified Factors	RII (Relative Importance Index)	Overall Rank	Category-wise Rank
1.0	**Project Category**			
1.1	Type of project	0.750	19	5
1.2	Nature of project	0.750	19	5
1.3	Number of floors of the project	0.720	21	6
1.4	Complexity of project	0.893	5	1
1.5	Size and value of project	0.840	11	3
1.6	Uniqueness of project activities	0.707	22	7
1.7	Urgency of project outcome	0.827	13	4
1.8	Clearly defined project goals / objectives	0.853	9	2
2.0	**Organisation Structure Category**			
2.1	Project organisation structure	0.827	13	4
2.2	Effective project team formation	0.920	3	1
2.3	Top management support	0.907	4	2
2.4	Functional manager's support	0.840	11	3
	Factors which were under categories 3 to 13 were omitted in the table for clarity and full details for 115 factors in Appendix F.			
14.0	**Health & Safety Category**			
14.1	Application of health and safety factors in organisation	0.773	17	2
14.2	Easiness to reach to the site (Project Location)	0.883	6	1
14.3	Reportable accidents rate in project	0.707	22	3
15.0	**Environmental Category**			
15.1	Air quality noise level	0.693	23	2
15.2	Waste around the site	0.693	23	2
15.3	Climate condition in the site	0.747	20	1
	Mean Value of RII Value in 1st round	**0.803**		

The first-round Delphi method questionnaire survey identified factors affecting project success in Sri Lanka Context. Based on the first-round questionnaire survey data analysis, results with Relative Importance Index values, ranking positions for factors are shown in Table 9 above, for clarity and full details of the 115 factors are provided in Appendix F

4.3 Data Analysis: Selection criteria for factors from 1st round responses

Data Analysis for the first round of the Delphi method questionnaire was carried out using the RII formula mentioned below and prepared the relative importance Index and based that index overall ranking and category wise raking for each factor was separately identified.

$RII = \sum W / (A*N)$

Where W = Weightage given to each factor by the respondent.

A = highest weightage given by respondents

N = total number of respondents.

Based on the RII values for each factor, the mean of RII was calculated using the formulae mentioned below:

Mean of $RII = \sum RII / n$

Where, n = total number of RII factor values.

Based on the data analysis for 1st round questionnaire responses, the mean value of RII value is 0.803. Criteria adopted to select significant factors affecting project success in Sri Lankan Context as follows:

The nearest Relative Importance Index (RII) lower value to the mean of RII is 0.800 and its overall ranking was 15.

The nearest Relative Importance Index (RII) higher value to the mean of RII is 0.813 and its overall ranking was 14.

Based on the above-mentioned criteria **0.800** is the nearest value of the mean value of RII and its overall ranking position was **15**. Therefore, it was established that the factors having their overall ranking position up **15** and RII value **0.800** or above factors considered as a significant factor affecting project success in Sri Lankan Context. A total number of selected factors from the analysis were 66 factors under 13 categories and their Relative Importance Index values, ranking positions for factors shown in

Table 10, below for clarity and full details of the 66 factors are provided in Appendix G.

From First Round data analysis for identified 66 Factors RII Value and Ranking positions

Table 10: From First Round data analysis for identified 66 Factors RII Value and Ranking positions

Ref	Identified Factors	RII (Relative Importance Index)	Overall Rank	Category-wise Rank
1.0	**Project Category**			
1.1	Complexity of project	0.893	5	1
1.2	Size and value of project	0.840	11	3
1.3	Urgency of project outcome	0.827	13	4
1.4	Clearly defined project goals / objectives	0.853	9	2
2.0	**Organisation Structure Category**			
2.1	Project organisation structure	0.827	13	4
2.2	Effective project team formation	0.920	3	1
2.3	Top management support	0.907	4	2
2.4	Functional manager's support	0.840	11	3
3.0	**Project Management Category**			
3.1	Contactor's communication system	0.867	8	3
3.2	Contactor's control mechanism	0.867	8	3
3.3	Contactor's feedback capabilities	0.853	9	4
3.4	Contactor's planning effort	0.933	2	1
3.5	Developing an appropriate project structure	0.893	5	2
3.6	Implementing an effective quality assurance program	0.893	5	2
3.7	Coordination effectiveness	0.867	8	3
3.8	Contactor's decision-making effectiveness	0.893	5	2
3.9	Project monitoring	0.893	5	2
3.10	Control of sub-contractors' works	0.867	8	3
3.11	Contactor's prior project management experience	0.853	9	4
3.12	Constructability program	0.800	15	5
3.13	Project risk management	0.800	15	5
Factors which were under categories 4 to 11 were omitted in the table for clarity and full details for 66 factors in Appendix G.				
12.0	**Client Satisfaction Category**			
12.1	Leadership skills for project manager	0.867	8	1
13.0	**Health & Safety Category**			
13.1	Easiness to reach to the site (Project Location)	0.883	6	1

Table 11: Total Identified 66 Factors within 13 categories

No	Identified Categories	Identified Number of Factors
1.0	Project Category	4
2.0	Organisation Structure Category	4
3.0	Project Management Category	13
4.0	Contractor Category	4
5.0	Stakeholders Category	18
6.0	Procurement Category	1
7.0	Design Team Category	5
8.0	Cost Category	6
9.0	Time Category	3
10.0	Quality Category	3
11.0	Productivity Category	3
12.0	Client Satisfaction Category	1
13.0	Health & Safety Category	1
	Total identified factors	**66**

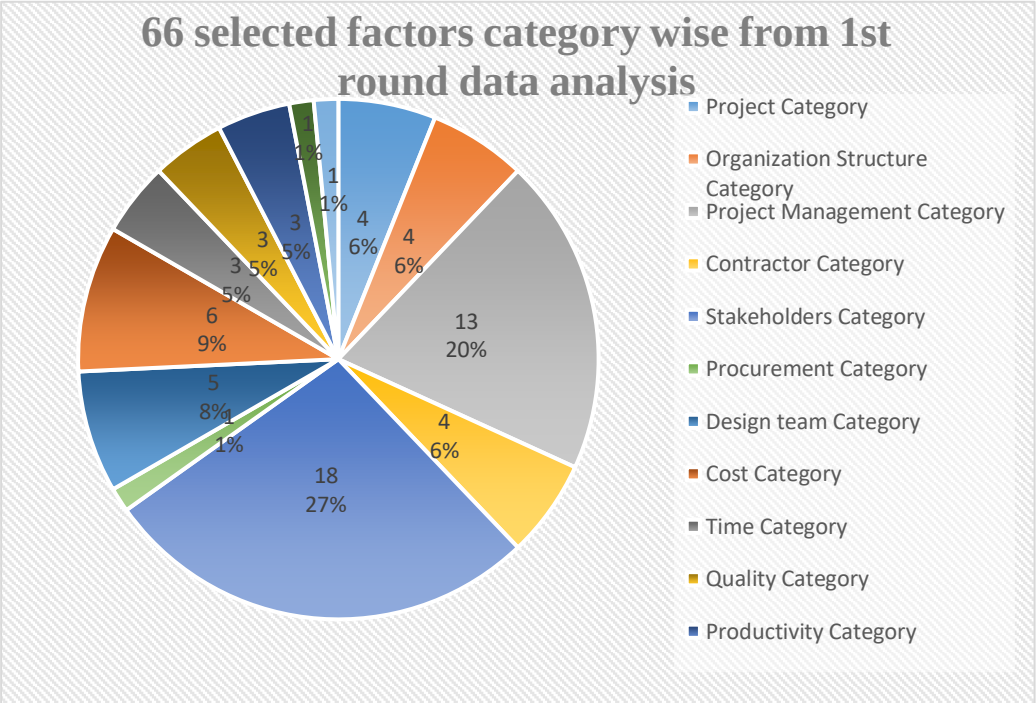

Figure 17: Selected 66 factors

Figure 17 shows the total of 66 factors affecting project success in the Sri Lankan Context that were identified under 13 categories from the first round of data analysis and as per criteria was established and described above. There is a reasonable number of factors under each category, which is explained below:

4.3.1 Project Category

There are four (4) factors that were identified in Sri Lankan Context from the first-round data analysis under the Project category. This is equal to 6% of the total 66 factors identified and identified factors have a considerable impact on the project success. Factors identified under the project category are Complexity of the project with an overall ranking position of 5, Size and value of the project with an overall ranking position of 11, Urgency of project outcome with an overall ranking position of 13 and clearly defined project goals/objectives with overall ranking position of 9.

4.3.2 Organisation Structure Category

Factors identified under Organisation Structure Category is one of the key drivers for any construction project. Therefore, factors under this category have a major impact on project success. The 4 major factors which were identified from the first-round data analysis for Sri Lankan Context represents 4% of the total 66 factors. These factors are project organisation structure with an overall ranking position of 13, Effective project team formation is having a high overall ranking position of 3, Top management support with an overall ranking position of 4 and Functional managers support with a ranking position of 11.

4.3.3 Project Management Category

There are 13 factors identified from first-round data analysis for Sri Lankan Context and it represents 20% of the total 66 factors identified. These factors are under the project management category and these factors are very influential factors to achieve project success. Most of the factors identified under this category are related to the Contractor’s project management factors as well as some of them are factors relevant to the cause of construction which the contractor's project manager must control. Factors identified under this category is Contactor's communication system, Contactor's control mechanism, Contactor's feedback capabilities, Contactor's planning

effort, Developing an appropriate project structure, Implementing an effective safety program, Implementing an effective quality assurance program, Coordination effectiveness, Contactor's decision making effectiveness, Project monitoring, Control of sub-contractors works, Contactor's prior project management experience, Constructability program and project risk management. Total 13 factors identified from 1st round data analysis and Table 12 below shows the ranking position for each project success factors under the Project management category.

Table 12: Identified Factors with Overall Ranking Position

Identified Factors	Overall Ranking Position
Contactor's communication system	8
Contactor's control mechanism	8
Contactor's feedback capabilities	9
Contactor's planning effort	2
Developing an appropriate project structure	5
Implementing an effective quality assurance program	5
Coordination effectiveness	8
Contactor's decision-making effectiveness	5
Project monitoring	5
Control of subcontractors works	8
Contactor's prior project management experience	9
Constructability program	15
Project risk management	15

4.3.4 Contractors Category

There are 4 factors identified from the first-round data analysis for Sri Lankan Context and it represents 6% of the total identified 66 factors. Factors identified under the contractor’s category is main important for projects success due to the project will be constructed by the Contractor and all factors under contractors’ control should be taken care of properly. These factors are Contractor’s experience with an overall ranking position of 9, Site management with an overall ranking position of 5, Supervision with an overall ranking position of 9 and Allocation of sufficient resources having an overall ranking position of 7.

4.3.5 Stakeholders Category

There are 18 factors identified from first-round data analysis for Sri Lankan Context and it represents 27% of the total identified 66 factors. These factors are under Stakeholder's category and these factors are very influential factors to achieve project success. All projects' participants of the project are included under the stakeholder's category and the stakeholder's willingness; capabilities and capacities largely influence the success of the projects. Total 18 factors identified from 1st round data analysis mentioned in Table 13 below which shows the ranking position for each project success factors under stakeholder's category.

Table 13: Identified Factors with Overall Ranking Position

Identified Factors	Overall Ranking Position
Client's emphasis on high quality of construction	13
Client's ability to brief	12
Client's ability to make decisions	14
Contractor's project team leader's experience	8
Technical skills of Contractor's project team leaders	8
Planning skills of Contractor's project team leaders	1
Organizing skills of Contractor's project team leaders	7
Coordinating skills of Contractor's project team leaders	8
Motivating skills of Contractor's project team leaders	14
Contractor's project team leaders' commitment to meet cost, time and quality	2
Contractor's project team leaders' early and continued involvement in the project	13
Contractor's project team leaders' adaptability to changes in the project plan	13
Contractor's project team leaders' working relationship with others.	9
Support and provision of resources from Contractor's project team leaders' parent company	15
Consultant Project Manager's ability to delegate the authorities	14
Consultant Project Manager's ability to coordinate	15
Consultant Project Manager's perception of role and responsibilities	13
Consultant Project Manager's commitment to complete the project	5

4.3.6 Procurement Category

Only one factor was identified from first-round data analysis for Sri Lankan Context and it represents circa 1% of the total identified 66 factors. The factor that is identified is the Project bidding method with an overall ranking position of 10. Project bidding method is directly influencing projects success and selection of suitable bidding method as part of the procurement strategy is very important.

4.3.7 Design Team Category

There are 5 factors identified from first-round data analysis for Sri Lankan Context and it represents 8% of the total identified 66 factors. Factors identified under the design team category is the main important factors to achieve projects success as the design team plays a major role in the project. The design team is playing a major role in the construction projects from inception to completion. Identifies factors are Design team experience with an overall ranking of 4, Project design complexity with an overall ranking of 11, well defined technical specification is having overall ranking position of 4, Mistake/delays in producing design documents with an overall ranking position of 7 and Design team's contribution to construction with overall ranking position of 15. Design team involvement is highly influenced for the success of the project.

4.3.8 Cost Category

There are 6 factors identified from the first-round data analysis for Sri Lankan Context and it represents 9% of the total identified 66 factors. Factors identified under the Cost category is the liquidity of the contractor's organisation with an overall ranking position of 9, financial stability, contractor's cash flow, client cash flow all three factors that have an RII value of 0.933 as well as an overall ranking position of 2, and client instructed variations and cost control system factors having RII value of 0.800 as well as overall ranking position of 15. These factors are highly critical to construction projects and have a great impact on project success.

4.3.9 Time Category

There are 3 factors identified from the first-round data analysis for Sri Lankan Context and it represents 5% of the total 66 factors identified. Factors identified under the Time category are Planned time for construction with an overall ranking position of 13, Average delay in payment from the owner to contractor with an overall ranking position of 9 and Availability of resources as planned through project duration with an overall ranking position of 11.

4.3.10 Quality Category

There are 3 factors identified from the first-round data analysis for Sri Lankan Context and it represents 5% of the total 66 factors identified. Factors identified under Quality Category are the availability of personals with high experience and qualification, Quality equipment and raw materials and the Quality assessment system of the contractor's organisation. All these three factors having an RII value of 0.813 and therefore overall ranking position for the three factors are the same and is 14.

4.3.11 Productivity Category

There are 3 factors identified from the first-round data analysis for Sri Lankan Context and it represents 5% of the total 66 factors identified. Factors identified under the Productivity category are labour skills and experience with an overall ranking position of 8, management-labour relationship with an overall ranking position of 13 and sequencing of work according to schedule with an overall ranking position of 11. Productivity factors are important and lead to completion of construction project and achievement of project success.

4.3.12 Client Satisfaction Category

Only one factor identified from the first-round data analysis for Sri Lankan Context and it represents circa 1% of the total 66 factors identified. Factor identified under leadership is Leadership skills for Project Manager with an overall ranking position of 8. This factor is under the Client satisfaction category and therefore it is most important for project success. One of the most important stakeholders is the Client and his satisfaction at the completion stage is a must requirement. If there is no Client satisfaction for the end product then there is no project success at all.

4.3.13 Health & Safety Category

Only one factor was identified from first-round data analysis for Sri Lankan Context and it represents circa 1% of the total 66 factors identified. The factor identified is Easiness to reach to the site (Project Location) with an overall ranking position of 6. The well-being of the people is of utmost importance under any circumstances. Therefore, Health and Safety is critical & very important for the construction industry

because Industry is completely depending on the workforce and dealing with people's life. Therefore, health and safety should be properly taken into account from inception to completion. It should be noted that more care should be taken during the cause of construction to avoid accidents any other health and safety-related issues.

A total of 66 factors were selected to identify the most significant factors that impact project success in Western Province, Sri Lanka.

Based on the 66 factors selected from the 1st round of data analysis method stated above, a 2nd round questionnaire was prepared in the same design as the first-round questionnaire and resent to the experts to obtain expert opinion for the most significant factors affecting project success in Western Provision, Sri Lanka (See Appendix B for Second Round Questionnaire).

Table 14: Second Round Data Analysis Results – RII Value and Rankings Position

Ref	Identified Factors	RII (Relative Importance Index)	Overall Rank	Category-wise Rank
1.0	**Project Category**			
1.1	Complexity of project	0.800	10	1
1.2	Size and value of project	0.787	11	2
1.3	Urgency of project outcome	0.760	13	3
1.4	Clearly defined project goals / objectives	0.787	11	2
2.0	**Organisation Structure Category**			
2.1	Project organisation structure	0.760	13	4
2.2	Effective project team formation	0.800	10	3
2.3	Top management support	0.853	6	1
2.4	Functional manager's support	0.813	9	2
3.0	**Project Management Category**			
3.1	Contactor's communication system	0.813	9	6
3.2	Contactor's control mechanism	0.840	7	4
3.3	Contactor's feedback capabilities	0.720	15	11
3.4	Contactor's planning effort	0.893	2	1
3.5	Developing an appropriate project structure	0.840	7	4
3.6	Implementing an effective quality assurance program	0.760	13	9
3.7	Coordination effectiveness	0.800	10	7
3.8	Contactor's decision-making effectiveness	0.827	8	5
3.9	Project monitoring	0.853	6	3
3.10	Control of sub-contractor’s works	0.880	4	2
3.11	Contactor's prior project management experience	0.760	13	9
3.12	Constructability program	0.787	11	8
3.13	Project risk management	0.733	14	10
Factors which were under categories 4 to 11 were omitted in the table for clarity and full details for 66 factors in Appendix H.				
12.0	**Client Satisfaction Category**			
12.1	Leadership skills for project manager	0.840	7	1
13.0	**Health & Safety Category**			
13.1	Easiness to reach to the site (Project Location)	0.883	3	1
	Mean Value of RII Value in 2nd round data analysis	**0.808**		

Based on the second-round questionnaire survey data analysis results with Relative Importance Index values, ranking positions for the factors are shown in Table 14 above for clarity and full details of the 66 factors are given under Appendix H.

4.4 Data Analysis: Selection criteria for factors from 2nd round responses

Fifteen expert panel individuals completed the round two Questionnaire survey & Data Analysis for the second round Delphi method questionnaire were carried out using the RII formula mentioned below. This was used to prepare the relative importance Index and was based on the fact that index overall ranking and category wise raking for each factor was identified separately.

$RII = \sum W / (A*N)$

Where W = Weightage given to each factor by the respondent.

A = highest weightage given by respondents

N = total number of respondents.

Based on the RII values for each factor, the mean of RII was calculated using the formulae mentioned below:

$Mean\ of\ RII = \sum RII / n$

Where, n = total number of RII factor values.

Based on the data analysis for second-round questionnaire responses, the mean value of RII is **0.808.** Criteria adopted to identify most significant factors affecting project success of private sector building in Western Province, Sri Lanka as follows**:**

Based on the mean value of **RII is 0.808** and the factors having Relative Importance Index value above the mean value of RII are given ranking positions & selected based on that ranking to consider the most significant factors affecting private sector building projects in Western Province, Sri Lanka.

A total number of selected factors from this analysis were 28 factors under 10 categories with factors with relevant ranking positions for each factor which describes separately in details and how these factors are most significant for the Project Success Table 15 below shows selected 28 factors in different 10 categories.

4.4.1 Identified the Most Significant 28 factors affecting project success in Western Province, Sri Lanka under 10 categories

Table 15: Identified Most significant factors affecting project success in Western Province, Sri Lanka under 10 categories.

Ref	Identified Factors	RII (Relative Importance Index)	Overall Rank	Category-wise Rank
1.0	**Organisation Structure Category**			
1.1	Top management support	0.853	6	1
1.2	Functional manager's support	0.813	9	2
2.0	**Project Management Category**			
2.1	Contactor's communication system	0.813	9	6
2.2	Contactor's control mechanism	0.840	7	4
2.3	Contactor's planning effort	0.893	2	1
2.4	Developing an appropriate project structure	0.840	7	4
2.5	Contactor's decision-making effectiveness	0.827	8	5
2.6	Project monitoring	0.853	6	3
2.7	Control of sub-contractors' works	0.880	4	2
3.0	**Contractor Category**			
3.1	Supervision	0.827	8	2
3.2	Allocation of sufficient resources	0.853	6	1
4.0	**Stakeholders Category**			
4.1	Contractor's project team leader's experience	0.853	6	2
4.2	Planning skills of Contractor's project team leaders	0.840	7	3
4.3	Organizing skills of Contractor's project team leaders	0.853	6	2
4.4	Contractor's project team leaders' commitment to meet cost, time and quality	0.867	5	1
4.5	Consultant Project Manager's commitment to complete the project	0.840	7	3
5.0	**Design Team Category**			
5.1	Project design complexity	0.813	9	2
5.2	Well defined technical specifications	0.840	7	1
5.3	Mistakes/ delays in producing design documents	0.840	7	1

Ref	Identified Factors	RII (Relative Importance Index)	Overall Rank	Category-wise Rank
6.0	**Cost Category**			
6.1	Liquidity of Contractor's organisation	0.827	8	3
6.2	Financial stability and adequate funding	0.867	5	2
6.3	Contractor’s cash flow	0.907	1	1
6.4	Client's cash flow	0.867	5	2
7.0	**Time Category**			
7.1	Planned time for construction	0.827	8	1
7.2	Availability of resources as planned through project duration	0.827	8	1
8.0	**Productivity Category**			
8.1	Sequencing of work according to schedule	0.813	9	1
9.0	**Client Satisfaction Category**			
9.1	Leadership skills for project manager	0.840	7	1
10.0	**Health & Safety Category**			
10.1	Easiness to reach to the site (Project Location)	0.883	3	1

The above Table 15 shows the overall ranking & category wise ranking of each factor against private sector building project success in Western province, Sri Lanka from all 28 factors under 10 categories.

All the above identified factors and their categories were initially derived from a widespread literature review which was done globally. From the results of the first round Delphi survey questionnaire responses and its data analysis, 66 factors were identified in the Sri Lankan Context under 13 different categories. Similarly, from the results of the second round Delphi survey questionnaire responses and its data analysis, 28 factors were identified as the most significant factors affecting project success in Western Province, Sri Lanka under 10 different categories. Furthermore, it is important to take into account that some of these categories overlap.

However, the aim and objectives of this research were to identify the most significant factors affecting project success unique to private sector building projects in Western Province, Sri Lanka. In conclusion, among those twenty-eight significant factors, the

most significant factors are Contractor' cash flow, Contractors planning effort, Easiness to reach to site (Project Location) and Control of sub-contractors works .

