

**THE IMPACT OF BANK LOAN INTEREST RATES ON
ROAD CONSTRUCTION INDUSTRY IN SRI LANKA**

Manamgoda Gamage Nimantha Manamgoda

(138418 F)

Master of Science in Project Management

Department of Building Economics

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Dissertation submitted in partial fulfillment of the requirement for the
Master of Science in Project Management

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Sri Lanka

June 2017

DECLARATION

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

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ABSTRACT

The road construction industry is a very important industry for the country's economic development. It provides main infrastructure to the economic activities. Cost of road projects are expensive compared to other type of construction. Therefore the debt money has been a reliable and main source of finance for the road construction industry. The interest against the debt money is the cost of the debt facility. There is a high tendency to fluctuate the rate of interest in Sri Lanka finance sector, which creates a financial risk against the local road construction industry.

This study has aimed to identify the impacts of interest rate of bank loans on road construction industry in Sri Lanka. The descriptive study was carried out through a preliminary survey, questionnaire survey and semi structured interviews among the practitioners of the industry. The data was analyzed using percentages on frequencies, relative importance index, correlation analysis and regression analysis. MINITAB EXPRESS (statistical software) was used to formulate the statistical analysis.

Literature has been carried out to identify the direct and indirect impacts of fluctuations of rate of interest bank loans on road construction industry. With the available research studies, there are six factors identified which determine the behavior patterns of the interest rate. i.e.: **government policies, demand and supply of funds, inflation, expectations, competition and uncertainty.**

The identified regions that have a direct impact of rate of interest on road construction industry are **financial decisions, investment decisions, dividend payments, bottom earnings, investment bearings and opportunity cost.** As per the literature there were six barriers identified as direct impacts on road projects. There are payment **delays, cash flow issues, financial resources, interest claims, lack of number of bidders and high project cost.** The effect of rate of interest on inputs of road projects is recognized as the indirect impact. As per the research findings the common inputs of a road project are **bitumen (18.89%), equipment (14.49%), Fuel (12.32%), A.B.C. (11.19%), Metal (6.13%) and earth (4.88 %).** It was proved that there is **strong and linear relationship between fluctuations of interest rate and price level of bitumen, A.B.C., metal and earth.** Therefore practitioners are recommended to take necessary measures to consider the financial risk of debt financing in developing capital structure for road construction project.

Key words: Road construction, financial risk, interest rate, bank loans, inputs, direct and indirect impacts, road inputs, fluctuations, correlation and regression analysis

DEDICATION

TO MY PARENTS.....

ACKNOWLEDGEMENT

This research study would not have been possible without the assistance and dedication of numerous individuals and organizations. Therefore, I take this opportunity to convey my gratefulness to each and every one of them.

It is my foremost duty to pay my gratitude to Ch.QS. (Mrs.) B.A.K.S.Perera for, my dissertation supervisor for her keen interest, continuous encouragement, invaluable guidance and precious support in making this research study a reality.

My heartfelt gratitude is extended to Dr. Y.G.Sandanayake, Head, and Department of Building Economics for her encouragement and guidance in producing this dissertation. As well as all the other academic staff of the Department of Building Economics. Another word of thank is extended to all non-academic staff members of the Department of Building Economics for the assistance given whenever I required.

I wish to express my greatest appreciation to all the professionals in the industry who contributed to this study by actively participating in the data collection process despite their busy work schedules. Unless for their valuable ideas, assistance and commitment, this study would not have been possible.

Last, but not least, I express my immeasurable thanks to my parents, brothers, relations and my colleagues for their priceless support to make this study a success.

M.G.N.S. Manamgoda

June 2017

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LIST OF ABBREVIATIONS

BIS	Bank for International Settlements
CIDA	Construction Industry Development Authority
DFID	Department of International Development
GDP	Gross Domestic Product
GITIC	Guangdong International Trust and Investment Corporation
ICTAD	Institute of Construction Training and Development
IRR	Interest Rate Risk
LIBOR	London Interbank Offered Rate
PMBOK	Project Management Body of Knowledge
PPP	Public Private Partnership
RDA	Road Development Authority
SABOR	San Antonio Board of Relators
SARB	South African Reserve Bank
SPV	Special Project Vehicle
SSE	Scottish and Southern Energy
UK	United Kingdom
UNESCAP	United Nations Economic and Social Commission for Asia and other Pacific

