University of Southern Queensland

Faculty of Health, Engineering & Sciences

Challenges in Project Management of Infrastructure Projects in Fiji

A dissertation submitted by

Hardeep Singh

In fulfilment of the requirements of

Towards the degree of

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Infrastructure is the link to economic growth of any nation. Fiji has seen tremendous progress in the construction industry, which is one of the main sectors that contribute to the national economy. However, the industry is tarnished by the existence of failure/abandoned projects, There are no concrete numbers on the percentage of projects that's has failed in Fiji, but from experience it is very rare that projects are completed on time and within budget.

This research aims to study the challenges in project management of infrastructure projects in Fiji. The purpose of this thesis is to make a contribution to the existing knowledge of Project Management in developing countries like Fiji. It is an attempt to test the rationality and correctness of the day-to-day challenges faced by Project Mangers in Fiji and thereby propose necessary changes in present ideas or additional issues that need consideration in future.

The research will take an in-depth look at previous research identified through academic and industry literature. A questionnaire survey was developed and distributed to government and private companies within the engineering industry. The questionnaire was designed to obtain the opinions and experiences respondents had in relation to the challenges in project management of infrastructure projects in Fiji.

Results from the questionnaire suggest that constructability in engineering design and quality/experience of designers, statutory approvals and land acquisition process initiate over 70% of project management challenges. Results also suggest that longstanding arrangement between client and contractor, shortage of construction materials and equipment, migration of skied workers and inadequate trade labour availability and competency is encountered frequently by respondents. It was also found that in achieving the best practice in the Fiji Construction Industries, project manager should straighten their capability in term of knowledge, skills and personal characteristics. Project Managers in Fiji need to enhance their knowledge in construction management and contract laws, need to build up technical skills and ability to resolve technical problems.

An industry case study was carried out on two different infrastructure projects. The data was analysed, identifying major project management challenges. Results from these case studies validates the results obtained from questionnaire survey.

Using the information gather through the case studies and questionnaire survey, recommendations were developed to minimise the challenges in project management on future infrastructure projects. Achievements, limitations and potential future studies were also identified.

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Declaration

I, Hardeep Singh hereby declare that this research work are entirely my own effort, except where otherwise indicated and acknowledged.

I further certify that the work is original and has not been previously submitted in whole or in part, to qualify for any other academic degree in any university.

Student Name: Hardeep Singh

Student Number: [redacted]

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PM	Project Management
ADB	Asian Development Bank
EU	European Union
CIC	Construction industry Council
CRFG	China Railway First Group
FNU	Fiji National University
WAF	Water Authority of Fiji
FIE	Fiji Institute of Engineers
FRA	Fiji Roads Authority
FEA	Fiji Electricity Authority
FNBC	Fiji National Building Code
PRB	Public Rental Board
PMI	Project Management Institute
NRW	NRW Macallan (Fiji) Ltd
RII	Relative Importance Index
USQ	University of Southern Queensland

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Infrastructure is the link to economic growth of any nation. Whether it is the impact of the climate change, advancement in technologies or political issues, we are living in a world where the future is more challenging and uncertain than ever before. Good leadership is required to drive change and innovation and reimagine the future developments.

Following the release of the "Global infrastructure Outlook" (Outlook), a research and publication of Oxford Economics and Global Infrastructure Hub (GIHub), a G20 initiative, in the third quarter of 2017, the South Pacific Engineers Association (SPEA) have taken quick steps to understand the key messages in the Outlook.

The following excerpt is from the Outlook "Global infrastructure Outlook" (Outlook), is the detailed review and analytical tool that enables governments, businesses and infrastructure organizations to comprehensively analyse and predict infrastructure investment requirements across the globe over the 25 years. Globally the need for infrastructure investment is forecast to reach $94 trillion by the year 2040, and further $3.5 trillion will be required to meet the United Nations Sustainable Development Goals for electricity and water."

"The findings are compelling. Quantifying country-level needs is a powerful and positive step. These insights will help governments identify and respond to infrastructure needs, and guide opportunities for private sector investors. With the right information, policy leadership, and supportive financing environments the investment gaps highlighted in the report can be successfully addressed"

Regardless of how developed a nation is, for its economy to successfully perform to a required expectation, the basic underlying framework or fundamental facilities and systems, be they physical, meaning the utility services or organizational, meaning the governance, they all must function effectively. However this is not easily achieved in developing countries like Fiji.

Fiji faces significant development challenges, and the government has set ambitious development objectives to address them. However, where one may raise a question in spite of huge public spending on infrastructure why there is still a gap, is the capital available to fill in seams short or performance in project management is problematic. (Government of the Republic of Fiji, 2017)

This Research aims to study the challenges in project management of infrastructure projects in Fiji. The purpose of this thesis is to make a contribution to the existing knowledge of Project Management in developing countries like Fiji. It is an attempt to test the rationality and correctness of the day-to-day challenges faced by Project Mangers in Fiji and thereby propose necessary changes in present ideas or additional issues that need consideration in future.

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Fiji is situated in the South Pacific Ocean comprising citizens from diverse cultural background fragmented along ethnic lines. The country has an area of about 18,274 square kilometres and it is made up of more than 332 islands, of which 110 are inhabited. Its major islands are Viti Levu and Vanua Levu which predominantly hold most of the population. Suva is the capital city of Fiji and is located in the Viti Levu. Fiji has a population of about nine hundred eleven thousand three hundred and fifty six. (World Bank Group, 2017). The Capital, Suva has a population of over 200,000.

The official language is English. Fiji has a great potential to become an integrated, equitable and peaceful multi-ethnic state, 'the way the world should be', according to Pope who visited the country in 1987. The British established the colony of Fiji in 1874. But the country has experienced political instability and military coups d' e'tat since it attained its independence from Great Britain in 1970. The most recent of these coups was executed by the republic of Fiji Military Forces in December 2006. It has a tropical climate and the main source of income in the tourism industry.

Nevertheless, Fiji has one of the most sophisticated economies among the Pacific Islands. Fiji is also one of the largest economy in the Pacific and it is most industrially advanced, with substantial services and manufacturing sectors. (World Bank Group, 2016)

On 20 February 2016, Fiji was hit by severe Cyclone Winston, an extremely Category 5 tropical cyclone to make landfall in the nation. According to meteorological sources, maximum average wind speeds reached 233km/hour and wind gusts peaked at around 306km/hour, making Winston one of the most powerful cyclones ever recorded in the Southern Hemisphere.it was one of the strongest cyclone in the recorded history. (ADB, 2015).

Tropical cyclone Winston destroyed major infrastructure like schools, hospitals, power lines, road, bridges and thousands of homes across the island, killing 44 people and

displacing thousands of people. According to Fijian Government the cost of damages by Tropical Cyclone Winston is estimated as FJ$1. 99 billion. (Government of Fiji, 2017)

The country has a mixed economy as is formally classified as a developing country: its gross domestic product per capita in 2017 was about 9.7 billion Fijian dollars (International Monetary Fund). Since the 1970's the country, the country has gone through major developments in infrastructure and currently is one of the most developed economies in the Pacific.

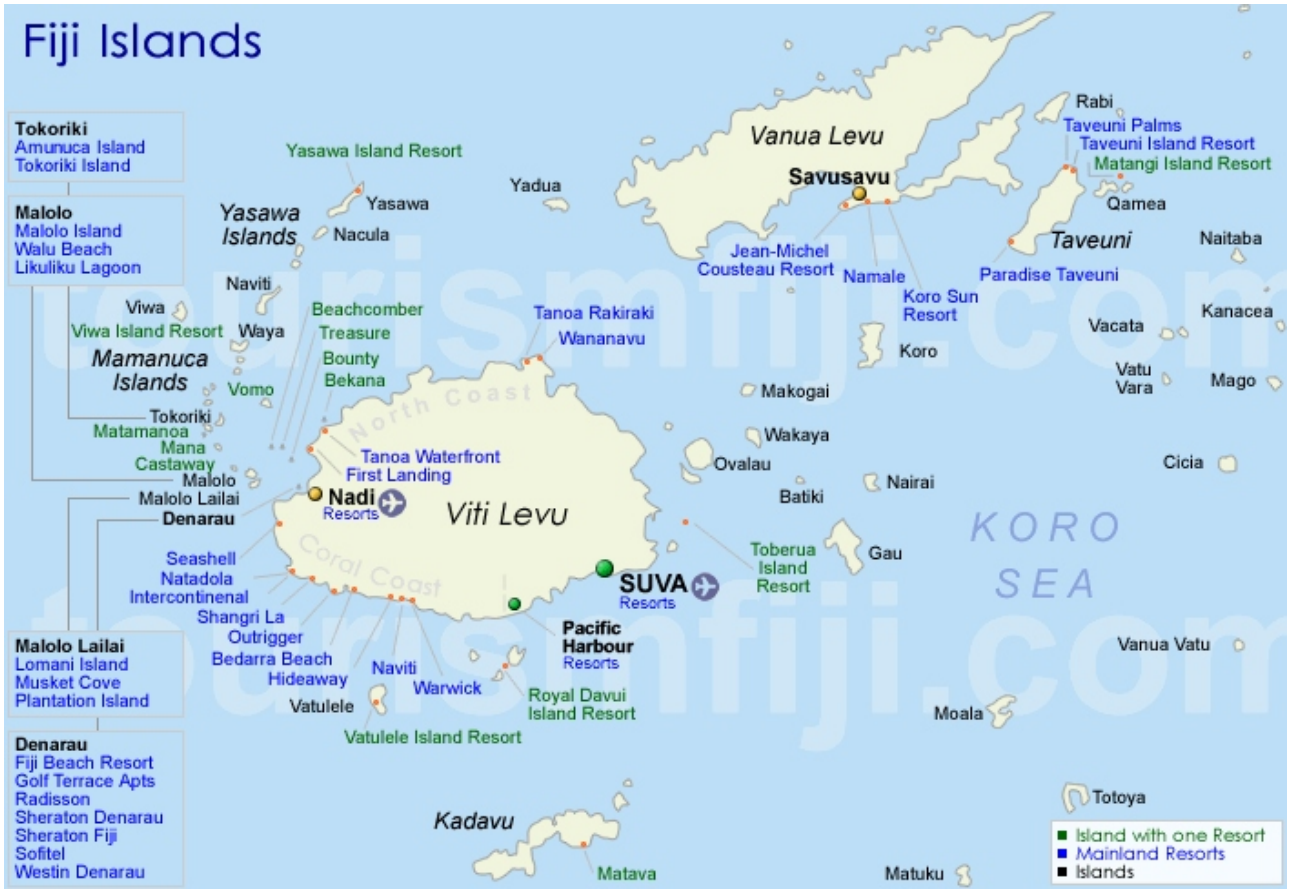

Figure 1: Map of Fiji (Tourism Fiji)

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Project management in Engineering is always evolving. Project exist in all countries, both developed and developing. Kejuo (2012) contents that many projects around the world keeps failing, resulting in millions of losses for organisations. From a survey carried out by Hekala (2012) it was found that 64% donor projects fail.

There exist literatures in Project Management. Unfortunately, there is no standard project management methodology tailored to suit specific countries. Project Managers coordinate complex projects with task deadline and people with many areas of expertise, material resources, throughout the life cycle of a project using modern techniques of

management for the achievement of predetermined objectives in a particular scope, cost, time, quality and the satisfaction of project stakeholders. Maria et. al (2016). Furthermore, McKinsey and Devex survey was carried out in January and February 2011, put forward findings that substantiates that the two major reasons of project failure were poor project planning and lack of managerial skills.

According to Shaw, (2005) project managers and engineers work together to successfully complete a project. Furthermore, he stated that Project Management Methodology is very similar to the engineering method. Where the first step is to define the problem, evaluate the options, selection of the best option, implementation of this plan, and evaluate the outcome.

The study of planning and implementation of projects to drive project success has, over the years resulted in a significant number of published articles. The inability to identify, prepare, formulate, and implement projects continues to be a major problem in developing countries (Rondinelli, 1976).

There are no concrete numbers on the percentage of projects that's has failed in Fiji, but from experience it is very rare that projects are completed on time and within budget. The prime example of this is the Suva-Nausori four lane project, which has been delayed for a year now. Talei (2017) reports that the delays are due to land acquisition issues, engineering problems and ground conditions at the site. Furthermore, Lacanivalu (2018) highlights that construction of the Kinoya Sewerage Treatment plant in Fiji was delayed for 2 years and stated the reason for the delay was late payments to the contractor. In December 2016 Reserve bank of Fiji (RBF) in their press statement have highlighted that delays in supply of building materials have affected the reconstruction in the aftereffects of Tropical Cyclone Winston which has become one of the biggest challenges in terms of shelter.

From the arguments presented above it is evident that without successful project initiation, strategic planning and implementation, developing countries in search for economic and social development like "Fiji'' would remain stagnant or regress, despite, the development schemes orchestrated by the government and the international donors. This has initiated the idea for this research project, which aims to minimise project failures in Fiji, by defining the need of improving the project management performance.

The study will target key infrastructure areas in Fiji like, ports, Jetties, housing and subdivisions etc.

The data presented in this research project is through extensive literature reviews, questionnaire analysis, field visits, and reviewing case studies.

In addition, to this introduction, the report also evaluates the literature reviews and methodology.

The closing section presents the findings and references.

The research objectives can be illustrated in the form of a flow diagram as shown in figure 1.

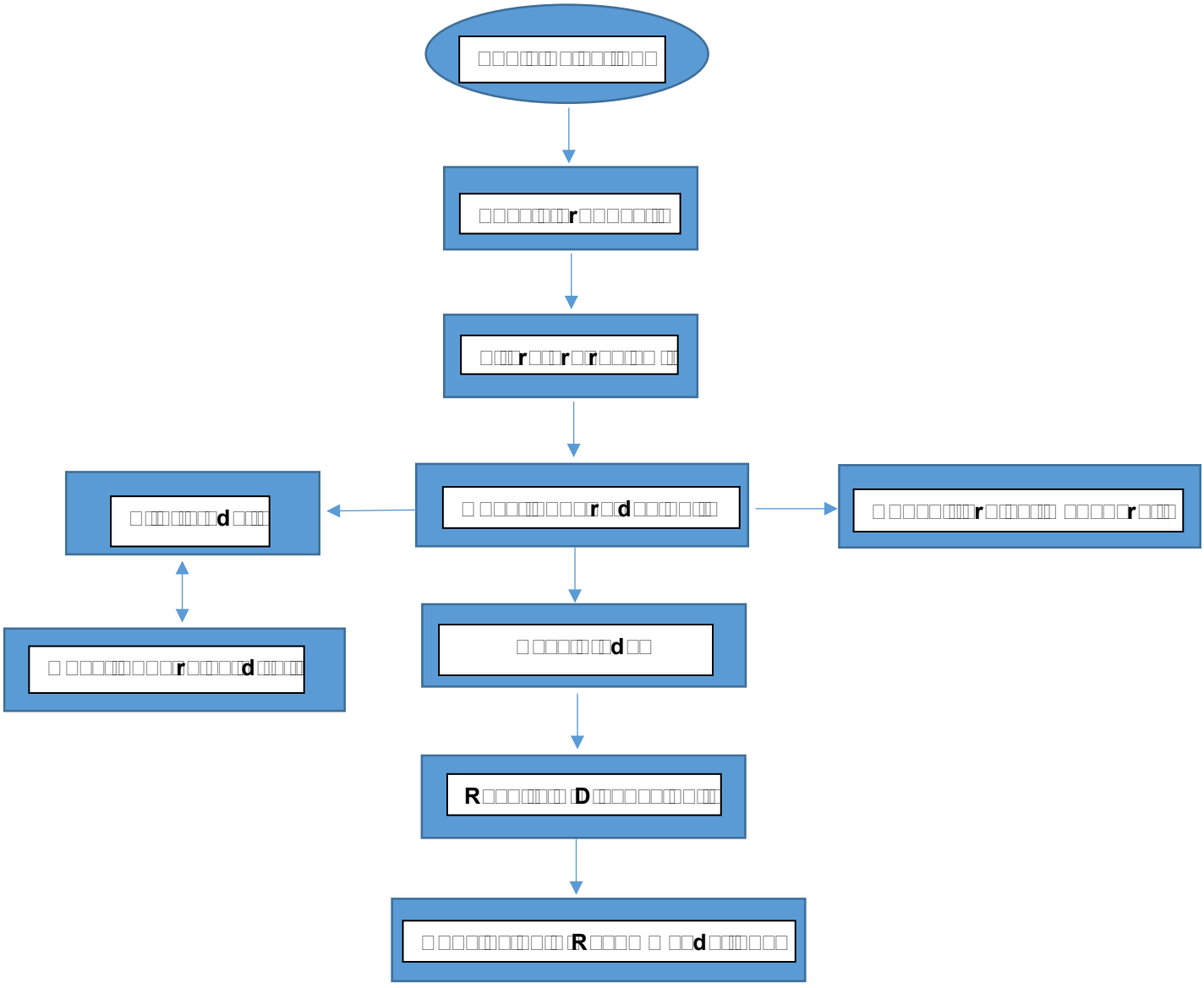

Figure 2: Diagrammatic Representation of Outline of Thesis

1.1 Background of the Study

Project management existed for a very long time. Project management is management of complex tasks so what is needed is attained. Project management approach in project delivery evolved in the United States of America (USA) when it was first used by the American Army for military projects execution. The success recorded through project management approach emerged in to an important activity in the Defense sector. Furthermore, led to its establishment as a reliable method of project delivery in other large-scale government projects like construction, manufacturing, health, information technology (IT), media, pharmaceutical, education and entertainment (Oyedele, 2012).

Many countries have adopted this approach, but it is still unpopular in developing countries, especially in Fiji. There have been studies around the world that have focused on planning and managing development projects to facilitate development and economic growth in developing countries. Unfortunately, no significant research is found regarding the challenges of project management of projects in Fiji. This presents opportunity to fill the gap in the current body of knowledge to ensure that it meets the academic demands as well as greater benefit to this region.

1.2 Research Objectives

The Rationale developed in the above section leads to the following research objectives:

- Investigate the issues related to the infrastructure projects in Fiji
- Explore the current practices of project management in Fiji
- Study of past and on-going projects presented as case studies
- Identify strategies to increase the skills and capabilities of project managers
- Find strategies to improve project management practices

1.3 Background of the Fiji Islands

Republic of Fiji Islands is a hub of pacific island and holds geographical importance. Fiji is currently undergoing extensive developments under the current government. One of the main priorities of the current government is infrastructure developments and billions of dollars have been allocated to facilitate this. Most of the funds are borrowed/ donated from her developing partners like Asia Development Bank (ADB), European Union (EU), World Bank Group, China's Development Aid and many more. Fiji is on the path of modernisation to reach its desired goal. (Fiji National Report 2013).

The proposed research needs to be implemented for the reason that despite a tenfold increase in project investment, legislative and institutional mechanisms. Fiji still lacks capacity to effectively monitor and implement these regulations is resulting in poor management practices. (Fiji National Report 2013).

The expected research outcome will be a useful for the Fijian universities, contractors, private sectors, government, foreign investors as well as aid donors. This paves the way for future researchers to make further extension to this topic. Furthermore, the outcome of this research will be used for the development of strategies to improve project management performance in Fiji.

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The research project includes: the identification and assessment of key infrastructure project areas in Fiji like roads, ports and harbours and housing.

Investigating as to why project delivery is an issue in Fiji, determine the factors that are causing the problems, develop possible solutions to mitigate / address project management failures, and prepare a study report that outlines all the collected information, investigations, possible options and recommended solutions. The proposed research will be limited to engineering aspects of project management only.

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This thesis will consist of 5 chapters. Chapter 2 reviews the existing literature on project management of infrastructure projects and provides an insight into the applications and background of Project Management and challenges faced by Project Managers.

Chapter 3 provides a detailed description of the methodology adopted in this research. The data gathering process and challenges.

In Chapter 4, the results of the thesis are presented. Chapter 5 presents the case study which validates the results from questionnaire survey with two infrastructure projects in Fiji. Chapter 6 outlines the major findings of this research and provides recommendations for future research.

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The literature review presented here would provide readers with existing knowledge in the field of Project Management and allow the appreciation of the challenges faced by project managers managing projects. This chapter discusses the application of project management and reviews the existing research available on project management.

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The key to a triumphant project is planning (Hamiduzzaman 2011). Many authors state that depending on the project size, planning the project requires a substantial commitment of time, energy, and resources. The implementation phase of the project is only successful if the project plan and the project team are perfect. (Hutcheson, J. M. (1984); Debabrata Kar 2009).

Other researchers such as Ofori (2007) and Alias et al. (2012) implied that the construction industry is one of the major sectors that contribute and boost a national economy. However, there the industry is tarnished by a series of failed projects. Ofori discusses in broad terms the importance of project management and performance of project manager is a key factor in the success of any project. Furthermore, Lewis (2007) affirms and expresses his concerns that developing countries are failing and not developing and are left behind because of poor project management. He also outlines that all countries should formulate appropriate medium – and long-term action plan to improve the performance of the construction project managers in order to address infrastructure developmental constraints facing the country.

There is currently no specific study of project management in Fiji. However, there have been many studies regarding the planning and implementation of projects in developing countries, such as, the effects of construction delays on project delivery in Nigerian construction industry Aibinu et. Al (2002); Planning and Managing of Development Projects in Bangladesh Hamiduzzaman (2011). And many more.

Baharum et al. (2012) noted that there are no guideline and criteria of best practice that governs project management. Tan (2004) highlighted that no nation can be fully developed without a proper project management. Baharum et al. (2012) also emphasized the need to improve project management performance is by educating the project managers and selecting the right project manager for the right job.

In the following, we briefly discuss the historical background of project management, some of the research articles that deal with the subject of challenges in project planning and implementation.

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The principles of project management have been utilized since 3000BC with the construction of many ancient structures like the great pyramids, the Great Wall of China, the Panama Canal and many more. During the 1910 Gantt chart was developed by HenryGantt to aid project scheduling (Trabold 1922). Gantt chart was effectively used in the Hoover Dam construction in 1931. Gantt charts provide a visual view of the tasks that needs to be completed in a project. In late 1950's Morgan R Waker of Dupont Corporation and James E Kelly of Remington Rand developed the Critical Path Method (CPM). CPM is a step by step project managing techniques that integrate planning and defines critical and non-critical task with the goal of getting the task completed on a time. CPM was first implemented in 1958 on a chemical plant construction project. It was later used for the Manhattan project (Thayer 1996).

In 1958 the US navy in association with Aerospace Company Lockhead missile system developed the Program Evaluation review technique (PERT) for the development of Polaris-Submarine Weapon system. The PERT'S aim was to save time for projects. PERT is a decision making tool that was purely designed to control approximately 3000 contractors in the Polaris Missile Project. (Stauber et al; 1959).

To facilitate military campaigns in 1962 the US military developed the work breakdown structure (WBS) to divide the large projects into manageable sections. WBS focuses on the final deliverables rather than the entire work required, allowing costs to well-planned and straight forward assignments of tasks. (Haughey 2010).

The Theory of Constraints (TOC) is an improvement of CPM and was developed by Eliyahu Goldratt in 1990. TOC was further modified into the concepts of the critical chain project management (CCPM) in the year 2000. CCPM emphasizes the resources required to execute the project and to manage resources evenly loaded with more resilience to time and less resilience to resources. (Steyn 2002).

Project Management Institute is the World's leading non-profit professional membership association which was founded in 1969 to educate and promote Project Management around the world. (PMI Founders n.d). PMI publishes the Project Management Body of knowledge (PMBOK) standards to continually improve the profession for modern project

managers. The PMBOK guide is a powerful tool for project managers. Project management is the application of knowledge, skills, tools and techniques to project activities to meet project requirements (PBBOK Guide, 4th Edition)

According to Alias et al (2012). Project Management has clearly been designed to achieve a successful outcome of the project. However, without a proper practicing, it can become dreadful and convey a different result.

Acknowledging the importance of project management, it is observed that over the years the advancement in technologies are driving the speed of innovations. This drive has developed new project management tools, methodologies and skills that are vital for project managers to deliver successful projects. Therefore, finding the right project manager for an infrastructure project is a major task in project implementation.

From the above literature review project management can be briefly summarised as follows:

- Project management is a unique field.
- Project management is the application of knowledge, skills, tools and techniques to plan, organise, initiate and control the implementation of the projects.
- Successful project management requires vigorous planning. Planning will include setting project goals and objectives, scoping, estimating cost and defining permissible budget.
- Project management has a beginning and an end.
- Project management uses tools such as work breakdown structures and Gantt charts and much more to track progress and measure accomplishment.
- Project management needs resources to operate.
- Project management is a group of interrelated processes, implemented in a progressive manner to reach the desired project outcome safely.
- Project management reduces project risks significantly.
- Project management was started in 1950’s
- The military was the first institute that adopted project management.
- Most countries have professional project management bodies.

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A project is defined by PMBOK in the following way: “A project is a temporary endeavour undertaken to create a unique product, service, or result” (PMI, 2014).

A project will have the following characteristics:

- Goal-oriented
- Sequence of activities
- Unique events
- Finite with a begin and end date
- Limited resources and budget
- Team of people
- End product

[redacted]

Many researchers indicate that the objectives of a project are mainly defined in terms of time, cost and scope and rationally this was also used to measure project success. In project management this is referred to as the triple constraint while some researchers like (Munns et. al; 1996) refers this as Iron triangle presented in figure 3 below. Furthermore, over the years, researchers have found out that the traditional iron triangle has derived many more shapes in project management. A different project manager has different styles and strategies when it comes to project management.

Figure 3: Triple Constraints (Rory Burke 2007)

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As documented from the source of the project management body of knowledge which is produced by the project management institute (PBBOK Guide, 4th Edition). Project life cycle consists of a series of process that project managers take to deliver a project on time. These processes mainly include the pre-feasibility, feasibility, planning, implementation, handover and project closure. Figure 4 below illustrates generic project life cycles.

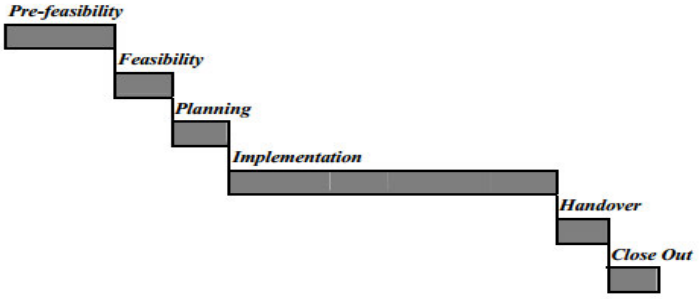

Figure 4: Typical Project Life Cycle for an Infrastructure Project (IDC Technologies)

Using this view, Baloyi (2013) highlights that these processes, manage inputs to and produce outputs from specific activities for example, the feasibility report could be an input to a preliminary design phase where decision point is made from one of the feasible alternatives. The out of a design phase can be detailed design, construction drawings and specifications, cost estimates and tenders. This advancement involves project management insights, expertise, tools and techniques, including change management, contingency development and risk analysis and mitigation techniques. Figure 5 below shows the project context and the different process involved to deliver the project outputs.