Table 16 below shows the most significant factors affecting project success in Western Province, Sri Lanka and factors having Relative Importance Index value with relevant ranking positions for each factor.

4.4.2 Most significant factors affecting project success in Western Province, Sri Lanka.

Table 16: Most significant factors affecting project success in Western Province, Sri Lanka.

Ref	Identified Most Significant Project Success Factors	RII (Relative Importance Index)	Overall Rank
1	Contractor's cash flow	0.907	1
2	Contactor's planning effort	0.893	2
3	Easiness to reach to the site (Project Location)	0.883	3
4	Control of sub-contractors' works	0.880	4
5	Contractor's project team leaders' commitment to meet cost, time and quality	0.867	5
6	Financial stability and adequate funding	0.867	5
7	Client's cash flow	0.867	5
8	Top management support	0.853	6
9	Allocation of sufficient resources	0.853	6
10	Contractor's project team leader's experience	0.853	6
11	Organizing skills of Contractor's project team leaders	0.853	6
12	Project monitoring	0.853	6
13	Leadership skills for project manager	0.840	7
14	Well defined technical specifications	0.840	7
15	Mistakes/ delays in producing design documents	0.840	7
16	Planning skills of Contractor's project team leaders	0.840	7
17	Consultant Project Manager's commitment to complete the project	0.840	7
18	Contactor's control mechanism	0.840	7
19	Developing an appropriate project structure	0.840	7
20	Planned time for construction	0.827	8
21	Availability of resources as planned through project duration	0.827	8
22	Supervision	0.827	8
23	Liquidity of Contractor's organisation	0.827	8
24	Contactor's decision-making effectiveness	0.827	8
25	Sequencing of work according to schedule	0.813	9
26	Functional manager's support	0.813	9
27	Project design complexity	0.813	9
28	Contactor's communication system	0.813	9

The bar chart below shows the most significant factors affecting project success in private sector building in Western Province, Sri Lanka.

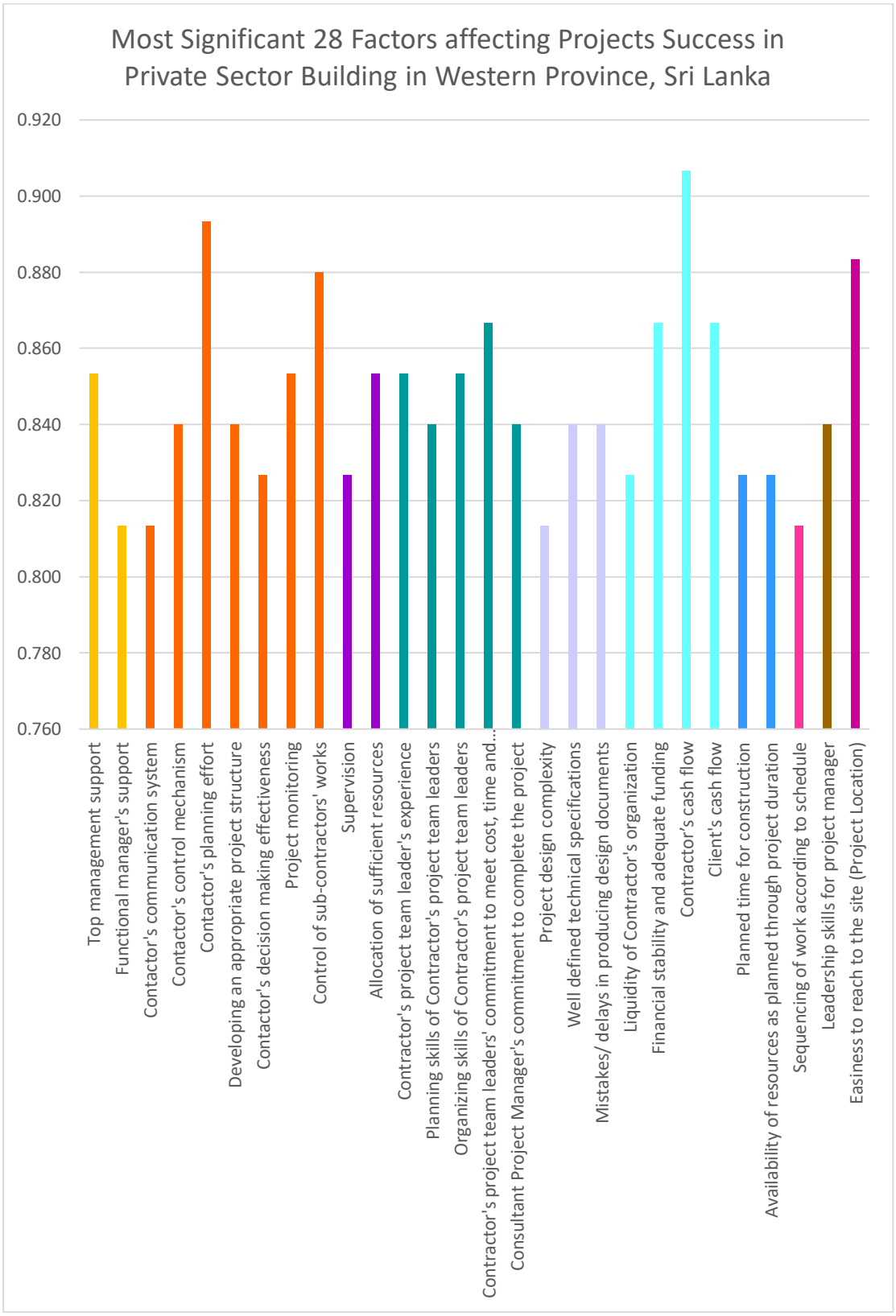

Figure 18: Most significant factors affecting project success

There were twenty-eight project success factors identified by a panel of experts in the Construction Industry in Western Province, Sri Lanka. According to the results Contractor's Cash flow, Contractor's Planning efforts, Easiness to reach to the site (Project Location) and Control of sub-contractors works are the most significant factors that received the ranking position of 1 to 4 respectively.

It is important to describe all these twenty-eight most significant factors affecting project success on Private Sector Building Project in Western Province, Sri Lanka. Position and described below:

4.4.3 Contractors' Cash flow

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified that how experts gave an importance level for this factor. Eleven experts gave a very high importance level of 5 and three experts gave a high importance level of 4 and only one expert gave a very low importance level of 1.

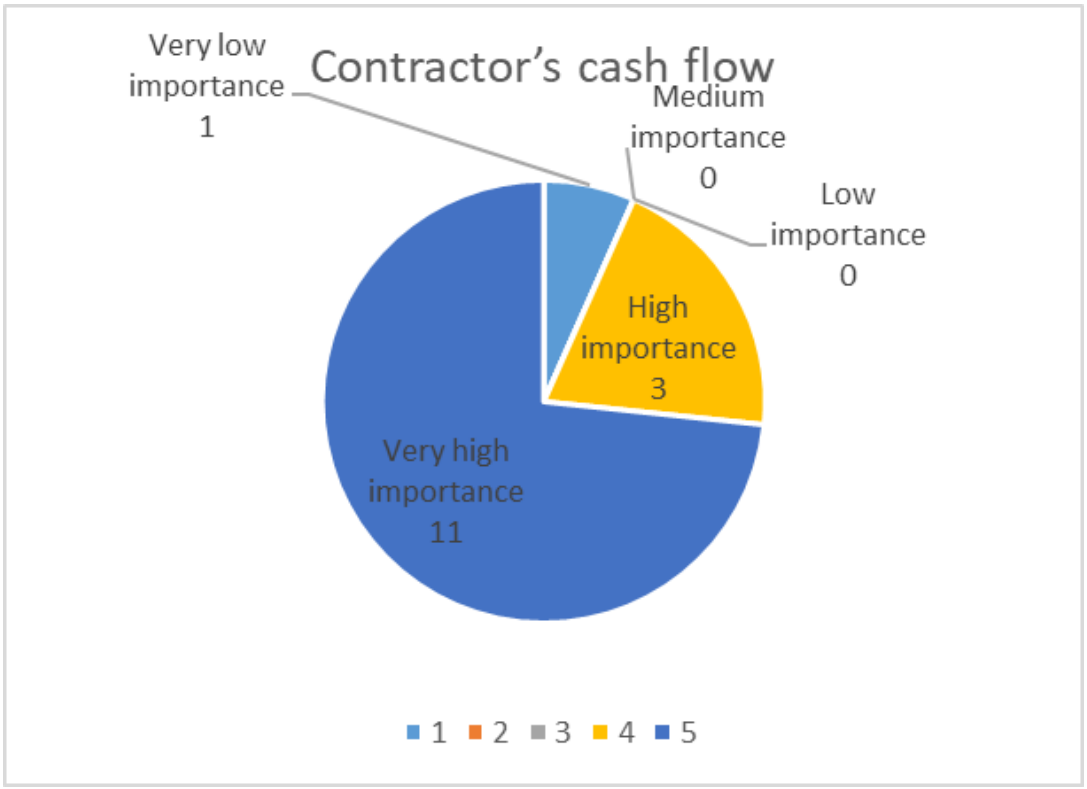

Figure 19 : Contractors Cash flow

The contractor's cash flow factor is given a ranking position of 1 with an RII value of 0.907. The contractor's cash flow ranking position is 1 which is shown in Appendix I.

Therefore, this factor is critical and one of the most significant factors affecting project success. The contractor is one of the major stakeholders of the Project. The contractor's Cash flow under the cost category is very important for building construction projects to have a project successful completion. It directly impacts the project success. The contractor's cash flow should always be kept as a positive cash flow throughout the project. However, first few months from the contract award, the contractor is to fund the project from the contractor's accounts until the first payment received from the Client. It is a requirement to maintains a positive cash flow to the Contractor until completion of the project to have project success. However, the Contractor is also required to put additional efforts to maintain positive cash flow throughout the project. The contractor should also adopt some strategies to maintain and improve cash flow to benefit and achieve the successful completion of the project. Suggested improvement of cash flow strategy by the contractor includes two ways such as, reducing possible expenditure and delaying expenditure, obtaining some long period credit facilities from the supply chain and expediting or advancing income such as advance payment and negotiating shorter period to receive a monthly payment from the Client. The contractor's cash flow improvement can also include an early claim of preliminaries, agreeing with all variations and claiming at the earliest, requesting material off-site payment through Contract amendment, negotiate to reduce retention money etc.

4.4.4 Contractors' Planning Effort

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified how experts gave an importance level for this factor. Nine experts gave a very high importance level to 5 and five experts gave a high importance level to 4 and only one expert gave a low importance level of 2.

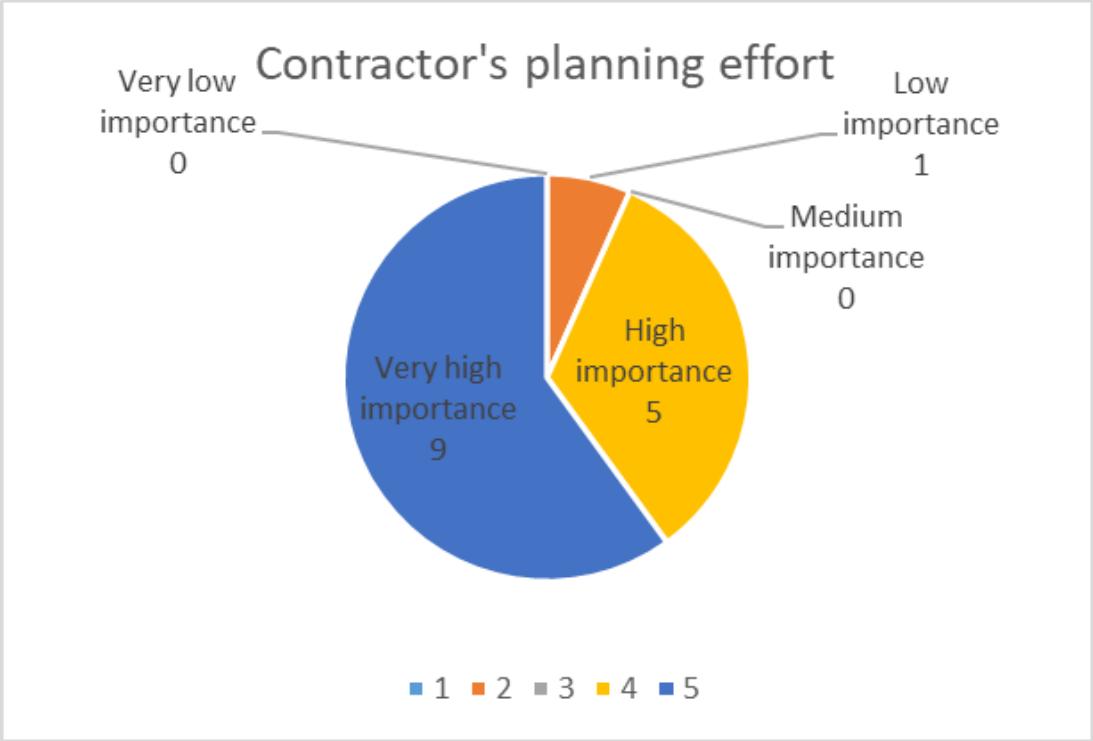

Figure 20: Contractor's planning effort

The contractor's planning effort factor is ranking position as 2 with an RII value of 0.893. This factor is also another critical factor affecting project success. The contractor's planning effort ranking position is 2 which shows in Appendix I. Therefore, the contractor's planning effort should be done from the award of the contract until its completion. The contractor must plan everything properly to achieve a successful project at the end. Failure to do proper planning will result in a failed outcome of the project instead of project success. Therefore, the contractor should plan to take into account factors such as required labour resources, materials procurement schedule with its plan, long lead items, materials delivery schedule for the project, subcontractors' payment, contractor's financial planning not stuck with any financial difficulties during course construction including planning for necessary Contractor's cash flow. Therefore, having received a higher ranking of 2 for this factor, the Contractor's planning effort should be done from the beginning to completion to have project success.

4.4.5 Easiness to reach to the site (Project Location)

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified that how experts gave an importance level for this factor. Eight experts gave high importance level of 4 and five experts gave a medium importance level of 3.

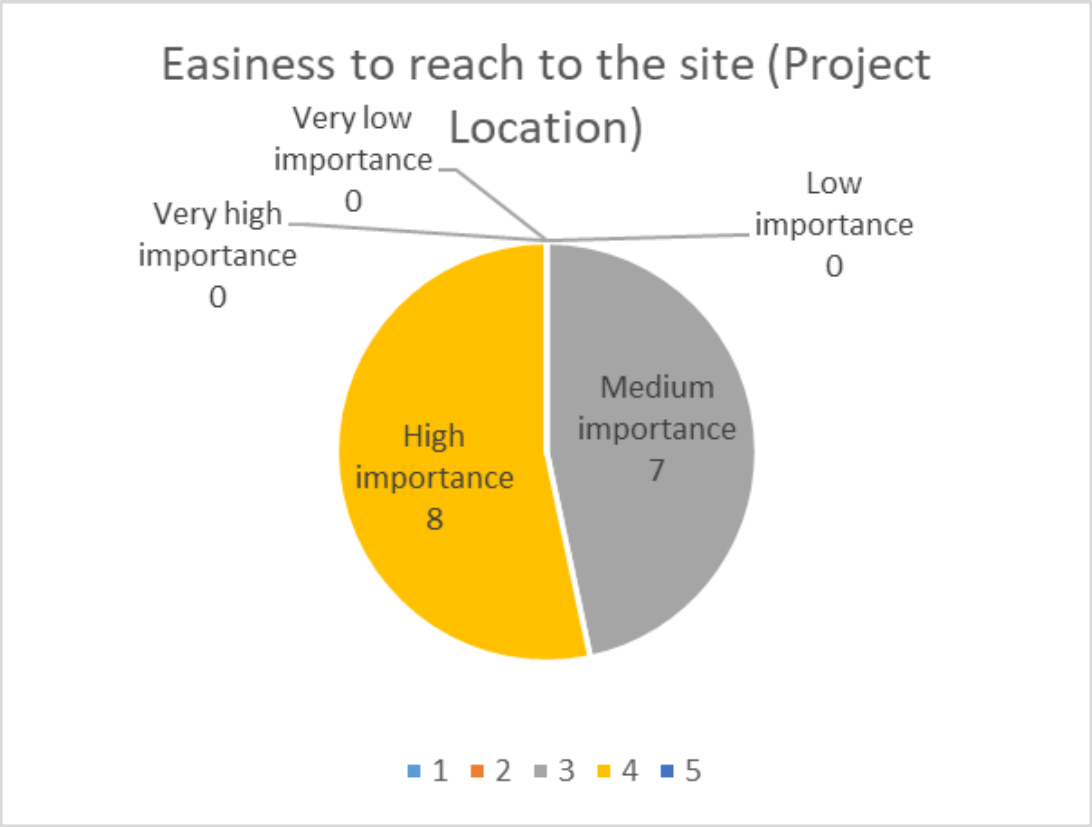

Figure 21: Easiness to reach to the site

Health and Safety category was also identified as highly important for Construction Industry. Experts have ranked easiness to reach to the site as an overall ranking position of 3 with an RII value of 0.883 which shows in Appendix I. This factor directly influences project success due to easy access to project location is supporting fast construction works for the project which project can be completed as scheduled. Easiness to reach to the site is mainly easy access to the project site and it is helping to prepare a robust logistic plan for the project. A logistic plan for any construction project is greatly important and easiness to reach the project site will provide better control of construction traffic. Easiness to reach to the site will benefit for easy material delivery, easy to transport labourers. When access to the project is easy, site establishment,

installation of temporary plant & equipment such as tower cranes, generators etc. will be an easy task and will not create any problematic issues for project completion. This will influence to have a successful project in the end.

4.4.6 Control of sub-contractor's works

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified that how experts gave an importance level for this factor. Six experts gave a very high importance level of 5 and nine experts gave a high importance level of 4.

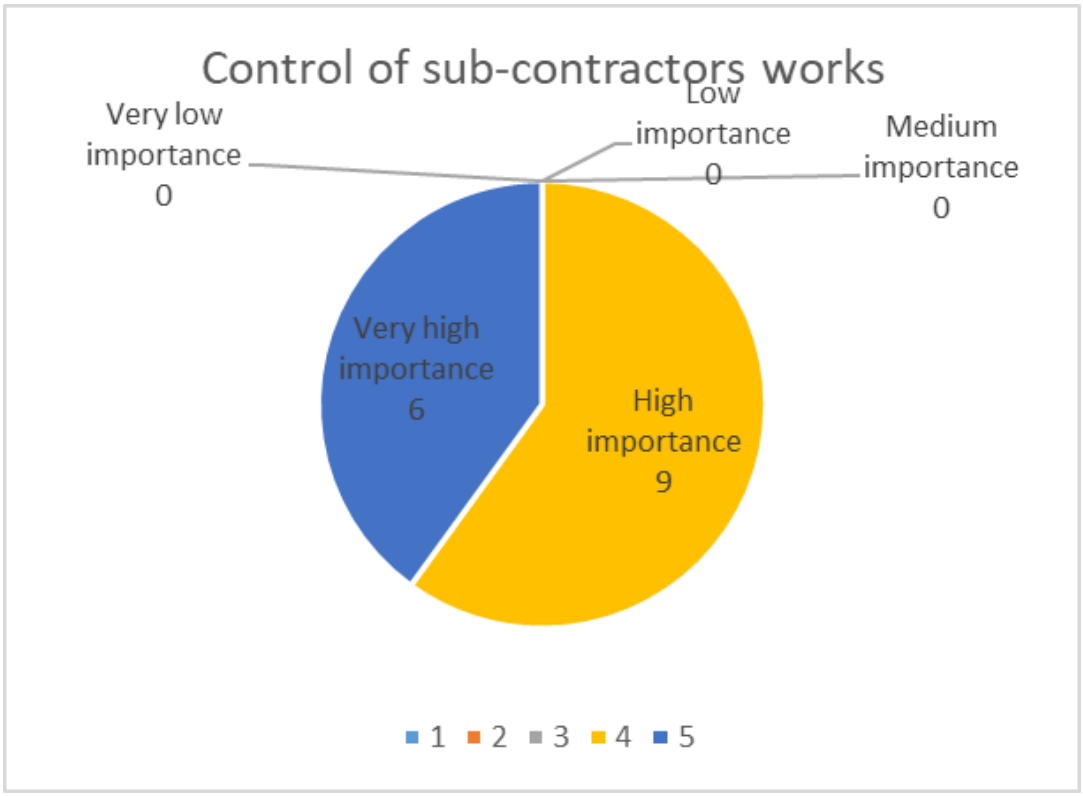

Figure 22: Control of Sub-contractors works

Control of sub-contractors' works factor which is overall ranking position as 4 with RII value 0.880 which shows in Appendix I. In a construction project, it is obvious that many works carried out by sub-contractors and therefore control of the subcontractor's works are directly influencing project success. Most of the time in building construction projects, there are many specialised works to be carried out by specialised subcontractors. Subcontractors are domestic subcontractors or nominated subcontractors, Control of the subcontractors work by General Contractor or Main Contractor based on the awarded contractual arrangement adopted to the project and

signed contract document. Under the traditional procurement path, it is the main contractor's responsibility to control the subcontractors to carry out the works in accordance with the execution program and therefore, control of subcontractor's works is a must requirement to achieve project success.

4.4.7 Contractor's project team leaders' commitment to meet cost, time and quality

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified that how experts gave an importance level for this factor. Nine experts gave a very high importance level of 5 and four experts gave a high importance level of 4 and only one expert gave a medium importance level of 2 and another expert gave a very low importance level of 1.

Figure 23: Contractor's project team leaders' commitment to meet cost, time and quality

Contractor's project team leaders' commitment to meet cost, time and quality factor which is overall ranking position as 5 with RII value 0.867 which shows in Appendix I. It is a basic principle to have any construction projects complete on time, within budget and expected quality and most of the construction project's objective include to

meet the time, cost and quality triangle. The contractor's project team leaders are committed to achieving this objective from the award of the contract to completion of the contract. To meet this requirement, the contractor's leader should establish a proper plan to monitor, and carrying out works in accordance with agree on construction program and plan, monitor and control cost against the budget or awarded contract price. From a Quality perspective Contractors' project team leader must achieve quality standard as per the established quality requirement for the project to achieve project success.

4.4.8 Financial stability and adequate funding

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified that how experts gave an importance level for this factor. Eight experts gave a very high importance level of 5 and six experts gave a high importance level of 4 and only one expert gave a very low importance level of 1.