1 CHAPTER –INTROUDUCTION

1.1 Background

Expanding global demand for the infrastructure is an emerging industry for the private provision of roads, power, water and sanitation, telecommunication and other services (Gregory Fisber & Suman Babbar, 2015). Further, infrastructure is a crucial factor for a country on its own development, if a country intends to step in the ladder of development a developed infrastructure network is a must. Infrastructure development has high positive correlation to economic development of a country (Senarathan, 2001). All developed countries in the world have a well-planned infrastructure within the country. Sri Lanka itself as a developing country, the infrastructure system has become a dominating factor in on country's development. Currently the prevailing government has recognized that a serviceable road network system facilitates the socio economics development of a country in the form of speedy transport of both people and cargo. Roads are the backbone of the transportation system. The country has an extensive road network; the total length of the road network is about 116,862 kms comprising 169.13 km of expressways, 12,240.36 km of national highways (classes A and B), 16,532 km of provincial roads (classes C and D), and 88,428 km of roads maintained by local authorities, agencies, estates and state agencies(Central Bank Annual Report, 2008). Though the coverage of the road network in Sri Lanka is relatively satisfactory with 1.8 km of roads per km², the conditions and the capacity of roads are inadequate to cater to the rapidly growing demand for freight and passenger transportation.

Further the Central Bank Annual Report, 2009 emphasizes that the government policy on road development emphasizes constructing a national highway system and integrated road network, improving the management of the existing road network, strengthen the traffic management and implementing measures to minimize road accidents by regulatory agencies and promoting private sector participation in investment in new roads.

The ultimate objective of a construction project is to complete the project within the time and the budget while achieving the other requirements such as quality (Seeley, 1996). The term budget or cost of the project is very crucial for client and also for the

contractor. Final cost of the project is the highly volatile due to external and internal influences (Ivna Damnjanovic and Xue Zhou, 2009). Many of the challenges to developing and financing road projects are similar to those faced by other infrastructure projects which are typically capital intensive and share certain risks, including construction risk, political risk, financial risk and force majeure risk. But road face greater risk in certain important areas including acquisition of long segments of right of way, unforeseen geological and weather conditions that may increase the cost and cause delays and most importantly unpredictability of future traffic and revenue levels (Gregory Fisber & Suman Babbar, 2015).

Because of unique challenges facing road projects the road industry is less developed than other infrastructure sector. The World Bank estimate that road development accounts for 8 percent of the \$ 60 billion annual market for private infrastructure projects worldwide (Gregory Fisber & Suman Babbar, 2015).

Investment in a road project represent a cost in the short term that returns benefits only over the long-term use of the project after the completion. Thus, cost occur earlier than the benefits, and employer of must obtain the capital resources to finance the costs of construction. Construction projects cannot proceed without adequate financing, and the cost of providing adequate financing can be quite large. For these reasons attention to project finance is an important aspect of project management. Finance is also a concern to the other organizations involved in a project such as the general contractor and material suppliers (Hendrickson, 1998).

Plans considered by owners and contractors for financing typically have both long and short-term aspects. In the long term, sources of revenue include sales, grants and tax revenues. Borrowed funds must be eventually paid back from these other sources. In the short term, a wider variety of financing options exist, including borrowing, grants, corporate investment funds, payment delays and others. Many of these financing options involve the participation of third parties such as bank and bond underwriters (Gregory Fisber & Suman Babbar, 2015).

On the other hand, options for borrowing by contractors to bridge their expenditure and receipts during construction are relatively limited. For small or medium size projects, overdrafts from bank accounts are the most common form of construction

financing (Project management for construction: Financing of constructed facility, 2016).

Interest rates fluctuate over time with an historical ceiling. Even though in high inflation periods the nominal interest rate can reach extremely high levels. Interest rates primarily depends on policy and expectations (demand), thus the relationship with the business cycle depend on the explicit decision and subjective judgments of key players (Valentino Piana, 2002). This situation creates a financial risk against the financing the road construction projects.

As the constructions cost of road projects is often in multi millions, there for even for a very small percentage of increment in construction cost will lent to a considerable impact to the client as well as to contractor, obviously there is a significant impact on the construction cost which is will be studied thoroughly in this research study.