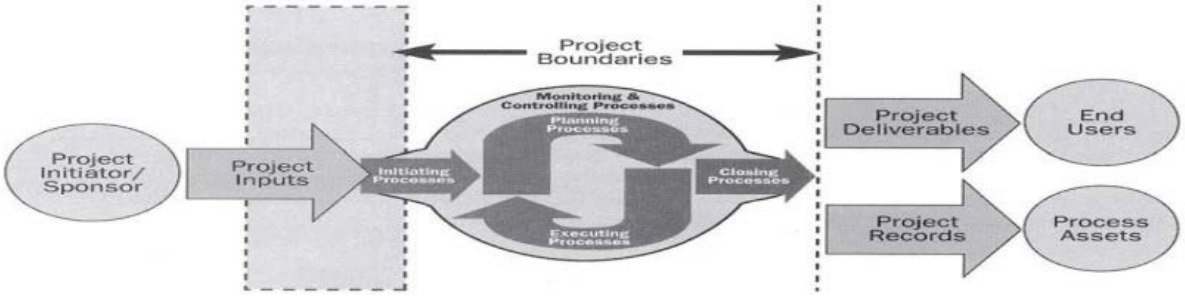

Figure 5: Shows Process in Place to Manage Project Inputs to Deliver the Outputs (PMBOK 2004)

The management and control of cost are fundamental to all projects. The life cycle costs of a project can be influenced by inadequate planning, ineffective approaches to identifying risks, managing and controlling client needs, project scope and project cost. Building on the idea of controlling cost overruns Smith (2007) in his research indicates

the importance of engaging a cost consultant in the planning phases of the project for the purposes of effective cost management and project controls. Over the last decades, many research efforts, including Abbasi et al. (2000). Indicates that planning phase is the most important phase in a project life cycle. Furthermore, it may be considered the most time-consuming phase, but at the same time the most rewarding one if done adequately. Adding on if critical decisions are made in the planning phase the greater is its potential to influence the project life cycle costs. This concept is depicted in figure 6 below.

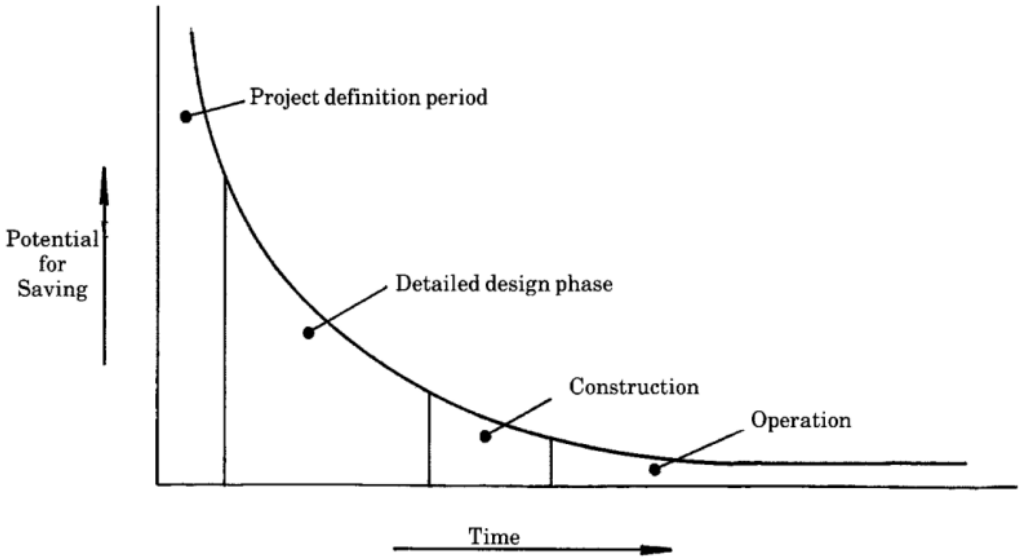

Figure 6: Shows Decision Influencing Project Cost (USQ 2014)

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According to the researchers' projects may possibly succeed or fail to reach their goals. (Lehtonen and Martinsuo, 2006). The achievement of project goals requires efficient project control (Nieminen and Lehtonen, 2008).

In project management life cycle, there are 5 distinct phases. We can call them initiating, planning, organising, controlling and closing. Each phase is unique and have specific steps involved that expand the process into a detail set of processors. The figure below shows the different phases (Weiss & Wysocki 1992).

- Initiating: is the starting of the project and selection of project manager who normally carries out feasibility studies on the project. Project budget and stakeholders are also identified.

- Planning: sets the direction of the project and involves deciding the objectives of the project.
- Organizing: involves selection of team members and other resources to accomplish the goal.
- Control: monitor project progress at discrete points during project duration.
- Close: after planning and implementation projects are formally and informally closed. Final sign off by all parties and issuing of the final report are major process of project closing.

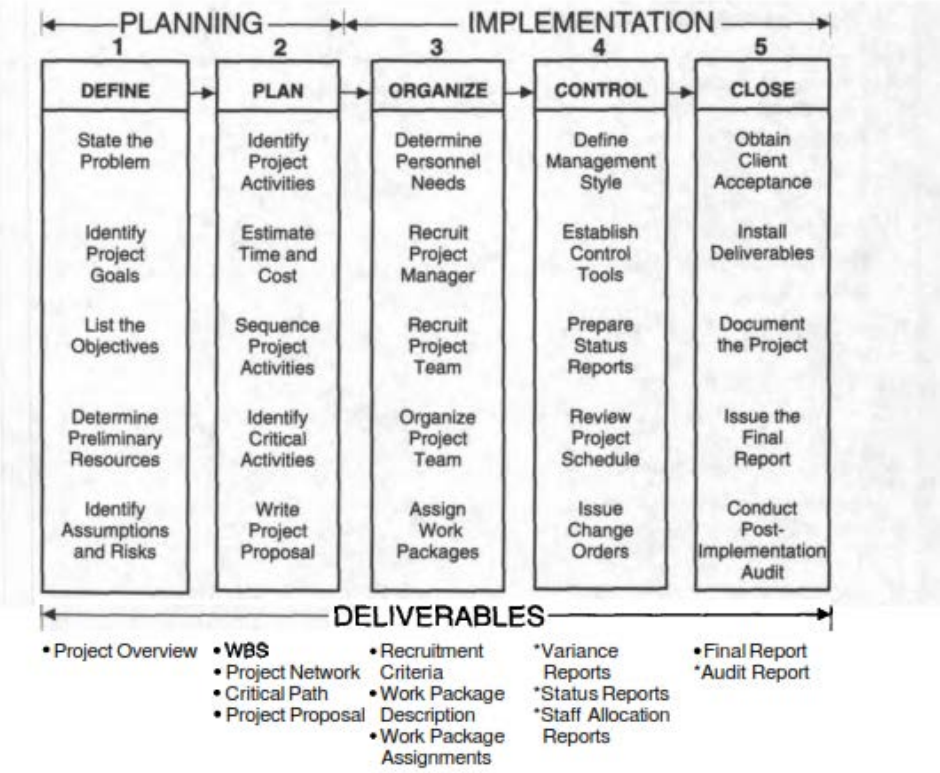

Figure 7: 5 Phases of Project Management (Weiss & Wysocki 1992)

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Project management practices vary depending on the project environment. Project environment can be defined as a connection, where the project is processed. In a commercial project environment, the projects can be classified in various forms such as donor funded project, a government funded project, commercial/for profit project, non-profit, and military projects. There are numerous factors that interacts with the project environment, this factor is mainly physical, economic, cultural, financial, ecological, operational, organizational and social. Furthermore, this factor also influences the project

positively and negatively (PMI, 2004). Figure 8 below depicts the project and its environment. From the figure below, it can be seen that that the project environment is a series of overlapping circles linking to each other, therefore it is vital for project managers to understand the rational of each team's roles and responsibilities in a project.

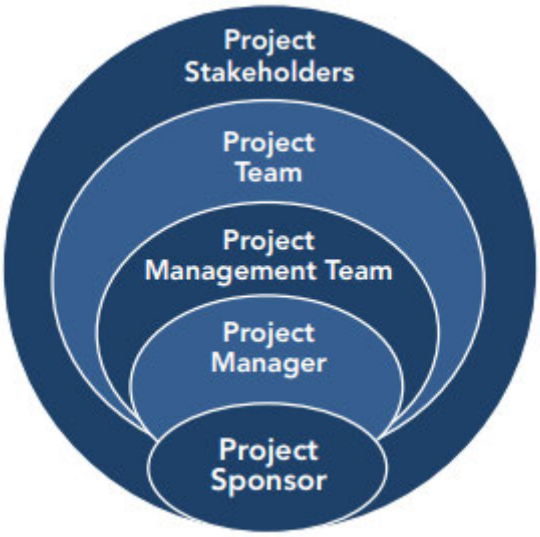

Figure 8: The Project and Its Environment (Paul Newton 2015)

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Projects must be delivered on time that is meeting the expected deadlines, the project must be finished with the permissible budget that's the cost aspects of project success and most importantly must be of the required quality. International Project Management Association (International Project Management Association, 2006) also acknowledges that project success is adherence to criteria of time, cost and quality and confirms that this criterion was the first model of project management success.

Figure 9: Overview of Project Management (John Wiley & Sons 2006)

However, after further studies carried out by (Munns et. al; 1996) it was found that even if the projects are delivered within time, cost and quality is only proven to be part of project success. He implied that there is a further dimension of project success, such as the strategic effect of project's end value to an organization's objective, the relevance to the users of the project and the sustainability aspects after project completion also must be considered and controlled to ensure true project success. This argument is further support by several researchers (De Wilt, 1998; Shenhar et al, 1997; Pinto and Slevin 1988) that there could be different criteria for the success of the project. The figure 9 below illustrates the project success criteria perceive by Pinto and Slevin.

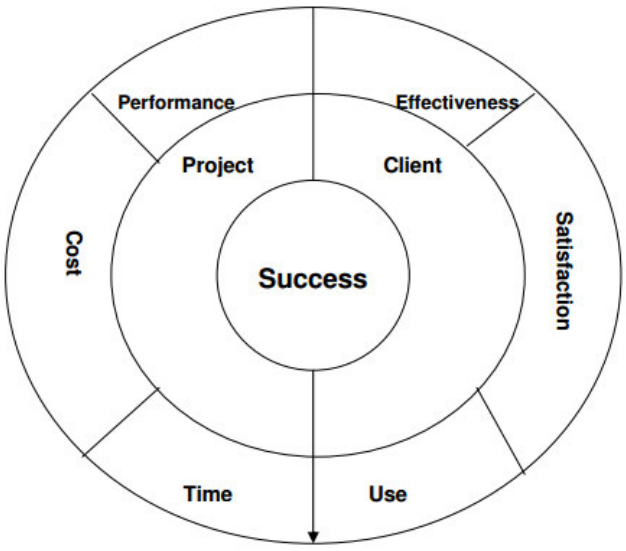

Figure 10: Project Success Criteria (Cooke-Davies, 2004)

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Project Managers play a vital role in managing projects. The project can be simply defined as a temporary endeavour to create a unique product. There have been extensive studies on project managers in terms of their delivery, selection, leadership, personality, competency and overall performance. Project managers have overall responsibilities to strategically plan, organise, control and lead projects ensure that projects are completed on time and within the allocated budget and according to specification. To ensure project success a project manager must be able to direct the team to a common goal. Selecting the right project manager for the project is always a challenge for any project team Ahsan et al. (2013). According to Crawford (2000) in general and Chen et al. (2015) in construction industries, have recognized that project leadership is an important component of project managers' competency skills. Furthermore, Yang et al. (2011) and Obusami e al. (2003) established that in construction industries project leaderships are directly related to project success.

Every project is unique, and most projects will encounter unexpected challenges. Payne and Turner, 1999 supports this statement by highlighting that PM practices vary significantly from one type of project to another. Tan (2004) emphasized the importance of selecting an experienced and qualified project manager for a job to avoid unnecessary mistakes and pitfalls. Other authors such as (Archibald, 2003) and Jugdev et al. (2007) corroborates that PM is a critical success factor (CSF) in a project and must be equipped with skills. (Soderlund and Maylor, 2012) discusses that most project managers focused mainly on hard skills and not soft skills in the implementation of projects. According (Soderlund and Maylor, 2012) hard and soft skills must be combined together to achieve better results.

Gray and Larson (2002), discuss that there are various types of project managers because they have special skills that needs to be fill special needs and clearly, project management is a unique and a challenging profession. In spite of that project managers must be competent to be able to integrate everything to achieve the project objectives and deliver projects within acceptable time and budget.

Traditionally, the project manager has been trained to handle scope, cost estimation, scheduling, team building and decision making, but because of more complex projects the skill set of project managers has been increasing.

Some of the key skills that the PM must possess include:

- Planning
- Expediting
- Political sensitivity
- Team building
- Good communication
- Problem solving skills
- Good listening skills
- Organisation skills

But this skill will not warrant the PM success because PM' generally work in a goal driven environment that requires additional skills, and abilities where leadership skills becomes handy. Furthermore, the PM must ne also good at the following:

- Flexibility in management styles to effectively manage change
- Creative as a problem solver
- Credibility
- Tolerance for ambiguity
- Technical skills to give the project manager the credibility to provide leadership on technically based problem and the ability to communicate in the language of the technicians
- Administrative skills would include planning, organizing and controlling the work
- Interpersonal skills to provide direction, communicating, assisting with problem solving and dealing effectively with people without having authority.
- The project manager must be an interdependent person who is self-aware, principle centred and able to motivate and empower team members.
- Manage client expectations
- Strong goal orientation
- High self-esteem and should acknowledge their own errors

[illegible]

Delivering the defined project on time, within budget, and according to specifications.

[illegible]

Project managers are unique people they are leaders of the project. Project manager plays a major role in the planning and execution of a project. Project managers deal with many challenges throughout the life cycle of the project from concept till closure. Some of the biggest problems the project managers face is failure to understand the outcome of a project, failure to understand the stakeholders and working in an environment that does not support project management.

Project managers from time to time manage limited budget, smaller staff, shorter deadlines and more demanding clients. Thus, project management becomes a very stressful job.

According to Project Management Institute (Project Management Institute, 2004) managing scope, time and cost is directly related to project success. However, the relationship among these factors is such that if one of the factors change it will directly affect the other factor which will sway the project quality. The project manager must tightly manage these factors to ensure project success.

Managing people is always a challenge there are different people on the team with different mind-sets. To overcome these challenges, project manager needs to concentrate on team building process from the very beginning of the project to avoid conflicts and friction among the team. The project manager should implement a team-oriented way of working together by involving team members in implementing project plans, making decision and participating in project workshops. This will keep the team motivated and focused.

Many researchers have highlighted the importance of early involvement of stakeholders in project planning (Olander and Landin, 2005; Yang and Shen, 2015). The stakeholders in this context can be defined as anyone who is affected by the project. They can be policy makers, companies, sponsor, local governments, the neighbours, project team or even family. Project managers often fails to understand stakeholders and their involvement in a project as a result this causes unwanted delays and project failures. Davis, 2016 emphasizes that stakeholder satisfaction is a key element that influences project cost, quality and time. Leung et al. (2004) found out that stakeholder satisfaction

can be achieved through management mechanisms such as communication, participation and commitment. Henceforth, stakeholder management is a challenge and effectively managing stakeholders is a crucial indicator of infrastructure project success.

Project managers often has to deal with complex projects which are very challenging and for right execution they require preparation. Planning is considered one of the most important functions in project management. Shield et al (2016) from their research found out that global competition has increased in the last decades there has been a significant increase in projects. Indicators have proven that a substantial number of projects are failing to meet objectives. With the limited project successful project management process, its implementation through planning and execution has become an area of considerable interest.

Previous studies about project management has focused on project management methods, techniques and tools, numerous critical success factors have been identified from these studies. This paper proposes the application of strategic management theory to develop and modify more generalized project management approach to improve project success. Qualitative research methods in the form of questionnaire surveys were carried out at the first stage. Six local project managers completed the initial survey and their responses were refined and the finally an online survey was carried out on the website of the project management institute.

From this study it was found that application of strategic planning characteristics of prior strategic planning research to project management yielding project success. From the discussion of this research it can be established that proper planning of project is an important factor of success and may require a substantial commitment of time, energy, and resources. The project manager must develop a frame of mind that takes planning seriously.

Communication is the act of imparting or exchanging information with some. For example, interchange of thoughts, opinions, or information by speech, writing, or signs. Effective communication is the heart of project management. Many surveys have been conducted in the past that substantiates that poor communication is one of the major causes of project failure. A project manager who cannot effectively communicate with its client or team members will cause the project to fail, therefore it is vital for project managers to effectively communicate.

The consequences of poor communication are discussed by Steyn H. et. al (2008) and according to his research ineffective communication can lead to misunderstanding in respect of construction projects which can lead to poor planning of tasks and process,

uncertainties regarding responsibilities, scope or objectives of construction hence causing project failure.

Zulch (2014) in his research title Communication: the foundation of project management asserts that importance of communication to effectively communicate critical constraint factors in project management such as cost, scope and time, and quality, which are the results of the interrelationship between scope, cost and time. Furthermore, he explains that communication is the function that integrates cost, scope and time to achieve a quality product and may be seen as having a foundation function in project management.

Challenges faced by project managers in managing cultural issues cannot be ignored. Project team and project managers have to deal with several cultural waves which influences the delivery of projects. Rodrigues (2010) draws attention that culture controls a project to a great extent. He discusses that various problems faced by companies, are due to conflicts caused by different cultures. Gestoso et. al (2014) further highlights that project managers managing projects around the globe, success is the ultimate goal and to achieve this, project managers must not neglect the importance of managing and understanding diversity and culture. Gestoso, indicated that the waves of cultural effects are valued and taken into consideration during project planning and control activities. Furthermore, this study also highlights the importance of managing culture as to managing any aspects of the project.

However, Obikunle (2002) discovers that project manager faces daily challenges in understanding the culture of the team members. This challenge is faced because project managers lack knowledge and skill in cultural diversity. Furthermore, he stressed that this issue should be treated as a positive challenge for the managers and advises managers to develop skills in cultural diversity to effectively manage their teams.

Building and maintaining positive client relationship is also a challenge for project managers. Over the years project managers gain valuable experience, build reputation and gain new clients. To ensure that the clientele increases project managers must be consistent with their performance and try to further improve project management skills combined with people skills to build stronger connections with clients.

According to Davis and Pharro (2013) relationship management is so important in project management that the researchers claim that relationship management is the next generation of project management. Walker (2013) also highlights that project managers must have skill and attribute to lead or influence others and ensure that relationship effort is sustained. The project manager must have social networks and soft skills to build relationships among team members.

If the availability of resources is liberal or unlimited managing resources becomes a challenge for project managers. Resource is a physical variable, such as machines, money, space, materials or men. The resource is always scarce availability of manpower, funds, capital investment is critical, therefore, planning to be done in such a manner that resources are utilized in a more or less uniform manner.

The project scope is a document that defines the project. The level of scope definition in projects is significant. A well –defined project scope enables the project manager and project stakeholders to develop and maintain a common understanding as what product and services the project will deliver. If any change in expectations is not captured early in the project scope will create confusion. Mohamed (1997) in his study states that projects that have a well-defined scope during the planning stage are less likely to encounter surprises such as scope creep, schedule slippage, cost overruns and deliverables. Generally, when there is a change in scope it will be affecting project schedule, budget and project plan and if changes occur later in the project, the greater the increase in the project costs.

Risks exist on all projects and managing project risks is a great challenge. Project manager role is to understand the kinds of risks on the project and it is his or her responsibility to develop and implement plans to mitigate these risks and the area of risk management is essential to achieve successful project completion.

Szymanski (2017) highlights that before the implementation of the project, it is significant that each project should undergo risk analysis performed along with the identification of possible risks.

A different project manager has different comfort levels of risks, but the best project manager will be more risk averse than the others and this skill will aid in project success.

Poor quality management can slip the project off the rails and all project managers are aware of these and the challenges associated with managing quality. Ingason (2015) highlighted that quality management system is a standard collection of policies, procedures, process and stress out that organizations that plan for internal cost of the implementation of the quality management system and the involvement of their employees tends to drive consistency in employee training and this lead to employee morale and happier customers. A well implemented quality management system will ensure quality products and services with fewer defects and all of the above increased profitability and cost saving.

The geographical environment of the project can have a major effect on a project as discussed previously that the multiple cultural will play a different role. Many different legal jurisdictions may influence the project, for example, different countries have different public holidays and working days which affects the schedule for the projects. Movement of good between countries becomes complicated different political and legal systems are in control in different project locations. Time difference in countries affects the ability of the team to work together all of this come into action when the project managers' work on international projects and this impact needs to be considered when doing project planning.

Now day's projects are more complex than olden days and project managers face an array of challenges related to political and insecurity problems. They can be mainly national nature like the series of notable coups d'état in Fiji, or partially nationally or international like the turmoil in Middle East countries. These events are outside the control of the project manager and causes unanticipated delays to project.

Upholding professional conduct in project management is a concern. Project managers face many ethical challenges in project management. They have to make ethical decisions on a daily basis and ensure that the code of conduct of everyone involve in the project to be upheld at all times. Project managers often deal with offers and gifts from contractors, pressure to compromise quality to meet contractual clause and many other problems such as bid rigging, low-balling, bribery, expense account padding, use of substandard materials, compromising health/safety standards, withholding needed information and failure to admit project failure at the project closure stage. (Bharadwaj 2013)

In a paper on the ethical dimension of project management Helgadó´ttir (2007) noted that educating project managers on the topic of ethics is very important. This will help project managers to view projects in an ethical way.

2.2.3 Challenges that cause p r oject failu r e

Triple constraints such as scope, time and cost are deeply challenged, and project management success is related to these criteria's. However, according to Project Management Institute (Project Management Institute, 2005) project manager is not responsible only for time, cost and quality management, but also communication, human resource, procurement management, scope and risks he or she is the most responsible person for project success.

After carrying out literature reviews in the project management domain all research indicates that a considerable number of projects fails due to the following reasons:

- Projects inadequately planned and implemented
- Inappropriate team members, including project managers
- No one taking in charge
- The project is under budgeted
- Insufficient resources are allocated
- Inability to manage change
- Project objectives not properly defined
- Project goals poorly defined
- Lack of stakeholder involvement
- Stakeholders do not provide support
- Scope creep
- Risk analysis not performed
- Project managers lack knowledge and skill in cultural diversity.
- Failure to manage relationship with project team, especially clients
- Social and political issues
- Poor communication skills
- Poor quality management

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All projects, particularly those relating to engineering do slip initially or in various intermediate stages during implementation. Planning and managing projects over the years have become a challenge and there is an ever-growing need to improve project delivery. According to APM, 2015; PMI, 2015; Standish Group, 2015 large percentage of projects do not meet their objectives and only 40% of project objectives are aligned with organizational strategy (KPMG, 2010; PMI, 2014). It is noted, that there has been significant research conducted in this area, but it has become a rising concern that despite so many research papers published to support the importance of project planning and implementation there has been a shortfall of projects meeting objectives and key goals.

It is often inappropriate to state that technology and innovations in project planning increase the chance of project success. Over the last few decades, there has been increasingly more planning software's like PERT (Program Evaluation and Review Technique) and CPM (Critical Path Method) with the application of computers, smart phone applications, iPad etc. Made available to practitioners. Debabrata Kar (2009) in his study states that these modern tools are certainly helpful in managing the project, but in the developing countries like India Civil Engineering construction projects are still found to be delayed and go beyond control.

There are host of serious problems like lack of resources, lack of funds, natural disasters, and unavailability of land, unavailability of materials, delays in approvals, political influence, economic, operational, social and physical difficulties and many more latent problems depending on the scale of the project.

However, Kar et al. (2007) states that the main reasons for project failure in developing countries are due to lack of advance planning, a holistic approach, deficiency of engineering and management strategies, communication problems with stakeholders and the absence of a methodical approach.

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Upon approval of project implementation begins. During this stage the Project Manager and the project team are selected. The project manager has several responsibilities such as managing issues, managing people, managing communication and monitor projects to ensure that it is completed on time. According to Sabeghi et al. (2015), project plans always change, and changes to the baseline schedule of projects seem to a challenge. Sabeghi argues that to successfully deliver a project planning and execution must be properly implemented.

Furthermore, John M. Nicholas, 4th published book on Project Management for Engineering, Business and Technology states that large construction projects are often in the news because the main cause of project failure is frequently poor management and lack of control. In many research articles it was found that during implementation phase project suffers from many problems like schedule slippages, cost overruns, scope variance, unrealistic deadlines, risk mitigation and leadership, but the most critical component is how to manage the project and get continuous control to satisfy the project objectives. Various studies have examined the factors that facilitate the implementation of the project, but the most important factor is planning. (kar, 2007; Lehtonen and

Martinsuo, 2006). They verified that planning is the heart of project implementation and if planning fails then implementation fails.

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Many researchers in the past have highlighted the importance of training and up Skilling professionals in the field of project management. Ogunde et al. (2017), in their studies recommend that training and skill modification programs should be compulsory for project management professionals to aid the sustainability of construction project management systems in Nigeria. Ali (2010) claims that educating, and training project managers will enhance the leadership capabilities of project managers. Radujković et al. (2017), also portrayed the importance of education on project management competence and strengthening project team and organisation competence. Alias et al., 2012 considered that to achieve the best practice in project management it is essential that training and professional development programs are set for project managers.

After conducting several studies, it is deemed that continuous improvement in project management is vital. For future project managers who will be coming from different discipline of engineering, will require extensive education and training programs to be able to meet the requirement of this ever-evolving field. Projects are getting more complex than ever before the future project managers will require different professional skill sets to effectively manage these complex projects.

Government and education policy makers should start developing frameworks on how to cater the higher education needs for future project managers in Fiji.

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The construction industry is an important sector of a country's economy and has multiple backward and forward linkage with sectors. (Mir et al. 2007). The construction industry is one of the key components of Fiji's economy. Construction projects in Fiji include infrastructural and utilities project such as buildings (hospitals, schools, and factories), electrification, jetties/shore projections, pipelines, roads/ bridges and water works. Currently, on-going infrastructural projects consume 40%-50% of annual capital budgetary expenditure. Most of the projects are out-sourced to contractors and

engineering consultants for execution. Conversely, Sen et al. (2018), highlighted expenditure boosted by infrastructure projects will boost Fiji's economy.

Construction industry council Fiji (CIC, 2017) reported that construction industry is growing at an alarming rate. However, also reports challenges such as:

- High construction cost because of the boom.
- Construction delays.
- Construction cost over runs.
- Shortage of skilled labour.
- Shortage of building materials like cement.
- Heavy reliance on imports and low-quality work.
- Importing second hand equipment out of Australia and New Zealand.
- Unavailability of construction equipment like excavators.
- Brain-drain caused by low salaries offered to engineers, technicians and tradesmen leading to lack of skilled workers.

Furthermore, CIC (2017), has highlighted that local builders find it easier to import building materials from overseas to keep up with the demand and this has skyrocketed the construction cost.

Pacific Cement a major cement supplier catering approximately 80% of the Fiji market ceased operation. This had caused a halt in the construction works in Fiji. To ease the supply shortage the Fijian government allowed local business to import cement from overseas. The cost of freight and the associated cost of important services made the end price very unattractive. (Nath 2018)

The review shows that the construction industry in Fiji is still at a developing stage. Majority of the equipment and plants are imported from abroad.