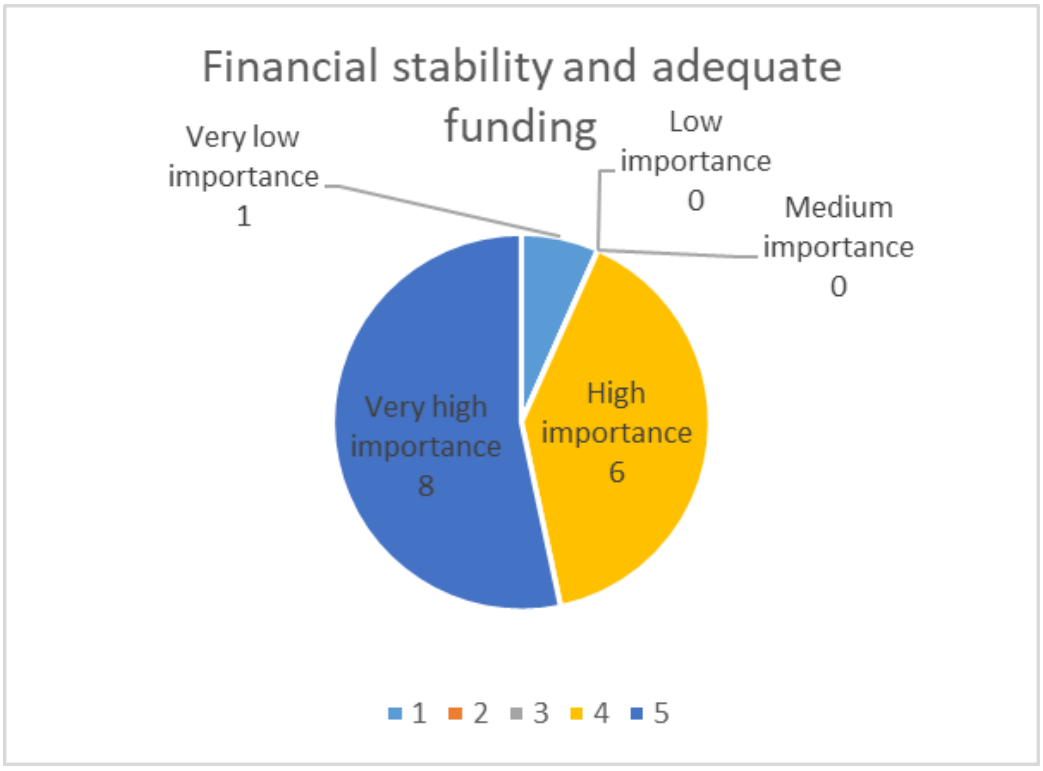

Figure 24: Financial stability and adequate funding

Financial stability and adequate funding factor which is overall ranking position as 5 with RII value 0.867 which shows in Appendix I. Client should have proper financial stability and adequate funding capabilities before the commencement of the project.

This should be identified during the project feasibility stage. According to Clause 2.4 of the FIDIC 1999 Red book, upon the Contractor's request, it is Employer's responsibility to make with reasonable evidence that Employer has arranged financial arrangement for the project. Without adequate funding for the project and financial stability of the Client, there is no way to complete a successful project and therefore, this factor is another very fundamental factor to achieve project success.

4.4.9 Client's cash flow

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified that how experts gave an importance level for this factor. Nine experts gave a very high importance level of 5 and four experts gave a high importance level of 4, one expert gave a medium importance level of 3 and another expert gave a very low importance level of 1.

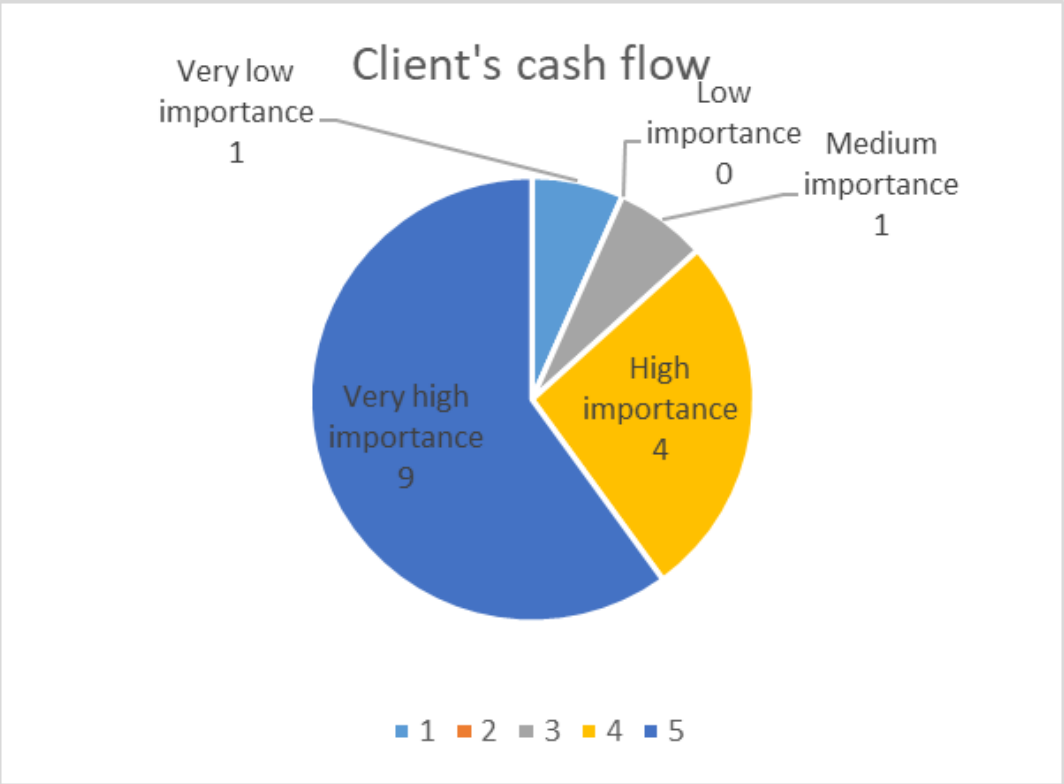

Figure 25 : Client's cash flow

The client's cash flow factor which is overall ranking position as 5 with an RII value of 0.867 which shows in the Appendix I. Client must maintain his cash flow to pay the contractors payment when it is due. Any delayed payment by the Client to Contractor will create a critical situation to the project progress and leads to project delays as well

as an effect on the supply chain for the project. In addition to the Contractor, the Client's cash flow is should properly be maintained to pay all other stakeholders such as Consultants, Sub consultants etc, Therefore, Client's cash flow factor is directly affecting to achieve project success.

4.4.10 Top management support

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified that how experts gave an importance level for this factor. Nine experts gave a very high importance level of 5 and three experts gave a high importance level of 4, two experts gave a medium importance level of 3 and an expert gave a very low importance level of 1.

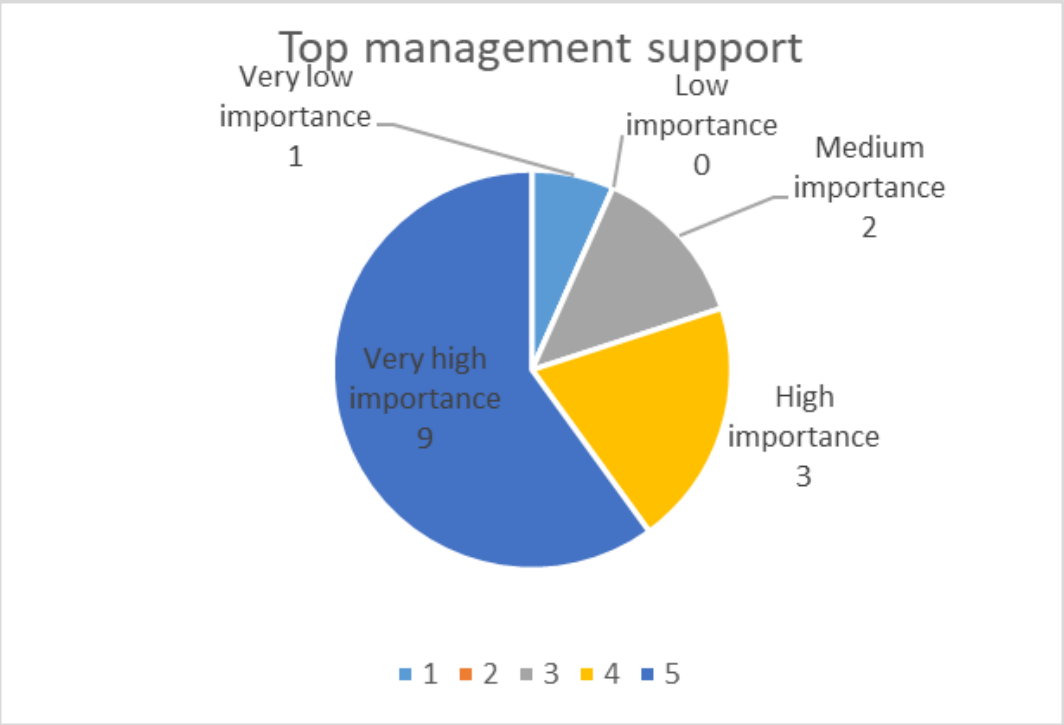

Figure 26: Top Management support

Top Management support factor which is overall ranking position as 6 with RII value 0.853 which shows in Appendix I. Top management is the steering force of any organisation. Therefore, the project team and project leader should have clear instruction and maximum support from the top management of their organisation. This will enhance the project team to make decisions regarding the project where necessary. Contractors' top management support is critical for any construction project and this

should be required from the award of the contract until successful completion of the project to achieve project success.

4.4.11 Allocation of sufficient resources

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified how experts gave an importance level for this factor. Seven experts gave a very high importance level of 5 and another seven experts gave a high importance level of 4 and only one expert gave a very low importance level of 1.

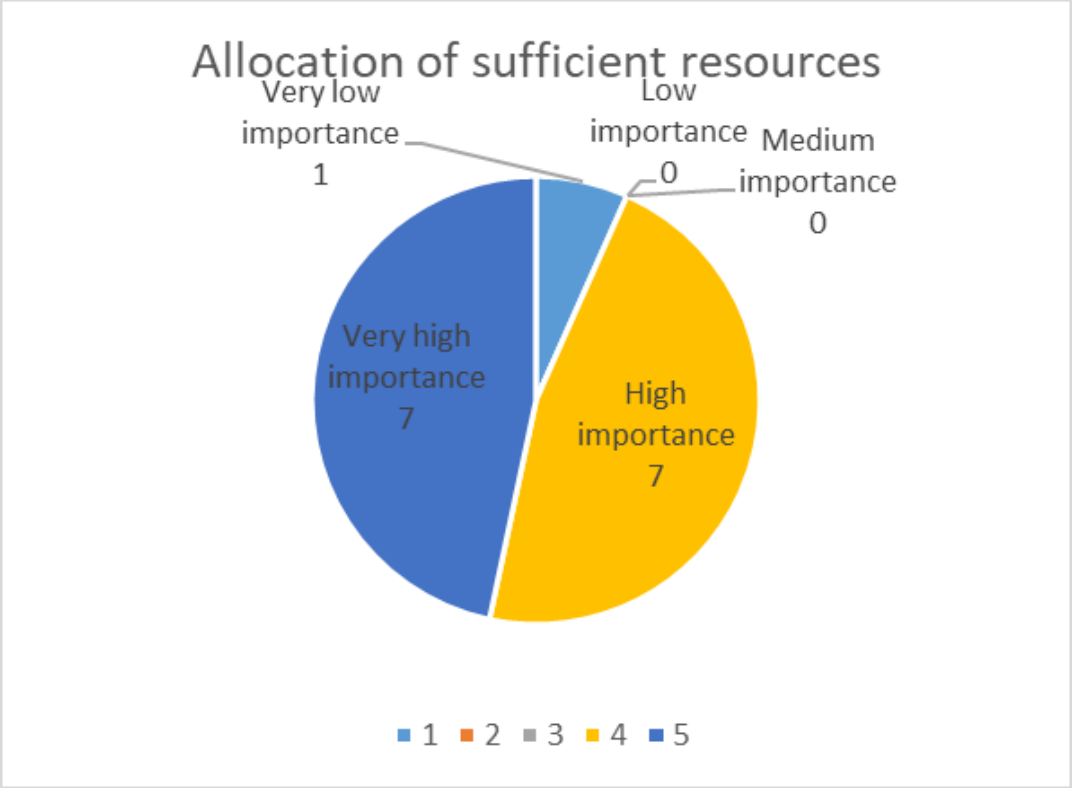

Figure 27: Allocation of sufficient resources

Allocation of sufficient resources factor is having an overall ranking position as 6 with RII value 0.853 which shows in Appendix I. It is a necessary requirement to do proper resources planning and allocating enough resources to the construction projects to carry out works and to achieve project objectives. Allocation of resources is another most significant factor for affecting project success and construction business mainly depends on the material, labour, plant, financial and management resources. Without the allocation of sufficient resources to the project, no project success will be achieved.

4.4.12 Contractor's project team leader's experience

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified that how experts gave an importance level for this factor. Six experts gave a very high importance level of 5 and eight experts gave a high importance level of 4 and only one expert gave a very low importance level of 1.

Figure 28: Contractor's project team leader's experience

Project team leaders of the Contractor must be a well-experienced professional who is able to achieve project goals and objectives. This factor is having an overall ranking position of 6 with an RII value of 0.853 which shows in Appendix I. Experience of the project team leader leads to a direct influence on the project success because during the construction any project related issues occurred that can be sorted out using his extensive experience. Therefore, appointing of experience leader for the project team will be a benefit to the project.

4.4.13 Organizing skills of Contractor's project team leaders

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified that how experts gave an importance level for this factor. Five

experts gave a very high importance level of 5 and nine experts gave a high importance level of 4 and only one expert gave a medium importance level of 1.

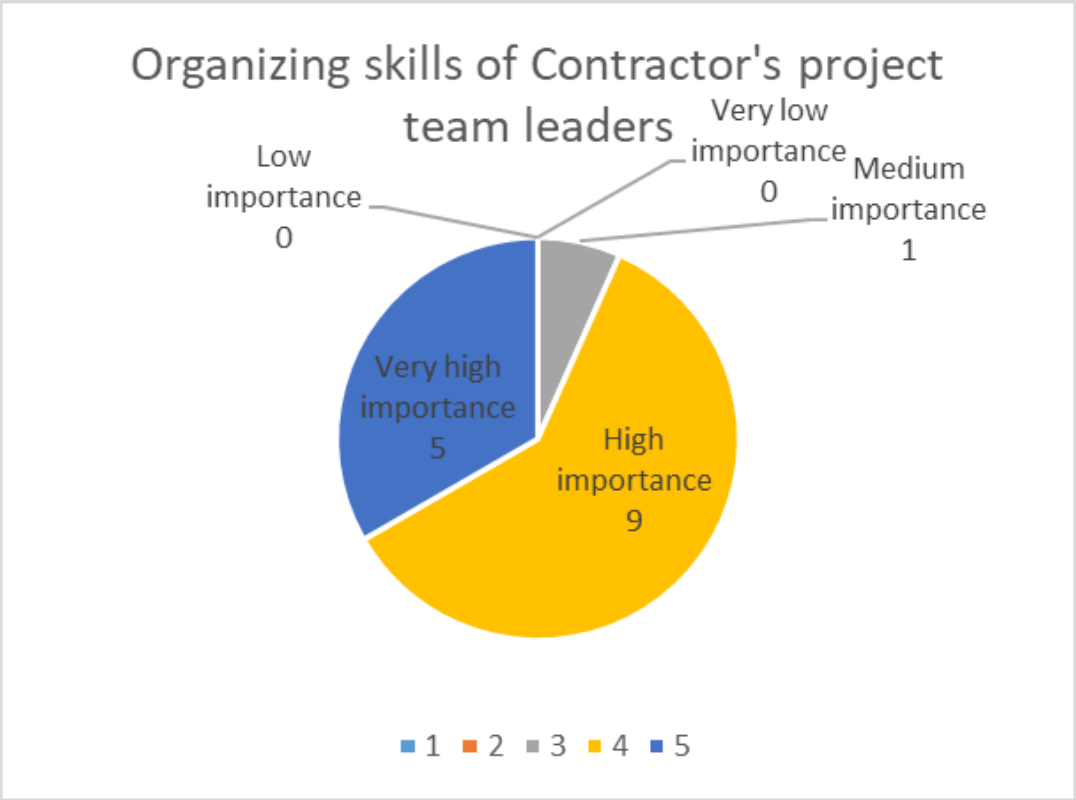

Figure 29 : Organizing skills of Contractor's project team leaders

Organising skill is required for leaders and otherwise, it is not possible to lead the project. To achieve the project objective of the construction project, it is a requirement to organise project matters from beginning to end. With good organising ability and skills by the project, leaders will provide smooth running of the project and to be able to achieve defined project objectives. According to data analysis, the overall ranking for this factor is 6 with an RII value of the same is 0.853 which shows in Appendix I.

4.4.14 Project monitoring

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified how experts gave an importance level for this factor. Seven experts gave a very high importance level of 5 and seven experts gave a high importance level of 4 and only one expert gave a very low importance level of 1.

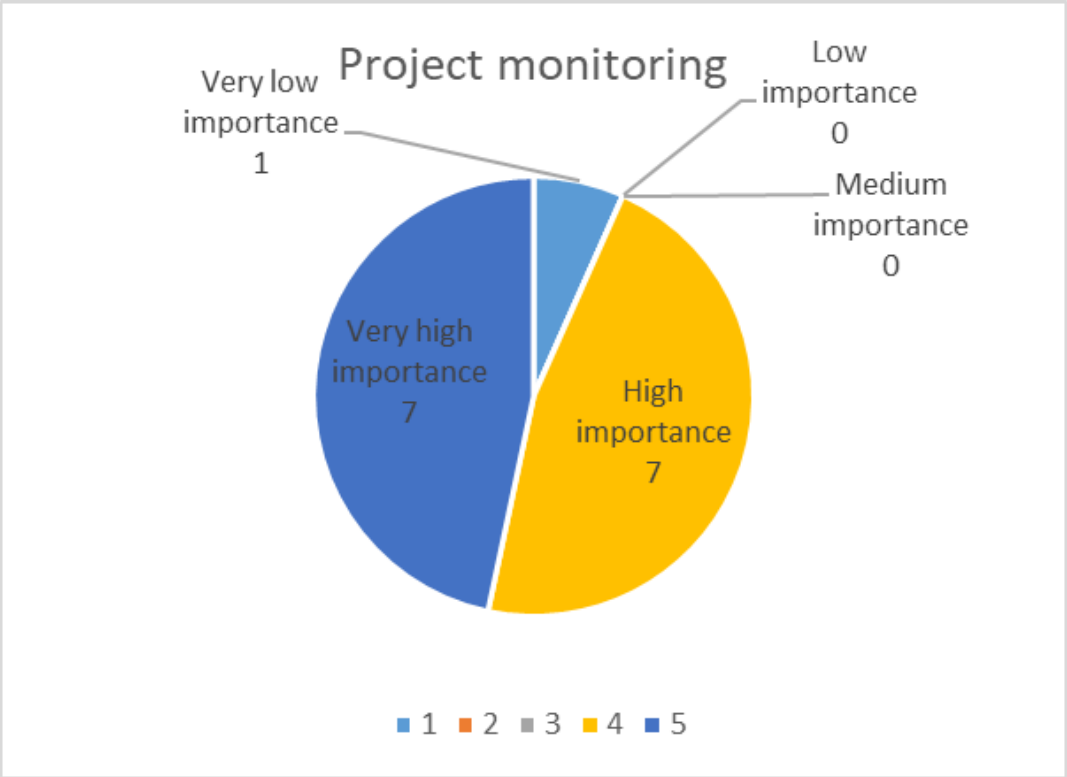

Figure 30: Project Monitoring

Project monitoring should be done against the project master schedule from inception to completion to achieve project success. Therefore, first of all, the project must have a project master schedule with plotting all necessary key dates or key milestone dates for each stage. a Building construction project comprises mainly the preparation stage, Design stage, pre-construction stage and Construction stage. Project monitoring should be carried all these stages to achieve project success. Pre-construction stage comprising Appraisal stage and Design brief stage once the appraisal is done and the project is going ahead the project monitoring is compulsory for the project. The design stage comprises several design stages from concept design to production of tender documents and tender action. The construction stage is carrying out all construction activities until their completion. The project should be monitored for all of the above-mentioned stages

against the established project master schedule. As per final data analysis, this factor is ranked to no. 6 with an RII value of 0.853 as shown in Appendix I.

4.4.15 Leadership skills for project manager

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified how experts gave an importance level for this factor. Six experts gave a very high importance level of 5 and Eight experts gave a high importance level of 4 and only one expert gave a very low importance level of 1.

Figure 31: Leadership skill for project manager

The project manager should be a good leader and must have leadership skills to manage the project. As this category falls under the client satisfaction category, the Project Manager is having the responsibility to manage the project activities to achieve project objectives. Therefore, having good leadership skills for the project manager will lead to achieving project success. As per analysis, this factor is having an overall ranking position of 7 with an RII value of 0.840 which shows in Appendix I.

4.4.16 Well defined technical specifications

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified how experts gave an importance level for this factor. Six experts gave a very high importance level of 5 and seven experts gave a high importance level

of 4, one expert gave a medium importance level of 3 and an expert gave a very low importance level of 1.