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CIC is the official body of Fiji's construction industry. The purpose of the CIC is to support contractors, suppliers, manufactures, tradespersons, construction managers, quantity

surveyors' sub-contractors, architects, developers, government representatives and project managers. Some of the services provided by CIC are:

- Working on a strategy to improve the licensing of builders.
- Working with government to improve education and training
- Provide training, professional development programs for builders and trades
- Advice on building regulations
- Manage workplace safety
- Provide technical assistance
- Assist consumers from unfair practices and maintains standard of work

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Infrastructure across all sectors serves a common purpose and that is to deliver services to people. Water and wastewater treatment facilitates are setup so people can access clean water and safely dispose of waste. Grid infrastructure supply electricity to households and businesses. ICT infrastructure enables people to communicate with one another and share information. Roads, ports and airports are established to facilitate movement of people from point to another and similarly facilitate movement of goods and services. All three transport sub-sectors are about enabling the mobility of people and goods. The upgrading of Fiji's infrastructure to global standards is the government top priorities. (Joyti 2015).

Hardwicke (2005) stressed that Infrastructure assets play a vital role to support a nation's economic growth. Conversely, communities provided with road access has immediate impacts, such as facilitating market access and increasing household income.

Fiji Roads Authority Fiji (FRA) was established in January 2012 to effectively manage and develop Fiji's road network. According to FRA the road network is Fiji's most valuable asset. Expenditure and investment in infrastructure requires long term planning to ensure the money is spent wisely. FRA was setup as a planning and procurement authority with a view of developing Fiji's critical infrastructure such as road networks, bridges, jetties and street lights. FRA is accountable to Minister for Infrastructure and Transport through an appointed Board. FRA face many challenges on a daily basis getting the projects completed as planned. Some of the challenges are difficulty in obtaining gravel extraction licenses for unsealed road re-sheeting. The current government policy and legislation requires persons seeking gravel extraction licences to obtain approval signatures from

60% of the registered land owners in that particular area. Then submitting this application to the department of environment and lands department for approval. Finding 60% of landowners is difficult and time consuming exercise as many landowners have left the land and have migrated. The procedures of the Fijian Government Depart are very complex and take time to complete. As a consequences contractors are delayed with the road renewals works. Furthermore, delays by other Government Departments in land acquisition has resulted in failing to meet the programme of work planned for infrastructure works. (Fiji Roads Authority, 2014)

However, in the last decade or so, the high cost and myriad problems associated with maintaining the infrastructure services in Fiji has become onerous because of frequent natural disasters hitting the country. Provision of infrastructure services is challenging in these circumstances. (Infrastructure maintenance in the pacific, 2013).

Moreover, the impacts of which are exacerbated by climate change has significantly caused huge infrastructure damage. (Vula 2018)

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Fiji infrastructure consists of social and economic infrastructure and falls under the Ministry for infrastructure and transport (MoIT), Ministry of Economy and Ministry of Public Enterprises, Civil Services and Communications.

Water Authority of Fiji (WAF) manages infrastructure that provides clean water to urban and rural areas in Fiji. In additional to this WAF is also responsible for managing the wastewater. Municipal council is responsible for collection and disposal of many types of waste, including solid waste, liquid waste and hazardous waste. Fijian Government will be allocating resources to maintain the existing treatment plants and have plans to construct new water treatment plants, reservoirs and reticulation systems, rural water schemes, development of groundwater sources and distribution of tanks in rural areas. To meet the long term demand the government have identified potential new dam sites and will be undertaking feasibility studies prior to the development with a view of building climate resilient water infrastructure for all new projects. (Ministry of Economy, 2017)

Energy Fiji Limited is a capital structure manged by government agencies that provide electricity to urban and rural areas in Fiji. 99 percent of Fijian have access to electricity. The Fijian government is involved in this sector and have plans to expedite electrification projects in the rural and maritime areas so that the entire population has access to electricity and power.

Fiji's information and communication technology has a growth spurt in recent years. The provision of ICT services in Fiji is increasingly conducted by the private sector. The Government will expand digital connectivity through high-speed internet networks in all regions. Fibre optic ring around the major island will be one of Fiji's most success story. Hence, these development in the communication infrastructure will create a more conducive environment for commerce and development. (Ministry of Economy, 2017)

Throughout history, road infrastructure has a very strong linkage with the development and economic growth of a nation. However, currently the road infrastructure in Fiji is inadequate to cover the vast area of the whole country (Mavoa 2017). In addition to this Fiji's existing road is far from satisfactory. Fiji Roads Authority (FRA) is the organisation responsible for planning and maintaining Fiji $11billion road infrastructure which primarily consists of over 7600kms of road, 1200 bridges, 9000+ streetlights and 47 jetties. (FRA 2018).

Ports and wharves are the backbone of any country they constitute an important activity in coastal areas. Fiji's ports and major wharves are managed by Fiji Ports Cooperation Limited (FPCL). FPCL, is a partially privatisation company that owns and operate four major ports in Fiji; Port of Suva is the largest, busiest general port of Fiji. Fiji Ports facilitate commercial shipping operations for the movement of people and cargo containers. Overseas port facilities including local interisland, fishing and international barge port facilities, through the provision of ports infrastructure and related services to warrant ultimate security and safety. Currently Fiji Ports are undergoing extensive extension and reconfiguration of the wharves. (Fiji Ports Limited, 2015).

Airport are as important as ports. Fiji main source of income is through tourism and airports facilitate quick and easy travel within Fiji and the rest of the world. Fiji Airport is responsible for operations of public airports in Fiji and is a fully owned government commercial company. Fiji's airports are undergoing upgrading works to meet international standard. The Fijian Government is obliged to keep primary airports operating and have invested significant about of money to support the travel of high income tourist. Nadi international Airport is a prime example where the government spend $105m terminal upgrade project which involves a complete renovation of international and domestic terminal facilities, along with major airside extension. (Airports Fiji Limited, 2016)

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A contract is an agreement enforceable by law and is between two parties to do a certain things for a legal consideration. (Singh 2009). Sound prepared contract documents can lessen the impact of variations in construction projects (Keane, et al. 2010.)

The quality of the contract documents can significantly include the outcome of any project thus, contract document should be clear, complete and made available to all parties affected.

Each construction contract has its own different areas of risk. For a Project manager it is important to understand and distinguish between the different types of construction contracts that are predominant in today's industry and the risks that can arise. There are many types of contracts that are utilised in the engineering industry however, in Fiji the most common type of contracts are Lump Sum Contract and Design Built contract.

For small scale projects in Fiji Lump sum contracts are utilised. Where the Principal engage the services of the consultants to prepare tender documents for the contractor to tender and the contractor submit a lump-sum price to build to the requirements of these documents.

Major infrastructure projects such as roads, in Fiji are currently delivered utilising a Design and Build approach in which the contract execute both the design and construction under one agreement.

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This chapter describes the author's review of literature relating to the following major topics:

- Background
- Brief history on project management
- Project triple constraint
- Project life cycle
- Phases of project management
- What is a project
- Project management environment
- Project success
- Project manger
- Best practices of project managers

- Challenges faced by project manager
- Challenges that cause project failure
- Challenges in Planning in developing countries
- Challenges in implementation in developing countries
- Training for project managers.
- Construction industries in Fiji
- Infrastructure Services in Fiji
- Infrastructure Sectors in Fiji
- Contract Types

The following emerged from the literature review:

- In project management life cycle, there are 5 distinct phases. We can call them initiating, planning, organising, controlling and closing.
- Project environment is a series of overlapping circles linking to each other, therefore it is vital for project managers to understand the rational of each team's roles and responsibilities in a project.
- Project managers are unique people they are leaders of the project.
- Proper planning of project is an important factor of success and may require a substantial commitment of time, energy, and resources. The project manager must develop a frame of mind that takes planning seriously.
- Communication is the function that integrates cost, scope and time to achieve a quality product and may be seen as having a foundation function in project management.
- Many researchers like (Olander and Landin, 2005; Yang and Shen, 2015) have highlighted the importance of early involvement of stakeholders in project planning.
- Project team and project managers have to deal with several cultural waves which influences the delivery of projects.
- Project managers lack knowledge and skill in cultural diversity.
- Relationship management is the next generation of project management.
- Project managers must develop soft skills to hold the team together.
- A different project manager has different comfort levels of risks, but the best project manager will be more risk averse than the others and this skill will aid in project success.

- Upholding professional conduct in project management is a concern. Project managers face many ethical challenges in project management. They have to make ethical decisions on a daily basis and ensure that the code of conduct of everyone involve in the project to be upheld at all times.
- The project manager is not responsible only for time, cost and quality management, but also communication, human resource, procurement management, scope and risks he or she is the most responsible person for project success.
- In many research articles it was found that during implementation phase project suffers from many problems like schedule slippages, cost overruns, scope variance, unrealistic deadlines, risk mitigation and leadership, but the most critical component is how to manage the project and get continuous control to satisfy the project objectives. Various studies have examined the factors that facilitate the implementation of the project, but the most important factor is planning.
- It is deemed that continuous improvement in project management is vital.
- Smooth supply of building materials in Fiji seems to be a problem.
- The construction industry in Fiji is still at a developing stage and facing many challenges.
- Fiji infrastructures are significantly damaged by cyclones and floods
- Fijian Government is investing in infrastructure to support economic growth
- Major infrastructure projects such as roads, in Fiji are currently delivered utilising a Design and Build contract.

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[illegible] Methodology

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Research can be defined as a learning and a sharing process that identifies problems by following a step-by-step logical, structured and rigorous method, gather data, analyse data, and draw valid conclusions from them. (Sekaran 2003). Research is simple term, is concerned with defining the problem, formulating hypothesis, recommending solutions, collecting, organising and analysing facts and information and making conclusions.

According to Gajewsha et al. (2011), research projects encompass various numbers of chronological steps that generally initiates with finding the research area, investigating the area for knowledge gap and formulating research questions to fulfil the knowledge gap. A best investigation method that suits the researcher is developed along with research design and data collection techniques.

Gathering data require a research method. Easterby-Smith. et al. (2002) stated that methodology is the combination of techniques used to investigate a specific situation, whereas, methods are the individual techniques for data collection and analysis. There are two standard ways of conducting research they are qualitative research and quantitative research.

Saunders et al. (2003) define that in quantitative research the researcher ask specific questions and is concerned with numerical measurement and statistics data. Furthermore, it utilizes mathematical models to test the hypotheses.

In qualitative research the researcher purpose is to explore therefore more open ended questions are asked to study more from the participants. Therefore, in comparison to quantitative research the qualitative research is more concerned with the data that is not amenable to numerical measurement (Lancaster, 2005).

[illegible] Research Method

In this section the aim of the researcher is to identify the appropriate methodology for the research. Liu (2003) states that choice is affected by consideration of the research scope

and depth of the problem. The objective of the research is investigate the challenges in project management of infrastructure projects in Fiji. Therefore this research can be categorized as an exploratory study. Sekaran (2003) states that an exploratory study is undertaken when there are few or no earlier studies on similar problems or research issues in the past to refer to predict an outcome. Creswell et al. (2009) argues that qualitative research is exploratory and is useful when the researcher does not know the important variables to examine. Therefore, this type of approach may be needed because the topic is new, the topic has never been addressed with a certain sample, and existing theories do not apply with particular sample.

The aim of the research is to explore the project management practices in Fiji therefore the nature of questions posed are how, why and what. Yin (2009) perceives that in exploratory nature such as this case studies is the preferred method. The aim of this research is also to investigate the issues related to the infrastructure projects in Fiji and find strategies to improve project management practise and to increase skills and capabilities of project managers. Berg (2004) states that by many researchers adopt case study approach as a guide to their research. By concentrating on this phenomenon the researcher is able to uncover the manifest interaction of significant factors characteristics of this phenomenon. Furthermore, the researcher is able to capture various pattern, and more latent elements that other research approaches overlook. Yin (2009) reports that case studies also allow the capture and analysis of many variables however, restricted to a defined event which fits case study method adopted for this research.

After feasibility it was found that a mix method approach, which is the combination of both quantitative (questionnaire survey) and qualitative approach (qualitative analysis of existing case studies) is the most suitable method for this research. The quantitative approach will be used to evaluate the data that obtained through cross sectional survey while the qualitative approach will be used to identify the dimensions and validate the project management challenges. The feedback of the questionnaires will be based on the participants experience and practices. The data will be obtained will be analysed and computed using Frequency Analysis and Average Index.

The following methodology was deemed to be the most appropriate method of data collection:

1) Conduct extensive literature reviews to identify challenges of project management in infrastructure projects.
2) Create a questionnaire survey to obtain professionals' views and experiences with respect to challenges of project management of infrastructure projects in Fiji.
3) Disseminate the questionnaire to different relevant organisation for responses.

4) Obtain sample of ongoing and completed engineering projects to conduct a case study
5) Conduct a case study on each of the projects.
6) Determine the challenges in project management.
7) Using the information gathered, develop strategies for minimising the challenges in project management in Fiji.

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Extensive literature review were conducted to explore existing knowledge in project management and understand the relevant concepts. Literature were searched from various databases and websites, which include mainly relevant journals, conference papers, thesis, articles, newspaper articles and books related to the topic.

The knowledge attained form literature review was used as a basis to develop a questionnaire and during the interpretation of case studies.

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Questionnaire survey allows large amounts of information to be collected from a large number of people with limited effects on its validity and reliability. (Surrey, 2014). The semi-structured questionnaire was developed and distributed to different project stakeholders.

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It is almost impossible to gather data from the entire population, therefore samples are used to make this process attainable. Sekaran (2003) states that studying samples rather than the entire population is may give a more reliable result. The sample in this context can be defined as people who participate and contribute to the study through time, energy and information (Sumerson 2013).

The selection of participant is crucial for any research projects. Therefore, careful consideration is required as to who will be the best people that can be relayed to answer research questions. For the purpose of this research, it was deemed that roles such as Project Manager, Construction Manager, Site Manager, Building Foremen, Capital Works Manager, Senior Engineers, Senior Architects, Cost consultants, Donors and sponsors,

Government workers, engineering technicians, University lectures, Students, Politicians and other stakeholders within the Project Management sector are the reliable people to assist going forward with the dissertation.

The selected participant has managed projects before or were directly involved in project management. These participants have adequate knowledge in project management and are integral part of this dissertation.

[redacted]

Gaining access to case study data of private firms like NRW Macallan (Fiji) Ltd was hard due to client confidentiality agreement. To remit this it was decided that a questionnaire survey would be an imperative means to obtain data required for this study. Questionnaire surveys have been used previous relating to project management challenges of infrastructure projects across the globe.

Many researches have used questionnaire surveys before and found out that it is a very common and an easy method of conducting quantitative research. The quantitative is reliable and neutral method of conducting research studies, with results providing data that can be statically analysed to generalize findings and draw important conclusions. According to Surrey (2014) quantitative data is used more often to test theories and hypotheses and assumes that the sample is representative of a wider population.

In comparison to qualitative data, quantitative data are typically less detailed and easy to analyse.

To ensure that data collection is uniform through questionnaire surveys it is deemed important that questionnaires consist of the same set of questions asked and in the same chronological order and wording. Closed and fixed questions often strays away respondents' attention and interest this may also by chance force the respondent into a dilemma that they cannot quantify or explain. For the purpose of this research closed and fixed questions will be rejected. The method of collecting data through a questionnaire can include (Surrey, 2014):

- Online internet base questionnaire
- Telephone questionnaire
- Email questionnaire

- Formal interviews
- Postal questionnaires

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The questionnaire survey was designed for the purpose of highlighting the general challenges, project manager's faces on a daily basis when managing infrastructure projects in Fiji.

The questionnaire survey created for this research will be developed from extensive literature reviews and in consultation with the research supervisor. The current literature reviews have identified a number of central topics relating to the challenges of project management. These topics will be the focal point of the questionnaire design.

The questionnaire will be divided into six main sections and will include the following:

1. About the Project – will include details like description, funding particulars, client specifics, procurement method, project delivery method, contractor's details and project manager's details.
2. Instructions on how to fill the questionnaire
3. Profile of organisation/respondents
4. Main targeted questions regarding challenges in project management
5. Additional information
6. Contact information

The first section will briefly introduce the project aims and objective giving the reader some ideas on the type of response anticipated by the researcher.

The second section basically lays instructions on how the respondent will complete the survey. Special features will like colour coding and examples will guide the respondent all the way. The main target of the researcher is to ensure that respondent is able to complete the survey to the best of their abilities.

The third section aims to gather data on the organisation or respondent completing the questionnaire survey. Typical details that will be collected are name, age, position

(Architect etc.), Years of professional experience in project management and current project management commitment.

The fourth section will consist the main targeted questions developed from extensive literature reviews. Likert scale will be created using Microsoft word where the respondent can simply circle the responses that indicate how they feel about these statements. A sample of the Likert scale is shown in the table below. The use of five point Likert scale provides the respondent with a neutral position on answering the questions.

Table 1: Typical Likert Scale

	Always	Often	sometimes	Rarely	Never
Challenges in project management	(1)	2	3	4	5
Planning is important	1	2	3	(4)	5
Land procurement is a challenge	1	2	(3)	4	5

The Likert scales will be used throughout the questionnaire will include the following:

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□□ □□□□□

1. Low
2. Very low
3. Moderate
4. High

□□□Very high□

□r□□□□□□□□□

1. Always
2. Often
3. Sometimes
4. Rarely
5. Never

The fifth section will allow respondents to provide additional information that may be adding value to this research. This may include past experience in project management challenges.

The final selection is designed to acknowledge and thank the respondent for their quality time spend in answering the questions. Personal contact details of the respondent will be required in order to contact them if need requires.

[redacted]

The objective of this research was to provide a detailed explanation of the challenges of project management of infrastructure projects in Fiji. The researcher has selected infrastructure projects in Fiji as the context of this study mainly for the reason that the researcher is an external student based in Fiji.

The selection of research strategy for the research was subjected by the nature of the research questions which predominantly focus on project management challenges in Fiji and make the study as an exploratory study. Therefore case study approach was selected and Fiji is selected as a case.

The case study approach allows in-depth explorations of complex issues in the real life. Based on researcher seven years of professional experience spanning over the years 2012 to 2018, at least 5 ongoing and completed infrastructure projects around Fiji will be selected as the starting point of this case study.

A brief analysis and consideration will be conducted prior to selecting the best case studies.

[redacted]

In order to determine the challenges in project management of infrastructure projects in Fiji, a number of on-going and completed infrastructure projects will be investigated. For the scope of the studies and the resource available, case study information will be supplied from NRW Macallan (Fiji) Ltd a Fiji based multidisciplinary consulting

engineering company offering services in Project Management, Structural and Civil Engineering.

In addition the researcher will discuss how these challenges affect project management performance and what strategic steps could be taken as mitigation.

[illegible]

NRW Macallan (Fiji) Ltd offers a wide range of engineering services covering the disciplines of structural, civil, water, and wastewater, land developments, road and bridges, marine infrastructure and project management. (NRW Macallan Brochure)

Majority of infrastructure projects are designed and managed by NRW Macallan. For the purpose of this study, projects will vary infrastructure type.

[illegible]

As per desktop study case study project cost will range between FJD1 million to FJD30 million.

[illegible]

Case study projects were designed and constructed between the years 2000 and 2018.

[illegible]

Case study projects are located within Viti Levu and Vanua Levu the major island of Fiji. Project location ranges from rural, urban and future business hubs. The graphical representation of the project locations is provided together with the photographs.

[illegible]

Considering the time and the resource constraints, civil engineering projects will be investigated.

[illegible] Data Collection Method

[illegible] and Collection Method

Case study data for the two civil engineering projects was provided by NRW Macallan. Data was collected from respective project folders and trough verbal communication with the project manager that worked on the particular projects. Furthermore, the researcher who is an employee of NRW Macallan was directly involved in managing these projects.

3.3 Ethical Consideration

To safeguard participant's right to confidentiality and legal jurisdictions on data protection the researcher is always upholding the ethical code of conduct and will adhere to all rules and policies set forth. The researcher had distributed the survey questionnaires once it was reviewed and approved by University of Southern Queensland Human Research and Ethics Committee. The acceptance from University of Southern Queensland Human Research and Ethics Committee would ensure that no participants were subjected to any potential physical or physiological harms.

Risk Assessment

This project is based on theoretical knowledge, which requires extensive literature reviews. The major resource required outside theoretical knowledge to successfully complete this project is the input from the professionals and theses inputs will be collected via means of questionnaire surveys and case studies once approval has been granted from the University of Southern Queensland Human Research and Ethics Committee.

[illegible] Results and Discussion

[illegible] Introduction

The following section presents the data obtained through past and ongoing engineering case studies and the questionnaire survey distributed to participants within the project management sector. Result from the questionnaire survey have been analysed in Microsoft excel and presented in table format. Patterns and inconsistencies in the data will be discussed and conclusions drawn. Strategies for mitigating the challenges in Project Management of Infrastructure Projects in Fiji will be recommended.

[illegible] [illegible] [illegible]

The data collected by the questionnaire survey was divided into four major sections which include the following:

1) Profile of responses
2) Private company data
3) Government data
4) Combined data

Separating the data collected attempts to determine patterns within the responses.

[illegible] [illegible] [illegible]

[illegible] [illegible] [illegible]

The questionnaire survey was distributed between government and private organisations. The percentage of respondent from each type of organisation is shown below in Figure 11. It was found that majority of the respondents worked for private organisation.

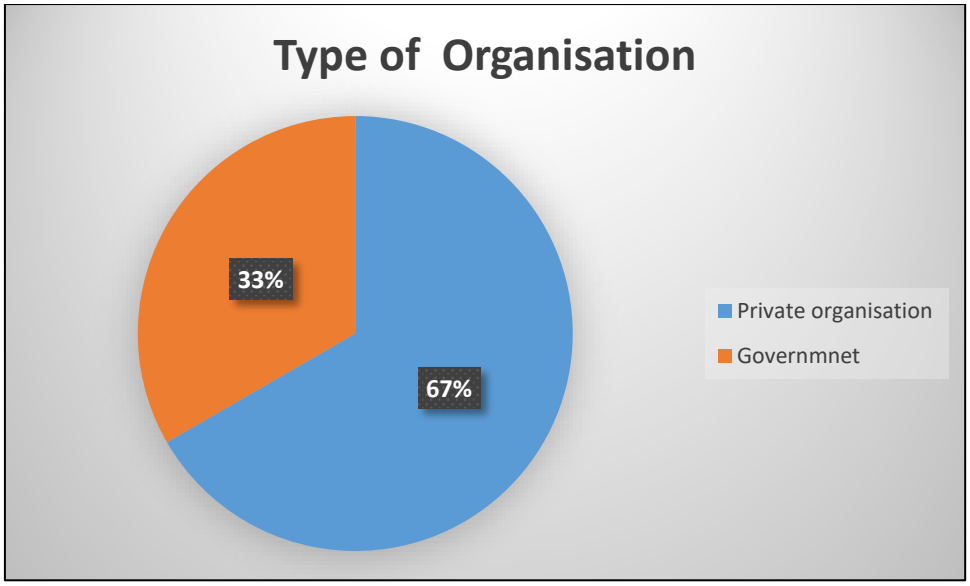

Figure 11: Type of organisation

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The position of the respondents in the organisation that responded to the questionnaire survey was distributed between project managers, engineers, contractors, engineering technicians and others. The percentage of respondents from each position within the organisation is shown in Figure 12. The majority of the respondents were Project Managers.

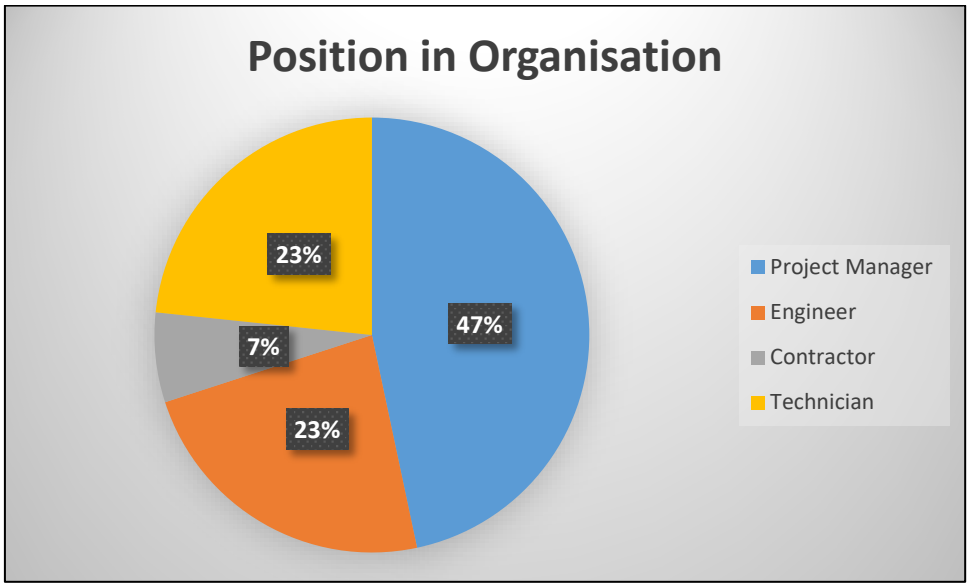

Figure 12: Position in organisation

[redacted]

The years of professional experiences of the respondent that responded to the questionnaire survey ranged from 1 – 5 years' experience up to more than 20 years' experience. The percentage of respondents within each band of experience is shown below in Figure 13. The majority of the participants had more than 6 years of professional experience and 10% have over 20 years of professional experience.

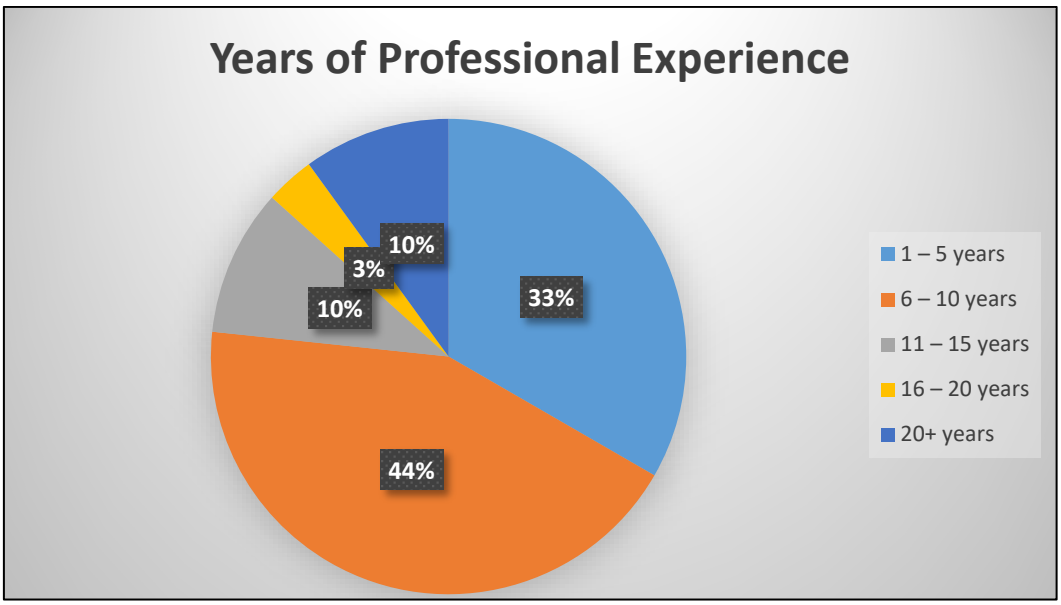

Figure 13: Years of professional experience

[redacted]

The following section presents the results obtained from private organisations. The tables shown in this section presents the response frequency and overall ranking of the following:

- Planning related challenges in project management of infrastructure projects in Fiji.
- Engineering design related challenges in project management of infrastructure projects in Fiji.
- Procurement related challenges in project management of infrastructure projects in Fiji.
- Material management related challenges in project management of infrastructure projects in Fiji.