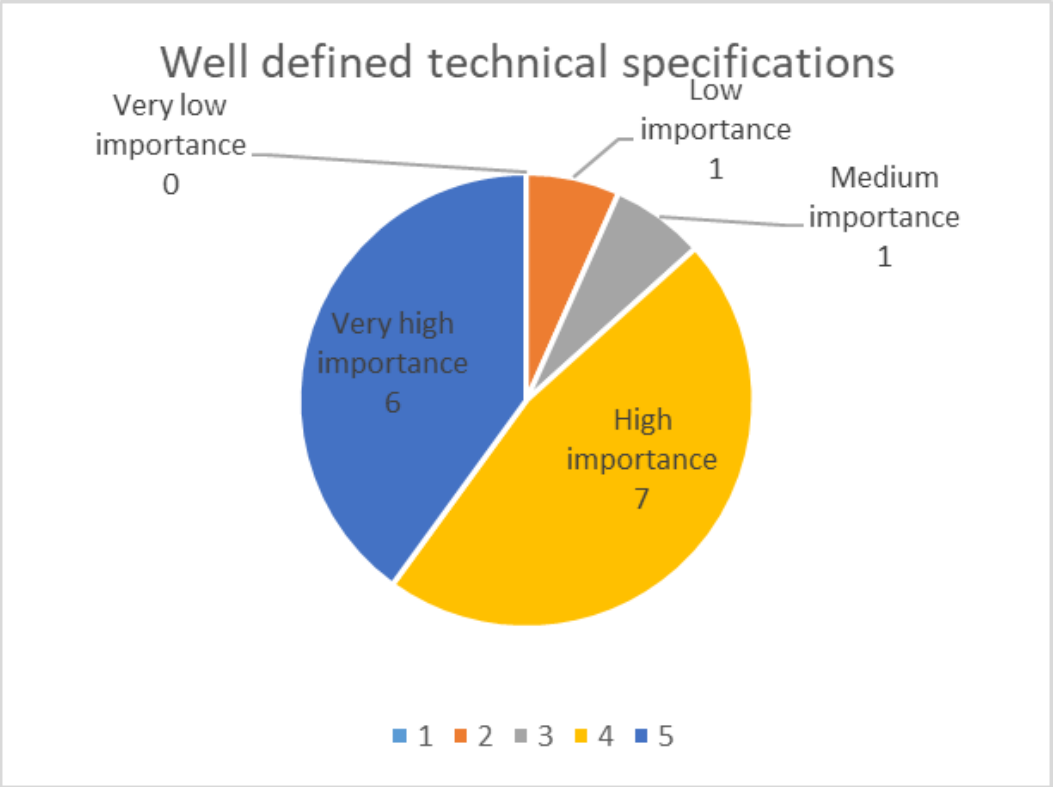

Figure 32: Well defined technical specifications

Well defined technical specification by the Design team directly influences to achieve the success of the project. It is the design team responsibility to provide well defined technical specification during the project design stages to include in the tender document. Ambiguities or any discrepancy between project document will always create a problematic issue and end up with cost and time variation to Project cost and agreed schedule. Therefore, the Design team should closely coordinate with other stakeholders of the project specifically during the design development from the concept design stage to the Tender document stage to have a sound tender document including well defined technical specification for the project. The overall ranking for this factor is 7 with an RII value of is 0.840. which shows in Appendix I. and therefore this factor is one of the most significant factors for project success even though it is in overall ranking position is 7.

4.4.17 Mistakes/ delays in producing design documents

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified how experts gave an importance level for this factor. Seven experts gave a very high importance level of 5 and six experts gave a high importance level of 4, one expert gave a medium importance level of 3 and an expert gave a very low importance level of 1.

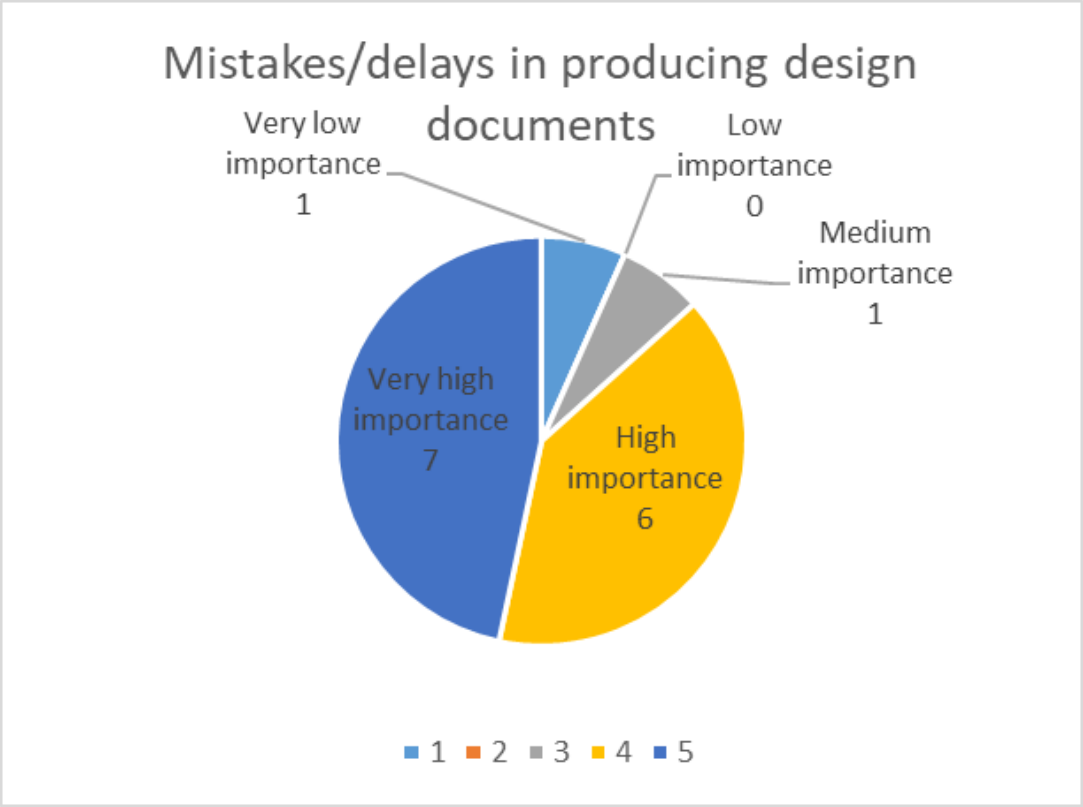

Figure 33: Mistakes/delays in producing design documents

It is the design team responsibility to produce accurate good quality design documents on time without any errors in the design document to the project team. Mistakes /delays in the design documents will lead to the delaying the project and additional cost incurred to the number of mistakes are accepted and delays should not happen when producing design documents to the project. This will have a significant impact on achieving project success. This factor is received an overall ranking of 7 and the RII value is 0.840which shows in Appendix I. Therefore, this factor is one of the most significant factors for project success even though it is in overall ranking position is 7.

4.4.18 Planning skills of Contractor's project team leaders

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified how experts gave an importance level for this factor. Five experts gave a very high importance level of 5 and nine experts gave a high importance level of 4, one expert gave a medium importance level of 3 and an expert gave a low importance level of 2.

Figure 34: Planning skills of Contractor's project team leaders

Planning is an important task for any construction project. Planning is required for everything in construction projects from the beginning. Planning skills of the contractor's project team leaders will be able to do project planning, resource planning, logistic planning, materials procurement planning to avoid any long lead items or equipment required for permanent works for the project. Therefore, having planning skills for the contractor's project team leaders will lead to achieving project success. This factor is received an overall ranking of 7 and RII value is 0.840 which shows in Appendix I. Consultant Project Manager's commitment to complete the project

4.4.19 Consultant's project manager's commitment to complete the project

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified how experts gave an importance level for this factor. Seven experts gave a very high importance level of 5 and six experts gave a high importance level of 4, one expert gave a medium importance level of 3 and an expert gave a very low importance level of 1.

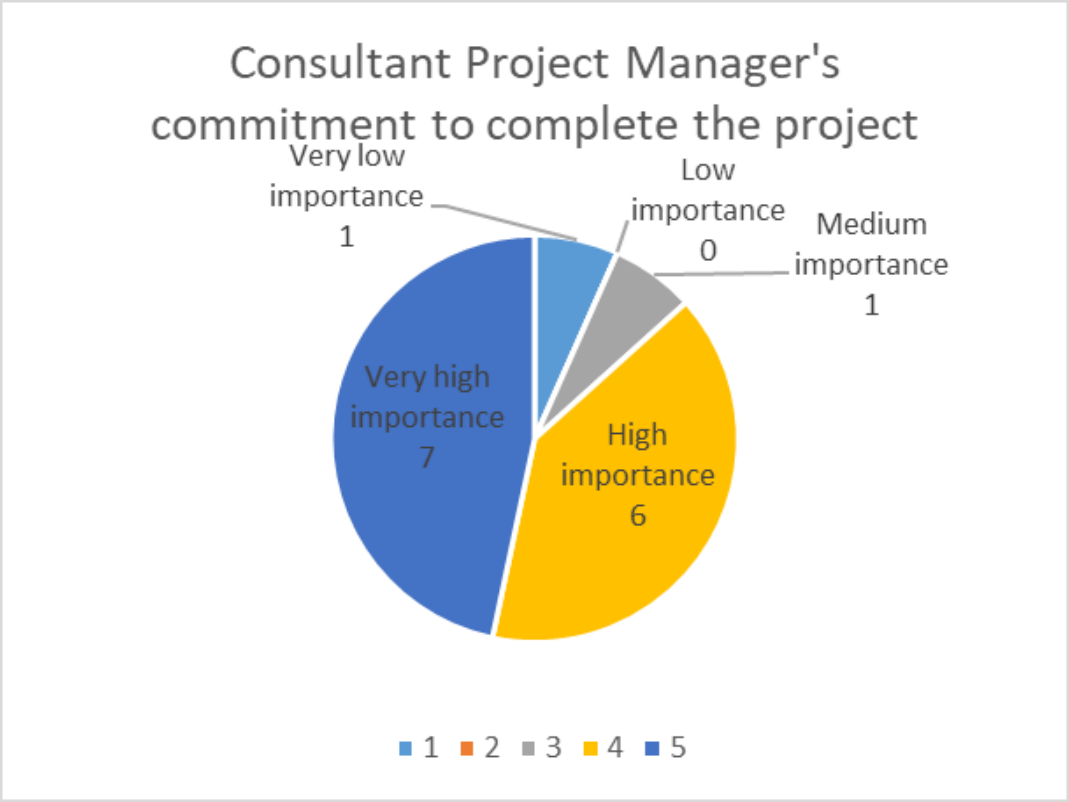

Figure 35 : Consultant Project Manager's commitment to complete the project

The consultant's project manager's commitment to complete the project is very important. Commitment is one of the major requirements to achieve project goals and objectives. This commitment is required not from only the consultant's Project Manager and it is required from all stakeholders participating project. This factor is received an overall ranking of 7 and the RII value is 0.840 which shows in Appendix I.

4.4.20 Contactor's control mechanism

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified how experts gave an importance level for this factor. Six experts gave a very high importance level of 5 and seven experts gave a high importance level

of 4, one expert gave a medium importance level of 3 and an expert gave a low importance level of 2.

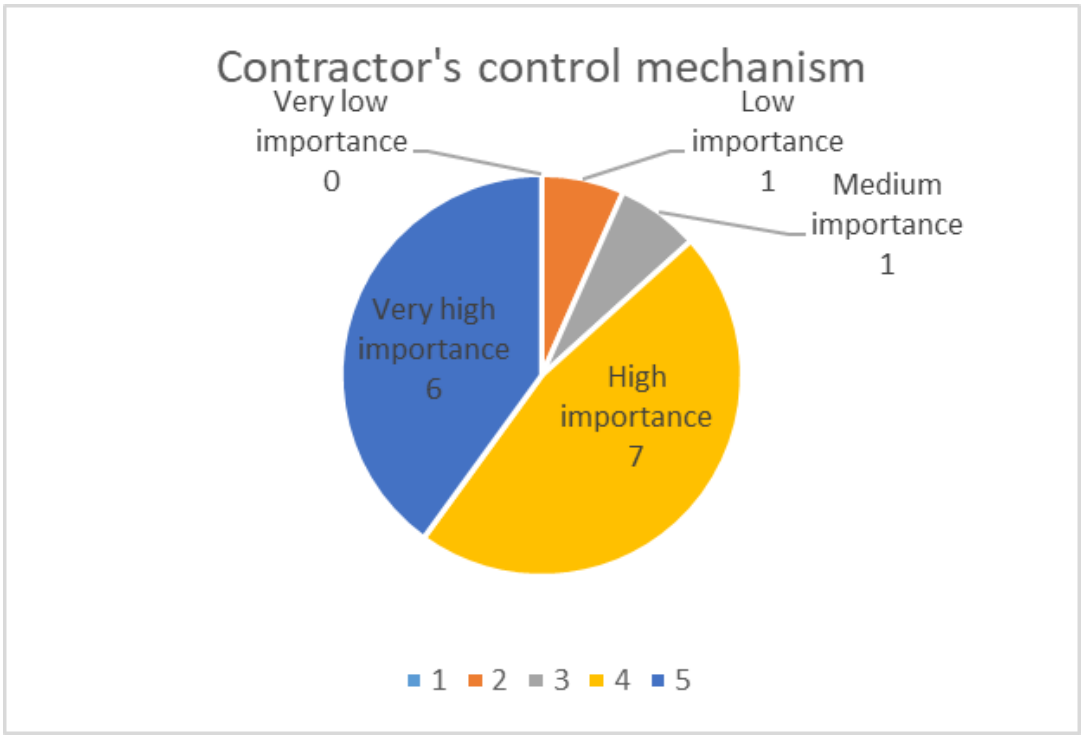

Figure 36: Contractor's control mechanism

The contractor's Control mechanism is anyway having the influence to project success. Contractors is one of the major stakeholders of the project and the construction of the project completely done by the contractor. Therefore, the contractor must establish a proper control mechanism for the project at the beginning to achieve the project objectives. Without proper control mechanism in terms of materials control without unnecessary wastage, labour resource control, quality control mechanism for construction works is more important to achieve project objectives as well as project success. This factor is received an overall ranking of 7 and the RII value is 0.840 which shows in Appendix I.

4.4.21 Developing an appropriate project structure

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified how experts gave an importance level for this factor. Six experts gave a very high importance level of 5 and six experts gave a high importance level of 4, three experts gave a medium importance level of 3.

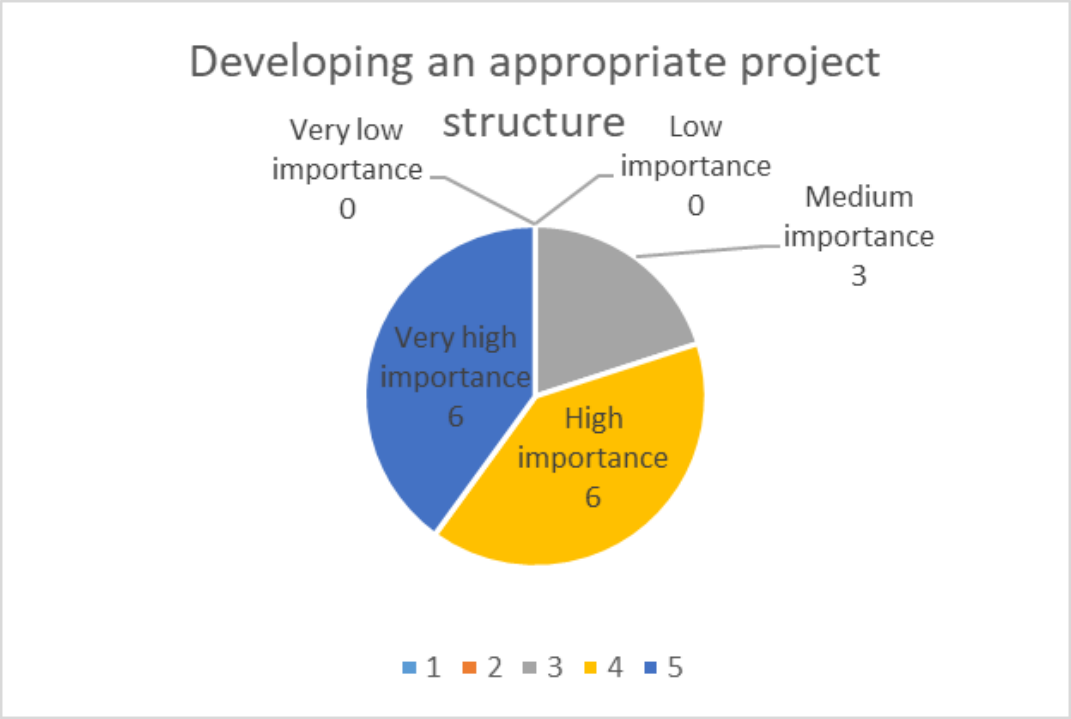

Figure 37: Developing an appropriate project structure

Developing project structure is a very important factor for project management point of view and correct and appropriate project structure always be important and leads to achieving project objectives. It is project management team to decide and identify which project structure is most suitable for the relevant project. Developing an appropriate project structure depends on the requirement of the project. This factor is received an overall ranking of 7 and the RII value is 0.840. which shows in Appendix I.

4.4.22 Planned time for construction

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified how experts gave an importance level for this factor. Six experts gave a very high importance level of 5 and six experts gave a high importance level of 4, two experts gave a medium importance level of 3, one expert gave an importance level of 2 and an expert gave a low importance level of 2

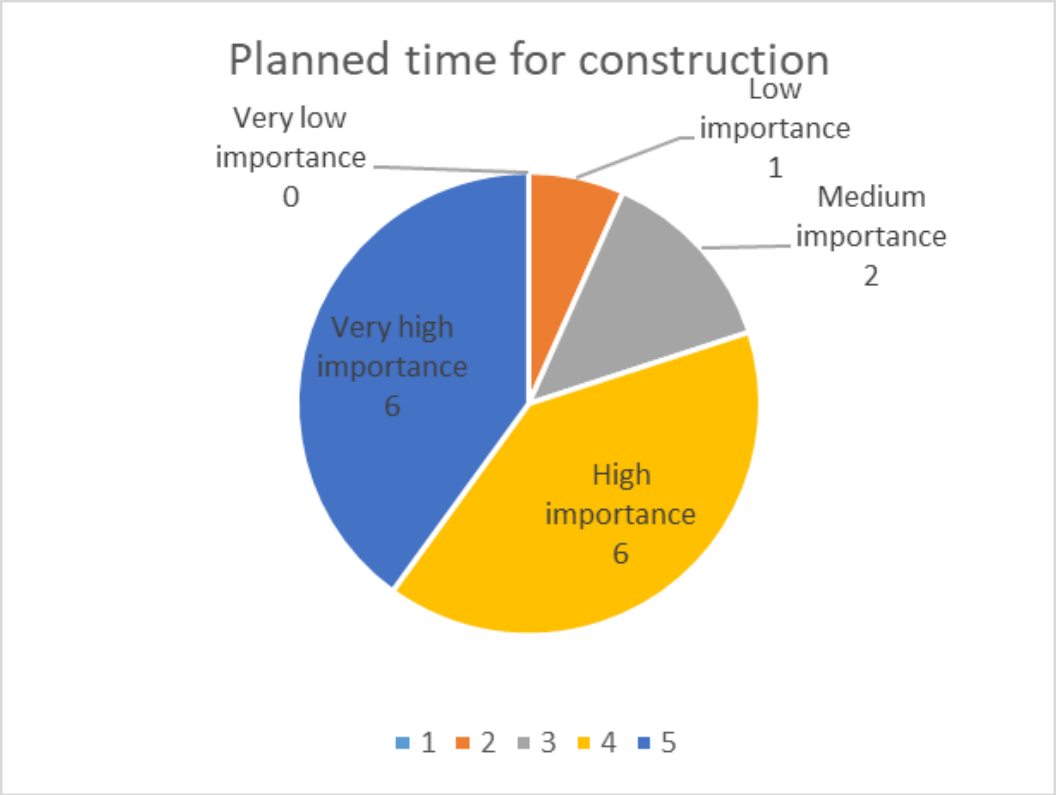

Figure 38: Planned time for construction

Planned time for construction should be realistic and carrying out according to the plan is a must requirement for the construction project and it leads to achieving project goals and project objectives. When planning for construction works, it is a requirement to carry out the construction execution programme correctly with the correct sequence of work activities. This should be done at the beginning and during the construction activities should be monitored according to the established execution programme. If any delays happened to the project programme by the contractor, then it leads to the overall completion of the project and has an impact on project success. Inception to completion or close-out of the projects are dealing with time and therefore this factor is mainly influencing project success. This factor is received an overall ranking of 8 and the RII value is 0.827 which shows in Appendix I. Therefore, this factor is one of the most significant factors for project success even though it is in an overall ranking position is 8.

4.4.23 Availability of resources as planned through project duration

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified how experts gave an importance level for this factor. Five

experts gave a very high importance level of 5 and eight experts gave a high importance level of 4, one expert gave a medium importance level of 3 and an expert gave a low importance level of 2.

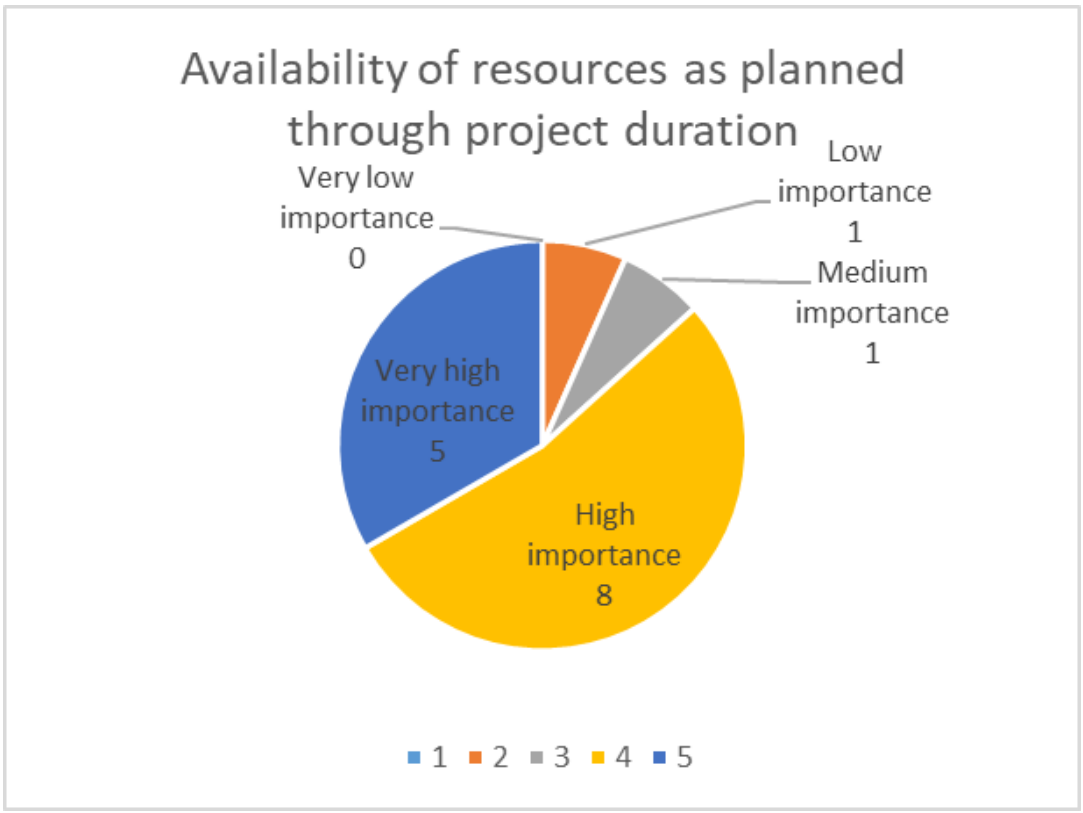

Figure 39: Availability of resources as planned through project duration

Resource availability during project duration as per the original plan directly impacts the achievement of project success. This is one of the factors to be taken care of within the Construction Industry as labour force strikes are normally bound to occur from time to time. This should be avoided. The Project Team must have plan B for resources at all the time even though it is not happening in the construction industry. This factor is received an overall ranking of 8 and the RII value is 0.827 which shows in Appendix I. Therefore, this factor is one of the most significant factors for project success even though it is in an overall ranking position is 8.

4.4.24 Supervision

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified that how experts gave an importance level for this factor. Five

experts gave a very high importance level of 5 and nine experts gave high importance level of 4, only one expert gave a very low importance level of 1.

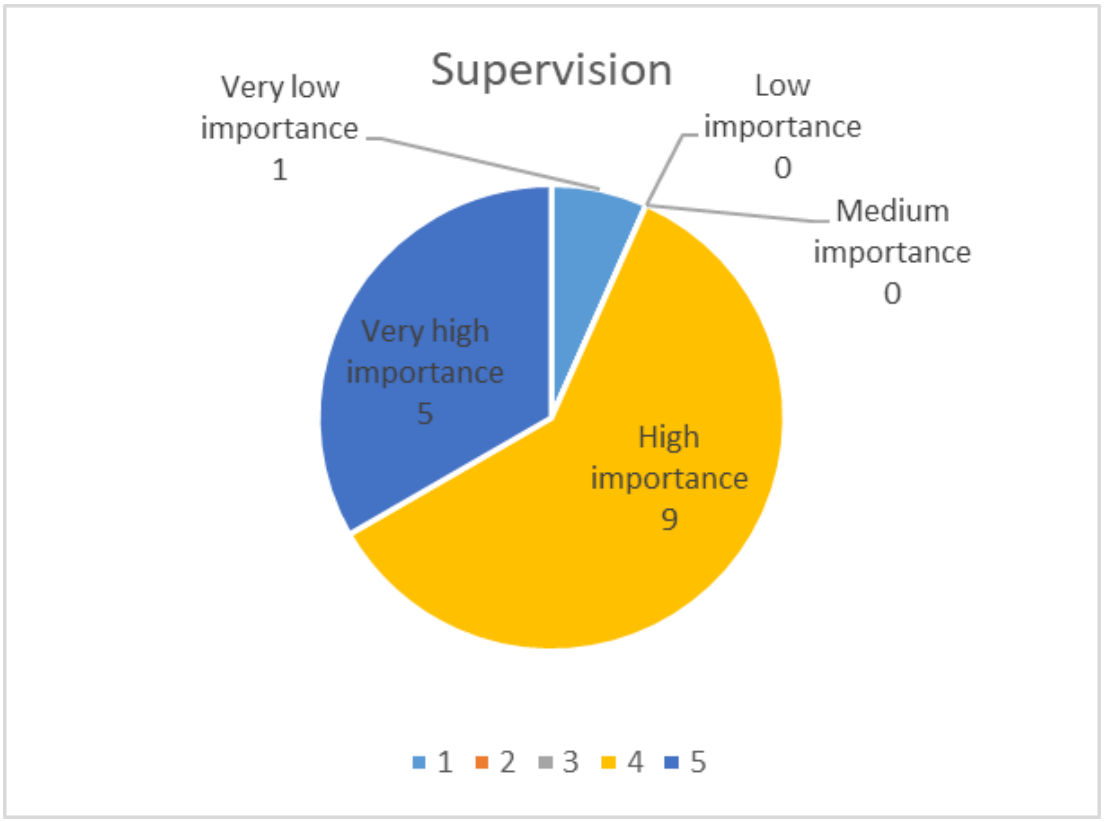

Figure 40: Supervision

Supervision is a compulsory requirement for the construction project. Construction supervision should be carried out during the course construction for labour forces to carry out works in accordance with drawings and specification. Without correct supervision for the workforce, it may lead to some abortive works from the end product if the workforce is misunderstanding the construction requirement as per drawings and technical specifications. Therefore, this factor has a considerable influence on project success. This factor is received an overall ranking of 8 and the RII value is 0.827 which shows in Appendix I.

4.4.25 Liquidity of Contractor's organisation

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified that how experts gave an importance level for this factor. Seven experts gave a very high importance level of 5 and five experts gave a high importance

level of 4, one expert gave a medium importance level of 3 and an expert gave an importance level of 2.

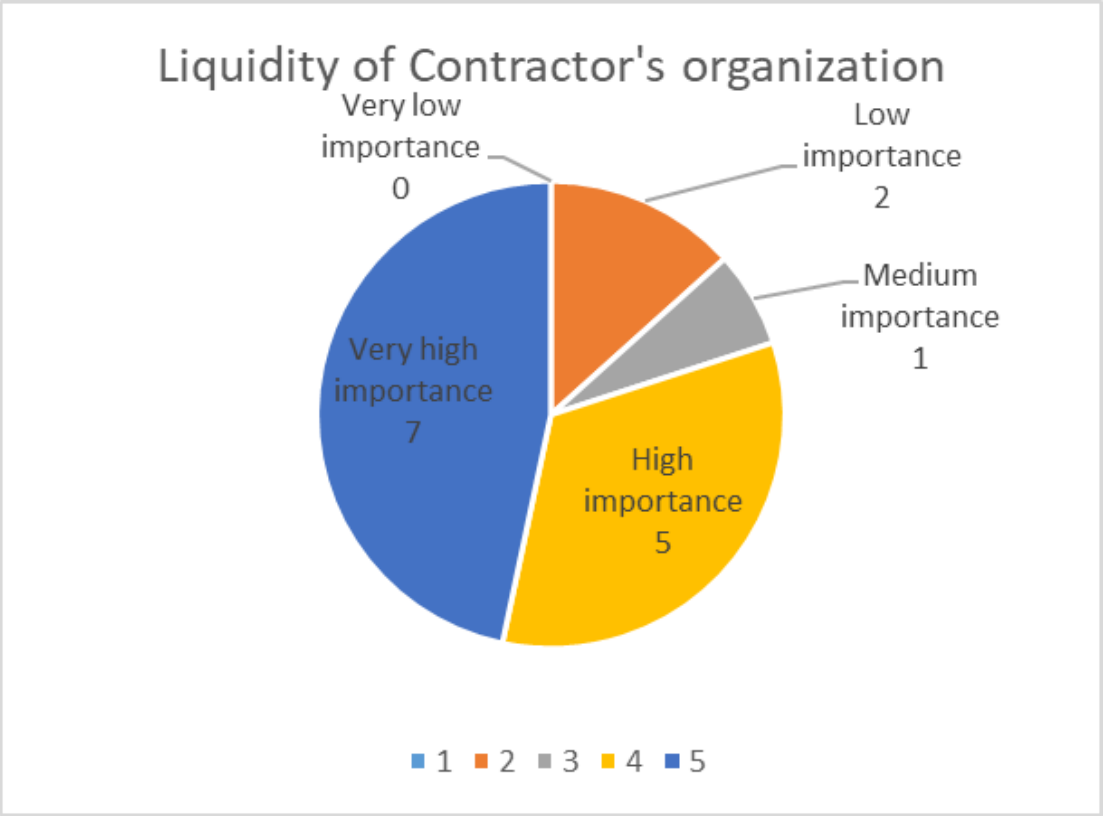

Figure 41 : Liquidity of Contractor's organisation

This factor is for the contracting organisation's ability to convert assets into cash which is required to finance the project and maintain a sound cash flow for the project. This factor is very critical for the project success of any organisation as the organisation should have sufficient funds to finance all ongoing projects in parallel. Therefore, the construction organisation should set out the origination's corporate budget forecast and financial management plan to run all the projects without any interruptions to the project in terms of finance. Henceforth, this factor directly impacts the project performance and the achievement of project success at the completion stage. This factor received an overall ranking of 8 and the RII value is 0.827 which is shown in Appendix I.

4.4.26 Contactor's decision-making effectiveness

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified that how experts gave an importance level for this factor. Four

experts gave a very high importance level of 5 and ten experts gave a high importance level of 4 and an expert gave an importance level of 2.

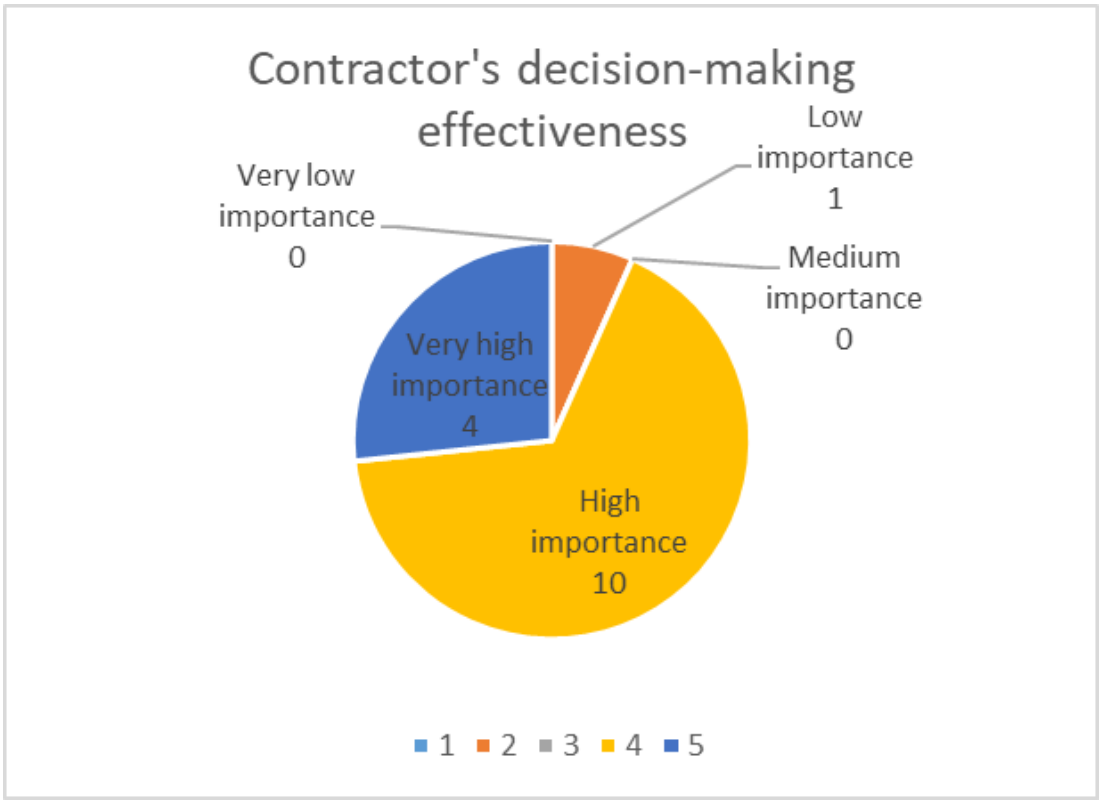

Figure 42: Contractor's decision-making effectiveness

It is a requirement to make decisions by the contractor at the earliest to achieve success in the construction projects. In general, in the construction industry, most of the construction projects suffer from delayed completion and if the contractors do not make effective decision making at the required time, those projects will further be delayed and this will adversely impact the overall project success. Contractors' decision-making effectiveness will have an impact on project cost. In terms of Health & Safety concern for the construction project, the contractor must have a quick decision-making ability to avoid any unpleasant situation in the construction project sites. Considering all construction activities, Decision-making effectiveness by the Contractor is very important and directly influence have a successful construction project. This factor received an overall ranking of 8 and the RII value is 0.827 which is shown in Appendix I.

4.4.27 Sequencing of work according to schedule

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified that how experts gave an importance level for this factor. Five experts gave a very high importance level of 5 and eight experts gave a high importance level of 4 and two experts gave an importance level of 2.

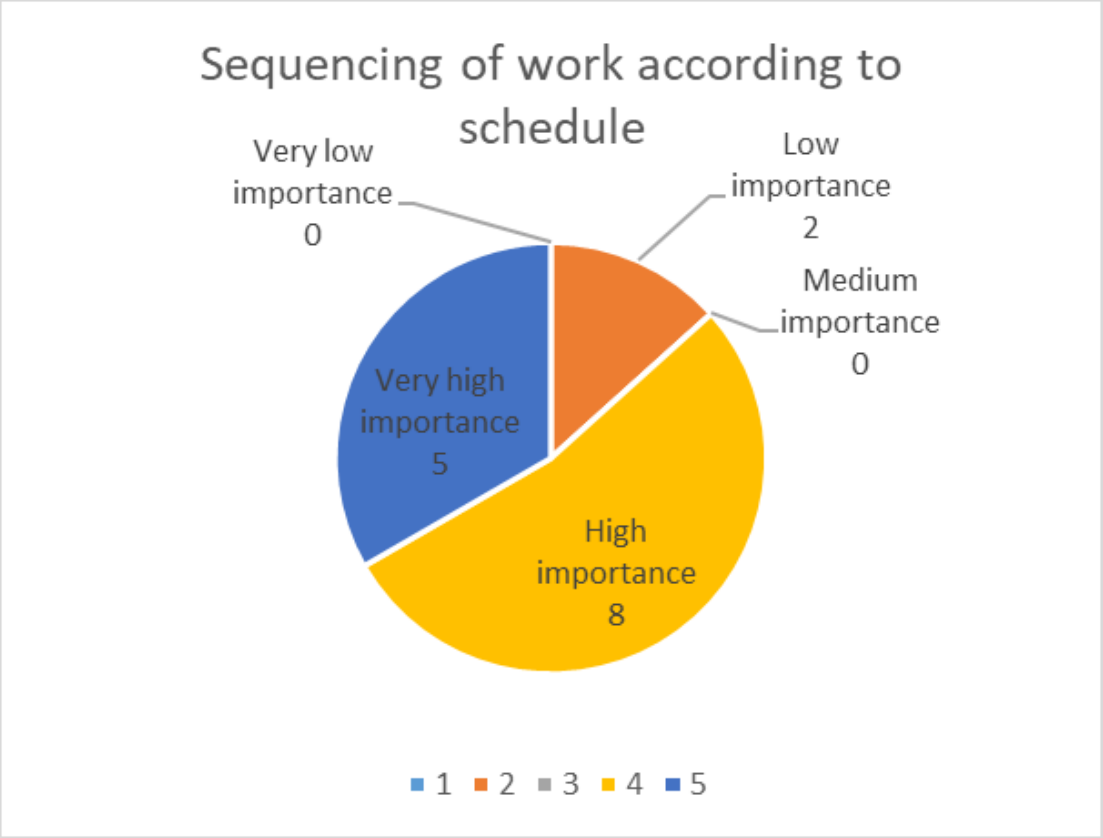

Figure 43 : Sequencing of work according to schedule

Sequencing of work according to schedule to be done from inception to completion to achieve project success. It is a requirement to prepare a project master schedule at the beginning of the project with a sequencing of work activities including design and construction. Once the master schedule is finalised for the project, Design should be carried out as agreed in accordance with the master schedule and production of each design deliverables should be done as per the agreed sequence indicated in the master schedule. Any delays to planned activities in schedule and sequencing of work in terms of design, the overall project master schedule will have an impact. Similarly, in the construction, continuation should be done in accordance with the established and agreed master schedule for the project to avoid any interruption to work activities during the construction. Therefore, the Sequencing of work according to schedule is

one of the most significant factors to achieve project success in building construction projects. This factor received an overall ranking of 9 and the RII value is 0.813 which is shown in Appendix I.

4.4.28 Functional manager's support

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified how experts gave an importance level for this factor. Six experts gave a very high importance level of 5 and six experts gave a high importance level of 4, One expert gave a medium importance level of 3 and two experts gave a low importance level of 2.

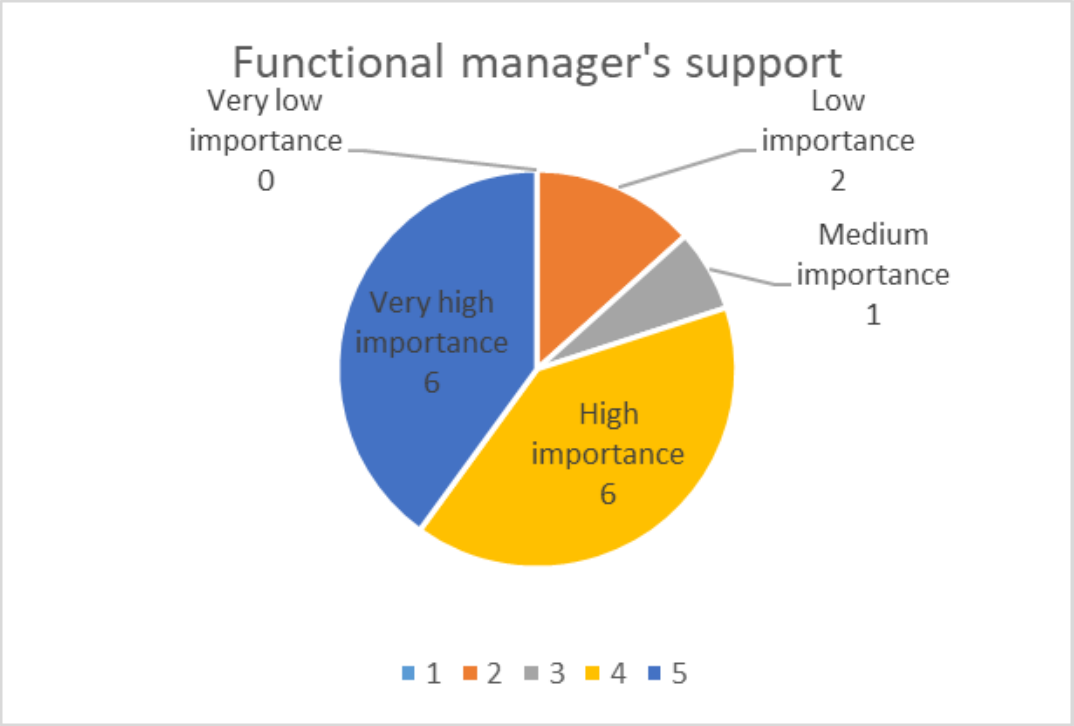

Figure 44 : Functional manager's support

When the organisation structure encompasses a matrix organisation or composite organisation, the Project manager gets the support of the functional managers and staff members under functional managers in different function will provide the required support service to the project. Functional managers are required to provide their services and support to the project manager to achieve his project goals and project objectives. Functional Manager in Structural Engineering discipline, Functional manager in MEP services discipline, Functional Manager in Contract & Commercial etc, must provide maximum support to the Project Manager to achieve and complete

the successful project. Without each functional manager support to the Project Manager, there will not be the completion of the successful project. Therefore, functional, manager's support is one of the most significant factors to have successful completion of the project and to achieve project success. This factor received an overall ranking of 9 and the RII value is 0.813 which is shown in Appendix I.

4.4.29 Project design complexity

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified that how the experts gave an importance level for this factor. Five experts gave a very high importance level of 5 and six experts gave a high importance level of 4 and three experts gave a medium importance level of 3.

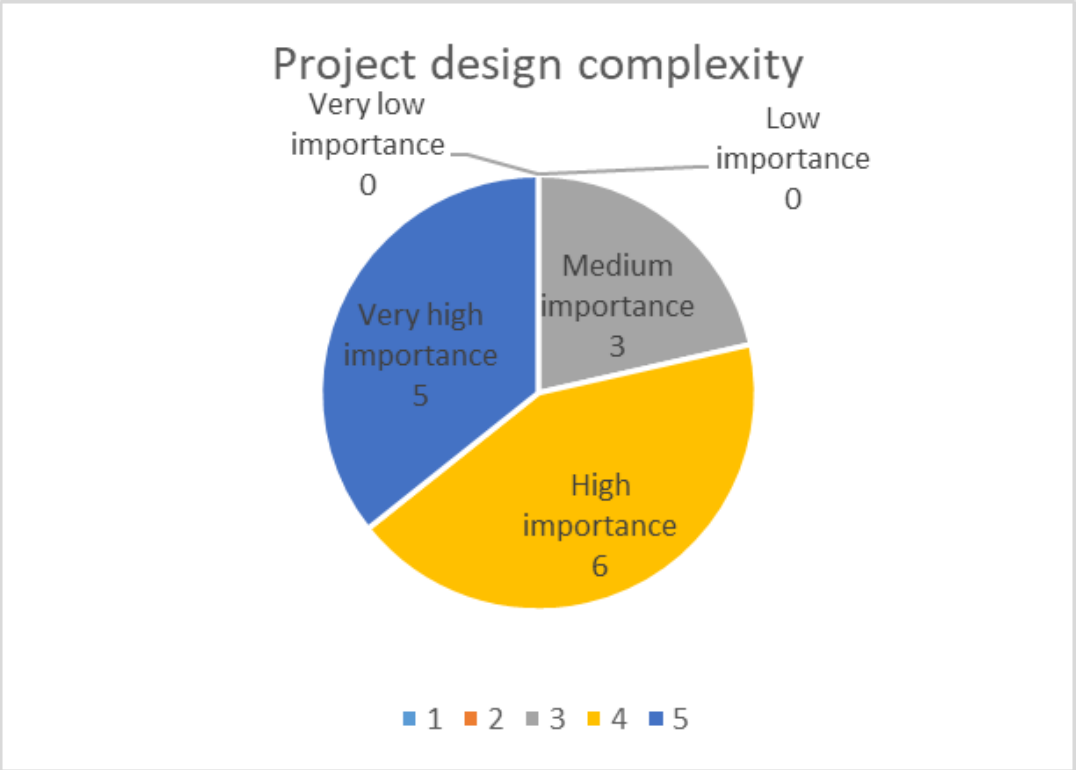

Figure 45 : Project design complexity

Design complexity is always having a critical influence on project success. When project design is complex in terms of size and type of the project, height, design criteria, it is a challenging task to achieve project success but it is all project stakeholders' responsibilities to achieve project success. When project design is complex, all project-related activities should be planned at the early stage of the project to have a successful completion. These should include a logistic plan for the project, procurement strategy,

project execution programme, risk management plan, project cost management procedures, etc., for the projects. Therefore, all project activities to be carried out according to the established strategy, programmes and procedures. This factor received an overall ranking of 9 and the RII value is 0.813 which is shown in Appendix I.