- Construction related challenges in project management of infrastructure projects in Fiji.
- Human related challenges in project management of infrastructure projects in Fiji.
- Project manager related challenges in project management of infrastructure projects in Fiji.
- Median response value for discussed project management challenges and effects.

□□□□□1□□r□□□□□d□□□□r□□□□□□□□

Respondents were asked to indicate the frequency of planning, engineering design, procurement, material, construction, human and project manager related challenges in project management of infrastructure projects in Fiji. A Likert scale ranging from 1 to 5 was used to analyse. The results show that:

- Challenges in statutory approvals and environmental issues.
- Challenges in constructability in engineering design and Quality/experience of designers.
- Challenges in final selection and longstanding arrangement between client and contractor.
- Challenges in on-time delivery of bulk materials and major equipment.
- Challenges in work programming and safety management procedures.
- Migration of skilled workers from Fiji.
- Project Manager's knowledge in construction and contract laws and knowledge in site and construction management is very important.
- Project manager's technical skills and ability to resolve technical problems is very important.
- Project manager's intellectual drive and knowledgeable, high initiative, enthusiastic and curiosity personal characteristics is very important.

Tables □□□□1□□presents the challenges experienced by the respondents.

Table 2: Private Data- Frequency of Planning

□□□□□□□□□□	R□□□□□□□□r□□□□□□□					□□r□□□□ R□□□□□	R□□□□□	R□□□□□□□□ □□ □□r□□□□□ □□d□□□□□ □□	R□□□□
	1□	□□	□□	□□	□□				
□□□□ □□□□□□r□□□□□ □□□□□□□□□□□□□□□□ □□□□□r□□□□□ □□□□□□□□□□	0	4	3	13	0	4	13	69%	7
D□□□□ □□□□□□□□□r□d□□□d□ d□r□□□□□□□□□□	0	2	2	16	0	4	16	74%	3

[redacted]	0	2	14	4	0	4	14	62%	12
[redacted]	1	2	5	12	0	4	12	68%	8
[redacted]	0	4	12	3	1	4	12	61%	13
[redacted]	0	0	14	5	1	4	14	67%	10
[redacted]	1	1	4	14	0	4	14	71%	4
[redacted]	0	1	4	14	0	3.8	14	70%	6
[redacted]	0	0	10	9	1	4	10	71%	4
[redacted]	0	0	6	13	1	4	13	75%	2
[redacted]	0	3	9	8	0	4	9	65%	11
[redacted]	0	4	4	12	0	4	12	68%	8
[redacted]	0	7	9	4	0	4	9	57%	15
[redacted]	0	4	12	4	0	4	12	60%	14
[redacted]	[redacted]	1[redacted]	1[redacted]	1[redacted]	[redacted]	[redacted]	1[redacted]	[redacted]	1[redacted]
[redacted]	0	10	7	3	0	4	10	53%	17
[redacted]	1	3	14	2	0	4	14	57%	15

The results presented in Table 2 above show that challenges in statutory approvals and environmental issues were experienced the most by the respondents.

Table 3 presents the frequency of engineering design related challenges.

Table 3: Private Data- Frequency of Engineering Design

[redacted]	[redacted]					[redacted]	[redacted]	[redacted]	[redacted]
	1[redacted]	[redacted]	[redacted]	[redacted]	[redacted]				
[redacted]	1[redacted]	[redacted]	[redacted]	1[redacted]	[redacted]	[redacted]	1[redacted]	[redacted]	1[redacted]
[redacted]	0	1	12	7	0	4	12	66%	4
[redacted]	0	3	11	6	0	4	11	63%	5
[redacted]	[redacted]	1[redacted]	[redacted]	1[redacted]	[redacted]	[redacted]	1[redacted]	[redacted]	1[redacted]
[redacted]	0	3	11	6	0	4	11	63%	5
[redacted]	0	0	9	11	0	4	11	71%	3
[redacted]	0	5	7	8	0	4	8	63%	5
[redacted]	0	4	12	4	0	4	12	60%	8

The results presented in Table 3 above show that challenges in constructability in engineering design and Quality/experience of designers were experienced the most by the respondents.

Table 4 presents the frequency of procurement related challenges.

Table 4: Private Data- Frequency of Procurement

[illegible]	R[illegible]r[illegible]					R[illegible]	R[illegible]	R[illegible] [illegible]	R[illegible]
	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
R[illegible]r[illegible]	0	1	8	11	0	4	11	70%	3
[illegible]	0	4	3	13	0	4	13	69%	4
[illegible]	0	2	4	14	0	4	14	72%	2
[illegible]	[illegible]	1[illegible]	[illegible]	1[illegible]	[illegible]	[illegible]	1[illegible]	[illegible]	1[illegible]

The results presented in Table 4 above show that challenges in final selection and longstanding arrangement between client and contractor were experienced the most by the respondents.

Table 5 presents the frequency of material management related challenges.

Table 5: Private Data- Frequency of Material Management

[illegible]	R[illegible]r[illegible]					[illegible] R[illegible]	R[illegible]	R[illegible] [illegible]	R[illegible]
	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
M[illegible]	1	3	8	8	0	4	8	63%	7
[illegible]	0	3	10	7	0	4	10	64%	6
[illegible]	0	3	9	8	0	4	9	65%	3
[illegible]	0	4	7	9	0	4	9	65%	3
[illegible]	0	4	5	11	0	4	11	67%	2
[illegible]	[illegible]	[illegible]	[illegible]	1[illegible]	[illegible]	[illegible]	1[illegible]	[illegible]	1[illegible]
[illegible]	0	3	9	8	0	4	9	65%	3
[illegible]	0	3	12	5	0	4	12	62%	8

The results presented in Table 5 above show that challenges in on-time delivery of bulk materials and major equipment were experienced the most by the respondents.

Table 6 presents the frequency of construction related challenges.

Table 6: Private Data- Frequency of Construction

[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	0	1	10	9	0	4	10	68%	5
[illegible]	0	2	10	8	0	4	10	66%	6
[illegible]	0	7	2	11	0	4	11	64%	7
[illegible]	0	4	3	13	0	4	13	69%	4
[illegible]	0	1	8	11	0	4	11	70%	3
[illegible]	0	3	10	7	0	4	10	64%	7
[illegible]	0	3	10	7	0	4	10	64%	7
[illegible]	0	3	10	7	0	4	10	64%	7

The results presented in Table 6 above show that challenges in work programming and safety management procedures were experienced the most by the respondents.

Table 7 presents the frequency of human related challenges.

Table 7: Private Data- Frequency of Human

[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	0	2	4	14	0	4	14	72%	3
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	0	12	6	2	0	4	12	50%	6
[illegible]	0	13	4	3	0	4	13	50%	6
[illegible]	1	7	2	10	0	4	10	61%	5
[illegible]	0	4	3	13	0	4	13	69%	4
[illegible]	0	2	3	15	0	4	15	73%	2

The results presented in Table 7 above show that migration of skilled workers from Fiji were experienced the most by the respondents.

Table 8, 9, 10 presents the frequency of project manager related challenges. That is project manager's capability in terms of knowledge, skills and personal characteristics.

Table 8: Private Data- Frequency of Project Manager's Area of Knowledge

[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	0	0	6	14	0	4	14	74%	3
[illegible]	0	1	11	8	0	4	11	67%	6
[illegible]	0	1	13	6	0	4	13	65%	10
[illegible]	1	1	12	6	0	4	12	63%	11
[illegible]	[illegible]	1[illegible]	[illegible]	1[illegible]	[illegible]	[illegible]	1[illegible]	[illegible]	1[illegible]
[illegible]	1	2	12	5	0	4	12	61%	18
[illegible]	0	3	11	6	0	4	11	63%	11
[illegible]	0	2	13	5	0	4	13	63%	11
[illegible]	1	2	11	6	0	4	11	62%	16
[illegible]	0	4	2	14	0	4	14	70%	5
[illegible]	0	1	4	15	0	4	15	74%	3
[illegible]	[illegible]	[illegible]	[illegible]	1[illegible]	[illegible]	[illegible]	1[illegible]	[illegible]	1[illegible]
[illegible]	0	2	13	5	0	4	13	63%	11
[illegible]	0	0	14	6	0	4	14	66%	7
[illegible]	0	1	12	7	0	4	12	66%	7
[illegible]	0	1	12	7	0	4	12	66%	7
[illegible]	1	1	12	6	0	4	12	63%	11
[illegible]	1	4	10	5	0	4	10	59%	19
[illegible]	1	1	13	5	0	4	13	62%	16

The results presented in Table 8 above show that knowledge in construction and contract laws and knowledge in site and construction management were experienced the most by the respondents.

Table 9: Private Data- Frequency of Project Manager's Skills

[illegible]	R[illegible]r[illegible]					[illegible]r[illegible] R[illegible]	R[illegible]	R[illegible] [illegible]r[illegible] [illegible]d[illegible] [illegible]	R[illegible]
	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]r[illegible] [illegible] [illegible]	0	2	5	13	0	4	13	71%	3
[illegible]r[illegible]	0	3	4	13	0	4	13	70%	6
[illegible]d[illegible]	0	2	9	9	0	4	9	67%	11
[illegible]	0	4	12	4	0	4	12	60%	20
[illegible]	[illegible]	[illegible]	[illegible]	1[illegible]	[illegible]	[illegible]	1[illegible]	[illegible]	1[illegible]
M[illegible]	0	3	12	5	0	4	12	62%	16
[illegible]r[illegible]	0	4	12	4	0	4	12	60%	20
[illegible]d[illegible]r[illegible]d[illegible] [illegible]	0	1	12	7	0	4	12	66%	13
M[illegible]	0	2	14	4	0	4	14	62%	16
[illegible]r[illegible]d[illegible]r[illegible]	0	1	11	8	0	4	11	67%	11
[illegible]r[illegible] [illegible]	0	3	12	5	0	4	12	62%	16
R[illegible]r[illegible]	0	0	11	9	0	4	11	69%	9
R[illegible] [illegible]	0	1	12	7	0	4	12	66%	13
[illegible] [illegible]	0	0	12	8	0	4	12	68%	10
[illegible]rd[illegible] [illegible]r[illegible]	0	2	12	6	0	4	12	64%	15
R[illegible]r[illegible] [illegible]	[illegible]	1[illegible]	[illegible]	1[illegible]	[illegible]	[illegible]	1[illegible]	[illegible]	1[illegible]
[illegible]d[illegible]d[illegible]	0	2	16	2	0	4	16	60%	20
[illegible]	0	1	8	11	0	4	11	70%	6
[illegible]r[illegible] [illegible]	0	2	5	13	0	4	13	71%	3
[illegible]r[illegible] [illegible]	0	1	7	12	0	4	12	71%	3
[illegible]r[illegible]d d[illegible] [illegible]r[illegible]	0	2	6	12	0	4	12	70%	6
[illegible] [illegible] [illegible]d [illegible]	0	3	13	4	0	4	13	61%	19

The results presented in Table 9 above show that project manager's technical skills and ability to resolve technical problems were experienced the most by the respondents.

Table 10: Private Data- Frequency of Project Manager's Personal Characteristics

[illegible]	R[illegible]r[illegible]					[illegible]r[illegible] R[illegible]	R[illegible]	R[illegible] [illegible]r[illegible] [illegible]d[illegible] [illegible]	R[illegible]
	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]r[illegible]	1	3	13	3	0	4	13	58%	12
[illegible]d[illegible]	1	2	11	6	0	4	11	62%	10
[illegible]r[illegible]d[illegible] [illegible]r[illegible]	1	2	10	7	0	4	10	63%	7
R[illegible]	0	2	13	5	0	4	13	63%	7

□□ □□□□□□□□□	1	1	7	11	0	4	11	68%	4
□□ □□□□□□□□	1	3	12	4	0	4	12	59%	11
□□□r□□□□	1	0	14	5	0	4	14	63%	7
□□□□□□□□□□	0	1	13	6	0	4	13	65%	6
□□□□□□□□□□□□□□dr□□□□□□□□d□ □□□□ □□d□□□□□□□	□□	□□	□□	1□□	□□	□□	1□□	□1□ □	1□
□ □□d□□ □□□d□□□ □□□□□□□□□□	0	3	6	11	0	4	11	68%	4
□r□□□□□□□□□□	0	3	5	12	0	4	12	69%	3
□□□□□□□□□□□□□□□□□□□□ □□□□□□□□□□□□□□□□□□d□□□r□□□□□□□	□□	□□	□□	1□□	□□	□□	1□□	□1□ □	1□

The results presented in Table 10 above show that project manager's intellectual drive and knowledgeable, high initiative, enthusiastic and curiosity personal characteristics were experienced the most by the respondents.

□□□□□□□r□□□□□□□□ □□□□□□

Respondents were asked to indicate the impact of:

- Planning related challenges in project management of infrastructure projects in Fiji.
- Engineering design related challenges in project management of infrastructure projects in Fiji.
- Procurement related challenges in project management of infrastructure projects in Fiji.
- Material management related challenges in project management of infrastructure projects in Fiji.
- Construction related challenges in project management of infrastructure projects in Fiji.
- Human related challenges in project management of infrastructure projects in Fiji.
- Project manager related challenges in project management of infrastructure projects in Fiji.
- Median response value for discussed project management challenges and effects.

A Likert scale ranging from 1 to 5 was used to analyse. The results below show the factors that perceived to impact the private respondents the most:

- Land and right-of-way acquisition in timely manner.
- Quality/experience of designers.
- Final selection and longstanding arrangement between client and contractor.
- Effective site materials management.

- Work programming.
- Availability of skilled workers.
- Project Manager's knowledge in construction method.
- Resolving technical problems and problem solving skills of Project Manager's
- Fairness and impartially characteristics of Project Manager's

Tables **11** [illegible] presents the impacts experienced by the respondents.

Table 11: Private Data- Impact of Planning

[illegible]	R[illegible]					[illegible] R[illegible]	R[illegible]	R[illegible]	R[illegible]
	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	1	1	4	6	8	4	7	79%	6
[illegible]	1	0	4	7	8	4	8	81%	3
[illegible]	2	1	2	14	1	4	13	71%	11
[illegible]	0	1	3	6	10	4	10	85%	2
[illegible]	2	3	4	10	1	4	9	65%	12
[illegible]	1	4	6	8	1	4	7	64%	14
[illegible]	0	2	4	6	8	4	8	80%	5
[illegible]	1	2	4	6	8	4.2	7	81%	3
[illegible]	1	1	3	13	2	4	12	74%	7
[illegible]	1	0	4	15	0	4	15	73%	9
[illegible]	0	0	8	12	0	4	12	72%	10
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	3	2	3	11	1	4	10	65%	12
[illegible]	2	2	9	7	0	4	9	61%	15
[illegible]	2	1	2	11	4	4	10	74%	7
[illegible]	0	3	14	3	0	4	14	60%	17
[illegible]	2	1	11	6	0	4	11	61%	15

The results presented in Table 11 above show that Land and right-of-way acquisition in timely manner were perceived to impact private respondents the most.

Table 12 presents the impact of engineering design related challenges.

Table 12: Private Data- Impact of Engineering Design

[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
	1	2	3	4	5				
[illegible]	1	1	3	14	1	4	13	73%	5
[illegible]	1	0	3	14	2	4	14	76%	3
[illegible]	1	0	3	13	3	4	13	77%	2
[illegible]	1	1	3	8	2	4	7	67%	7
[illegible]	1	1	2	14	2	4	13	75%	4
[illegible]	2	1	7	6	4	4	6	69%	6
[illegible]	1	2	14	3	0	4	14	59%	8

The results presented in Table 12 above show that quality/experience of designers were perceived to impact private respondents the most.

Table 13 presents the impact of procurement related challenges.

Table 13: Private Data- Impact of Procurement

[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
	1	2	3	4	5				
[illegible]	1	0	9	8	2	4	9	70%	4
[illegible]	1	2	3	13	1	4	12	71%	3
[illegible]	1	0	5	14	0	4	14	72%	2
[illegible]	1	1	3	13	1	4	12	71%	3

The results presented in Table 13 above show that final selection and longstanding arrangement between client and contractor were perceived to impact private respondents the most.

Table 14 presents the impact of material management related challenges.

Table 14: Private Data- Impact of Material Management

[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	1	1	4	14	0	4	14	71%	4
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	0	1	5	13	1	4	13	74%	3
[illegible]	0	1	11	7	1	4	11	68%	7
[illegible]	1	1	8	6	4	4	7	71%	4
[illegible]	0	1	4	12	3	4	12	77%	2
[illegible]	0	4	9	6	1	4	9	64%	8
[illegible]	1	3	4	10	2	4	9	69%	6

The results presented in Table 14 above show that effective site materials management were perceived to impact private respondents the most.

Table 15 presents the impact of construction related challenges.

Table 15: Private Data- Impact of Construction

[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	0	1	10	7	0	3.6	10	60%	10
[illegible]	0	1	3	15	1	4	15	76%	4
[illegible]	0	1	4	14	1	4	14	75%	5
[illegible]	0	0	4	12	4	4	12	80%	2
[illegible]	0	1	4	12	3	4	12	77%	3
[illegible]	1	1	3	12	3	4	11	75%	5
[illegible]	0	2	12	4	2	4	12	66%	7
[illegible]	0	2	12	4	2	4	12	66%	7
[illegible]	0	2	12	4	2	4	12	66%	7

The results presented in Table 15 above show that work programming were perceived to impact private respondents the most.

Table 16 presents the impact of human related challenges.

Table 16: Private Data- Impact of Human

[illegible]	R[illegible]r[illegible]					[illegible]r[illegible] R[illegible]	R[illegible]	R[illegible] [illegible] [illegible]r[illegible] [illegible]d[illegible] [illegible]	R[illegible]
	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]d [illegible]r[illegible]	[illegible]	1[illegible]	[illegible]	[illegible]	1[illegible]	[illegible]	1[illegible]	[illegible] [illegible]	1[illegible]
M[illegible]r[illegible] [illegible]d [illegible]r[illegible]	2	1	3	5	9	4	8	78%	4
[illegible] [illegible]r[illegible] [illegible]r[illegible] [illegible]	1	2	3	11	3	4	10	73%	5
[illegible]r[illegible] [illegible]r[illegible] [illegible]r[illegible]	1	2	3	11	3	4	10	73%	5
[illegible] [illegible]r[illegible] d[illegible]r[illegible]	3	0	2	5	10	4	10	79%	3
[illegible]d [illegible]r[illegible]d [illegible]r[illegible] [illegible]d [illegible] [illegible]	0	1	5	5	9	4	9	82%	2
[illegible]r[illegible]r[illegible] [illegible]d [illegible] [illegible]	1	1	2	16	0	4	16	73%	5

The results presented in Table 16 above show that availability of skilled workers were perceived to impact private respondents the most.

Table 17, 18, 19 presents the impact of project manager related challenges.

Table 17: Private Data- Impact of Project Manager's Area of Knowledge

[illegible]	R[illegible]r[illegible]					[illegible]r[illegible] R[illegible]	R[illegible]	R[illegible] [illegible] [illegible]r[illegible] [illegible]d[illegible] [illegible]	R[illegible]
	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible] [illegible]d [illegible] [illegible]r[illegible] [illegible] [illegible]	1	0	4	7	8	4	8	81%	4
[illegible] [illegible]d [illegible] [illegible] [illegible]d [illegible]r [illegible]r[illegible] [illegible]	1	0	3	7	9	4	9	83%	2
[illegible] [illegible]d [illegible] [illegible]r[illegible] [illegible]r[illegible] [illegible]d[illegible] [illegible]	1	0	12	6	1	4	12	66%	9
[illegible] [illegible]d [illegible] [illegible] [illegible] [illegible] [illegible]r[illegible] [illegible]	1	3	9	6	1	4	8	63%	10
[illegible] [illegible]d [illegible] [illegible] [illegible]r[illegible] [illegible]d[illegible]r[illegible] [illegible]	1	0	3	8	8	4	8	82%	3
[illegible] [illegible]d [illegible] [illegible] [illegible]r[illegible] [illegible] [illegible]r[illegible] [illegible]	0	2	10	5	3	4	10	69%	8
[illegible] [illegible]d [illegible] [illegible] [illegible]r[illegible]r [illegible]d[illegible] [illegible]	1	5	9	4	1	4	8	59%	16

[illegible]	0	4	10	5	1	4	10	63%	10
[illegible]	2	2	11	4	1	4	10	60%	15
[illegible]	0	1	5	12	2	4	12	75%	7
[illegible]	[illegible]	1[illegible]	[illegible]	[illegible]	1[illegible]	[illegible]	1[illegible]	[illegible]	1[illegible]
[illegible]	1	0	1	16	2	4	16	78%	5
[illegible]	0	4	10	5	1	4	10	63%	10
[illegible]	0	1	4	13	2	4	13	76%	6
[illegible]	1	1	13	5	0	4	13	62%	14
[illegible]	2	1	2	5	0	2	5	30%	19
[illegible]	1	2	11	5	1	4	10	63%	10
[illegible]	3	1	11	5	0	4	11	58%	17
[illegible]	3	1	11	5	0	4	11	58%	17

The results presented in Table 17 above show that Knowledge in construction method were perceived to impact private respondents the most.

Table 18: Private Data- Impact of Project Manager's Skills

[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	1	0	3	6	10	4	10	84%	3
[illegible]	1	1	4	4	10	4	9	81%	6
[illegible]	1	1	2	7	9	4	8	82%	4
[illegible]	1	2	12	4	1	4	11	62%	22
[illegible]	1	1	3	7	8	4	7	80%	7
[illegible]	1	1	4	13	1	4	12	72%	15
[illegible]	1	1	6	11	1	4	10	70%	18
[illegible]	1	0	2	14	3	4	14	78%	9
[illegible]	0	2	2	14	2	4	14	76%	11
[illegible]	0	1	10	7	2	4	10	70%	18
[illegible]	0	2	4	13	1	4	13	73%	14

[illegible]	0	1	12	6	1	4	12	67%	21
[illegible]	1	0	2	14	3	4	14	78%	9
[illegible]	0	1	11	6	2	4	11	69%	20
[illegible]	0	2	2	14	2	4	14	76%	11
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	0	2	5	12	1	4	12	72%	15
[illegible]	0	2	5	4	9	4	9	80%	7
[illegible]	0	2	3	6	9	4	9	82%	4
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	0	1	3	15	1	4	15	76%	11
[illegible]	1	1	5	11	2	4	10	72%	15

The results presented in Table 18 above show that resolving technical problems and problem solving skills were perceived to impact private respondents the most.

Table 19: Private Data- Impact of Project Manager's Personal Characteristics

[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The results presented in Table 19 above show that fairness and impartially were perceived to impact private respondents the most.

[redacted]

The results in Table 20 show the median Likert score for the frequency and impact of each of the identified challenges in project management of infrastructure in Fiji.

Table 20: Private Data- Median Responses

[redacted]	[redacted]	[redacted]
Planning		
Alignment of project execution plan with project objectives	Often	High
Documentation produced during planning	Often	High
Front end planning process	Often	High
Implementation of project execution plan	Often	High
Peer reviews during planning	Often	High
Track percentage complete	Often	High
Project planning recourses	Often	High
Clear definition of project objectives and priorities	Often	Very high
Stakeholder involvement and alignment	Often	High
Understanding client's goal and objectives	Often	High
Offsite fabrication	Often	High
Land and right-of-way acquisition in timely manner	Often	Very high
Life cycle cost analysis and consideration	Often	High
Community related issues	Often	High
Statutory approvals and environmental issues	Often	High
Preassembly	Often	High
Prefabrication	Often	High
Engineering design		
Constructability in engineering design	Often	High
Quality of engineering designs	Often	High
Involvement of experienced construction managers during design	Often	High
Quality/experience of designers	Often	High
Engineering design deliverables' accuracy and timelines	Often	High
Involvement of a cost engineer	Often	High
Procurement		
Request for proposals	Often	High
Evaluation of proposals	Often	High
Control and monitor proposals	Often	High
Final selection and longstanding arrangement between client and contractor constructability in engineering design	Often	High

Material management		
Material management plan	Often	High
Effective site materials management	Often	High
Procurement plan considering market conditions	Often	High
Procurement plan addressing local content requirements	Often	High
Procurement on time as per design specification	Often	High
On-time delivery of bulk materials and major equipment	Often	High
Supplier quality surveillance program	Often	High
Preferred supplier selection	Often	High
Construction		
Work programming	Often	High
Safety management procedures	Often	Mod-high
Appropriate contingency establishment	Often	High
Risk assessment and planning	Often	High
Initial site condition verification	Often	High
Work methodology	Often	High
Quality management system	Often	High
Commissioning with operations and maintenance manual	Often	High
Involvement of contractor's construction manager	Often	High
Foreman to labour ratio	Often	High
Human		
Availability of skilled workers	Often	High
Migration of skilled workers	Often	High
Ongoing training programs	Often	High
Professional work training	Often	High
Extensive labour disruption	Often	High
Adequate trade labour’s availability and competency	Often	High
Subcontractors availability and competency work programming	Often	High
Project manager’s area of knowledge		
Knowledge in project management	Often	High
Knowledge in civil and structural engineering	Often	High
Knowledge in architecture and town planning	Often	High
Knowledge in quantity surveying	Often	High
Knowledge in construction and contract laws	Often	High
Knowledge in services engineering	Often	High
Knowledge in interior designs	Often	High
Knowledge in land surveying and landscaping	Often	High
Knowledge in valuation studies	Often	High
Knowledge in geotechnical engineering and soil study	Often	High
Knowledge in construction method	Often	High
Knowledge in site and construction management	Often	High
Knowledge in environmental studies	Often	High
Knowledge in authority approving process	Often	High

Knowledge in project management software's	Often	High
Knowledge in conducting a feasibility study	Often	low
Knowledge in financing and cash flow	Often	High
Knowledge in socio-economics	Often	High
Knowledge of economics, trends, market and political condition in the country	Often	High
Project manager’s area of skill		
Project management skills	Often	High
Interpersonal skills	Often	High
Leadership qualities	Often	High
Business skills	Often	High
Technical skills	Often	High
Management skills	Often	High
Personal skill	Often	High
Understanding client's objectives	Often	High
Managing changes	Often	High
Written and oral skills	Often	High
Ability to chair meetings	Often	High
Report writing	Often	High
Risk management	Often	High
Quality management	Often	High
Technical coordination skills with other professionals	Often	High
Resolve technical problems	Often	high
Adaptability and flexibility	Often	High
Influencing skills	Often	High
Art of conflict management	Often	High
Problem solving skills	Often	high
Critical thinking and decision marking skills	Often	High
Emotional management and stability	Often	High
Project manager’s personal characteristics		
Visionary	Often	High
Honest and ethical	Often	High
Fairness and impartially	Often	High
Realistic	Often	High
Ambitious	Often	High
Empathy	Often	High
Energy	Often	High
Flexible	Often	High
Intellectual drive and knowledgeable	Often	High
Wisdom and imaginative	Often	High
Creativity	Often	High
High initiative, enthusiastic and curiosity	Often	High

[illegible] [illegible]

The following section presents the results obtained from private organisations. The tables shown in this section presents the response frequency and overall ranking of the following:

- Planning related challenges in project management of infrastructure projects in Fiji.
- Engineering design related challenges in project management of infrastructure projects in Fiji.
- Procurement related challenges in project management of infrastructure projects in Fiji.
- Material management related challenges in project management of infrastructure projects in Fiji.
- Construction related challenges in project management of infrastructure projects in Fiji.
- Human related challenges in project management of infrastructure projects in Fiji.
- Project manager related challenges in project management of infrastructure projects in Fiji.
- Median response value for discussed project management challenges and effects.

[illegible] [illegible]

Respondents were asked to indicate the frequency of planning, engineering design, procurement, material, construction, human and project manager related challenges in project management of infrastructure projects in Fiji. A Likert scale ranging from 1 to 5 was used to analyse. The results show that:

- Challenges in land and right-of-way acquisition in timely manner
- Challenges in quality/experience of designers and qualifications of designers
- Challenges in final selection and longstanding arrangement between client and contractor.
- Challenges in on-time delivery of bulk materials and major equipment.
- Challenges in safety management procedures.
- Migration of skilled workers from Fiji.
- Knowledge in construction and contract laws, knowledge in construction method and Knowledge in geotechnical engineering is very important.
- Project manager's critical thinking and decision making skills is very important.

- Project manager's intellectual drive and knowledgeable, high initiative, enthusiastic and curiosity is very important.

Tables [illegible] presents the challenges experienced by the respondents.

Table 21: Government Data- Frequency of Planning

[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	1	1	4	6	8	4	7	79%	6
[illegible]	1	0	4	7	8	4	8	81%	3
[illegible]	2	1	2	14	1	4	13	71%	11
[illegible]	0	1	3	6	10	4	10	85%	2
[illegible]	2	3	4	10	1	4	9	65%	12
[illegible]	1	4	6	8	1	4	7	64%	14
[illegible]	0	2	4	6	8	4	8	80%	5
[illegible]	1	2	4	6	8	4.2	7	81%	3
[illegible]	1	1	3	13	2	4	12	74%	7
[illegible]	1	0	4	15	0	4	15	73%	9
[illegible]	0	0	8	12	0	4	12	72%	10
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	3	2	3	11	1	4	10	65%	12
[illegible]	2	2	9	7	0	4	9	61%	15
[illegible]	2	1	2	11	4	4	10	74%	7
[illegible]	0	3	14	3	0	4	14	60%	17
[illegible]	2	1	11	6	0	4	11	61%	15

The results presented in Table 21 above show that challenges in land and right-of-way acquisition in timely manner were experienced the most by the respondents.

Table 22 presents the frequency of engineering design related challenges.

Table 22: Government Data- Frequency of Engineering Design

[illegible]	R[illegible]r[illegible]					[illegible]r[illegible] R[illegible]	R[illegible]	R[illegible] [illegible] r[illegible] d[illegible] [illegible]	R[illegible]
	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]r[illegible] [illegible] d[illegible]	0	0	1	9	0	2	9	78%	1
[illegible] r[illegible] d[illegible]	0	0	7	3	0	2	7	66%	4
[illegible] [illegible] [illegible]r[illegible] d[illegible]	0	0	9	1	0	2	9	62%	5
[illegible] [illegible] d[illegible]	[illegible]	[illegible]	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1[illegible]
[illegible] d[illegible]	[illegible]	[illegible]	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1[illegible]
[illegible] d[illegible]	0	0	9	1	0	2	9	62%	5
[illegible] d[illegible]	0	1	8	1	0	2	8	60%	7
[illegible] [illegible]	0	1	8	1	0	2	8	60%	7

The results presented in Table 22 above show that challenges in quality/experience of designers and qualifications of designers were experienced the most by the respondents.

Table 23 presents the frequency of procurement related challenges.

Table 23: Government Data- Frequency of Procurement

[illegible]	R[illegible]r[illegible]					[illegible]r[illegible] R[illegible]	R[illegible]	R[illegible] [illegible] r[illegible] d[illegible] [illegible]	R[illegible]
	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
R[illegible] r[illegible]	0	0	8	2	0	2	8	64%	4
[illegible] r[illegible]	0	0	3	7	0	2	7	74%	3
[illegible] d[illegible] [illegible] r[illegible]	0	0	2	8	0	2	8	76%	2
[illegible] d[illegible] rr[illegible] [illegible] [illegible] d[illegible] r[illegible]	[illegible]	[illegible]	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1[illegible]

The results presented in Table 23 above show that challenges in final selection and longstanding arrangement between client and contractor were experienced the most by the respondents.

Table 24 presents the frequency of material management related challenges.

Table 24: Government Data- Frequency of Material Management

[illegible]	R[illegible]r[illegible]					[illegible]r[illegible] R[illegible]	R[illegible]	R[illegible] [illegible] r[illegible] d[illegible] [illegible]	R[illegible]
	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
M[illegible]r[illegible] [illegible] [illegible] [illegible]	0	1	9	0	0	2	9	58%	7
[illegible] [illegible] r[illegible] [illegible] [illegible]	0	0	10	0	0	2	10	60%	4
[illegible]r[illegible] [illegible] [illegible] d[illegible] [illegible] [illegible]	0	1	9	0	0	2	9	58%	7
[illegible]r[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]	0	1	8	1	0	2	8	60%	4
[illegible]r[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]	0	1	4	5	0	2	5	68%	2
[illegible] [illegible] d[illegible] r[illegible] [illegible] [illegible] [illegible] [illegible] [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1[illegible]
[illegible] [illegible] r[illegible] [illegible] [illegible] [illegible] r[illegible]	0	0	9	1	0	2	9	62%	3
[illegible]r[illegible] d[illegible] [illegible] [illegible] r[illegible] [illegible] [illegible]	0	0	10	0	0	2	10	60%	4

The results presented in Table 24 above show that challenges in on-time delivery of bulk materials and major equipment were experienced the most by the respondents.

Table 25 presents the frequency of construction related challenges.

Table 25: Government Data- Frequency of Construction

[illegible]	R[illegible]r[illegible]					[illegible]r[illegible] R[illegible]	R[illegible]	R[illegible] [illegible] r[illegible] d[illegible] [illegible]	R[illegible]
	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible] r[illegible] r[illegible] [illegible] [illegible]	0	0	2	8	0	2	8	76%	2
[illegible] [illegible] [illegible] [illegible] r[illegible] d[illegible] [illegible]	[illegible]	[illegible]	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1[illegible]
[illegible] [illegible] r[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]	0	0	2	8	0	2	8	76%	2
R[illegible] [illegible] [illegible] [illegible] [illegible] d[illegible] [illegible] [illegible]	0	0	9	1	0	2	9	62%	10
[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] d[illegible] [illegible] [illegible] r[illegible] [illegible] [illegible]	0	0	2	8	0	2	8	76%	2
[illegible] r[illegible] [illegible] d[illegible] [illegible] [illegible]	0	1	2	7	0	2	7	72%	6
[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]	0	0	3	7	0	2	7	74%	5
[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]	0	0	8	2	0	2	8	64%	7
[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]	0	0	8	2	0	2	8	64%	7
[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]	0	0	8	2	0	2	8	64%	7

The results presented in Table 25 above show that challenges in safety management procedures were experienced the most by the respondents.

Table 26 presents the frequency of human related challenges.

Table 26: Government Data- Frequency of Human

[illegible]	R[illegible]					[illegible] R[illegible]	R[illegible]	R[illegible] [illegible]	R[illegible]
	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	0	0	2	8	0	2	8	76%	2
M[illegible]	[illegible]	[illegible]	[illegible]	**1[illegible]**	[illegible]	[illegible]	**1[illegible]**	[illegible]	**1[illegible]**
[illegible]	0	7	2	1	0	2	7	48%	6
[illegible]	0	7	3	0	0	2	7	46%	7
[illegible]	0	5	1	4	0	2	5	58%	5
[illegible]	0	1	0	9	0	2	9	76%	2
[illegible]	0	1	1	8	0	2	8	74%	4

The results presented in Table 26 above show that migration of skilled workers from Fiji were experienced the most by the respondents.

Table 8, 9, 10 presents the frequency of project manager related challenges. That is project manager's capability in terms of knowledge, skills and personal characteristics.

Table 27: Government Data- Frequency of Project Manager's Area of Knowledge

[illegible]	R[illegible]					[illegible] R[illegible]	R[illegible]	R[illegible] [illegible]	R[illegible]
	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	0	0	1	9	0	2	9	78%	4
[illegible]	0	0	6	4	0	2	6	68%	6
[illegible]	0	0	7	3	0	2	7	66%	7
[illegible]	0	0	9	1	0	2	9	62%	9
[illegible]	[illegible]	[illegible]	[illegible]	**1[illegible]**	[illegible]	[illegible]	**1[illegible]**	[illegible]	**1[illegible]**
[illegible]	0	1	8	1	0	2	8	60%	14
[illegible]	0	2	7	1	0	2	7	58%	16

[redacted]	0	2	8	0	0	2	8	56%	17
[redacted]	0	1	7	2	0	2	7	62%	9
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	0	0	1	9	0	2	9	78%	4
[redacted]	0	2	8	0	0	2	8	56%	17
[redacted]	0	1	7	2	0	2	7	62%	9
[redacted]	0	0	9	1	0	2	9	62%	9
[redacted]	0	1	7	1	0	1.8	7	54%	19
[redacted]	0	0	8	2	0	2	8	64%	8
[redacted]	0	1	8	1	0	2	8	60%	14
[redacted]	0	0	9	1	0	2	9	62%	9

The results presented in Table 27 above show that knowledge in construction and contract laws, knowledge in construction method and Knowledge in geotechnical engineering were experienced the most by the respondents.

Table 28: Government Data- Frequency of Project Manager's Skills

[redacted]	[redacted]					[redacted]	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]				
[redacted]	0	0	2	8	0	2	8	76%	4
[redacted]	0	0	3	7	0	2	7	74%	7
[redacted]	0	0	7	3	0	2	7	66%	9
[redacted]	0	0	8	2	0	2	8	64%	14
[redacted]	0	0	2	8	0	2	8	76%	4
[redacted]	0	0	8	2	0	2	8	64%	14
[redacted]	0	0	8	2	0	2	8	64%	14
[redacted]	0	1	6	3	0	2	6	64%	14
[redacted]	0	0	7	3	0	2	7	66%	9
[redacted]	0	0	7	3	0	2	7	66%	9

[illegible]	0	0	8	2	0	2	8	64%	14
[illegible]	0	0	7	3	0	2	7	66%	9
[illegible]	0	1	6	3	0	2	6	64%	14
[illegible]	0	1	6	3	0	2	6	64%	14
[illegible]	0	1	7	2	0	2	7	62%	21
[illegible]	0	0	1	9	0	2	9	78%	2
[illegible]	0	0	7	3	0	2	7	66%	9
[illegible]	0	0	2	8	0	2	8	76%	4
[illegible]	0	1	1	8	0	2	8	74%	7
[illegible]	0	0	1	9	0	2	9	78%	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	0	2	6	2	0	2	6	60%	22

The results presented in Table 28 above show that project manager's critical thinking and decision making skills were experienced the most by the respondents.

Table 29: Government Data- Frequency of Project Manager's Personal Characteristics

[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	0	0	9	1	0	2	9	62%	9
[illegible]	0	0	9	1	0	2	9	62%	9
[illegible]	0	0	9	1	0	2	9	62%	9
[illegible]	0	0	8	2	0	2	8	64%	8
[illegible]	0	1	2	7	0	2	7	72%	5
[illegible]	0	1	7	2	0	2	7	62%	9
[illegible]	0	0	9	1	0	2	9	62%	9
[illegible]	0	2	6	2	0	2	6	60%	14
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	0	1	1	8	0	2	8	74%	3
[illegible]	0	1	1	8	0	2	8	74%	3
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The results presented in Table 29 above show that project manager's intellectual drive and knowledgeable, high initiative, enthusiastic and curiosity were experienced the most by the respondents.

□□□□□□□□ □□□r□□ □□□□□□ □□□□□□

Respondents were asked to indicate the impact of:

- Planning related challenges in project management of infrastructure projects in Fiji.
- Engineering design related challenges in project management of infrastructure projects in Fiji.
- Procurement related challenges in project management of infrastructure projects in Fiji.
- Material management related challenges in project management of infrastructure projects in Fiji.
- Construction related challenges in project management of infrastructure projects in Fiji.
- Human related challenges in project management of infrastructure projects in Fiji.
- Project manager related challenges in project management of infrastructure projects in Fiji.
- Median response value for discussed project management challenges and effects.

A Likert scale ranging from 1 to 5 was used to analyse. The results below show the factors that perceived to impact the government respondents the most:

- Clear definition of project objectives and priorities
- Quality of engineering designs
- Final selection and longstanding arrangement between client and contractor
- Effective site materials management
- Work programming
- Extensive labour disruption and adequate trade labour's availability and competency
- Leadership qualities and technical skills
- Project manager's knowledge in project management, knowledge in civil and structural engineering and knowledge in construction and contract laws
- Fairness and impartially characteristics of project manager's

Tables □□□□□□□□presents the impacts experienced by the respondents.

Table 30: Government Data- Impact of Planning

[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	0	1	1	1	7	2	7	88%	6
[illegible]	0	0	1	2	7	2	7	92%	4
[illegible]	1	0	1	8	0	2	8	72%	13
[illegible]	0	0	0	4	6	2	6	92%	4
[illegible]	0	1	2	6	1	2	6	74%	11
[illegible]	0	0	4	6	0	2	6	72%	13
[illegible]	0	0	1	1	8	2	8	94%	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	0	0	0	7	3	2	7	86%	7
[illegible]	0	0	1	7	2	2	7	82%	8
[illegible]	0	1	1	8	0	2	8	74%	11
[illegible]	0	1	0	0	9	2	9	94%	2
[illegible]	0	0	2	8	0	2	8	76%	10
[illegible]	1	0	2	7	0	2	7	70%	15
[illegible]	0	0	2	5	3	2	5	82%	8
[illegible]	0	1	8	1	0	2	8	60%	16
[illegible]	0	1	9	0	0	2	9	58%	17

The results presented in Table 30 above show that clear definition of project objectives were perceived to impact respondents the most.

Table 31 presents the impact of engineering design related challenges.

Table 31: Government Data- Impact of Engineering Design

[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	0	0	1	7	2	2	7	82%	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	0	0	1	8	1	2	8	80%	6
[illegible]	0	0	1	7	2	2	7	82%	2
[illegible]	0	0	1	7	2	2	7	82%	2
[illegible]	0	0	1	8	1	2	8	80%	6
[illegible]	0	0	4	1	5	2	5	82%	2
[illegible]	0	0	8	2	0	2	8	64%	8

The results presented in Table 31 above show that quality of engineering designs were perceived to impact respondents the most.

Table 32 presents the impact of procurement related challenges.

Table 32: Government Data- Impact of Procurement

[illegible]	R[illegible]					[illegible] R[illegible]	R[illegible]	R[illegible] [illegible]	R[illegible]
	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
R[illegible]	0	0	8	2	0	2	8	64%	4
[illegible]	0	0	1	9	0	2	9	78%	2
[illegible]	0	0	2	8	0	2	8	76%	3
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1[illegible]	[illegible]	[illegible]	[illegible]	1[illegible]

The results presented in Table 32 above show that final selection and longstanding arrangement between client and contractor were perceived to impact respondents the most.

Table 33 presents the impact of material management related challenges.

Table 33: Government Data- Impact of Material Management

[illegible]	R[illegible]					[illegible] R[illegible]	R[illegible]	R[illegible] [illegible]	R[illegible]
	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
M[illegible]	0	1	0	9	0	2	9	76%	5
[illegible]	[illegible]	[illegible]	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1[illegible]
[illegible]	0	0	1	9	0	2	9	78%	4

[redacted]	0	0	7	3	0	2	7	66%	7
[redacted]	0	0	7	2	1	2	7	68%	6
[redacted]	0	0	1	8	1	2	8	80%	3
[redacted]	0	1	7	1	1	2	7	64%	8
[redacted]	0	0	1	7	2	2	7	82%	2

The results presented in Table 33 above show that effective site materials management were perceived to impact respondents the most.

Table 34 presents the impact of construction related challenges.

Table 34: Government Data- Impact of Construction

[redacted]	[redacted]								
	1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	1	[redacted]	[redacted]	[redacted]	[redacted]	1
[redacted]	0	0	8	1	1	2	8	66%	10
[redacted]	0	0	2	7	1	2	7	78%	3
[redacted]	0	0	3	7	0	2	7	74%	6
[redacted]	0	0	1	7	2	2	7	82%	2
[redacted]	0	0	2	8	0	2	8	76%	4
[redacted]	0	0	2	8	0	2	8	76%	4
[redacted]	0	0	8	0	2	2	8	68%	7
[redacted]	0	0	8	0	2	2	8	68%	7
[redacted]	0	0	8	0	2	2	8	68%	7

The results presented in Table 34 above show that work programming were perceived to impact respondents the most.

Table 35 presents the impact of human related challenges.

Table 35: Government Data- Impact of Human

[illegible]	R[illegible]r[illegible]					[illegible]r[illegible] R[illegible]	R[illegible]	R[illegible] [illegible] r[illegible] d[illegible]	R[illegible]
	1								
[illegible]	0	0	1	1	8	2	8	94%	4
M[illegible]	0	0	0	2	8	2	8	96%	3
[illegible]	0	0	0	10	0	2	10	80%	6
[illegible]	0	0	0	10	0	2	10	80%	6
[illegible]	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	1
[illegible]	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	1
[illegible]	0	0	0	8	2	2	8	84%	5

The results presented in Table 35 above show that extensive labour disruption and adequate trade labour's availability and competency were perceived to impact respondents the most.

Table 36, 37, 38 presents the impact of project manager related challenges.

Table 36: Government Data- Impact of Project Manager's Area of Knowledge

[illegible]	R[illegible]r[illegible]					[illegible]r[illegible] R[illegible]	R[illegible]	R[illegible] [illegible] r[illegible] d[illegible]	R[illegible]
	1								
[illegible]	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	1
[illegible]	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	1
[illegible]	0	0	7	1	2	2	7	70%	8
[illegible]	0	0	7	1	2	2	7	70%	8
[illegible]	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	1
[illegible]	0	0	8	1	1	2	8	66%	14
[illegible]	0	1	7	2	0	2	7	62%	18
[illegible]	0	0	7	2	1	2	7	68%	11

[illegible]	0	0	8	1	1	2	8	66%	14
[illegible]	0	0	1	8	1	2	8	80%	7
[illegible]	0	0	0	2	8	2	8	96%	4
[illegible]	0	0	0	9	1	2	9	82%	5
[illegible]	0	0	7	2	1	2	7	68%	11
[illegible]	0	0	1	7	2	2	7	82%	5
[illegible]	0	0	7	2	1	2	7	68%	11
[illegible]	0	0	1	2	1	0.8	2	32%	19
[illegible]	0	0	7	1	2	2	7	70%	8
[illegible]	0	0	7	3	0	2	7	66%	14
[illegible]	0	0	8	1	1	2	8	66%	14

The results presented in Table 36 above show that knowledge in project management, knowledge in civil and structural engineering and knowledge in construction and contract laws were perceived to impact respondents the most.

Table 37: Government Data- Impact of Project Manager's Skills

[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
	1	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	0	0	0	2	8	2	8	96%	3
[illegible]	0	0	0	3	7	2	7	94%	5
[illegible]	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	1
[illegible]	0	0	9	1	0	2	9	62%	22
[illegible]	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	1
[illegible]	0	0	0	9	1	2	9	82%	12
[illegible]	0	0	1	9	0	2	9	78%	17
[illegible]	0	0	0	8	2	2	8	84%	9
[illegible]	0	0	1	8	1	2	8	80%	15
[illegible]	0	1	7	1	1	2	7	64%	20
[illegible]	0	0	1	8	1	2	8	80%	15
[illegible]	0	1	7	1	1	2	7	64%	20

[redacted]	0	0	0	8	2	2	8	84%	9
[redacted]	0	0	7	1	2	2	7	70%	19
[redacted]	0	0	0	9	1	2	9	82%	12
[redacted]	0	0	0	2	8	2	8	96%	3
[redacted]	0	0	0	8	2	2	8	84%	9
[redacted]	0	1	0	1	8	2	8	92%	8
[redacted]	0	0	1	1	8	2	8	94%	5
[redacted]	0	0	1	1	8	2	8	94%	5
[redacted]	0	0	0	9	1	2	9	82%	12
[redacted]	1	0	0	8	1	2	8	76%	18

The results presented in Table 37 above show that leadership qualities and technical skills were perceived to impact private respondents the most.

Table 38: Government Data- Impact of Project Manager's Personal Characteristics

[redacted]	[redacted]					[redacted]	[redacted]	[redacted]	[redacted]
	1								
[redacted]	0	0	1	2	7	2	7	92%	2
[redacted]	0	0	1	7	2	2	7	82%	6
[redacted]			1	1					1
[redacted]	0	0	7	1	2	2	7	70%	10
[redacted]	0	0	1	8	1	2	8	80%	8
[redacted]	0	0	8	2	0	2	8	64%	12
[redacted]	0	0	6	3	1	2	6	70%	10
[redacted]	0	0	6	2	2	2	6	72%	9
[redacted]	0	0	0	8	2	2	8	84%	4
[redacted]	0	0	1	2	7	2	7	92%	2
[redacted]	0	0	0	9	1	2	9	82%	6
[redacted]	0	0	0	8	2	2	8	84%	4

The results presented in Table 36 above show that fairness and impartially were perceived to impact respondents the most.

[redacted]

The results in Table 37 show the median Likert score for the frequency and impact of each of the identified challenges in project management of infrastructure in Fiji.

Table 39: Government Data- Median Responses

[redacted]	[redacted]	[redacted]
Planning		
Alignment of project execution plan with project objectives	Rarely	Low
Documentation produced during planning	Rarely	Low
Front end planning process	Rarely	Low
Implementation of project execution plan	Rarely	Low
Peer reviews during planning	Rarely	Low
Track percentage complete	Rarely	Low
Project planning recourses	Rarely	Low
Clear definition of project objectives and priorities	rarely	Moderate
Stakeholder involvement and alignment	Rarely	Low
Understanding client's goal and objectives	Rarely	Low
Offsite fabrication	Rarely	Low
Land and right-of-way acquisition in timely manner	Rarely	Low
Life cycle cost analysis and consideration	Rarely	Low
Community related issues	Rarely	Low
Statutory approvals and environmental issues	Rarely	Low
Preassembly	Rarely	Low
Prefabrication	Rarely	Low
Engineering design		
Constructability in engineering design	Rarely	Low
Quality of engineering designs	Rarely	Low
Involvement of experienced construction managers during design	Rarely	Low
Quality/experience of designers	Rarely	Low
Engineering design deliverables' accuracy and timelines	Rarely	Low
Involvement of a cost engineer	Rarely	Low
Procurement		
Request for proposals	Rarely	Low
Evaluation of proposals	Rarely	Low
Control and monitor proposals	Rarely	Low
Final selection and longstanding arrangement between client and contractor constructability in engineering design	Rarely	Low
Material management		
Material management plan	Rarely	Low

Effective site materials management	Rarely	Low
Procurement plan considering market conditions	Rarely	Low
Procurement plan addressing local content requirements	Rarely	Low
Procurement on time as per design specification	Rarely	Low
On-time delivery of bulk materials and major equipment	Rarely	Low
Supplier quality surveillance program	Rarely	Low
Preferred supplier selection	Rarely	Low
Construction		
Work programming	Rarely	Low
Safety management procedures	Rarely	Low
Appropriate contingency establishment	Rarely	Low
Risk assessment and planning	Rarely	Low
Initial site condition verification	Rarely	Low
Work methodology	Rarely	Low
Quality management system	Rarely	Low
Commissioning with operations and maintenance manual	Rarely	Low
Involvement of contractor's construction manager	Rarely	Low
Foreman to labour ratio	Rarely	Low
Human		
Availability of skilled workers	Rarely	Low
Migration of skilled workers	Rarely	Low
Ongoing training programs	Rarely	Low
Professional work training	Rarely	Low
Extensive labour disruption	Rarely	Low
Adequate trade labour’s availability and competency	Rarely	Low
Subcontractors availability and competency work programming	Rarely	Low
Project manager’s area of knowledge		
Knowledge in project management	Rarely	Low
Knowledge in civil and structural engineering	Rarely	Low
Knowledge in architecture and town planning	Rarely	Low
Knowledge in quantity surveying	Rarely	Low
Knowledge in construction and contract laws	Rarely	Low
Knowledge in services engineering	Rarely	Low
Knowledge in interior designs	Rarely	Low
Knowledge in land surveying and landscaping	Rarely	Low
Knowledge in valuation studies	Rarely	Low
Knowledge in geotechnical engineering and soil study	Rarely	Low
Knowledge in construction method	Rarely	Low
Knowledge in site and construction management	Rarely	Low
Knowledge in environmental studies	Rarely	Low
Knowledge in authority approving process	Rarely	Low
Knowledge in project management software's	Rarely	Low
Knowledge in conducting a feasibility study	Never	very low

Knowledge in financing and cash flow	Rarely	Low
Knowledge in socio-economics	Rarely	Low
Knowledge of economics, trends, market and political condition in the country	Rarely	Low
Project manager's area of skill		
Project management skills	Rarely	Low
Interpersonal skills	Rarely	Low
Leadership qualities	Rarely	Low
Business skills	Rarely	Low
Technical skills	Rarely	Low
Management skills	Rarely	Low
Personal skill	Never	Low
Understanding client's objectives	Rarely	Low
Managing changes	Rarely	Low
Written and oral skills	Rarely	Low
Ability to chair meetings	Rarely	Low
Report writing	Rarely	Low
Risk management	Rarely	Low
Quality management	Rarely	Low
Technical coordination skills with other professionals	Rarely	Low
Resolve technical problems	Rarely	low
Adaptability and flexibility	Rarely	Low
Influencing skills	Rarely	Low
Art of conflict management	Rarely	Low
Problem solving skills	Rarely	low
Critical thinking and decision marking skills	Rarely	Low
Emotional management and stability	Rarely	Low
Project manager's personal characteristics		
Visionary	Rarely	Low
Honest and ethical	Rarely	Low
Fairness and impartially	Rarely	Low
Realistic	Rarely	Low
Ambitious	Rarely	Low
Empathy	Rarely	Low
Energy	Rarely	Low
Flexible	Rarely	Low
Intellectual drive and knowledgeable	Rarely	Low
Wisdom and imaginative	Rarely	Low
Creativity	Rarely	Low
High initiative, enthusiastic and curiosity	Rarely	Low

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The following section presents the results obtained from government and private engineering organisations. The Bar graphs presents the overall Relative Importance Index ranking of the following:

- Planning related challenges in project management of infrastructure projects in Fiji.
- Engineering design related challenges in project management of infrastructure projects in Fiji.
- Procurement related challenges in project management of infrastructure projects in Fiji.
- Material management related challenges in project management of infrastructure projects in Fiji.
- Construction related challenges in project management of infrastructure projects in Fiji.
- Human related challenges in project management of infrastructure projects in Fiji.