4.4.30 Contactor's communication system

The pie chart below indicates how experts responded to the second-round questionnaire and analysis identified that experts gave an importance level for this factor. Five experts gave a very high importance level of 5 and seven experts gave a high importance level of 4, two experts gave a medium importance level of 3 and an expert gave a low importance level of 1.

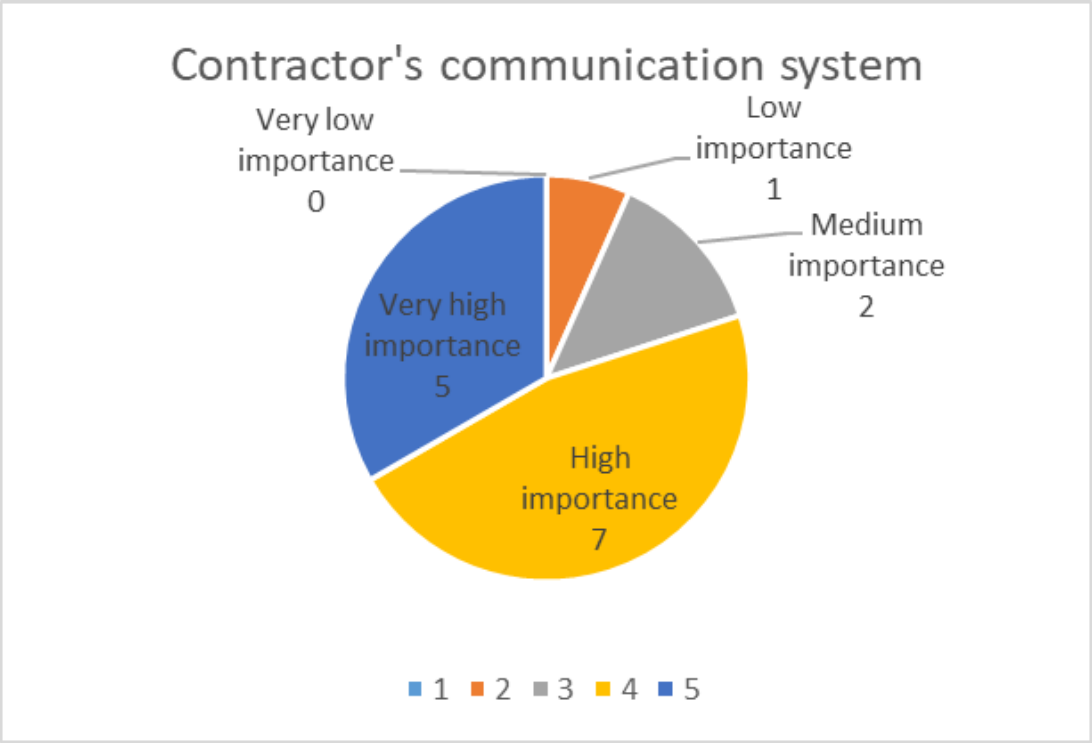

Figure 46: Contractor's communication system

The communication system established for the project by the contractor is one of the most significant factors for the achievement of project success. An effective communication system should be established at the beginning for the project to communicate with all stakeholders and project team members. These communication systems may include electronic communication such as video conferencing, conference telephone calls, emails, text messages, social media etc' to communicate with the

project team and project leaders or project manager. However, for the smooth running of project activities, a communication protocol should be established and implemented to the project from the beginning between all others stakeholders and the Contractor. This will lead to achieving project success as a result. This factor received an overall ranking of 9 and the RII value is 0.813 which is shown in Appendix I.

Chapter 5: Conclusion and Recommendation

5 Conclusion and Recommendation

5.1 Conclusion

Project success is becoming challenging and proved difficult to be achieved due to a large number of factors repeatedly impacting the Construction Industry. Thus, this research aimed to identify the most significant factors affecting private sector building projects in Western Province, Sri Lanka. Based on the analysis conveyed, it can be concluded that there are twenty-eight significant factors which commonly affect project success in Western Province, Sri Lanka. Among those twenty-eight significant factors, the most significant factors are Contractor' cash flow, Contractors planning effort, Easiness to reach to site (Project Location) and Control of sub-contractors works which is shown in the Table 17 below with Relative Important Index (RII) values and overall ranking of the factors.

Table 17: The Most significant four factors affecting project success in Western Province, Sri Lanka – RII Values, Overall Ranking Position

The Most Significant Project Success Factors	RII (Relative Important Index)	Overall Rank
Contractor's cash flow	0.907	1
Contactor's planning effort	0.893	2
Easiness to reach to the site (Project Location)	0.883	3
Control of sub-contractors' works	0.880	4

According to this research study, its' analysis and according to the data depicted in the Table 17 above, the utmost significant projects success factor is Contractor's cash flow. It is mainly Contractor's responsibility to maintain a positive cash flow throughout the project. Contractor can adopt proper strategies to maintain positive cashflows until completion of the projects. Some of those strategies are special advance payments, credit facilities early claims on preliminaries, requesting Contract amendments for claiming material off sites, early retention release and reduced retention percentages etc.

As per study, analysis and its findings, another most significant factor is the Contractor's planning effort. In order to achieve a successful completion of the Project, Contractor must carry out proper planning from the beginning of the project to the completion of the Project. Contractor should concentrate more on important planning factors as labour resources, material procurement schedule, long lead items plant and machinery mobilisation, material delivery schedule and sub-contractors works.

Research study findings identified that Easiness to reach to the site (Project Location) is another most significant factor that is affecting project success for private sector building projects in Sri Lanka. As the Western Province is a congested urban area in Sri Lanka, easy access is provided to the site, there should be a robust logistic plan which will provide better control of the construction traffic. Hence, site works can be more efficient due to easy material delivery to the site, labour transportation, easy mobilisation of machineries, temporary plan and structure etc. It is common in the construction industry that Sub-contractors are carry out specialised works in the complex building. As per Table 17 above and the research findings show that another most significant factor is control of sub-contractors works which affects project success. Therefore, control of the sub-contractors' works by the main contractor is very important to achieve project success. It is main contractor's responsibility to plan, monitor and control sub-contractors' works whether sub-contractors are domestic or nominated sub-contractors and effective management for payments to sub-contractors are important to achieve projects success.

These most significant factors commonly affecting to the project success of private sector building projects in Western Province, Sri Lanka. Hence there should be proper procedures in the project management framework to address these factors in planning and control the effects of these most significant factors in order to achieve project success. The outcome of the research can be used as a guideline to all project stakeholders attached to private sector building projects in Western Province, Sri Lanka. Therefore, it is recommended that concentrating on these factors through implementation of the project from inception can help achieve project success.

5.2 Recommendations for Future Research

The primary aim of this research study was to identify the most significant factors that were affecting project success in private sector building projects in Western Province, Sri Lanka. Based on the findings of this study, the research methodology and analysis can be utilized and applied to expand the research to private sector building projects in the rest of the country. As there will be abundant data, the conceptual framework created through the aforementioned research will then serve as an accurate benchmark to monitor project success in the construction industry in Sri Lanka. It is recommended that further research is conducted where the study can be expanded to include public sectors building projects in Sri Lanka.

5.3 Limitations

The focus of this study is specifically for the Private Sector Building Construction Projects within Western Province, Sri Lanka as public sector building projects must follow a large number of guidelines and procedures established by the Government of Sri Lanka which will require a long period to the procurement of public sector projects. This study mainly focused on identifying the most significant factors that are impact Project Success. During the process of this research, as part of the data collection sample size was limited to 15 experts to represent an entire population and those experts are well qualified and experienced practitioners who are practising in Western Province, Sri Lanka and are involved in Private Sector Building Projects.

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List Appendixes

Appendix A: Identified 115 factors from global Construction Industry

Appendix A: Identified 115 factors from global Construction Industry

Ref	Identified Factors	RII (Relative Important Index)	Overall Rank	Category-wise Rank
1.0	**Project Category**			
1.1	Type of project			
1.2	Nature of project			
1.3	Number of floors of the project			
1.4	Complexity of project			
1.5	Size and value of project			
1.6	Uniqueness of project activities			
1.7	Urgency of project outcome			
1.8	Clearly defined project goals / objectives			
2.0	**Organization Structure Category**			
2.1	Project organization structure			
2.2	Effective project team formation			
2.3	Top management support			
2.4	Functional manager's support			
3.0	**Project Management Category**			
3.1	Contactor's communication system			
3.2	Contactor's control mechanism			
3.3	Contactor's feedback capabilities			
3.4	Contactor's planning effort			
3.5	Developing an appropriate project structure			
3.6	Implementing an effective safety program			
3.7	Implementing an effective quality assurance program			
3.8	Coordination effectiveness			
3.9	Contactor's decision-making effectiveness			
3.10	Project monitoring			
3.11	Control of sub-contractors' works			
3.12	Contactor's prior project management experience			
3.13	Constructability program			
3.14	Project risk management			

Ref	Identified Factors	RII (Relative Important Index)	Overall Rank	Category-wise Rank
4.0	**Contractor Category**			
4.1	Contractor experience			
4.2	Site management			
4.3	Supervision			
4.4	Extent of Subcontracting			
4.5	Allocation of sufficient resources			
4.6	Frequent progress meetings			
5.0	**Stakeholders Category**			
5.1	Client's experience means whether he is a sophisticated or specialized client			
5.2	Size of client's organization			
5.3	Client's emphasis on low construction cost			
5.4	Client's emphasis on high quality of construction			
5.5	Client's emphasis on quick construction			
5.6	Client's ability to brief			
5.7	Client's ability to make decisions			
5.8	Client's ability to define roles			
5.9	Client's contribution to design			
5.10	Client's contribution to construction			
5.11	Contractor's project team leader's experience			
5.12	Technical skills of Contractor's project team leaders			
5.13	Planning skills of Contractor's project team leaders			
5.14	Organizing skills of Contractor's project team leaders			
5.15	Coordinating skills of Contractor's project team leaders			
5.16	Motivating skills of Contractor's project team leaders			
5.17	Contractor's project team leaders' commitment to meet cost, time and quality			
5.18	Contractor's project team leaders' early and continued involvement in the project			
5.19	Contractor's project team leaders' adaptability to changes in the project plan			

Ref	Identified Factors	RII (Relative Important Index)	Overall Rank	Category-wise Rank
5.20	Contractor's project team leaders' working relationship with others.			
5.21	Support and provision of resources from Contractor's project team leaders' parent company			
5.22	Consultant Project Manager's ability to delegate the authorities			
5.23	Consultant Project Manager's ability to coordinate			
5.24	Consultant Project Manager's perception of role and responsibilities			
5.25	Consultant Project Manager's commitment to complete the project			
6.0	**Procurement Category**			
6.1	Project procurement method			
6.2	Project bidding method			
6.3	Project contract mechanism			
7.0	**Design Team Category**			
7.1	Design team experience			
7.2	Project design complexity			
7.3	Well defined technical specifications			
7.4	Mistakes/ delays in producing design documents			
7.5	Design team’s contribution to construction			
8.0	**External Environment Category**			
8.1	Economic environment			
8.2	Social environment			
8.3	Political environment			
8.4	Physical environment			
8.5	Industrial relations environment			
8.6	Technological environment			
9.0	**Cost Category**			
9.1	Market share of Contractor's organization			
9.2	Liquidity of Contractor's organization			
9.3	Financial stability and adequate funding			
9.4	Contractor’s cash flow			
9.5	Client's cash flow			

Ref	Identified Factors	RII (Relative Important Index Rank)	Overall Rank	Category-wise Rank
9.6	Overhead and profit rate of project			
9.7	Project design cost			
9.8	Material and equipment cost			
9.9	Project labour cost			
9.10	Cost of rework			
9.11	Client instructed variations			
9.12	Waste rate of materials			
9.13	Cost control system			
9.14	Escalation of material prices			
9.15	Differentiation of currency prices			
10.0	**Time Category**			
10.1	Planned time for design			
10.2	Planned time for tender period			
10.3	Planned time for construction			
10.4	Percentage of orders delivered late			
10.5	Time needed to implement variation orders			
10.6	Average delay in claim approval			
10.7	Average delay because of closures leading to material shortage			
10.8	Average delay in payment from owner to contractor			
10.9	Availability of resources as planned through project duration			
11.0	**Quality Category**			
11.1	Conformance to specification			
11.2	Availability of personals with high experience and qualification			
11.3	Quality training/meeting			
11.4	Participation of managerial levels with decision making			
11.5	Quality of equipment and raw materials			
11.6	Quality assessment system of Contractor's organization			
12.0	**Productivity Category**			
12.1	Labourer’s skills and experience			
12.2	Management-labour relationship			
12.3	Absenteeism rate through project			
12.4	Sequencing of work according to schedule			
13.0	**Client Satisfaction Category**			
13.1	Information coordination between owner and other stakeholders of the project			

Ref	Identified Factors	RII (Relative Important Index Rank)	Overall Rank	Category-wise Rank
13.3	Speed and reliability of service to owner			
13.4	Number of disputes between owner and other stakeholders of the project			
14.0	**Health & Safety Category**			
14.1	Application of health and safety factors in organization			
14.2	Easiness to reach to the site (Project Location)			
14.3	Reportable accidents rate in project			
15.0	**Environmental Category**			
15.1	Air quality noise level			
15.2	Waste around the site			
15.3	Climate condition in the site			

Appendix B: First Round Questionnaire for Experts

Appendix B : First Round Questionnaire for Experts

First Round Questionnaire for Experts (Factors Affecting Private Sector Building Project Success)

To identify significant factors affecting Project Success in Sri Lankan context

1. Please enter information requested in the form below. Your name, name of your organization, qualifications and contact details will be kept confidential and will be used to 2nd round questionnaire to you. Summaries and statistical analyses of responses will be presented to the University.

Name	
Organization	
Profession	
Nr of experience in years	
Academic qualification	
Professional qualification	
E-mail	
Telephone	
Date	

2. Please identify in Sri Lankan context, the level of importance of below listed fctors for project success factors at completion or close-out stage considering private sector building projects in Western Province of Sri Lanka as per your view. Please tick one of the five based on its importance level.

Sl	Identified Factors	1 - Very low important	2 - Low important	3 - Medium important	4 - High important	5 - Very high important
1.0	**Project Category**					
1.1	Type of project	☐	☐	☐	☐	☐
1.2	Nature of project	☐	☐	☐	☐	☐
1.3	Number of floors of the project	☐	☐	☐	☐	☐
1.4	Complexity of project	☐	☐	☐	☐	☐
1.5	Size and value of project	☐	☐	☐	☐	☐
1.6	Uniqueness of project activities	☐	☐	☐	☐	☐
1.7	Urgency of project outcome	☐	☐	☐	☐	☐
1.8	Clearly defined project goals / objectives	☐	☐	☐	☐	☐
2.0	**Organization Structure Category**					
2.1	Project organization structure	☐	☐	☐	☐	☐
2.2	Effective project team formation	☐	☐	☐	☐	☐
2.3	Top management support	☐	☐	☐	☐	☐
2.4	Functional manager's support	☐	☐	☐	☐	☐
3.0	**Project Management Category**					
3.1	Contactor's communication system	☐	☐	☐	☐	☐
3.2	Contactor's control mechanism	☐	☐	☐	☐	☐
3.3	Contactor's feedback capabilities	☐	☐	☐	☐	☐
3.4	Contactor's planning effort	☐	☐	☐	☐	☐
3.5	Developing an appropriate project structure	☐	☐	☐	☐	☐
3.6	Implementing an effective safety program	☐	☐	☐	☐	☐
3.7	Implementing an effective quality assurance program	☐	☐	☐	☐	☐
3.8	Coordination effectiveness	☐	☐	☐	☐	☐
3.9	Contactor's decision making effectiveness	☐	☐	☐	☐	☐
3.10	Project monitoring	☐	☐	☐	☐	☐
3.11	Control of sub-contractors' works	☐	☐	☐	☐	☐
3.12	Contactor's prior project management experience	☐	☐	☐	☐	☐
3.13	Constructability program	☐	☐	☐	☐	☐
3.14	Project risk management	☐	☐	☐	☐	☐
4.0	**Contractor Category**					
4.1	Contractor experience	☐	☐	☐	☐	☐
4.2	Site management	☐	☐	☐	☐	☐
4.3	Supervision	☐	☐	☐	☐	☐
4.4	Extent of Subcontracting	☐	☐	☐	☐	☐
4.5	Allocation of sufficient resources	☐	☐	☐	☐	☐
4.6	Frequent progress meetings	☐	☐	☐	☐	☐
5.0	**Stakeholders Category**					
5.1	Client's experience means whether he is a sophisticated or specialized client	☐	☐	☐	☐	☐
5.2	Size of client's organization	☐	☐	☐	☐	☐
5.3	Client's emphasis on low construction cost	☐	☐	☐	☐	☐
5.4	Client's emphasis on high quality of construction	☐	☐	☐	☐	☐
5.5	Client's emphasis on quick construction	☐	☐	☐	☐	☐
5.6	Client's ability to brief	☐	☐	☐	☐	☐
5.7	Client's ability to make decisions	☐	☐	☐	☐	☐
5.8	Client's ability to define roles	☐	☐	☐	☐	☐
5.9	Client's contribution to design	☐	☐	☐	☐	☐
5.10	Client's contribution to construction	☐	☐	☐	☐	☐
5.11	Contractor's project team leader's experience	☐	☐	☐	☐	☐

SI	Identified Factors	1 - Very low important	2 - Low important	3 - Medium important	4 - High important	5 - Very high important
5.12	Technical skills of Contractor's project team leaders	☐	☐	☐	☐	☐
5.13	Planning skills of Contractor's project team leaders	☐	☐	☐	☐	☐
5.14	Organizing skills of Contractor's project team leaders	☐	☐	☐	☐	☐
5.15	Coordinating skills of Contractor's project team leaders	☐	☐	☐	☐	☐
5.16	Motivating skills of Contractor's project team leaders	☐	☐	☐	☐	☐
5.17	Contractor's project team leaders' commitment to meet cost, time and quality	☐	☐	☐	☐	☐
5.18	Contractor's project team leaders' early and continued involvement in the project	☐	☐	☐	☐	☐
5.19	Contractor's project team leaders' adaptability to changes in the project plan	☐	☐	☐	☐	☐
5.20	Contractor's project team leaders' working relationship with others.	☐	☐	☐	☐	☐
5.21	Support and provision of resources from Contractor's project team leaders' parent company	☐	☐	☐	☐	☐
5.22	Consultant Project Manager's ability to delegate the authorities	☐	☐	☐	☐	☐
5.23	Consultant Project Manager's ability to coordinate	☐	☐	☐	☐	☐
5.24	Consultant Project Manager's perception of role and responsibilities	☐	☐	☐	☐	☐
5.25	Consultant Project Manager's commitment to complete the project	☐	☐	☐	☐	☐
6.0	**Procurement Category**					
6.1	Project procurement method	☐	☐	☐	☐	☐
6.2	Project bidding method	☐	☐	☐	☐	☐
6.3	Project contract mechanism	☐	☐	☐	☐	☐
7.0	**Design Team Category**					
7.1	Design team experience	☐	☐	☐	☐	☐
7.2	Project design complexity	☐	☐	☐	☐	☐
7.3	Well defined technical specifications	☐	☐	☐	☐	☐
7.4	Mistakes/ delays in producing design documents	☐	☐	☐	☐	☐
7.5	Design team’s contribution to construction	☐	☐	☐	☐	☐
8.0	**External Environment Category**					
8.1	Economic environment	☐	☐	☐	☐	☐
8.2	Social environment	☐	☐	☐	☐	☐
8.3	Political environment	☐	☐	☐	☐	☐
8.4	Physical environment	☐	☐	☐	☐	☐
8.5	Industrial relations environment	☐	☐	☐	☐	☐
8.6	Technological environment	☐	☐	☐	☐	☐
9.0	**Cost Category**					
9.1	Market share of Contractor's organization	☐	☐	☐	☐	☐
9.2	Liquidity of Contractor's organization	☐	☐	☐	☐	☐
9.3	Financial stability and adequate funding	☐	☐	☐	☐	☐
9.4	Contractor’s cash flow	☐	☐	☐	☐	☐
9.5	Client's cash flow	☐	☐	☐	☐	☐
9.6	Overhead and profit rate of project	☐	☐	☐	☐	☐
9.7	Project design cost	☐	☐	☐	☐	☐
9.8	Material and equipment cost	☐	☐	☐	☐	☐
9.9	Project labour cost	☐	☐	☐	☐	☐
9.10	Cost of rework	☐	☐	☐	☐	☐

SI	Identified Factors	1 - Very low important	2 - Low important	3 - Medium important	4 - High important	5 - Very high important
9.11	Client instructed variations	☐	☐	☐	☐	☐
9.12	Waste rate of materials	☐	☐	☐	☐	☐
9.13	Cost control system	☐	☐	☐	☐	☐
9.14	Escalation of material prices	☐	☐	☐	☐	☐
9.15	Differentiation of currency prices	☐	☐	☐	☐	☐
10.0	**Time Category**					
10.1	Planned time for design	☐	☐	☐	☐	☐
10.2	Planned time for tender period	☐	☐	☐	☐	☐
10.3	Planned time for construction	☐	☐	☐	☐	☐
10.4	Percentage of orders delivered late	☐	☐	☐	☐	☐
10.5	Time needed to implement variation orders	☐	☐	☐	☐	☐
10.6	Average delay in claim approval	☐	☐	☐	☐	☐
10.7	Average delay because of closures leading to material shortage	☐	☐	☐	☐	☐
10.8	Average delay in payment from owner to contractor	☐	☐	☐	☐	☐
10.9	Availability of resources as planned through project duration	☐	☐	☐	☐	☐
11.0	**Quality Category**					
11.1	Conformance to specification	☐	☐	☐	☐	☐
11.2	Availability of personals with high experience and qualification	☐	☐	☐	☐	☐
11.3	Quality training/meeting	☐	☐	☐	☐	☐
11.4	Participation of managerial levels with decision making	☐	☐	☐	☐	☐
11.5	Quality of equipment and raw materials	☐	☐	☐	☐	☐
11.6	Quality assessment system of Contractor's organization	☐	☐	☐	☐	☐
12.0	**Productivity Category**					
12.1	Laborer's skills and experience	☐	☐	☐	☐	☐
12.2	Management-labor relationship	☐	☐	☐	☐	☐
12.3	Absenteeism rate through project	☐	☐	☐	☐	☐
12.4	Sequencing of work according to schedule	☐	☐	☐	☐	☐
13.0	**Client Satisfaction Category**					
13.1	Information coordination between owner and other stakeholders of the project	☐	☐	☐	☐	☐
13.2	Leadership skills for project manager	☐	☐	☐	☐	☐
13.3	Speed and reliability of service to owner	☐	☐	☐	☐	☐
13.4	Number of disputes between owner and other stakeholders of the project	☐	☐	☐	☐	☐
14.0	**Health & Safety Category**					
14.1	Application of health and safety factors in organization	☐	☐	☐	☐	☐
14.2	Easiness to reach to the site (Project Location)	☐	☐	☐	☐	☐
14.3	Reportable accidents rate in project	☐	☐	☐	☐	☐
15.0	**Environmental Category**					
15.1	Air quality noise level	☐	☐	☐	☐	☐
15.2	Waste around the site	☐	☐	☐	☐	☐
15.3	Climate condition in the site	☐	☐	☐	☐	☐

Appendix C: Second Round Questionnaire for Experts

Appendix C : Second Round Questionnaire for Experts

Second Round Questionnaire for Experts (Factors Affecting Private Sector Building Project Success)

To identify most significant factors affecting Project Success in Western Province of Sri Lanka.

1. As previously you entered in the First Round questionnaire for your professional details, Please enter information requested in the form below. Your name, name of your organization, qualifications and contact details will be kept confidential. Summaries and statistical analyses of responses will be presented to the University.

Name	
Organization	
Profession	
Nr of experience in years	
Academic qualification	
Professional qualification	
E-mail	
Telephone	
Date	

2. Please identify, the level of importance of below listed factors for project success factors at completion or close-out stage considering private sector building projects in Western Province of Sri Lanka as per your view. Please tick one of the five based on its importance level. Please note that below factors have been selected based on your responses to First Round Questionnaire of this research using Relative Importance Index formula

SI	Identified Factors	1 - Very low important	2 - Low important	3 - Medium important	4 - High important	5 - Very high important
1.0	**Project Category**					
1.1	Complexity of project	☐	☐	☐	☐	☐
1.2	Size and value of project	☐	☐	☐	☐	☐
1.3	Urgency of project outcome	☐	☐	☐	☐	☐
1.4	Clearly defined project goals / objectives	☐	☐	☐	☐	☐
2.0	**Organization Structure Category**					
2.1	Project organization structure	☐	☐	☐	☐	☐
2.2	Effective project team formation	☐	☐	☐	☐	☐
2.3	Top management support	☐	☐	☐	☐	☐
2.4	Functional manager's support	☐	☐	☐	☐	☐
3.0	**Project Management Category**					
3.1	Contactor's communication system	☐	☐	☐	☐	☐
3.2	Contactor's control mechanism	☐	☐	☐	☐	☐
3.3	Contactor's feedback capabilities	☐	☐	☐	☐	☐
3.4	Contactor's planning effort	☐	☐	☐	☐	☐
3.5	Developing an appropriate project structure	☐	☐	☐	☐	☐
3.6	Implementing an effective quality assurance program	☐	☐	☐	☐	☐
3.7	Coordination effectiveness	☐	☐	☐	☐	☐
3.8	Contactor's decision making effectiveness	☐	☐	☐	☐	☐
3.9	Project monitoring	☐	☐	☐	☐	☐
3.10	Control of sub-contractors' works	☐	☐	☐	☐	☐
3.11	Contactor's prior project management experience	☐	☐	☐	☐	☐
3.12	Constructability program	☐	☐	☐	☐	☐
3.13	Project risk management	☐	☐	☐	☐	☐
4.0	**Contractor Category**					
4.1	Contractor experience	☐	☐	☐	☐	☐
4.2	Site management	☐	☐	☐	☐	☐
4.3	Supervision	☐	☐	☐	☐	☐
4.4	Allocation of sufficient resources	☐	☐	☐	☐	☐
5.0	**Stakeholders Category**					
5.1	Client's emphasis on high quality of construction	☐	☐	☐	☐	☐
5.2	Client's ability to brief	☐	☐	☐	☐	☐
5.3	Client's ability to make decisions	☐	☐	☐	☐	☐
5.4	Contractor's project team leader's experience	☐	☐	☐	☐	☐
5.5	Technical skills of Contractor's project team leaders	☐	☐	☐	☐	☐
5.6	Planning skills of Contractor's project team leaders	☐	☐	☐	☐	☐
5.7	Organizing skills of Contractor's project team leaders	☐	☐	☐	☐	☐
5.8	Coordinating skills of Contractor's project team leaders	☐	☐	☐	☐	☐
5.9	Motivating skills of Contractor's project team leaders	☐	☐	☐	☐	☐
5.10	Contractor's project team leaders' commitment to meet cost, time and quality	☐	☐	☐	☐	☐

SI	Identified Factors	1 - Very low important	2 - Low important	3 - Medium important	4 - High important	5 - Very high important
5.11	Contractor's project team leaders' early and continued involvement in the project	☐	☐	☐	☐	☐
5.12	Contractor's project team leaders' adaptability to changes in the project plan	☐	☐	☐	☐	☐
5.13	Contractor's project team leaders' working relationship with others.	☐	☐	☐	☐	☐
5.14	Support and provision of resources from Contractor's project team leaders' parent company	☐	☐	☐	☐	☐
5.15	Consultant Project Manager's ability to delegate the authorities	☐	☐	☐	☐	☐
5.16	Consultant Project Manager's ability to coordinate	☐	☐	☐	☐	☐
5.17	Consultant Project Manager's perception of role and responsibilities	☐	☐	☐	☐	☐
5.18	Consultant Project Manager's commitment to complete the project	☐	☐	☐	☐	☐
6.0	**Procurement Category**					
6.1	Project bidding method	☐	☐	☐	☐	☐
7.0	**Design Team Category**					
7.1	Design team experience	☐	☐	☐	☐	☐
7.2	Project design complexity	☐	☐	☐	☐	☐
7.3	Well defined technical specifications	☐	☐	☐	☐	☐
7.4	Mistakes/ delays in producing design documents	☐	☐	☐	☐	☐
7.5	Design team’s contribution to construction	☐	☐	☐	☐	☐
8.0	**Cost Category**					
8.1	Liquidity of Contractor's organization	☐	☐	☐	☐	☐
8.2	Financial stability and adequate funding	☐	☐	☐	☐	☐
8.3	Contractor’s cash flow	☐	☐	☐	☐	☐
8.4	Client's cash flow	☐	☐	☐	☐	☐
8.5	Client instructed variations	☐	☐	☐	☐	☐
8.6	Cost control system	☐	☐	☐	☐	☐
9.0	**Time Category**					
9.1	Planned time for construction	☐	☐	☐	☐	☐
9.2	Average delay in payment from owner to contractor	☐	☐	☐	☐	☐
9.3	Availability of resources as planned through project duration	☐	☐	☐	☐	☐
10.0	**Quality Category**					
10.1	Availability of personals with high experience and qualification	☐	☐	☐	☐	☐
10.2	Quality of equipment and raw materials	☐	☐	☐	☐	☐
10.3	Quality assessment system of Contractor's organization	☐	☐	☐	☐	☐
11.0	**Productivity Category**					
11.1	Laborer's skills and experience	☐	☐	☐	☐	☐
11.2	Management-labor relationship	☐	☐	☐	☐	☐
11.3	Sequencing of work according to schedule	☐	☐	☐	☐	☐
12.0	**Client Satisfaction Category**					
12.1	Leadership skills for project manager	☐	☐	☐	☐	☐
13.0	**Health & Safety Category**					
13.1	Easiness to reach to the site (Project Location)	☐	☐	☐	☐	☐

Appendix D: Data Collected from Expert panel from First Round Questionnaire

Appendix D: Data Collected from Expert Panel from First Round Questionnaire

Ref	Identified Factors	1 - Very low important	2 - Low important	3 - Medium important	4 - High important	5 - Very high important	RII (Relative Important Index)	Overall Rank	Category-wise Rank
1.0	**Project Category**								
1.1	Type of project	2	1	7	5	0	0.750	19	5
1.2	Nature of project	0	2	11	2	0	0.750	19	5
1.3	Number of floors of the project	0	1	6	6	2	0.720	21	6
1.4	**Complexity of project**	0	1	0	5	9	0.893	5	1
1.5	**Size and value of project**	0	1	2	5	7	0.840	11	3
1.6	Uniqueness of project activities	0	2	6	4	3	0.707	22	7
1.7	**Urgency of project outcome**	0	0	4	5	6	0.827	13	4
1.8	**Clearly defined project goals / objectives**	0	0	4	3	8	0.853	9	2
2.0	**Organization Structure Category**								
2.1	**Project organization structure**	0	0	3	7	5	0.827	13	4
2.2	**Effective project team formation**	0	0	0	6	9	0.920	3	1
2.3	**Top management support**	0	0	1	5	9	0.907	4	2
2.4	**Functional manager's support**	0	0	2	8	5	0.840	11	3

Ref	Identified Factors	1 - Very low important	2 - Low important	3 - Medium important	4 - High important	5 - Very high important	RII (Relative Important Index)	Overall Rank	Category-wise Rank
3.0	**Project Management Category**								
3.1	**Contactor's communication system**	0	0	1	8	6	0.867	8	3
3.2	**Contactor's control mechanism**	0	0	1	8	6	0.867	8	3
3.3	**Contactor's feedback capabilities**	0	0	3	5	7	0.853	9	4
3.4	**Contactor's planning effort**	0	0	0	5	10	0.933	2	1
3.5	**Developing an appropriate project structure**	0	0	0	8	7	0.893	5	2
3.6	Implementing an effective safety program	0	0	4	9	2	0.773	17	6
3.7	**Implementing an effective quality assurance program**	0	0	0	8	7	0.893	5	2
3.8	**Coordination effectiveness**	0	0	1	8	6	0.867	8	3
3.9	**Contactor's decision-making effectiveness**	0	0	0	8	7	0.893	5	2
3.10	**Project monitoring**	0	0	0	8	7	0.893	5	2
3.11	**Control of sub-contractors' works**	0	0	2	6	7	0.867	8	3
3.12	**Contactor's prior project management experience**	0	0	1	9	5	0.853	9	4
3.13	**Constructability program**	0	0	3	9	3	0.800	15	5
3.14	**Project risk management**	0	0	4	7	4	0.800	15	5
4.0	**Contractor Category**								
4.1	**Contractor experience**	0	0	1	9	4	0.853	9	3
4.2	**Site management**	0	0	1	6	7	0.893	5	1
4.3	**Supervision**	0	0	2	7	6	0.853	9	3
4.4	Extent of Subcontracting	0	0	5	7	3	0.773	17	4
4.5	**Allocation of sufficient resources**	0	0	1	7	7	0.880	7	2
4.6	Frequent progress meetings	0	0	3	11	1	0.773	17	4

Ref	Identified Factors	1 - Very low important	2 - Low important	3 - Medium important	4 - High important	5 - Very high important	RII (Relative Important Index)	Overall Rank	Category-wise Rank
5.0	**Stakeholders Category**								
5.1	Client's experience means whether he is a sophisticated or specialized client	0	2	6	6	1	0.680	24	14
5.2	Size of client's organization	0	3	9	1	2	0.627	28	15
5.3	Client's emphasis on low construction cost	0	0	9	3	3	0.720	21	12
5.4	**Client's emphasis on high quality of construction**	0	0	3	7	5	0.827	13	8
5.5	Client's emphasis on quick construction	0	0	4	8	3	0.787	16	11
5.6	**Client's ability to brief**	0	2	7	6	0	0.833	12	7
5.7	**Client's ability to make decisions**	0	2	2	4	7	0.813	14	9
5.8	Client's ability to define roles	0	2	5	6	2	0.720	21	12
5.9	Client's contribution to design	0	2	6	5	2	0.693	23	13
5.10	Client's contribution to construction	0	2	7	4	2	0.693	23	13
5.11	**Contractor's project team leader's experience**	0	0	2	6	7	0.867	8	5
5.12	**Technical skills of Contractor's project team leaders**	0	0	3	4	8	0.867	8	5
5.13	**Planning skills of Contractor's project team leaders**	0	0	0	4	11	0.947	1	1
5.14	**Organizing skills of Contractor's project team leaders**	0	0	1	7	7	0.880	7	4
5.15	**Coordinating skills of Contractor's project team leaders**	0	0	2	6	7	0.867	8	5
5.16	**Motivating skills of Contractor's project team leaders**	0	0	3	8	4	0.813	14	9

Ref	Identified Factors	1 - Very low important	2 - Low important	3 - Medium important	4 - High important	5 - Very high important	RII (Relative Important Index)	Overall Rank	Category-wise Rank
5.17	**Contractor's project team leaders' commitment to meet cost, time and quality**	0	0	0	5	10	0.933	2	2
5.18	**Contractor's project team leaders' early and continued involvement in the project**	0	0	1	11	3	0.827	13	8
5.19	**Contractor's project team leaders' adaptability to changes in the project plan**	0	0	2	9	4	0.827	13	8
5.20	**Contractor's project team leaders' working relationship with others.**	0	0	1	9	5	0.853	9	6
5.21	**Support and provision of resources from Contractor's project team leaders' parent company**	0	1	3	6	5	0.800	15	10
5.22	**Consultant Project Manager's ability to delegate the authorities**	0	0	4	6	5	0.813	14	9
5.23	**Consultant Project Manager's ability to coordinate**	0	0	4	7	4	0.800	15	10
5.24	**Consultant Project Manager's perception of role and responsibilities**	0	0	3	7	5	0.827	13	8
5.25	**Consultant Project Manager's commitment to complete the project**	0	0	0	8	7	0.893	5	3
6.0	**Procurement Category**								
6.1	Project procurement method	0	2	3	4	6	0.787	16	2
6.2	**Project bidding method**	0	1	7	7	0	0.850	10	1
6.3	Project contract mechanism	0	2	3	9	1	0.720	21	3

Ref	Identified Factors	1 - Very low important	2 - Low important	3 - Medium important	4 - High important	5 - Very high important	RII (Relative Important Index)	Overall Rank	Category-wise Rank
7.0	**Design Team Category**								
7.1	**Design team experience**	0	0	1	5	9	0.907	4	1
7.2	**Project design complexity**	0	1	3	3	8	0.840	11	3
7.3	**Well defined technical specifications**	0	0	1	5	9	0.907	4	1
7.4	**Mistakes/ delays in producing design documents**	0	0	1	7	7	0.880	7	2
7.5	**Design team's contribution to construction**	0	1	4	4	6	0.800	15	4
8.0	**External Environment Category**								
8.1	Economic environment	0	1	3	7	4	0.787	16	1
8.2	Social environment	0	2	6	6	1	0.667	25	4
8.3	Political environment	0	3	5	5	2	0.680	24	3
8.4	Physical environment	0	1	7	6	1	0.693	23	2
8.5	Industrial relations environment	0	2	8	2	3	0.680	24	3
8.6	Technological environment	0	3	7	2	3	0.667	25	4
9.0	**Cost Category**								
9.1	Market share of Contractor's organization	0	4	7	1	3	0.640	27	11
9.2	**Liquidity of Contractor's organization**	0	1	1	6	7	0.853	9	2
9.3	**Financial stability and adequate funding**	0	0	0	5	10	0.933	2	1
9.4	**Contractor's cash flow**	0	0	0	5	10	0.933	2	1
9.5	**Client's cash flow**	0	0	0	5	10	0.933	2	1
9.6	Overhead and profit rate of project	0	0	7	5	3	0.747	20	6
9.7	Project design cost	1	1	8	1	4	0.680	24	10
9.8	Material and equipment cost	0	2	5	2	6	0.760	18	5
9.9	Project labour cost	0	1	9	0	5	0.720	21	7
9.10	Cost of rework	0	1	9	1	4	0.707	22	8
9.11	**Client instructed variations**	0	0	4	7	4	0.800	15	3
9.12	Waste rate of materials	0	3	5	4	3	0.693	23	9
9.13	**Cost control system**	0	1	4	4	6	0.800	15	3

Ref	Identified Factors	1 - Very low important	2 - Low important	3 - Medium important	4 - High important	5 - Very high important	RII (Relative Important Index)	Overall Rank	Category-wise Rank
10.0	**Time Category**								
10.1	Planned time for design	0	1	9	2	3	0.693	23	7
10.2	Planned time for tender period	0	3	7	3	2	0.653	26	8
10.3	**Planned time for construction**	0	0	4	5	6	0.827	13	3
10.4	Percentage of orders delivered late	0	0	5	6	4	0.787	16	4
10.5	Time needed to implement variation orders	0	0	6	5	4	0.773	17	5
10.6	Average delay in claim approval	0	1	6	4	4	0.747	20	6
10.7	Average delay because of closures leading to material shortage	0	2	2	6	5	0.787	16	4
10.8	**Average delay in payment from owner to contractor**	0	0	2	7	6	0.853	9	1
10.9	**Availability of resources as planned through project duration**	0	0	1	10	4	0.840	11	2
11.0	**Quality Category**								
11.1	Conformance to specification	0	1	4	6	4	0.773	17	2
11.2	**Availability of personals with high experience and qualification**	0	0	5	4	6	0.813	14	1
11.3	Quality training/meeting	0	0	8	5	2	0.720	21	3
11.4	Participation of managerial levels with decision making	0	0	4	9	2	0.773	17	2
11.5	**Quality of equipment and raw materials**	0	0	3	8	4	0.813	14	1
11.6	**Quality assessment system of Contractor's organization**	0	1	2	7	5	0.813	14	1

Ref	Identified Factors	1 - Very low important	2 - Low important	3 - Medium important	4 - High important	5 - Very high important	RII (Relative Important Index)	Overall Rank	Category-wise Rank
12.0	**Productivity Category**								
12.1	**Laborer's skills and experience**	0	0	3	4	8	0.867	8	1
12.2	**Management-labor relationship**	0	0	3	7	5	0.827	13	3
12.3	Absenteeism rate through project	0	1	4	6	4	0.773	17	4
12.4	**Sequencing of work according to schedule**	0	0	4	4	7	0.840	11	2
13.0	**Client Satisfaction Category**								
13.1	Information coordination between owner and other stakeholders of the project	0	1	5	6	3	0.747	20	3
13.2	**Leadership skills for project manager**	0	0	2	6	7	0.867	8	1
13.3	Speed and reliability of service to owner	0	0	6	6	3	0.760	18	2
13.4	Number of disputes between owner and other stakeholders of the project	0	0	5	8	2	0.760	18	2
14.0	**Health & Safety Category**								
14.1	Application of health and safety factors in organization	0	1	2	10	1	0.773	17	2
14.2	**Easiness to reach to the site (Project Location)**	0	0	7	8	0	0.883	6	1
14.3	Reportable accidents rate in project	0	1	7	5	2	0.707	22	3
15.0	**Environmental Category**								
15.1	Air quality noise level	1	1	4	8	1	0.693	23	2
15.2	Waste around the site	0	2	5	7	1	0.693	23	2
15.3	Climate condition in the site	0	0	6	7	2	0.747	20	1

Appendix E: Data Collected from Expert panel from Second Round Questionnaire

Appendix E: Data Collected from Expert Panel from Second Round Questionnaire

Ref	Identified Factors	Very low important	Low important	Medium important	High important	Very high important	Overall Rank	Category-wise Rank
1.0	**Project Category**							
1.1	Complexity of project	0	0	4	7	4	10	1
1.2	Size and value of project	1	0	3	6	5	11	2
1.3	Urgency of project outcome	0	2	4	4	5	13	3
1.4	Clearly defined project goals / objectives	1	0	3	6	5	11	2
2.0	**Organization Structure Category**							
2.1	Project organization structure	0	0	6	6	3	13	4
2.2	Effective project team formation	1	0	2	7	5	10	3
2.3	**Top management support**	1	0	2	3	9	6	1
2.4	**Functional manager's support**	0	2	1	6	6	9	2
3.0	**Project Management Category**							
3.1	**Contactor's communication system**	0	1	2	7	5	9	6
3.2	**Contactor's control mechanism**	0	1	1	7	6	7	4
3.3	**Contactor's feedback capabilities**	1	1	4	6	3	15	11
3.4	**Contactor's planning effort**	0	1	0	5	9	2	1
3.5	**Developing an appropriate project structure**	0	0	3	6	6	7	4
3.6	**Implementing an effective quality assurance program**	1	0	3	5	6	13	9
3.7	**Coordination effectiveness**	1	0	3	5	6	10	7
3.8	**Contactor's decision-making effectiveness**	0	1	0	10	4	8	5
3.9	**Project monitoring**	1	0	0	7	7	6	3
3.10	**Control of sub-contractors' works**	0	0	0	9	6	4	2
3.11	**Contactor's prior project management experience**	0	1	6	3	5	13	9
3.12	**Constructability program**	0	0	4	8	3	11	8
3.13	**Project risk management**	0	0	7	6	2	14	10

Ref	Identified Factors	Very low important	Low important	Medium important	High important	Very high important	Overall Rank	Category-wise Rank
4.0	**Contractor Category**							
4.1	**Contractor experience**	0	1	3	7	4	11	3
4.2	**Site management**	1	0	2	9	3	12	4
4.3	**Supervision**	1	0	0	9	5	8	2
4.4	**Allocation of sufficient resources**	1	0	0	7	7	6	1
5.0	**Stakeholders Category**							
5.1	**Client's emphasis on high quality of construction**	0	1	4	9	1	14	7
5.2	**Client's ability to brief**	0	1	6	5	3	14	7
5.3	**Client's ability to make decisions**	1	0	4	4	6	11	5
5.4	**Contractor's project team leader's experience**	0	1	0	8	6	6	2
5.5	**Technical skills of Contractor's project team leaders**	1	0	1	11	2	12	6
5.6	**Planning skills of Contractor's project team leaders**	0	1	0	9	5	7	3
5.7	**Organizing skills of Contractor's project team leaders**	0	0	1	9	5	6	2
5.8	**Coordinating skills of Contractor's project team leaders**	0	2	2	5	6	10	4
5.9	**Motivating skills of Contractor's project team leaders**	0	0	4	7	4	10	4
5.10	**Contractor's project team leaders' commitment to meet cost, time and quality**	1	0	1	4	9	5	1
5.11	**Contractor's project team leaders' early and continued involvement in the project**	0	0	4	7	4	10	4