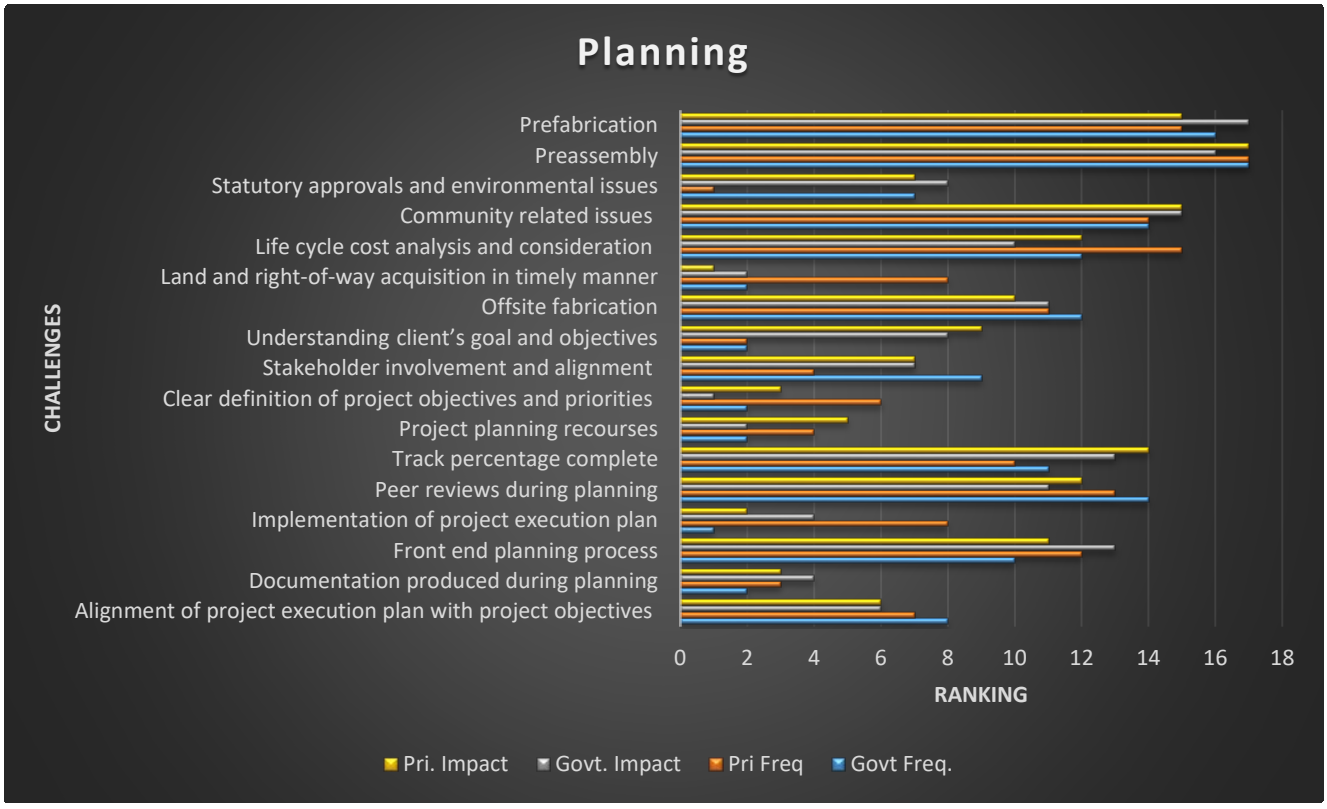

Figure 14: Planning related challenges

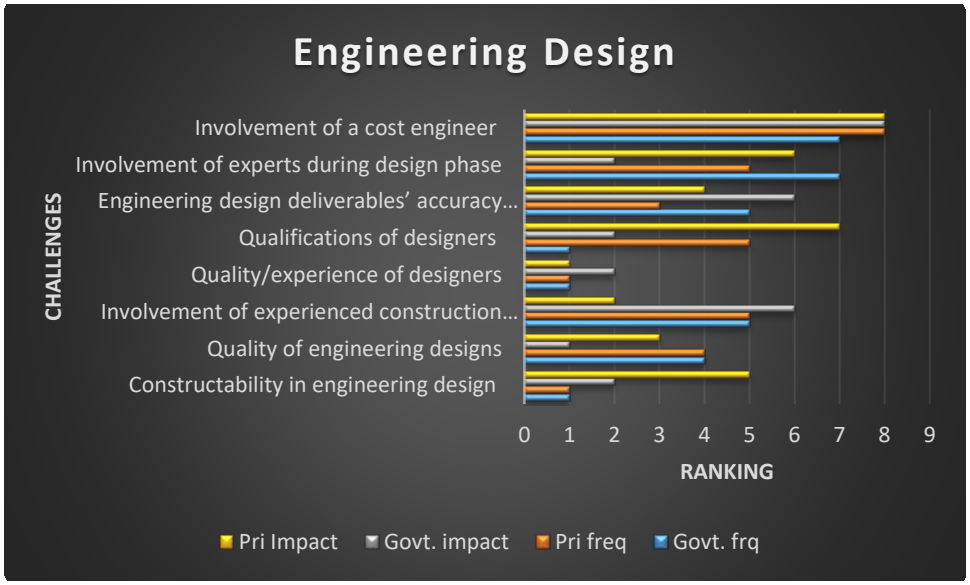

Figure 15: Engineering design related challenges

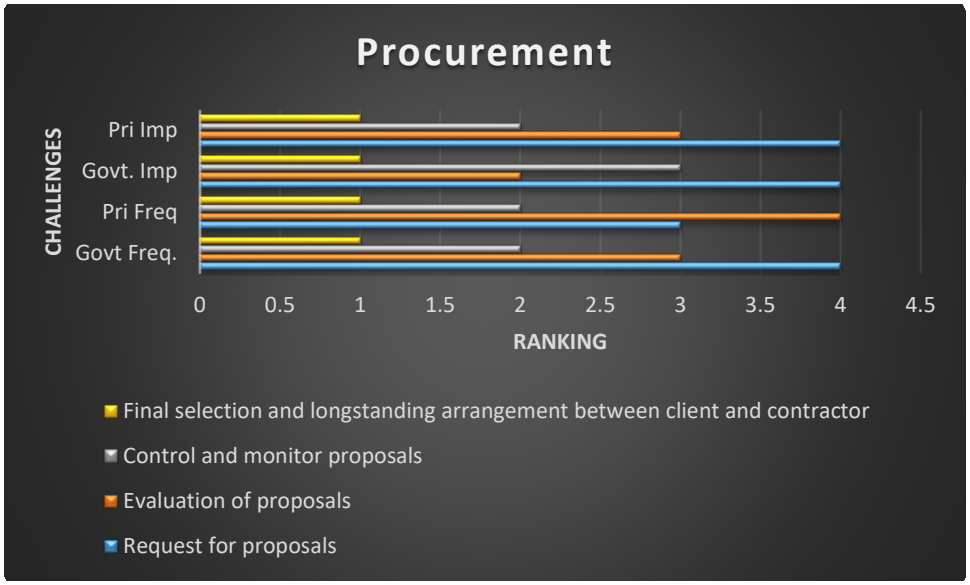

Figure 16: Procurement related challenges

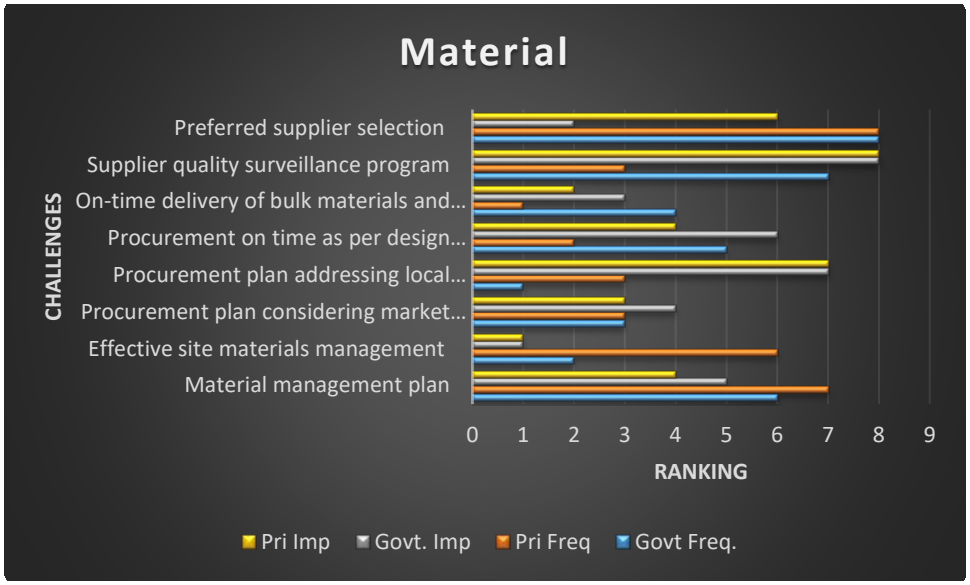

Figure 17: Material related challenges

Figure 18: Construction related challenges

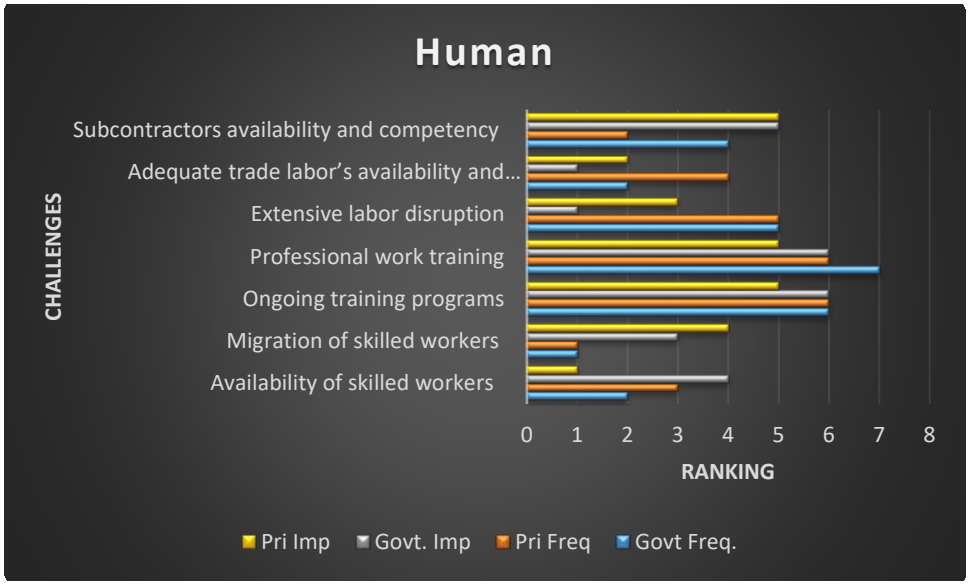

Figure 19: Human related challenges

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This section of the report discussed the results obtained by the questionnaire survey by identifying possible patterns and discrepancies in the data. It may be noted that the response rate from government organisation was only 33% which is less than ideal. Table 40 presents the highest RII items (shown in red) and lowest RII items (shown in blue) for the private and government respondents.

Table 40: Highest and Lowest RII values

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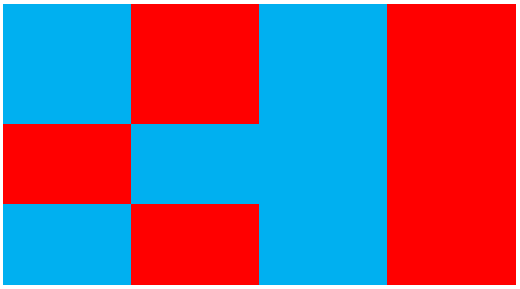
□□□□□□□□□	F	I
Alignment of project execution plan with project objectives		
Documentation produced during planning		
Front end planning process		
Implementation of project execution plan		
Peer reviews during planning		
Track percentage complete		
Project planning recourses		
Clear definition of project objectives and priorities		
Stakeholder involvement and alignment		
Understanding client's goal and objectives		

Offsite fabrication
Land and right-of-way acquisition in timely manner
Life cycle cost analysis and consideration
Community related issues
Statutory approvals and environmental issues
Preassembly
Prefabrication



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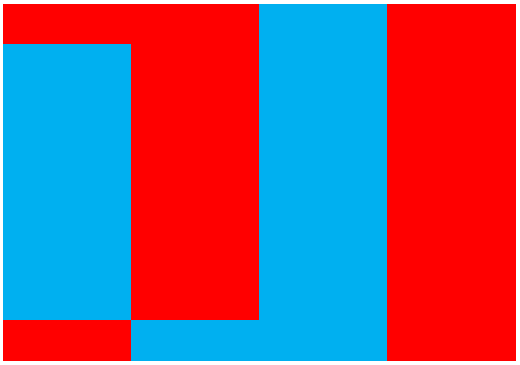
Constructability in engineering design
Quality of engineering designs
Involvement of experienced construction managers during design
Quality/experience of designers
Qualifications of designers
Engineering design deliverables' accuracy and timelines
Involvement of experts during design phase
Involvement of a cost engineer



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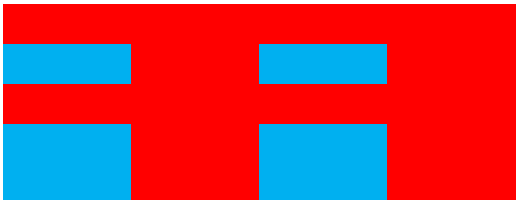
Request for proposals
Evaluation of proposals
Control and monitor proposals
Final selection and longstanding arrangement between client and contractor



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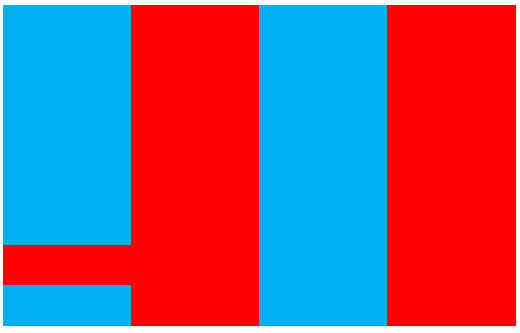
Material management plan
Effective site materials management
Procurement plan considering market conditions
Procurement plan addressing local content requirements
Procurement on time as per design specification
On-time delivery of bulk materials and major equipment
Supplier quality surveillance program
Preferred supplier selection



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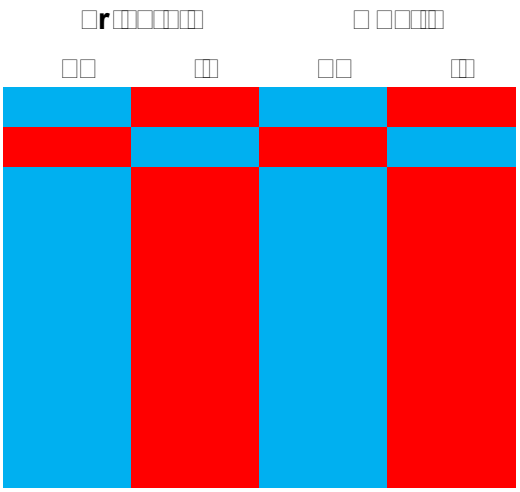
Work programming
Safety management procedures
Appropriate contingency establishment
Risk assessment and planning
Initial site condition verification
Work methodology
Quality management system
Commissioning with operations and maintenance manual
involvement of contractor's construction manager
Foreman to labour ratio



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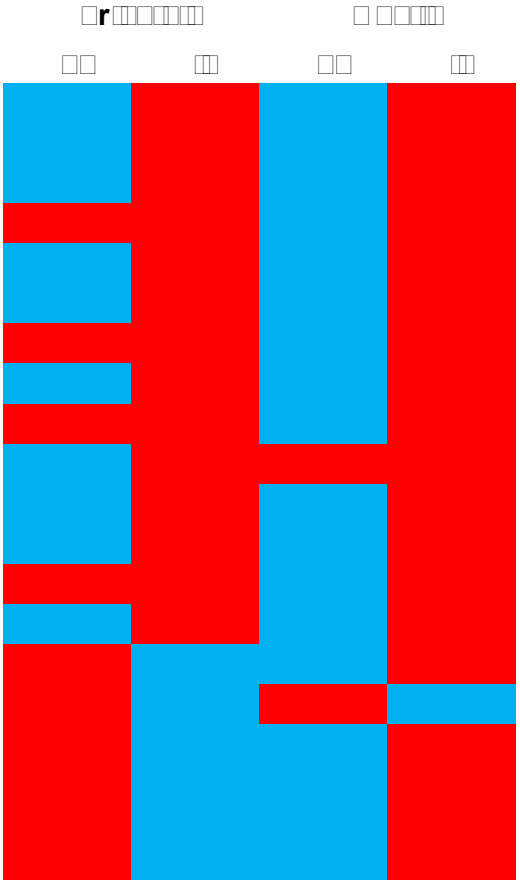
Knowledge in project management
Knowledge in civil and structural engineering
Knowledge in architecture and town planning
Knowledge in quantity surveying
Knowledge in construction and contract laws
Knowledge in services engineering
Knowledge in interior designs
Knowledge in land surveying and landscaping
Knowledge in valuation studies
Knowledge in geotechnical engineering and soil study
Knowledge in construction method
Knowledge in site and construction management
Knowledge in environmental studies
Knowledge in authority approving process
Knowledge in project management software's
Knowledge in conducting a feasibility study
Knowledge in financing and cash flow
Knowledge in socio-economics
Knowledge of economics, trends, market and political condition in the country



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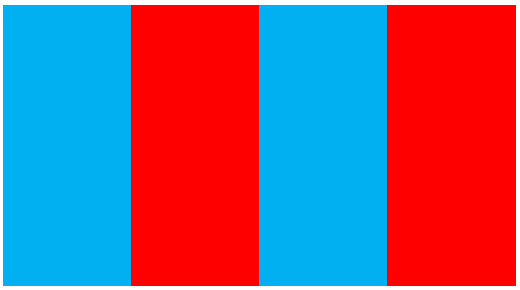
Availability of skilled workers
Migration of skilled workers
Ongoing training programs
Professional work training
Extensive labor disruption
Adequate trade labor's availability and competency
Subcontractors availability and competency



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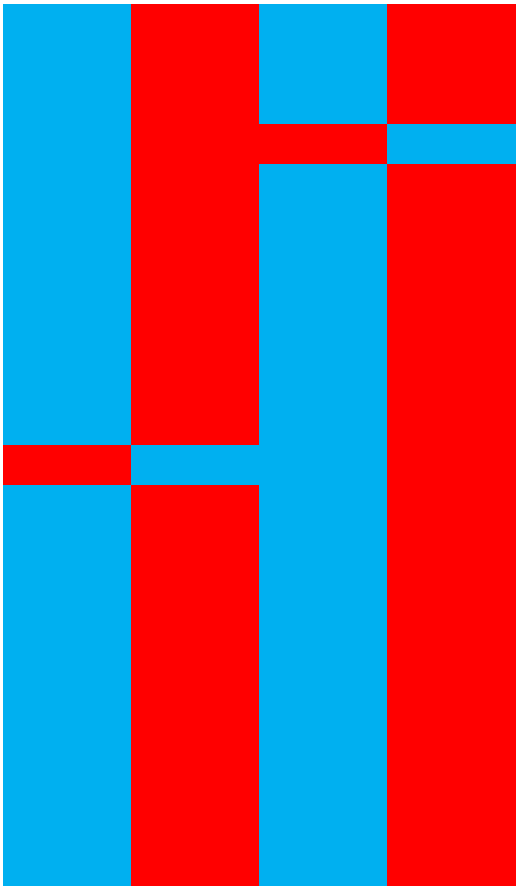
Project management skills
Interpersonal skills
Leadership qualities
Business skills
Technical skills
Management skills
Personal skill
Understanding client's objectives
Managing changes
Written and oral skills
Ability to chair meetings
Report writing
Risk management
Quality management
Technical coordination skills with other professionals
Resolve technical problems
Adaptability and flexibility
Influencing skills
Art of conflict management
Problem solving skills
Critical thinking and decision marking skills
Emotional management and stability



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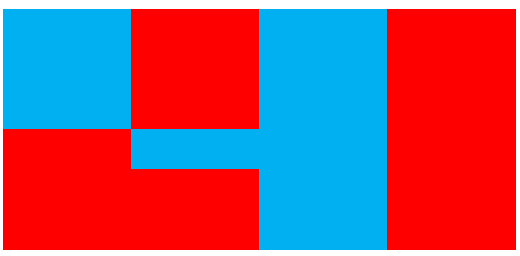
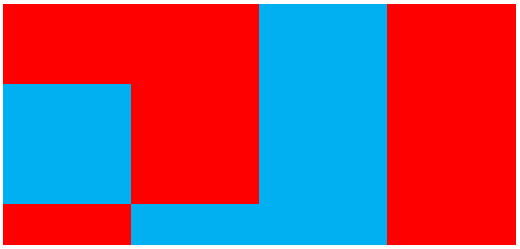
Visionary
Honest and ethical
Fairness and impartially
Realistic
Ambitious
Empathy



Energy
Flexible
Intellectual drive and knowledgeable
Wisdom and imaginative
Creativity
High initiative, enthusiastic and curiosity



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Challenges in statutory approvals, environmental issues and land acquisition in timely manner was identified by both sets of respondents as the highest RII score and highest impact. Approvals affect both the private sector and public sector specially the land acquisition activities significantly influence the project time frame. In the private sector the land acquisition project planning is normally provided by the client in the scope brief however, private consultants are heavily involved in the anticipated method of acquisition, such as outlying the communication and coordination process among the land acquisition staff, consultants, affected landowners and statutory authorities. In the public sector project planning and brief will be provided during the procurement of the consultants or when the new project is identified for construction. The new project will have been identified on either a 5 year or 10 year capital works program.

Challenges in constructability in engineering design and quality/ experience of designers was identified by both respondents as the highest RII score and impact. On various public infrastructure projects, design consultants are commissioned to undertake design and documentation of the project. To investigate this further a number of private and public organisation were contacted on phone. A number of respondents from the public sector pointed out that private design consulting firms have provided inadequate plans.

Inadequacies include poor designs that are not practical, poor drafting, omission of critical specification and overall substandard documents. However, the private companies identified that project brief supplied by government department to designers lack important information and majority of the information is requested prior to complete a detailed design and documentation.

Migration of skilled workers from Fiji was identified by both sets of respondents as the highest RII score and impact. Delailovoni (2008) reports that skilled and hourly paid workers in some government ministries are resigning to take up trade jobs abroad because of better working conditions and pay. Azmat et al. (1995) in his study reports that migration of highly skilled and professionally trained workers from Fiji to neighbouring

countries like New Zealand and Australia was recorded highest during the period of 1987 – 1990 and this was due to political instability in Fiji. The study find out that migration of professionals from Fiji will significantly increase in due course because of constant political instability and positive vibes from previous years migrants.

Building long standing relationship with the contractor and poor quality of work by the contractors was identified by both sets of respondents as the highest RII score and impact. Challenges in work programming and safety management procedures onsite was evident.

Challenges in on-time delivery of bulk material and equipment was identified by the private respondents as having the highest RII score for frequency and impact. Private companies specially construction companies are profit driven organisation. A delay in supply of materials affects construction time limes and have a flow on effect to other infrastructure projects.

Project Manager's knowledge in construction, contract laws and in construction management was identified by both sets of respondents as the highest RII score. From literature review it was found that causes of delays in the construction industry is knowledge and competence shortage of project managers. Due to the advanced in technology, construction techniques and methods and involvement of numerous foreign contractors in Infrastructure projects in Fiji it is perceived that the Project Mangers in Fiji are still catching up on knowledge.

Project manager's technical skills and ability to resolve problems, critical thinking and decision making received highest RII scores and impact by both parties and project manager's high initiative, enthusiastic and curiosity characteristics received the highest RII score.

[illegible]

Involvement of a cost engineer in the planning phase was identified by both sets of respondents as the lowest RII score and lowest project impact. However, after extensive literature review it was found that early involvement of the cost engineer during the technical feasibility and development of cost and schedule is an add advantage. These planning estimates are used for scoping studies and for defining preliminary budget.

Evaluation of proposal during procurement phase and foremen to labour ratio was recorded lowest RII scores and impact.

Continuing professional development of employees was identified by both sets of respondents as the lowest RII score for frequency and impact. It is shocking to note that professional development training is overlooked and underappreciated by both sets of respondents. However, many researchers such as Ogunde et al. (2017) and Radujković et al. (2017) have highlighted the importance of training and up Skilling professionals in the field of project management.

Offering professional training programme will allow employees to perform better and prepares them for a position for a greater responsibilities. Private organisation are profit driven companies and may not want to spend money on continuing professional development and maybe encourages employee to manage their own career development. However, government organisation have implemented training courses for employees. Government employee might not want to attend the training and perceive training within their profession is least important. Project manager's knowledge in conducting a feasibility study, business skills and empathy characteristics recorded the lowest score and impact.

From this discussion above a number of conclusions can be determined;

- Private and government company respondents believed that statutory approvals and land and right-of-way acquisition in timely manner is a major planning related challenges in project management of infrastructure projects in Fiji.
- Private and government company respondents believed that constructability in design and quality/experience of designers is a major engineering design related challenges in project management of infrastructure projects in Fiji.
- Private and government company respondents believed that final selection and longstanding arrangement between client and contractor is a major procurement related challenges in project management of infrastructure projects in Fiji.
- Private and government company respondents believed that on-time delivery of bulk materials and major equipment is a major material related challenges in project management of infrastructure projects in Fiji.
- Private and government company respondents believed that work programming and safety management procedures is a major construction related challenges in project management of infrastructure projects in Fiji.

- Private and government company respondents believed that migration of skilled workers and extensive labour disruption and adequate trade labour's availability and competency is a major human related challenges in project management of infrastructure projects in Fiji.
- Private and government company respondents believed that project manager's knowledge in construction and contract management is important area of knowledge.
- Private and government company respondents believed that project manager's critical thinking, decision making and technical skills and ability to resolve technical problems is very important project manager's skill.
- Private and government company respondents believed that project manager's Intellectual drive, knowledgeable, high initiative, enthusiastic and curiosity personal characteristics is very important characteristics skill.
- Private and government company respondents believed that professional development training is not important.

This section provides a simple analysis of the patterns discovered in the responses from private and government sectors. A number of correlations can be drawn between the two sets of data suggesting that the challenges identified above are nationwide and not confined into private and government sectors.

[redacted]

1.[redacted]

Public Rental Board (PRB) was established on 16th May 1989. The Public Rental Board has an obligation to provide affordable rental accommodation to low income earners on a transitional basis without incurring a loss. (Fiji, 2018)

On 3rd April 1997, the public rental board was declared a Commercial Statutory Authority under the Public Enterprises Act 1996. Now the Public Rental Board operates under a predefined definition of their customers.

The PRB is owned by the Fijian Government and managed by Board of Directors. The Board's operations are undertaken by staff of Public Rental Board. Currently 1,554 rental flats are rented or available for renting at any given time from 20 rental estates. However, PRB has continued to face shortfall in the supply of rental units especially in the Suva area.

PRB's objective is to provide new rental accommodations to address the need for rental housing. Ease the demand for rental housing and to support government's objectives in providing affordable and quality housing. (Public Rental Board Annual Report 2013)

The researcher was actively involved in carrying out site inspections and compiling defects report.

1.1 [redacted]

On 3rd of March, 2009 the Principal was Public Rental Board and the main contractor China Railway First Group (Fiji) Co. Ltd entered into a construction agreement with a view to developing a number of medium rise, residential building structures in Raiwai and Raiwaqa utilising the FIDIC Conditions of Contract for EPC/Turnkey Projects, 1999. As per the agreement between PRB and CRFG, the house construction rate was FJ$700-FJ$1,000/m2 and this will be finalized once the detailed plans are approved by Suva City Council in the commercial contract. The Engineer to the Contract and was NRW Macallan (Fiji) Limited. The Project consultancy and construction was approximately FJD$ 25 million and was funded by Exim Bank of China.

The project is located on the Raiwai and Raiwaqa field of Suva suburb of Republic of Fiji Islands. The total area is 13790m2. The housing of Raiwai is 1411m2 and Raiwaqa's housing is about 1411m2. The design plan mainly contains three types of housing. They are 3 floors residential building, 2 floors residential and single building. Figure 11 shows an aerial photograph of the site.