Ref	Identified Factors	Very low important	Low important	Medium important	High important	Very high important	Overall Rank	Category-wise Rank
5.12	**Contractor's project team leaders' adaptability to changes in the project plan**	0	1	2	8	4	10	4
5.13	**Contractor's project team leaders' working relationship with others.**	0	0	3	10	2	11	5
5.14	**Support and provision of resources from Contractor's project team leaders' parent company**	1	0	3	5	6	10	4
5.15	**Consultant Project Manager's ability to delegate the authorities**	0	0	5	7	3	12	6
5.16	**Consultant Project Manager's ability to coordinate**	0	1	2	9	3	11	5
5.17	**Consultant Project Manager's perception of role and responsibilities**	0	0	6	3	6	10	4
5.18	**Consultant Project Manager's commitment to complete the project**	1	0	1	6	7	7	3
6.0	**Procurement Category**							
6.1	**Project bidding method**	1	1	4	7	2	16	1
7.0	**Design Team Category**							
7.1	**Design team experience**	1	0	2	7	5	10	3
7.2	**Project design complexity**	0	0	3	6	5	9	2
7.3	**Well defined technical specifications**	0	1	1	7	6	7	1
7.4	**Mistakes/ delays in producing design documents**	1	0	1	6	7	7	1
7.5	**Design team’s contribution to construction**	0	0	3	9	3	10	3

Ref	Identified Factors	Very low important	Low important	Medium important	High important	Very high important	Overall Rank	Category-wise Rank
8.0	**Cost Category**							
8.1	**Liquidity of Contractor's organization**	0	2	1	5	7	8	3
8.2	**Financial stability and adequate funding**	1	0	0	6	8	5	2
8.3	**Contractor's cash flow**	1	0	0	3	11	1	1
8.4	**Client's cash flow**	1	0	1	4	9	5	2
8.5	Client instructed variations	0	0	3	9	3	10	4
8.6	Cost control system	0	1	3	7	4	11	5
9.0	**Time Category**							
9.1	**Planned time for construction**	0	1	2	6	6	8	1
9.2	Average delay in payment from owner to contractor	0	1	2	8	4	10	2
9.3	**Availability of resources as planned through project duration**	0	1	1	8	5	8	1
10.0	**Quality Category**							
10.1	Availability of personals with high experience and qualification	0	1	2	8	4	10	1
10.2	Quality of equipment and raw materials	1	0	1	9	4	10	1
10.3	Quality assessment system of Contractor's organization	0	1	3	6	5	10	1
11.0	**Productivity Category**							
11.1	Laborer's skills and experience	1	0	1	12	1	13	3
11.2	Management-labor relationship	0	2	0	9	4	10	2
11.3	Sequencing of work according to schedule	0	2	0	8	5	9	1

Ref	Identified Factors	Very low important	Low important	Medium important	High important	Very high important	Overall Rank	Category-wise Rank
12.0	**Client Satisfaction Category**							
12.1	Leadership skills for project manager	1	0	0	8	6	7	1
13.0	**Health & Safety Category**							
13.1	Easiness to reach to the site (Project Location)	0	0	7	8	0	3	1

Appendix F: First Round Data Analysis Results with RII Value and Ranking Positions

Appendix F: First Round Data Analysis Results with RII Value and Ranking Positions

Ref	Identified Factors	RII (Relative Important Index)	Overall Rank	Category-wise Rank
1.0	**Project Category**			
1.1	Type of project	0.750	19	5
1.2	Nature of project	0.750	19	5
1.3	Number of floors of the project	0.720	21	6
1.4	Complexity of project	0.893	5	1
1.5	Size and value of project	0.840	11	3
1.6	Uniqueness of project activities	0.707	22	7
1.7	Urgency of project outcome	0.827	13	4
1.8	Clearly defined project goals / objectives	0.853	9	2
2.0	**Organization Structure Category**			
2.1	Project organization structure	0.827	13	4
2.2	Effective project team formation	0.920	3	1
2.3	Top management support	0.907	4	2
2.4	Functional manager's support	0.840	11	3
3.0	**Project Management Category**			
3.1	Contactor's communication system	0.867	8	3
3.2	Contactor's control mechanism	0.867	8	3
3.3	Contactor's feedback capabilities	0.853	9	4
3.4	Contactor's planning effort	0.933	2	1
3.5	Developing an appropriate project structure	0.893	5	2
3.6	Implementing an effective safety program	0.773	17	6
3.7	Implementing an effective quality assurance program	0.893	5	2
3.8	Coordination effectiveness	0.867	8	3
3.9	Contactor's decision-making effectiveness	0.893	5	2
3.10	Project monitoring	0.893	5	2
3.11	Control of sub-contractors' works	0.867	8	3
3.12	Contactor's prior project management experience	0.853	9	4
3.13	Constructability program	0.800	15	5
3.14	Project risk management	0.800	15	5

Ref	Identified Factors	RII (Relative Important Index)	Overall Rank	Category-wise Rank
4.0	**Contractor Category**			
4.1	Contractor experience	0.853	9	3
4.2	Site management	0.893	5	1
4.3	Supervision	0.853	9	3
4.4	Extent of Subcontracting	0.773	17	4
4.5	Allocation of sufficient resources	0.880	7	2
4.6	Frequent progress meetings	0.773	17	4
5.0	**Stakeholders Category**			
5.1	Client's experience means whether he is a sophisticated or specialized client	0.680	24	14
5.2	Size of client's organization	0.627	28	15
5.3	Client's emphasis on low construction cost	0.720	21	12
5.4	Client's emphasis on high quality of construction	0.827	13	8
5.5	Client's emphasis on quick construction	0.787	16	11
5.6	Client's ability to brief	0.833	12	7
5.7	Client's ability to make decisions	0.813	14	9
5.8	Client's ability to define roles	0.720	21	12
5.9	Client's contribution to design	0.693	23	13
5.10	Client's contribution to construction	0.693	23	13
5.11	Contractor's project team leader's experience	0.867	8	5
5.12	Technical skills of Contractor's project team leaders	0.867	8	5
5.13	Planning skills of Contractor's project team leaders	0.947	1	1
5.14	Organizing skills of Contractor's project team leaders	0.880	7	4
5.15	Coordinating skills of Contractor's project team leaders	0.867	8	5
5.16	Motivating skills of Contractor's project team leaders	0.813	14	9
5.17	Contractor's project team leaders' commitment to meet cost, time and quality	0.933	2	2
5.18	Contractor's project team leaders' early and continued involvement in the project	0.827	13	8
5.19	Contractor's project team leaders' adaptability to changes in the project plan	0.827	13	8

Ref	Identified Factors	RII (Relative Important Index)	Overall Rank	Category-wise Rank
5.20	Contractor's project team leaders' working relationship with others.	0.853	9	6
5.21	Support and provision of resources from Contractor's project team leaders' parent company	0.800	15	10
5.22	Consultant Project Manager's ability to delegate the authorities	0.813	14	9
5.23	Consultant Project Manager's ability to coordinate	0.800	15	10
5.24	Consultant Project Manager's perception of role and responsibilities	0.827	13	8
5.25	Consultant Project Manager's commitment to complete the project	0.893	5	3
6.0	**Procurement Category**			
6.1	Project procurement method	0.787	16	2
6.2	Project bidding method	0.850	10	1
6.3	Project contract mechanism	0.720	21	3
7.0	**Design Team Category**			
7.1	Design team experience	0.907	4	1
7.2	Project design complexity	0.840	11	3
7.3	Well defined technical specifications	0.907	4	1
7.4	Mistakes/ delays in producing design documents	0.880	7	2
7.5	Design team’s contribution to construction	0.800	15	4
8.0	**External Environment Category**			
8.1	Economic environment	0.787	16	1
8.2	Social environment	0.667	25	4
8.3	Political environment	0.680	24	3
8.4	Physical environment	0.693	23	2
8.5	Industrial relations environment	0.680	24	3
8.6	Technological environment	0.667	25	4
9.0	**Cost Category**			
9.1	Market share of Contractor's organization	0.640	27	11
9.2	Liquidity of Contractor's organization	0.853	9	2
9.3	Financial stability and adequate funding	0.933	2	1
9.4	Contractor’s cash flow	0.933	2	1
9.5	Client's cash flow	0.933	2	1

Ref	Identified Factors	RII (Relative Important Index Rank)	Overall Rank	Category-wise Rank
9.6	Overhead and profit rate of project	0.747	20	6
9.7	Project design cost	0.680	24	10
9.8	Material and equipment cost	0.760	18	5
9.9	Project labour cost	0.720	21	7
9.10	Cost of rework	0.707	22	8
9.11	Client instructed variations	0.800	15	3
9.12	Waste rate of materials	0.693	23	9
9.13	Cost control system	0.800	15	3
9.14	Escalation of material prices	0.747	20	6
9.15	Differentiation of currency prices	0.787	16	4
10.0	**Time Category**			
10.1	Planned time for design	0.693	23	7
10.2	Planned time for tender period	0.653	26	8
10.3	Planned time for construction	0.827	13	3
10.4	Percentage of orders delivered late	0.787	16	4
10.5	Time needed to implement variation orders	0.773	17	5
10.6	Average delay in claim approval	0.747	20	6
10.7	Average delay because of closures leading to material shortage	0.787	16	4
10.8	Average delay in payment from owner to contractor	0.853	9	1
10.9	Availability of resources as planned through project duration	0.840	11	2
11.0	**Quality Category**			
11.1	Conformance to specification	0.773	17	2
11.2	Availability of personals with high experience and qualification	0.813	14	1
11.3	Quality training/meeting	0.720	21	3
11.4	Participation of managerial levels with decision making	0.773	17	2
11.5	Quality of equipment and raw materials	0.813	14	1
11.6	Quality assessment system of Contractor's organization	0.813	14	1
12.0	**Productivity Category**			
12.1	Labourer’s skills and experience	0.867	8	1
12.2	Management-labour relationship	0.827	13	3
12.3	Absenteeism rate through project	0.773	17	4
12.4	Sequencing of work according to schedule	0.840	11	2
13.0	**Client Satisfaction Category**			
13.1	Information coordination between owner and other stakeholders of the project	0.747	20	3

Ref	Identified Factors	RII (Relative Important Index Rank)	Overall Rank	Category-wise Rank
13.3	Speed and reliability of service to owner	0.760	18	2
13.4	Number of disputes between owner and other stakeholders of the project	0.760	18	2
14.0	**Health & Safety Category**			
14.1	Application of health and safety factors in organization	0.773	17	2
14.2	Easiness to reach to the site (Project Location)	0.883	6	1
14.3	Reportable accidents rate in project	0.707	22	3
15.0	**Environmental Category**			
15.1	Air quality noise level	0.693	23	2
15.2	Waste around the site	0.693	23	2
15.3	Climate condition in the site	0.747	20	1
	Mean Value of RII Value in 1st Round Data Analysis	**0.803**		

Appendix G: Selected 66 Factors from First Round Data Analysis with RII Value and Ranking positions.

Appendix G: Selected 66 Factors from First Round Data Analysis with RII Value and Ranking positions

Ref	Identified Factors	RII (Relative Important Index)	Overall Rank	Category-wise Rank
1.0	**Project Category**			
1.1	Complexity of project	0.893	5	1
1.2	Size and value of project	0.840	11	3
1.3	Urgency of project outcome	0.827	13	4
1.4	Clearly defined project goals / objectives	0.853	9	2
2.0	**Organization Structure Category**			
2.1	Project organization structure	0.827	13	4
2.2	Effective project team formation	0.920	3	1
2.3	Top management support	0.907	4	2
2.4	Functional manager's support	0.840	11	3
3.0	**Project Management Category**			
3.1	Contactor's communication system	0.867	8	3
3.2	Contactor's control mechanism	0.867	8	3
3.3	Contactor's feedback capabilities	0.853	9	4
3.4	Contactor's planning effort	0.933	2	1
3.5	Developing an appropriate project structure	0.893	5	2
3.6	Implementing an effective quality assurance program	0.893	5	2
3.7	Coordination effectiveness	0.867	8	3
3.8	Contactor's decision-making effectiveness	0.893	5	2
3.9	Project monitoring	0.893	5	2
3.10	Control of sub-contractors' works	0.867	8	3
3.11	Contactor's prior project management experience	0.853	9	4
3.12	Constructability program	0.800	15	5
3.13	Project risk management	0.800	15	5
4.0	**Contractor Category**			
4.1	Contractor experience	0.853	9	3
4.2	Site management	0.893	5	1
4.3	Supervision	0.853	9	3
4.4	Allocation of sufficient resources	0.880	7	2

Ref	Identified Factors	RII (Relative Important Rank)	Overall Rank	Category-wise Rank
5.0	**Stakeholders Category**			
5.1	Client's emphasis on high quality of construction	0.827	13	8
5.2	Client's ability to brief	0.833	12	7
5.3	Client's ability to make decisions	0.813	14	9
5.4	Contractor's project team leader's experience	0.867	8	5
5.5	Technical skills of Contractor's project team leaders	0.867	8	5
5.6	Planning skills of Contractor's project team leaders	0.947	1	1
5.7	Organizing skills of Contractor's project team leaders	0.880	7	4
5.8	Coordinating skills of Contractor's project team leaders	0.867	8	5
5.9	Motivating skills of Contractor's project team leaders	0.813	14	9
5.10	Contractor's project team leaders' commitment to meet cost, time and quality	0.933	2	2
5.11	Contractor's project team leaders' early and continued involvement in the project	0.827	13	8
5.12	Contractor's project team leaders' adaptability to changes in the project plan	0.827	13	8
5.13	Contractor's project team leaders' working relationship with others.	0.853	9	6
5.14	Support and provision of resources from Contractor's project team leaders' parent company	0.800	15	10
5.15	Consultant Project Manager's ability to delegate the authorities	0.813	14	9
5.16	Consultant Project Manager's ability to coordinate	0.800	15	10

Ref	Identified Factors	RII (Relative Important Index)	Overall Rank	Category-wise Rank
5.17	Consultant Project Manager's perception of role and responsibilities	0.827	13	8
5.18	Consultant Project Manager's commitment to complete the project	0.893	5	3
6.0	**Procurement Category**			
6.1	Project bidding method	0.850	10	1
7.0	**Design Team Category**			
7.1	Design team experience	0.907	4	1
7.2	Project design complexity	0.840	11	3
7.3	Well defined technical specifications	0.907	4	1
7.4	Mistakes/ delays in producing design documents	0.880	7	2
7.5	Design team’s contribution to construction	0.800	15	4
8.0	**Cost Category**			
8.1	Liquidity of Contractor's organization	0.853	9	2
8.2	Financial stability and adequate funding	0.933	2	1
8.3	Contractor’s cash flow	0.933	2	1
8.4	Client's cash flow	0.933	2	1
8.5	Client instructed variations	0.800	15	3
8.6	Cost control system	0.800	15	3
9.0	**Time Category**			
9.1	Planned time for construction	0.827	13	3
9.2	Average delay in payment from owner to contractor	0.853	9	1
9.3	Availability of resources as planned through project duration	0.840	11	2
10.0	**Quality Category**			
10.1	Availability of personals with high experience and qualification	0.813	14	1
10.2	Quality of equipment and raw materials	0.813	14	1
10.3	Quality assessment system of Contractor's organization	0.813	14	1
11.0	**Productivity Category**			
11.1	Labourer’s skills and experience	0.867	8	1
11.2	Management-labour relationship	0.827	13	3
11.3	Sequencing of work according to schedule	0.840	11	2

Ref	Identified Factors	RII (Relative Important Index)	Overall Rank	Category-wise Rank
12.0	**Client Satisfaction Category**			
12.1	Leadership skills for project manager	0.867	8	1
13.0	**Health & Safety Category**			
13.1	Easiness to reach to the site (Project Location)	0.883	6	1

Appendix H: Second Round Data Analysis Results with RII Value and Ranking positions

Appendix H: Second Round Data Analysis Results with RII Value and Ranking positions

Ref	Identified Factors	RII (Relative Important Index)	Overall Rank	Category-wise Rank
1.0	**Project Category**			
1.1	Complexity of project	0.800	10	1
1.2	Size and value of project	0.787	11	2
1.3	Urgency of project outcome	0.760	13	3
1.4	Clearly defined project goals / objectives	0.787	11	2
2.0	**Organization Structure Category**			
2.1	Project organization structure	0.760	13	4
2.2	Effective project team formation	0.800	10	3
2.3	Top management support	0.853	6	1
2.4	Functional manager's support	0.813	9	2
3.0	**Project Management Category**			
3.1	Contactor's communication system	0.813	9	6
3.2	Contactor's control mechanism	0.840	7	4
3.3	Contactor's feedback capabilities	0.720	15	11
3.4	Contactor's planning effort	0.893	2	1
3.5	Developing an appropriate project structure	0.840	7	4
3.6	Implementing an effective quality assurance program	0.760	13	9
3.7	Coordination effectiveness	0.800	10	7
3.8	Contactor's decision-making effectiveness	0.827	8	5
3.9	Project monitoring	0.853	6	3
3.10	Control of sub-contractors' works	0.880	4	2
3.11	Contactor's prior project management experience	0.760	13	9
3.12	Constructability program	0.787	11	8
3.13	Project risk management	0.733	14	10
4.0	**Contractor Category**			
4.1	Contractor experience	0.787	11	3
4.2	Site management	0.773	12	4
4.3	Supervision	0.827	8	2
4.4	Allocation of sufficient resources	0.853	6	1

Ref	Identified Factors	RII (Relative Important Index)	Overall Rank	Category-wise Rank
5.0	**Stakeholders Category**			
5.1	Client's emphasis on high quality of construction	0.733	14	7
5.2	Client's ability to brief	0.733	14	7
5.3	Client's ability to make decisions	0.787	11	5
5.4	Contractor's project team leader's experience	0.853	6	2
5.5	Technical skills of Contractor's project team leaders	0.773	12	6
5.6	Planning skills of Contractor's project team leaders	0.840	7	3
5.7	Organizing skills of Contractor's project team leaders	0.853	6	2
5.8	Coordinating skills of Contractor's project team leaders	0.800	10	4
5.9	Motivating skills of Contractor's project team leaders	0.800	10	4
5.10	Contractor's project team leaders' commitment to meet cost, time and quality	0.867	5	1
5.11	Contractor's project team leaders' early and continued involvement in the project	0.800	10	4
5.12	Contractor's project team leaders' adaptability to changes in the project plan	0.800	10	4
5.13	Contractor's project team leaders' working relationship with others.	0.787	11	5
5.14	Support and provision of resources from Contractor's project team leaders' parent company	0.800	10	4
5.15	Consultant Project Manager's ability to delegate the authorities	0.773	12	6
5.16	Consultant Project Manager's ability to coordinate	0.787	11	5
5.17	Consultant Project Manager's perception of role and responsibilities	0.800	10	4
5.18	Consultant Project Manager's commitment to complete the project	0.840	7	3

Ref	Identified Factors	RII (Relative Important Index)	Overall Rank	Category-wise Rank
6.0	**Procurement Category**			
6.1	Project bidding method	0.707	16	1
7.0	**Design Team Category**			
7.1	Design team experience	0.800	10	3
7.2	Project design complexity	0.813	9	2
7.3	Well defined technical specifications	0.840	7	1
7.4	Mistakes/ delays in producing design documents	0.840	7	1
7.5	Design team's contribution to construction	0.800	10	3
8.0	**Cost Category**			
8.1	Liquidity of Contractor's organization	0.827	8	3
8.2	Financial stability and adequate funding	0.867	5	2
8.3	Contractor's cash flow	0.907	1	1
8.4	Client's cash flow	0.867	5	2
8.5	Client instructed variations	0.800	10	4
8.6	Cost control system	0.787	11	5
9.0	**Time Category**			
9.1	Planned time for construction	0.827	8	1
9.2	Average delay in payment from owner to contractor	0.800	10	2
9.3	Availability of resources as planned through project duration	0.827	8	1
10.0	**Quality Category**			
10.1	Availability of personals with high experience and qualification	0.800	10	1
10.2	Quality of equipment and raw materials	0.800	10	1
10.3	Quality assessment system of Contractor's organization	0.800	10	1

Ref	Identified Factors	RII (Relative Important Index)	Overall Rank	Category-wise Rank
11.0	**Productivity Category**			
11.1	Labourer's skills and experience	0.760	13	3
11.2	Management-labour relationship	0.800	10	2
11.3	Sequencing of work according to schedule	0.813	9	1
12.0	**Client Satisfaction Category**			
12.1	Leadership skills for project manager	0.840	7	1
13.0	**Health & Safety Category**			
13.1	Easiness to reach to the site (Project Location)	0.883	3	1
	Mean Value of RII Value in 2nd Round Data Analysis	**0.808**		

Appendix I: Most significant factors affecting project success in Western Province, Sri Lanka – RII Values, Overall Ranking Position

Appendix I: Most significant factors affecting project success in Western Province, Sri Lanka – RII Values, Overall Ranking Position

Ref	Identified Most Significant Project Success Factors	RII (Relative Important Index)	Overall Rank
1	Contractor's cash flow	0.907	1
2	Contactor's planning effort	0.893	2
3	Easiness to reach to the site (Project Location)	0.883	3
4	Control of sub-contractors' works	0.880	4
5	Contractor's project team leaders' commitment to meet cost, time and quality	0.867	5
6	Financial stability and adequate funding	0.867	5
7	Client's cash flow	0.867	5
8	Top management support	0.853	6
9	Allocation of sufficient resources	0.853	6
10	Contractor's project team leader's experience	0.853	6
11	Organizing skills of Contractor's project team leaders	0.853	6
12	Project monitoring	0.853	6
13	Leadership skills for project manager	0.840	7
14	Well defined technical specifications	0.840	7
15	Mistakes/ delays in producing design documents	0.840	7
16	Planning skills of Contractor's project team leaders	0.840	7
17	Consultant Project Manager's commitment to complete the project	0.840	7
18	Contactor's control mechanism	0.840	7
19	Developing an appropriate project structure	0.840	7
20	Planned time for construction	0.827	8
21	Availability of resources as planned through project duration	0.827	8
22	Supervision	0.827	8
23	Liquidity of Contractor's organization	0.827	8
24	Contactor's decision-making effectiveness	0.827	8
25	Sequencing of work according to schedule	0.813	9
26	Functional manager's support	0.813	9
27	Project design complexity	0.813	9
28	Contactor's communication system	0.813	9