The main service facility includes Community building and housing concept. Generally the building compromise of semi-high rise construction, insitu concrete and blockwork structure with similar finishes including plastered walls and louvered windows. The composition of the structures at the Raiwai housing development are summarised in table 5 below:

Table 41: The Composition of the Structures at the Raiwai Housing Development

□□□□ □□□	□□□□□	□□□□
□□□□**d**□□□□□	The structures are founded on shallow Reinforced Concrete Strip Footings	400*1200 reinforced concrete with HD12 @ 200mm
□ □□□□	The main lateral and vertical load resisting system are the 200mm Masonry with partially grouted blockwalls	200mm partially grouted blockwalls with HD12 bars in grouted cells. Mesh at 400mm centres vertically.
□□□□ □□	Reinforced Concrete Bond Beams	400x200 Reinforced concrete bond beams with 3 HD 16 top and bottom with HR 10 @ 200
□□□□□	Cast in-situ	120mm thick slab with HD 10 @ 200mm centres bottom steel
□□**r**□□□□	Folded steel purlins	Z150/2 Purlins @ 1250mm centres
R□□□□□□	Trimdeck type roofing profile	0.53mm BMT roofing iron
□□□□ □□□	Reinforced Concrete Columns	8 HD 16 bars with HR 10 @200mm Centres

Figure 20: Shows an Aerial Photograph of the Site. (NRW Macallan)

Figure 21: Shows an Overall Photograph of the Site during Construction Works in 2012 (NRW Macallan)

□1□□□□r□□□□□□ □□□□□ □□□□□□□□□□□□□□

The Raiwaqa and Raiwai project was subjected to a number of Project Management Challenges during the course of the project. Major challenges was that the project started without clear objectives, a specific direction and a prepared plan. The client awarded the design and built contract on the best value basis to a Chinese contractor. The client was under the impression that the design and built contract will limit the client's liabilities and the Contractor will be responsible for all delays and additional costs. The Contractor being China Railway First Group (Fiji) Co. Ltd had brought along all skilled and unskilled employees from China and also imported supplies such as steel, architectural fixings etc. from China. Since employees were from China language barriers became an increasingly problematic. The lack of professional communication support was a daily challenge that the managers had to go through. As stated in a letter from M. Senibulu on 3rd July 2009, it content that the initial contract agreement between PRB and CRFGC that was signed on the 03rd March, 2009 and the Contractor was required to submit the conceptual

designs for the Board of directors vetting. However, the conceptual designs were not submitted on time. According to (American Association of Fishmongers, 2011) (Erasito Consultants Ltd: Minutes of Meeting No.2 Dispute Adjudication Board (DAB), 2013. p. 3) the conceptual drawings were submitted on the 30th August, 2011 followed by the bill of quantities on the 5th September, 2011.

Senibulu (2009) [letter on Cost effective designs, 10 November] outlined that the Board rejected the Concept design on the 6th November, 2009 since the design fails to serve the target market with costs that have been suggested, that was around $1000 per square meter. Approval of the conceptual design was a potential obstacle however agreement was finally made and the final commercial contract was signed on the 18th June, 2010. On the 8th July, 2011 PRB engaged NRW Macallan (Fiji) Ltd consulting engineers to act at the capacity of the Principal's representative and perform certain functions in connection with the main contract in procuring, building and repairing any damages to the Raiwai and Raiwaqa Housing Project. (Construction Management Agreement, 2011). Subsequently, and to avoid any further delays to this project the client instructed the contractor to mobilised on site and commence on construction work. It was found that construction work commenced without the approval of the local authorities.

During the wider course of the project PRB queried the Contractor on the overall project cost as the Board wanted to know the overall project direction as to check if there is a financial metrics in place to trace the funds and to ensure that the construction activities are aligned to the overall strategic direction. It was bought to attention that contractor had submitted a set of bound documents as Project Cost List to PRB, dated September 2011. PRB noted that the submitted document was an estimate and not a bill of quantities. Furthermore, the Contractor highlighted that the submitted Project Cost List was matched up to the current design and amendments would be done accordingly once the drawings are changed after receiving comments from the local authorities. (NRW Macallan: Meeting minutes No.12 Raiwaqa & Raiwai Project, 2011. p. 2)

On 19th of December, 2011 Fiji National OHS carried out health and safety inspection and the findings revealed that the construction site failed to meet the minimum requirements of the Health and Safety at Work Act 1996 and its associated legislation. According to the OHS report the Contractor was recommended the following:

- Develop an OHS Policy the workplace and also display this policy at an appropriate place where it is decipherable.
- Appoint an OHS Representative for the workplace.
- Provide training to OHS Representative.
- Provide first aid supplies.
- Be acquainted with moral and legal responsibility to provide a safe and healthy work environment for employees, contractors, customers and visitors.

(National OHS Service OHS Inspection Report for Public Rental Board Construction Site Raiwaqa, 2011)

Attention was drawn to construction defects that was found during the life cycle of the projects. Defects were caused by poor quality of work done and poor quality management. Palmer (2012) receives notice from clerk of works, Mr. Jitoko, on Thursday, 19th of April, 2012 after multiple cracks were seen on first floor slab between

gridlines 1-3 & B-C. However, from the inspection details it was found that the Schmidt hammer test was conducted to determine the localized surface compressive strength of the concrete floor slab and the results yielded that plastic shrinkage cracks occurred and was associated with bleeding of fresh concrete. Cracks were in the range of 1-2mm wide at the surface and were minor. Concrete crushing test results was also sighed and it had attain the minimum required strength of 25MPa. Architect also report that plastering works carried onsite not acceptable. Trowel marks visible on walls and walls not properly sanded as gaps still visible, painting defects was also reported.

The Engineer who was also the construction manager issued many site instructions but the contractor failed to adhere them. The Principal PRB deliberatively shown great concern over Contractor's continuous disregard to Engineer's site instructions and their overall management of the project. After consultation with higher authorities, the Principal decided to notify Suva city council (SCC) to place a stop work order on the Contractor. *Public Rental Board. (2012). Stop Work Order: 2012 progress report.*

Defective work and poor workmanship was a major challenge. It was evident from the structural defects report dated 18th January, 2013 which outlined many defects notwithstanding prior approvals given. The main rational behind this report was that the Contractor failed to comply with the Fiji National Building Code (under the public health act) as outlined in the contract. The issues identified that don't comply with the Fiji National Building Code were:

1. CRFG stating that their design only compiles with Chinese National Building Code standards which was a concern whether seismic compliance has been achieved.
2. The lack of sufficient reinforcing cover to the reinforcing bars under NZS 3101
3. Lack of cyclone rated glass of cyclone shutters to the windows.
4. A lack of a compliant fire egress system
5. Concealing of water pipes within the walls.

Furthermore, the contractor was instructed to rectify these issues under the contract at their cost. The client was in dispute with CRFG over the above issues as CRFG will not address them as instructed by the Engineer. PRB point of view is that the contractor signed the design and build contract of the Raiwai and Raiwaqa housing projects for FJD 20 million and are expected to honour the contract. (Kirk, 2013). However, the contractor claimed that the Contract sum of FJD$20.5 million as specified in the Contract Agreement between Public Rental Board of Fiji and China Railway First Group Co. Ltd for the Raiwai and Raiwaqa Housing Construction dated 3rd of March, 2009 is provisional only and that the Contractor has the opportunity under the Contract to modify this sum once the detail design and documentation is completed. The relationship between the client and the contractor became a contentious climate and was referred to a Dispute Adjudication board. (DAB).

The first dispute adjudication board project meeting was held on the 14th January, 2013 and in this meeting was used to define the specifics relating to the items that are in dispute. The party who is raising the dispute will then provide a detailed submission contacting the basis of the dispute and provide data and documentation to support the disputed item. The disputed items was the project cost related matters, Structural Standard and Architectural Standard.

The second meeting of the DAB was held on the 23rd January 2013 to discuss the content of the respective Submissions submitted by the two parties on the 18th January, 2013. Both parties were given time till the 29th January, 2013 to provide formal response to the submissions on the issues of dispute.

Erasito a local consulting company were commissioned to Chair a Dispute Adjudication Board (DAB) which was formed to adjudicate on disputes involving construction matters which arose between the main contractor (China Railway First Group (Fiji) Co. Ltd) and the Principal (Public Rental Board) in relatively large building construction contract (that is, the Raiwai and Raiwaqa Low Rise Housing Project). Submissions were received by the two contracting parties in January 2013 outlining details of the disputes which had arisen during construction phase. The submissions were accompanied by relevant supporting documentation. The two parties were invited to provide responses to the other party's submission with a view to providing a counter claim or an explanation to the claim. The DAB deliberated over the submissions and subsequent responses and the Chairman produced a final Determination on the disputes that were presented to the DAB.

According to Erasito, 2013 the primary finding of the DAB was that the issues which were raised as disputes were attributed to poor documentation and procedures in the formation of the Design and Build Contract and ambiguous and contradicting statements of the modified clauses under the FIDIC, EPC General Conditions of Contract which were used to form the main construction contract between the two parties.

At the time of negotiation of the construction contract (2009-2010) the Contractor was required to provide a Contract Price (that is, an offer to construct the Raiwai and Raiwaqa housing project) in the absence of a Design Report (or a Performance Specification) from the Principal which is not normal in Design and Build Contracts of this nature.

As a result, the agreed Contract Price was deemed to be substantially lower that construction costs based on fair market rates for labour and materials that were prevalent in Fiji at the time of construction.

A second consequence of the improper manner in which the Design and Build Contract was formed was that the Contract has built the building structures possibly using non-complaint structural design standards (seismic and cyclonic) and building practices (i.e., concrete cover to steel reinforcement; architectural standards and services standards). The Contractor had designed the structural frame and components of the buildings in accordance with Chinese design codes and not in accordance with Fiji Building Code. It was recommended that an IPENZ Registered structural engineer is engaged to check if the Chinese design standard is in compliance against Fiji seismic design requirements.

NRW Macallan (Fiji) Ltd was engaged to conduct a review of the design of the Raiwai flats in accordance with the Fiji National Building Building Code (FNBC) and more specifically compliance with the following codes was assessed:

1. AS/NZS 1170.5 :2002 Structural Design Actions : Seismic Loads
2. AS/NZS 1170.2 :2011 Structural Design Actions : Wind actions
3. AS/NZS 1170.1:2002 Structural Design Actions : Permanent, imposed and other actions

4. NZS 4230:2004 Design of Reinforced Concrete Masonry Structures
5. NZS 3101:2006: Concrete Structures Standard: The design of Concrete Structures

According to NRW Macallan Structural assessment report dated 17 June, 2013 various deficiencies were noted such as:

1 [illegible]

a. Seismic analysis of the buildings has indicated that the bottom two levels of the four storey structures need to have all of their cells fully grouted. For three storey structures these need to have the bottom level fully grouted. The two storey structures comply. As they are the structures are vulnerable to shear failure.

[illegible]

[illegible] After reviewing some of the photos during the early construction it was noted that in lieu of continuous mesh shown on the drawings 6mm round rod has been used (and tied with steel wire). This means that the rod will not develop effectively and will not be compliant with the minimum steel requirements of NZS 4230:2004 under 6.3.1.1 “Use of deformed reinforcement. All reinforcement other than ties, stirrups, spirals and joint reinforcement shall be deformed”. For the horizontal reinforcement it could be argued that fully welded mesh could act in a similar fashion to deformed reinforcement. However, 6mm round bar tied with binding wire will not develop properly and is non-compliant.

[illegible] The cover to the steel in the walls and the slabs is in many cases inadequate.

[illegible]

In order to address the design defect identified in 1 above the cells that are needed to be grouted should be retrospectively grouted. The empty cells would need to have a hole made at the bottom and a sloped hole through the bond beam at the top. Then grout would be introduced through the bottom cell until it is visible at the top.

Figure 22: Shows an Overall Photograph of the Site during Construction Works in 2013 (NRW Macallan)

Figure 23: Shows 15mm Cover to Main Bar. Note the Bar Next to the One with the Tape Has Even Less Cover (NRW Macallan)

Figure 24: Showing Almost Zero Cover to Main Bar (NRW Macallan)

Finally, work commenced on January 2013. The final cost was estimated to be between FJD 11.5 million – FJD 15.5 million for the Raiwai project. The contract was clear that design errors be rectified by the Contractor and the contractor also agreed to rectify all defects as per the Engineers satisfaction. Principal had the option to issue a notice of dissatisfaction under section 20.1 of the Contract and proceed to arbitration. However, this process would be a time consuming process and would have cost significant amount of money. The Principal pursued to consider trying to reach some sort of compromise with the Contractor just to get the project finished.

Public Rental Board reported that the project has costed $18.3 million dollars and has been made possible through a $9 million soft loan from the EXIM bank of China through the Fijian Government as well as an additional $9.3 million grant by the Chinese Government to the PRB. (Deo, 2014)

The project failed to meet the original expected duration as set out in the contract, and was delayed for approximately 2.5 years the project was completed in late October, 2014.

[illegible]

Fiji roads authority have the responsibility of keeping vital assets such as Savusavu jetty in good condition. The researcher was actively involved from the project planning phase till project close off.

[illegible]

Savusavu Jetty is located in Vanua Levu, on Savusavu Bay, approximately 1 Kilometre west of the town of Savusavu and is a critical transport infrastructure facility in Vanua

Levu. It provides a key transportation link between Vanua Levu and Viti Levu. It services a wide range of users. Including but not limited to vehicular ferries, police, customs, and navy, fishing vehicles, government supply ships and small locally based vessels. Savusavu jetty therefore sees a significant amount of Roll on Roll off traffic, while also providing the needs of many smaller vessels. The site is also expected to see an increase in vessel traffic in the future.

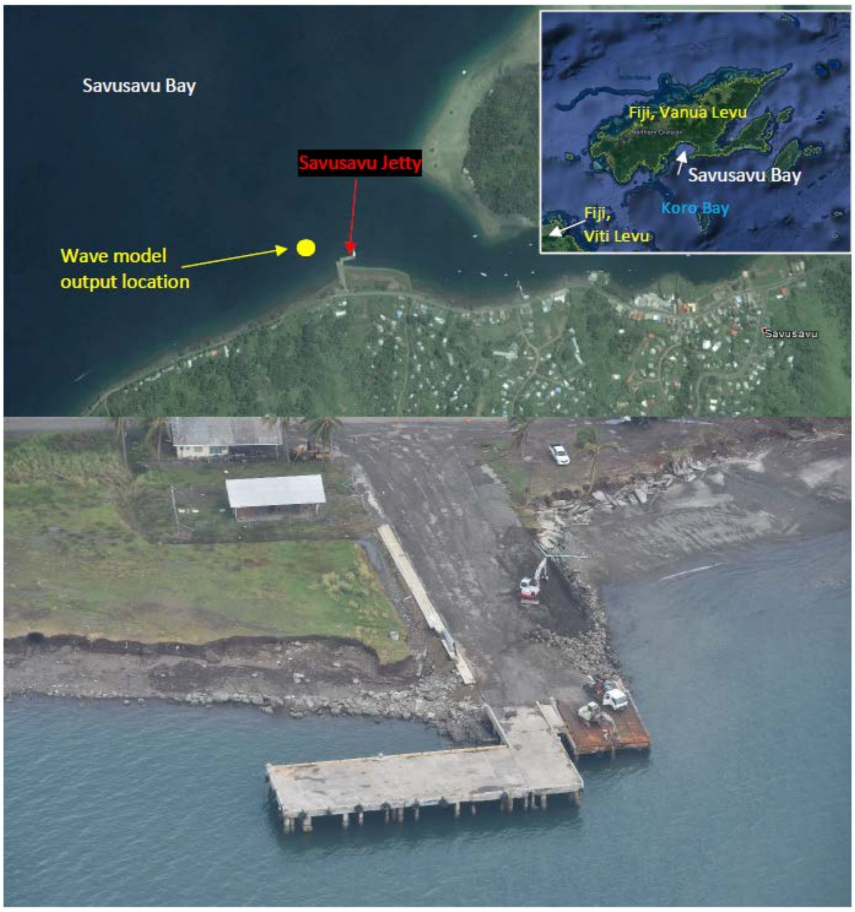

Figure 25: [illegible]

Existing structure has deteriorated beyond its useful design life. Repair work was undertake in 2014 to attend to critical safety issues and extend its operational life. Whilst investigation was undertaken regarding the long term solution. Investigation was completed and a detailed report was prepared which included the risk register, preferred options, environmental studies and recommendations, stakeholder engagement records, procurement strategy and other data useful for design. Detailed planning was done prior to the engagement of a professional consultant to provide a technically robust solution to the jetty service. In summary, the following services was required by the consultant:

- Undertake investigation
- Manage Land, Consents, Environmental, and stakeholder, liaison
- Prepare Consultant's documents, design and specification
- Prepare request for tender documents

- Interact with tenderers during tender period
- Perform tender evaluation and report to Client with recommendation
- Contract management of physical works
- Provide Surveillance and Quality Assurances to the level specified.

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Detail work breakdown structure was prepared by the client which clearly identified the details such as cost, schedule, and starting and finishing dates of the various activities together with the resources needed to achieve this. Client's gathering and carefully studying all the standards, regulations and rules needed to complete the project was satisfactory. Preparation of all relevant project documents such as feasibility documents, project scope and plans had structure. Conversely, in November, 2015 high level of review of all the documentation provided by FRA was reviewed by project consultants NRW Macallan and Cardno Emerging Markets from Australia. The following constraints were highlighted:

R□□□□□ □□□□ □□□□□□□□□□□d□□□□□□□ □□□□ □□r□□1 □□□□□M□ □ □□ □□□□□

1. With reference to the geotechnical investigation report provided by MWH, the depth of rock appears to be fairly consistent throughout the depth, thus driven or bored piling method will be used for foundation types.
2. Preference of driven piles is given as there is no boring rig available in Fiji, capable of boring piles up to 22m top depth.
3. 310UC11 or driven steel tube piles of 700mm diameter at 4m centres spacing shall be used for our preliminary pile design due substantial high value of structural loading resulting from very high significant wave height - wave study model (Based on Extreme Wave Assessment completed by Mulgor Consulting Ltd, *Waves in the Koro Basin Rev 2, July 2013*) Table 10.3 for 100 year return period wave height.
4. This size of driven pile is non economical for design.

R□□□□□ □□□R□□□r□□□□□ □□□□□□□□ □r□□ □□□□□□ □□□□ □□r□□1 □□□□□□□□□M□□□□r□ □□□□□□□□□□□□□d□□

1. The deep water model point is south east of the basin where the applicability of the wave data is from the deep water point to jetty location is questionable.
2. The SE to SW quadrant used in the report may not properly capture the largest wave reaching the Jetty. The largest wave are likely to come from SSW through west, which is largely protected from wave energy by the main island of Viti Levu.
3. This means that design wave condition for the jetty is very much lower than implied in this report. Due to this defective and uncertain wave model, the significant wave height is higher resulting much higher structural loading and ramp level.
4. It is also noted that in section 10.4.2 Extreme Wave from SE to SW Quadrant, the fit of the distribution in fig. 10.6 is poor and the confidence interval are too

large to plot - there is high degree of uncertainty in the result presented in table 10.3.

5. This report does not provide design conditions for waves at Savusavu Jetty.
6. Project consultant recommends new modelling to:
   - transfer wave conditions from deep water to jetty site;
   - Investigate wave from more western direction and the effects of waves from tropical cyclones at the site.

[illegible]

1. The nearshore is a mix of coarse, fine sand and silt, and courser with shell-lag from 10-15m deep, where coral patched becomes common.
2. Debris covers much of the seabed area close to the jetty. For this reason of debris and coral patches occurrence even in deeper water is the recommendation for detailed hydrographic survey of the site.
3. For locations where dredging is required to reach required design depth, debris around the structure shall be effectively cleared before any formal dredging activity due to cost and delays.
4. The Environmental report includes a short section on bathymetric survey, including some additional works to that presented in 1973 and 1999 surveys. The location of these surveys runs and lack information about equipment or methodology, and its apparent inclusion in a broader data set for contour preparation, should be disregarded entirely.
5. The Environmental Report provides some excellent background photographs of significant waste on the seabed for which some is undoubtedly in line with future works and / or widening of causeways etc. This should, at least, in the vicinity of future works and jetty approaches, be properly documented in future hydrographic surveys due to issues associated with vessel operations as well as future dredging considerations.

[illegible]

1. There was a concern on berth depth and access which is not addressed anywhere in reports.
2. Vessel draft not clear.
3. There is no allowance for wave response which, subject to actual significant wave height and design parameters at the jetty could be higher and could otherwise result in vessel / hull damage.

[illegible]

1. A review of the 1973 (H48) survey and 1999 (H198) surveys for Savusavu have been undertaken. These survey plans, line spacing's, report and / or notations, do not provide sufficient detail as to the class of survey undertaken or equipment and survey methodology.
2. As the proposed jetty will be used for passenger and cargo related vessels, albeit of a minimal draft requirement, it must consider potential for obstacle in the berth,

approaches and nearby areas, and to a suitable tolerance or confidence level as adopted for the Under-keel clearance parameters of the vessels using the facility.

3. It is therefore recommended that a detailed survey, including guaranteed 100% bottom coverage and to minimum International Hydrographic Organisation special order requirements be undertaken. This should include a survey methodology statement, preparation for charting of reduced depths, equipment and checking information and qualification (Level 1) of the Hydrographic Surveyor.
4. The survey to include areas inshore of the existing jetty and along the causeway alignment for proper assessment of construction requirements as well as any debris requiring removal in advanced, a minimum side scan but ideally full 3D underwater scan to pick up damage below the existing structure and in the vicinity of the new piles, and identification of obstructions in berth pockets or beyond, including possibility of above mentioned coral outcrops.

From the peer review undertaken by Cardno on the existing wave and storm surge assessment including Savusavu Bay concluded that the Mulgor (2013) wave reports does not provide design conditions for waves at Savusavu jetty and that modelling is required to transfer wave conditions from deep water to the site, to investigate waves from a more westerly direction and to investigate the effects of cyclonic waves at the site. Furthermore, it was found that the wave assessment report and values recommended seem to be conservative and a detailed wave study recommended to reduce the wave setup and heights as it will have a design impact on pile size and jetty ramp heights.in addition to this, it has been reported that the structural design, particularly uplift due to wave action, is unrealistic. The wave study are anticipated to provide more realistic design wave criteria and setup values for structural design.

Communication of the uncertainties was made to the client and the recommendation discussed. After constant follow ups and meetings the Client decided to move forward with further investigations to enable it to complete the designs. Tenders was called for the wave and storm surge analyses on the 15th February, 2016.

On the 20th February, 2016 a severe category 5 Tropical Cyclone Winston the strongest tropical cyclone ever thrashed Fiji destroying hundreds of infrastructure networks, such as water supply, wastewater collection, transport, and flood protection and killing 40 people. Following this disaster
There was pressure to reinstate these services to pre disaster levels as quickly as possible, helping restore some form of normality to urban life.

Reconstruction programmes began and FRA needed to perform numerous tasks very quickly, and many simultaneously communication became an obstacle for months. All resources was shifted to carry out post-disaster recovery works. Recovery works lasted weeks, months and extended for years.

It is unknown what wind speed and rainfall were at Savusavu jetty however observation of the damage to the jetty structure would indicate the conditions were severe.

The inspection was carried out by the researcher on the 23rd February, 2016. The purpose was to assess the magnitude of the damage caused by tropical cyclone Winston and collects such information as required to determine with some certainty the state of the existing jetty. From the site inspection the following was reported:

- A comprehensive visual inspection of the jetty was made on the 23rd February, 2016 after the TC Winston.
- At the time of the inspection FRA's maintenance contractor Fulton Hogan was carrying out interim causeway restoration works for temporary access.
- The causeway/approach road appeared to have suffered significant washout damage by the storm
- Causeway needs to be topped up by seal approx. 300mm - 500mm thick.
- Underlying rocks/boulders appeared satisfactory and can be utilised in the restoration works
- The steel ramp was severely damaged structurally. Concrete cracks were visible in the precast U sections. The inverted precast U sections and deck were no longer supported.
- The overlying steel ramp does not have continuous I beams running over the 3 concrete beams and therefore cannot be relied upon to provide cantilevered support if the beam gives way fully.
- The structural integrity of the western section of the roll on roll off ramp beam have been compromised and must be excluded from operation till remediation works are carried out
- Front of the jetty ramp has been compromised and the existing steel ramp cannot be relied upon to provide support for its full width.
- For temporary access it was recommended FRA's contractor establish access on the adjacent higher jetty head to allow other ships to berth here at high tide. (Eastern end to be utilised)
- The structural integrity of the western section of the roll on roll off ramp beam have been compromised and recommended that this element be excluded from operation till detailed assessment and remediation works are carried out
- Jetty fenders installed on the end of the jetty ramp and the fender hold down bolts have also sustain damage and are in poor condition
- The mooring bollards on the ramp appears to be in fair condition
- Concrete stairs along the footpath area have been completely damaged
- Strong winds associated with TC Winston created high energy wave conditions, causing erosion along the part of the causeway and the shore protection area/rock armouring and gabion baskets

- Power supply line supplies that extend in a line out from the southern side of the jetty has been completed damaged
- No major damages were noted for the waiting area
- Maritime Safety Authority of Fiji office building sustained major roof damage
- Debris were found all around the site
- Civilians found loitering around the moving hydraulic excavator shows poor quality of physical works through lack of supervision and monitoring by FRA's nominated contractor.
- Detailed assessment of the jetty was recommend to be completed urgently to allow for efficient design of the new jetty elements.

A Post Disaster Needs Assessment (PDNA), headed by Fijian Government, was conducted in March/April 2016. Damage and losses as a result of the disaster were estimated at F$ 1.98 billion (PDNA Table 1). Of this, 2016. Fijian 1.28 billion dollars was classified as damage (i.e. destroyed physical assets), and F$ 0.70 billion as loss (i.e., changes in the economic flows of the production of goods and services). It was found that the combined damage and losses are about 20 percent of Fiji's gross domestic product (GDP) in 2016. The PDNA estimated recovery needs at F$1.98 billion, of which F$1.69 billion will be focused on reconstruction, F$218 million will be focused on recovery needs, and F$46 million will be focused on resilience activities (PDNA Table 5). In some sectors, such as agriculture, fully recovery will take many years. (Ministry of Economy Fiji, 2016)

It took approximately 2 months to complete the interim works for the jetty. In April the works was completed and jetty was operational however the existing jetty is in a poor state of repair (NRW Macallan Ltd, April 2016), with extensive cracking and reinforcing steel exposed in numerous locations. Fiji Roads Authority are planning an upgrade of this jetty.

In the intervening time hydrographic surveying and wave studies tenders were evaluated. All tenders were received by prospective bidders on the 15th March, 2016. After evaluation SPC Geo science Suva and Tokin and Taylor New Zealand was selected. Tender evaluation report was submitted to the client and after constant follow up it was late November, 2016 when client responded with the letter of appointment. The delays was caused because of lack of funds available to commission the consultants. Consultants also demanded 50% mobilisation fees prior to engagement which caused fiscal strain to the Client FRA.

MWH Global (New Zealand) was appointed by Fiji Roads Authority (FRA) in January, 2012 to act as Principal Engineering Services Advisor. However, in year 2016 the FRA has been involved in a protracted contractual dispute with MWH. The dispute is not about non-payment despite assertions to the contrary by MWH. MWH was claiming payment of almost F$20 million for its services in 2016. FRA required MWH to provide proper substantiation for this very large claim before payment could be made. MWH refused to

provide that substantiation and the dispute raised. This dispute also caused disruptions and delays to individual projects, programmes, and shortcomings and oversights for months. (The Fiji Sun, 2016)

On the Friday 23rd September MWH Global terminated their contract for the provision of road management services with the FRA. According to Sharma (2017), MWH failed to return of all contractual documents and project documents from January 2012 to FRA.

Due to prolonged delays from FRA the Hydrographers got committed to other projects and were only available in March 2017 to undertake the hydrographic surveying. All other hydrographic surveys got committed and there was no other option but to wait till March 2017 to get the survey completed. This delays directly affected Tonkin + Taylor International (T+TI) as there were commissioned to undertake a wave and storm surge analysis to inform design conditions for the proposed jetty structure upgrade. Finally, hydrographic surveying was completed by SPC Geoscience Suva. Subsequently to this Tokin + Taylor released the wave and storm surge report in May, 2017. This report was reviewed by FRA's consultants NRW Macallan together with Cardno and was accepted.

FRA was facing series of challenges due to the sudden termination of the main consultant MWH Global, according to Hutchinson (2016), FRA will need to continue to engage external consultants to complete the projects. But at the same time, majority of MWH's functions will be brought in-house and this will require FRA to increase its staffing. This strategic changes to FRA organisation structure had a vast impact on capital projects. There was no change management expert engaged to help FRA manage the changes they faced, the changes happening to their organisation structure. Thus, resulted in major communication breakdowns, dispersion of technical resource skills, lack of commitment to support stakeholder's decision making and non-consistent methodology for planning and executing the projects. Projects were delayed and there was limited funding to facilitate progress.

Stakeholder liaison was an ongoing process. Due to the course of the project several meetings was done with key stakeholders and local communities and villages to keep them active and engaged in the project. The key stakeholders included Savusavu town council, the provisional Administrator, iTaukei Land Trust Board, Shipping companies, Maritime Safety Authority of Fiji (MSAF) and local residents affected by the projects. Major challenges faced was getting approvals from stakeholders specially the natives. Due to stiff competition private shipping companies servicing this routes failed to cooperate and provide key information like berthing points, safety measures etc. The lack of interaction with stakeholders (communication) was also considered challenges and negatively affected the project deadline.

Additional land was required for the proposed jetty. Land procurement plan was prepared and a foreshore lease application was made bearing in mind the adequacy of footprint required for construction and operation of the facility including the existing structure of the jetty. Approval from department of lands was required for the reclamation of the seabed

and foreshores. The new lease was applied for. It was found that all reclaimed land, foreshore and seabed is owned by the government and administered by the department of Lands (DoL). However, from detailed topographical survey the surveyor the accuracy of the boundaries were verified and found that adjacent parcel of land belonged to a foreign investor. Local iTaukei Land Trust Board (iTLTB) was immediately contacted and land ownership was confirmed. It was unforeseen to note that adjacent land belonged to a foreigner. After long negotiations the outcome was not favourable. Due to time constraints FRA's land procurement sought Government for compulsory land acquisition and this turned out to be a vexation process.

Since the new jetty construction will have an impact on the seabed in the vicinity of the jetty site. Qoliqoli rights within the vicinity of the jetty was taken into consideration. Numerous consultation meeting was done to explain the associated Qoliqoli owner(s) that had fishing rights over that area. The meetings highlighted the purpose of the development and its contribution to the economic growth.

Many challenges were faced in managing the cultural issues, different Yavusa (different tribe groups) had different views. As part of Fiji Fisheries Act 1942 majority i.e. 75% of the Yavusa's approval must be sought prior to development. Several months of constant communication made this possible iTaukei Land and Fisheries Commission (iTLFC) assist in this process.

In order to move forward with the compensation for the loss of fishing rights the next process was to get approvals from iTaukei Land and Fisheries Commission (iTLFC). The compensation for loss of fishing rights is calculated and paid through the Ministry of Fisheries and Forest after the Ministry have undertaken a detailed fisheries assessment to ascertain the losses.

The daily challenges was to following up on progress of this process. Ministry of Fisheries reported that they have difficulties in arranging a team and vessel to be mobilised onsite. On the other land department had its own challenges such as no records of survey plans etc. From investigations it was found that both ministries were understaffed and projects seem to be initiated without much consideration for the resources required for execution.

This issue ties closely with the two issues raised earlier. Limited technical resourcing and communications meaning that the formation or operation of dedicated project teams is near impossible. Project requests are made by approaching these key resources directly who naturally have a tough time scheduling given the fact that operational demands take priority. The long lengthily approvals from Government ministries was a great concern.

Due the factors discussed above unfortunately the design of the jetty was not completed on time. There was enormous political pressure on infrastructure funds. FRA decided to consider the option of design and build approach most appropriate at this time for this project. Consultants were instructed to prepare performance specification and call for tender. After one month of tender period 4 reputable overseas firms submitted the tenders. However, the budget allocation was not enough to commence this project and on the 27th of November, 2017 FRA decided to abandon the project. Till date no major upgrading works have been carried out to the Jetty.

[redacted]

The case studies presented in section 5.1 and 5.2 provide an insight into the challenges in project management of infrastructure projects in Fiji. It is to be noted that there were myriad of challenges that was encountered during the case study investigation however the major challenges that were highlighted from the two case studies is listed below:

- Inadequate project planning.
- Inadequate/poor communication amongst project team.
- Long and complex statutory approvals and land acquisition process.
- Inadequate procurement process.
- Longstanding arrangement between client and contractor.
- Inadequate safety management procedures adopted by foreign contractor.
- Project manager's from public sector lack construction and contract knowledge.
- Project managers from public sector had poor leadership qualities and technical skills.
- Long lengthily approval process from Government ministries.
- Availability of skilled surveyors to undertake hydrographic surveys and wave study.
- Insufficient overall design time leading to design anomalies.
- Inefficiencies in the construction process which increased contractual and litigation risks.
- Poor management increased cost to both the contractor and the client, and increased potential for reduced quality of the completed project.

The challenges listed above from case studies validates the patterns discovered in the responses from private and government sectors.

[illegible]

Radujković (2017) in his studies highlighted that Project management is inevitable in today's world and continuous improvement is necessary. It is to be noted that in limited time the challenges in project management of infrastructure projects in Fiji were investigated and conclusions were drawn accordingly. However, further investigation is required to study all the project management challenges. In the interim all objectives were met, and recommendations are made to mitigate the challenges in project management of infrastructure projects in Fiji using the process outlined in the literature review and methodology section.

[illegible]

The following recommendations are proposed as a result of this research and are specific to Fiji only.

[illegible]

- Detailed design from the government should be provided in the project proposal before implementing design and build projects.
- Cost consultant must be involved at planning stage and proper cost estimation should be done before procurement phase.
- Identification of stakeholders
- Land acquisition impact long term operation and management of project and it is vital that acquisition process should start in the early phases of the planning. It is equally important that documentation of the acquisition process should clearly identify key project issues. Funding should be allocated to deploy a adequate land acquisition team to effectively manage this process.
- Detail work programme should be prepared after extensive planning.
- Detailed methodology should be developed prior to project implementation.
- Risk management should be introduced.
- Top project manager should be selected and should not be transferred once the project is underway.
- Innovative technologies should be used to monitor the project progress.
- A lesson learn report should be develop after each project is completed.

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- Develop the leadership capability of the project managers by education and professional training.
- Political influence on infrastructure projects should be minimised.
- Project management standard practice
- Guide should be developed for Fiji.

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This research project was completed by following the methodologies outlined in chapter 3. The objectives for this research outlined in chapter 2 were met despite a number of setbacks.

Questionnaire surveys was distributed to 75 participants in a very short period of time. The number of responses received were satisfactory. If there was more time could have supplemented by other means (meeting project managers onsite or in meetings) and increase the response rate especially in the government sector. This situation is not ideal; however, was dealt with skilfully with decent results obtained in just a short period of time.

Professional emails, networking on LinkedIn and personal telephone communication with potential companies helped to portray the importance of the research and the urgency of timely response required.

Former colleagues and workmates assisted by providing completed questionnaire surveys within a short time frame. The information provided was used to complete the results by comparing private and government responses.

After analysing the results obtained from government and private organization it was found that the challenges in project management of infrastructure projects is a national wide issue. The comparisons between the two organizations sheds light on different opinions and highlighted issues that are very common (over 75%). A number of correlations were made between frequency and impact of challenges in planning, design, procurement, material, construction, human and project manager affecting the

infrastructure projects in Fiji. Both parties agreed that, final selection and longstanding arrangement between client and contractor, challenges in on- time delivery of materials, migration of skilled workers from Fiji was common within the industry.

They also agreed that project managers' knowledge in construction and contract law, critical thinking and decision-making skills and notwithstanding intellectual drive, high initiative, and enthusiasm and curiosity characteristics is critical. Furthermore, both parties also agreed that preassembly and prefabrication of materials during planning and involvement of a cost engineer during planning phase, evaluation and request for proposal during procurement phase, professional work training and ongoing work training, project manager's knowledge in conducting a feasibility study, business skills and empathy characteristics were the less frequent and often had the least impact.

The areas were the parties disagreed were the frequency and the impact of project manager's skills and characteristics. Private organization perceive that project manger's technical skills and ability to resolve technical problem is essential were as on the other hand government organization believe that project manger's critical thinking and decision marking skills is imperative.

The case study data made available from NRW Macallan (Fiji) Limited provided an insight of ongoing project management challenges of infrastructure projects in Fiji. The key element in obtaining this valuable information was that the researcher was directly involved in the projects and had strong professional relationship with the client and other stakeholders. The ability to talk directly with the project managers and other key stakeholders was crucial in obtaining the information discussed in the case study section.

From the above data recommendations were made to mitigate the challenges in project management of infrastructure projects in Fiji.

Objectives for this research outlined in section one were met despite a number of seatbacks.

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During the data collection phase gaining access to case study data from companies within the infrastructure industry was difficult. Government department had confidential and agreements and ministerial approval need to be sought to disclose the information to third party. Private companies had commercial and confidential/sensitive arrangements with their clients and they were not willing to share information.

One government department showed potential interest in providing research data, but quickly changed their mind once the request for access to project technical reports, project correspondence and semi-structured interviews with department heads was discussed.

Another limitation was the number of respondents from government sector was interested and willing to complete the questionnaire survey but failed to respond. A number of private companies were not at all interested to take part in the survey.

A number of respondents accepted the questionnaire survey but did not reply. Upon following up it was found that the respondents did not reply due to heavy work load at this time of the year and time restraints.

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The limitations associated with this research are listed below:

- This research is limited to Fiji only.
- The research is focused only to study the challenges in project management of infrastructure projects in Fiji and recommend mitigating factors to assist in future infrastructure projects.

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Due to the scope of the project and the limitation of time, the investigation into various

Areas could not be conducted. However, undertaking this research has opened many venues for further research topics presented below:

- This research may have open doors for researchers to explore the project management practices in Fiji to validate this research.
- Researches can also investigate how to establish longstanding relationship between client and contractors in Fiji.
- Researches can also research how to efficiently minimize statutory approvals and land acquisition approval processes in Fiji.
- Investigate the leadership communication in project management in Fiji.
- Investigate short coming in on-time delivery of bulk materials and major equipment.
- Investigate how to develop the construction industries in Fiji.
- Researchers can study the impact of foreign contractors and consultants on Fiji's construction industry.
- Researchers can study the impact of migration of highly skilled workers from Fiji and its significances on Infrastructure projects in Fiji.
- Researchers can investigate how to improve sustainability outcomes in post-disaster infrastructure recovery projects in Fiji.

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A.A Aibinu, G.O Jagboro, The effects of construction delays on project delivery in Nigerian construction industry, In International Journal of Project Management, Volume 20, Issue 8, 2002,

Alemu Moges Belay, Olav Torp, Do Longer Projects Have Larger Cost Deviation Than Shorter Construction Projects, In Procedia Engineering, Volume 196, 2017, Pages 262-269

Tsegay Gebrehiwet, Hanbin Luo, Analysis of Delay Impact on Construction Project Based on RII and Correlation Coefficient: Empirical Study, In Procedia Engineering, Volume 196, 2017, Pages 366-374.

Mohamed M. Marzouk, Tarek I. El-Rasas, Analyzing delay causes in Egyptian construction projects, In Journal of Advanced Research, Volume 5, Issue 1, Pages 49-55.

Yaw Frimpong, Jacob Oluwoye, Lynn Crawford, Causes of delay and cost overruns in construction of groundwater projects in a developing countries; Ghana as a case study, In International Journal of Project Management, Volume 21, Issue 5, 2003, Pages 321-326.

G. Sweis, R. Sweis, A. Abu Hammad, A. Shboul, Delays in construction projects: The case of Jordan, In International Journal of Project Management, Volume 26, Issue 6, 2008, Pages 665-674.

Bohne, R.A., Klakegg, O.J. and Lædre, O., 2015. Evaluating sustainability of building projects in urban planning. *Procedia Economics and Finance*, *21*, pp.306-312.□

Pinto, J.K., 2013. Lies, damned lies, and project plans: Recurring human errors that can ruin the project planning process. *Business Horizons*, *56*(5), pp.643-653.□

Heravi, A., Coffey, V. and Trigunarsyah, B., 2015. Evaluating the level of stakeholder involvement during the project planning processes of building projects. *International Journal of Project Management*, *33*(5), pp.985-997

Ingason, H.T., 2015. Best project management practices in the implementation of an ISO 9001 quality management system. *Procedia-Social and Behavioral Sciences*, *194*, pp.192-200.□

Kozlovska, M., Mackova, D. and Spisakova, M., 2016. Survey of Construction Management Documentation Usage in Planning and Construction of Building Project. *Procedia Engineering*, *161*, pp.711-715

Ghaleb Y Abbasi, Hisham Al-Mharmah, Project management practice by the public sector in a developing country, In International Journal of Project Management, Volume 18, Issue 2, 2000, Pages 105-109.

Rodrigues, J.S., Costa, A.R. and Gestoso, C.G., 2014. Project planning and control: Does national culture influence project success? *Procedia Technology*, *16*, pp.1047-1056.

□

Papke-Shields, K.E. and Boyer-Wright, K.M., 2017. Strategic planning characteristics applied to project management. *International Journal of Project Management*, *35*(2), pp.169-179.□

Abdalla M Odeh, Hussien T Battaineh, Causes of construction delay: traditional contracts, In International Journal of Project Management, Volume 20, Issue 1, 2002, Pages 67-73.

Project Management Institute (2013), A Guide to the Project Management Body of Knowledge (PMBOK R Guide). Project Management Institute, Incorporated.

PMI Founders (n.d.), http://www.pmi.org/About-Us/Leaders-Founders.aspx.

Xianhai Meng, Paul Boyd, The role of the project manager in relationship management, In International Journal of Project Management, Volume 35, Issue 5, 2017, Pages 717-728.

JOSEPH W. WEISS and ROBERT K. WYSOCKI (1992) 5 Phase Project Management, 1 edn., United States of America.: Perseus Books Publishing, L.L.C.

National OHS Service OHS Inspection Report for Public Rental Board Construction Site Raiwaqa. (2011). Ministry of Labour, Industrial Relations and Employment. Suva Fiji: Ministry of Labour, Industrial Relations, Productivity and Environment, pp.1 and 6.

Erasito. T. (2013). Dispute Adjudication Board Public Rental Board Vs China Railway First Group Co. Ltd Raiwai and Raiwaqa Housing Project. Suva: Erasito Consultants Ltd, pp.1-15

Government of the Republic of Fiji (2017). *Climate Vulnerability Assessment.*
Making Fiji Climate Resilient. Suva: Government of the Republic of Fiji, pp. 12-135

World Bank Group (2017). *Systematic Country Diagnostic. Report No. 116491-FJ. Washington DC:* International Bank for Reconstruction and Development/ The World Bank, pp.1-50.

Upgrading of Fiji's Infrastructure to Global Standards | Fiji Sun. 2018. *Upgrading of Fiji's Infrastructure to Global Standards | Fiji Sun.* [ONLINE] Available at: http://fijisun.com.fj/2015/10/14/upgrading-of-fijis-infrastructure-to-global-standards/. [Accessed 13 September 2018]

Infrastructure maintenance in the pacific. (2013). Challenging the Build-Neglect-Rebuild Paradigm. Sydney, Australia: Pacific Infrastructure Advisory Centre, pp.6-32

Vula,M. (2018). Climate Change Causes Huge Infrastructure Damage. *Fiji Sun, pp. 1-3*.

Fiji Ports Corporation Limited (2015). *Annual Report. Suva*: Fiji Ports Corporation Limited, pp. 1-9.

Fiji Roads Authority (2014). *Annual Report. Suva*: Fiji Roads Authority, pp. 20-25.

Ministry of Economy Fiji (2016). *DISASTER RECOVERY FRAMEWORK Tropical Cyclone Winston, 20th February 2016*. Suva: Ministry of Economy Fiji, p.3.

Patel & Hutchinson, DP & JH, 2016. FRA Speaks Out On MWH Saga. *The Fiji Sun*, 16 September 2016. 1

The Fiji Sun (2016). FRA Speaks Out On MWH Saga. p.1.

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Questionnaire – Challenges in Project Management of Infrastructure Projects in Fiji

About the Project

The project involves obtaining questionnaire data from industry sources, with particular focus on the reasons on challenges in project management of infrastructure projects in Fiji.

Key objectives as follows:

- Investigate the issues related to the infrastructure projects in Fiji
- Explore the current practices of project management in Fiji
- Identify strategies to increase the skills and capabilities of project managers
- Find strategies to improve project management practices
- Understand the construction industries and inflexibility in the availability of construction equipment, materials and tradesmen;

Instructions for Questionnaire

Please type response into Enter here boxes provided in questionnaire:

Please click on the relevant green boxes provided in questionnaire: ☒

Please choose a response from the blue boxes provided in questionnaire:

Choose an item

Section A – Profile of Organization/Respondents

1) Name of organization: Enter here

2) Location of organization: Enter here

3) Type of organization:

- Private company ☐ Government ☐ International donors ☐
- Non-government ☐

4) Position in organization:

Engineer ☐ Architect ☐ Management ☐ Academic Professional ☐

☐

Other: Enter here

5) Years of professional experience:

1 – 5 years ☐ 6 – 10 years ☐ 11 – 15 years ☐ 16 – 20 years ☐

20+ years ☐

Section B – Questionnaire

6) Indicate the frequency and impact of planning related challenges in project management of infrastructure projects in Fiji.

Planning related challenges	***Frequency***	***Impact***
Alignment of project execution plan with project objectives	Choose an item	Choose an item
Documentation produced during planning	Choose an item	Choose an item
Front end planning process	Choose an item	Choose an item
Implementation of project execution plan	Choose an item	Choose an item
Peer reviews during planning	Choose an item	Choose an item
Track percentage complete	Choose an item	Choose an item
Project planning recourses	Choose an item	Choose an item
Clear definition of project objectives and priorities	Choose an item	Choose an item
Stakeholder involvement and alignment	Choose an item	Choose an item
Understanding client's goal and objectives	Choose an item	Choose an item
Offsite fabrication	Choose an item	Choose an item
Land and right-of-way acquisition in timely manner	Choose an item	Choose an item
Life cycle cost analysis and consideration	Choose an item	Choose an item
Community related issues	Choose an item	Choose an item
Statutory approvals and environmental issues	Choose an item	Choose an item
Preassembly	Choose an item	Choose an item
Prefabrication	Choose an item	Choose an item

7) Indicate the frequency and impact of engineering design related challenges in project management of infrastructure projects in Fiji.

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Engineering design related challenges	***Frequency***	***Impact***
Constructability in engineering design	Choose an item	Choose an item

Quality of engineering designs	Choose an item	Choose an item
Involvement of experienced construction managers during design	Choose an item	Choose an item
Quality/experience of designers	Choose an item	Choose an item
Qualifications of designers	Choose an item	Choose an item
Engineering design deliverables' accuracy and timelines	Choose an item	Choose an item
Involvement of experts during design phase	Choose an item	Choose an item
Involvement of a cost engineer	Choose an item	Choose an item

8) Indicate the frequency and impact of procurement related challenges in project management of infrastructure projects in Fiji.

Procurement related challenges	***Frequency***	***Impact***
Request for proposals	Choose an item	Choose an item
Evaluation of proposals	Choose an item	Choose an item
Control and monitor proposals	Choose an item	Choose an item
Final selection and longstanding arrangement between client and contractor	Choose an item	Choose an item

9) Indicate the frequency and impact of material management related challenges in project management of infrastructure projects in Fiji.

Material related challenges	***Frequency***	***Impact***
Material management plan	Choose an item	Choose an item
Effective site materials management	Choose an item	Choose an item
Procurement plan considering market conditions	Choose an item	Choose an item
Procurement plan addressing local content requirements	Choose an item	Choose an item
Procurement on time as per design specification	Choose an item	Choose an item
On-time delivery of bulk materials and major equipment	Choose an item	Choose an item
Supplier quality surveillance program	Choose an item	Choose an item
Preferred supplier selection	Choose an item	Choose an item

10) Indicate the frequency and impact of construction related challenges in project management of infrastructure projects in Fiji.

Construction related challenges	***Frequency***	***Impact***

Work programming	Choose an item	Choose an item
Safety management procedures	Choose an item	Choose an item
Appropriate contingency establishment	Choose an item	Choose an item
Risk assessment and planning	Choose an item	Choose an item
Initial site condition verification	Choose an item	Choose an item
Work methodology	Choose an item	Choose an item
Quality management system	Choose an item	Choose an item
Commissioning with operations and maintenance manual	Choose an item	Choose an item
involvement of contractor's construction manager	Choose an item	Choose an item
Foreman to labor ratio	Choose an item	Choose an item

11) Indicate the frequency and impact of human related challenges in project management of infrastructure projects in Fiji.

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Human related challenges	***Frequency***	***Impact***
Availability of skilled workers	Choose an item	Choose an item
Migration of skilled workers	Choose an item	Choose an item
Ongoing training programs	Choose an item	Choose an item
Professional work training	Choose an item	Choose an item
Extensive labor disruption	Choose an item	Choose an item
Adequate trade labor's availability and competency	Choose an item	Choose an item
Subcontractors availability and competency	Choose an item	Choose an item

12) Indicate the frequency and impact of project manager related challenges in project management of infrastructure projects in Fiji.

-

Project manager related challenges	***Frequency***	***Impact***
Project manager's area of knowledge		
Knowledge in project management	Choose an item	Choose an item
Knowledge in civil and structural engineering	Choose an item	Choose an item
Knowledge in architecture and town planning	Choose an item	Choose an item
Knowledge in quantity surveying	Choose an item	Choose an item

Knowledge in construction and contract laws	Choose an item	Choose an item
Knowledge in services engineering	Choose an item	Choose an item
Knowledge in interior designs	Choose an item	Choose an item
Knowledge in land surveying and landscaping	Choose an item	Choose an item
Knowledge in valuation studies	Choose an item	Choose an item
Knowledge in geotechnical engineering and soil study	Choose an item	Choose an item
Knowledge in construction method	Choose an item	Choose an item
Knowledge in site and construction management	Choose an item	Choose an item
Knowledge in environmental studies	Choose an item	Choose an item
Knowledge in authority approving process	Choose an item	Choose an item
Knowledge in project management software's	Choose an item	Choose an item
Knowledge in conducting a feasibility study	Choose an item	Choose an item
Knowledge in financing and cash flow	Choose an item	Choose an item
Knowledge in socio-economics	Choose an item	Choose an item
Knowledge of economics, trends, market and political condition in the country	Choose an item	Choose an item

Project manager related challenges	***Frequency***	***Impact***
Project manager's skills		
Project management skills	Choose an item	Choose an item
Interpersonal skills	Choose an item	Choose an item
Leadership qualities	Choose an item	Choose an item
Business skills	Choose an item	Choose an item
Technical skills	Choose an item	Choose an item
Management skills	Choose an item	Choose an item
Personal skill	Choose an item	Choose an item
Understanding client's objectives	Choose an item	Choose an item
Managing changes	Choose an item	Choose an item
Written and oral skills	Choose an item	Choose an item
Ability to chair meetings	Choose an item	Choose an item
Report writing	Choose an item	Choose an item

Risk management	Choose an item	Choose an item
Quality management	Choose an item	Choose an item
Technical coordination skills with other professionals	Choose an item	Choose an item
Resolve technical problems	Choose an item	Choose an item
Adaptability and flexibility	Choose an item	Choose an item
Influencing skills	Choose an item	Choose an item
Art of conflict management	Choose an item	Choose an item
Problem solving skills	Choose an item	Choose an item
Critical thinking and decision marking skills	Choose an item	Choose an item
Emotional management and stability	Choose an item	Choose an item

Project manager related challenges	***Frequency***	***Impact***
Project manager's personal characteristics		
Visionary	Choose an item	Choose an item
Honest and ethical	Choose an item	Choose an item
Fairness and impartially	Choose an item	Choose an item
Realistic	Choose an item	Choose an item
Ambitious	Choose an item	Choose an item
Empathy	Choose an item	Choose an item
Energy	Choose an item	Choose an item
Flexible	Choose an item	Choose an item
Intellectual drive and knowledgeable	Choose an item	Choose an item
Wisdom and imaginative	Choose an item	Choose an item
Creativity	Choose an item	Choose an item
High initiative, enthusiastic and curiosity	Choose an item	Choose an item

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ENG4111/4112 Research Project

Project Specification

For: **HARDEEP SINGH**

Title: Challenges in Project Management of Infrastructure Projects in Fiji

Major: Bachelor of Engineering (Honours) Civil

Supervisors: Nateque Mahmood

Enrolment: Semester 1 2018

Mode: External Student

Project Aim:

Infrastructure projects in developing countries like Fiji cover very long time periods from planning to completion. Apart from poor project management, cost overruns have become a chronic problem in Fiji. Despite, the development schemes orchestrated by the government and the world donors like Australian aid, Asian development bank and European Union etc. This has initiated the idea for this research project, which aims to minimize paucity of well executed infrastructure projects in Fiji, by defining the need of improving the project management performance in Fiji. To describe the current planning process of infrastructure projects in Fiji and explore the factors affecting project management, semi structured interviews will be carried out as a means of data collection.

The interview will contain some specific questions and more open questions where participants will have the liberty to discuss issues that affects project management in Fiji. The interviewees will include experts of public agencies and engineering offices in Fiji. The content of the interview questionnaires will be developed based on extensive literature reviews.

The results obtained from the interviews will be thoroughly reviewed, analysed and interpreted through the use of pie charts. Furthermore, the results will be

ranked, rated, sorted and compared in a systematic way that should make it easy for the readers to understand without referencing to the text.

Significant findings of this research will be used to confirm literature about the factors influencing the project management of infrastructure projects. The findings of this research will be a great importance to all project stakeholders in Fiji.

Key objectives are as follows:

1) The importance of project planning and how it impacts project implementation and delivery.
2) Understand the construction industries and inflexibility in the availability of construction equipment, materials and tradesmen.
3) Study why short comings in designs and uncertainties.
4) Appreciate the facilitation of various aid projects in Fiji and their project management.
5) Understand the financial control system and budgeting requirements of infrastructure projects in Fiji.
6) Understand cultural, social traditions and politics in Fiji and its impacts on projects.
7) Identify strategies to increase the skills and capabilities of project managers.
8) Find strategies to improve project management

AGREED:

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Hardeep Singh (Student) **Nateque Mahmood (Supervisor)**