1.2 Research Problem

Periodically use of bank loans to finance the road construction projects has largely occurred at the discretion of the stakeholders of the construction industry. Timely the debt money has been a reliable and main source of finance for the industry. The interest against the debt money is the cost of the debt facility. There is a high intendancy to fluctuate the rate of interest, which creates a financial risk against the construction industry. Further, there is a visible gap in literature to relate the risk of fluctuation of rate of interest and impact of it road on construction projects. Especially within the local industry, there are few research studies available to cover the subject. Therefore, a study about the impact of the behaviour of the rate of interest of loans on road construction projects in Sri Lanka is highly needed to fill the gap in literature and to face the demands of local construction industry which is going to boost the economy of our country in a fast-paced manner.

1.3 Aim

The aim of the research is to identify the impact of fluctuations of bank loan interest rates on Sri Lankan road construction industry

1.4 Objectives

The targeted objectives for addressing the above aim are as follows;

1. Identify the relationship between bank loans and road construction industry
2. Identify the direct and indirect impact of the fluctuation of the rate of interest of bank loans on road construction industry
3. Identify the factors determining the fluctuations of the rate of interest of bank loans
4. Identify the relationship between fluctuations of interest rate of loans and price of inputs of road projects

1.5 Methodology

1.5.1 Literature Survey and Review

A comprehensive literature survey was carried out to identify the real evidence for the relationship between behaviors of the interest of bank loans and cost of road construction projects and linear and non-linear impacts of behaviors of interest rates on road projects. Books, journals, dissertations, web sites, articles have been referred to cover the objective.

1.5.2 Interviews:

Initially, *semi structured interviews* were conducted with financial specialists and road construction experts to verify the relationship between the rate of interest of bank loans and road construction industry which is scientifically observed through the literature review.

1.5.3 Questionnaire Survey

Questionnaire survey were carried out to get the confirmation of the applicability of findings of the literature review. Literature synopsis was done based on foreign published resources. Objective of the survey was to identify the relationship and the impact of fluctuations of interest rate of bank loans on local road construction industry. Therefore, the applicability of the findings of the literature review was verified by local experts of the road construction industry.

1.5.4 Documentary Review

Documentary review was the use of outside sources, documents to support the viewpoint of research study. The purpose of documentary review often involves some or all of conceptualizing, using and assessing documents. The analysis of documents

in documentary review of this research study would be a quantitative analysis. Process of the documentary review would be done in three phases. The documents will be used under this study are reliable and acceptable in academic world.

1.5.4.1 Phase 1

The phase 1 of documentary review was carried out to identify the common inputs used in Sri Lankan road construction industry. The percentage of inputs of road projects was calculated according to the guidance of formula calculations for price escalation, which is published by CIDA. Data was collected through 30 similar types of local road projects. Data was used to calculate the average input percentage of each common input.

1.5.4.2 Phase 2

Data was collected through the CIDA bulletin for construction statistics, which is published monthly. Statistics in this bulletin is a development of data of price increment of inputs of construction such as materials, equipment and labour. Information published in this bulletin is used directly as input variable in above mention formula to calculate the price escalation. Therefore indices for price differences published in this bulletin is a reliable document, which provides source of information to support viewpoint of this research study. Price difference indices for the selected inputs will be used to collect data. Data will be collected within the year 1990 and the year 2015.

1.5.4.3 Phase 3

Fluctuation of rate of interest of local bank loans was the main variable of this research study. Report published by central bank Sri Lanka was used as a source of information about the pattern of the fluctuation of rate of interest of loans over the past years.

The Central Bank Sri Lanka is established in 1950 under the monetary law act no 58 of 1949 (MLA). It is a semi-autonomous body, which is responsible for the conduct of monetary policy of Sri Lanka and has wide supervisory power over the financial system of the country. It monitors all the fluctuations occur within the financial system. Therefore report of central bank provides reliable source of information to support the viewpoint of this research study.

1.5.5 Data Analysis

Collected data was analyzed by applying basic statistical concepts. Correlation analysis and regression analysis are the concepts used to analyze the data. Minitab 17 is the statistical software that was used in the study to perform the statistical functions.

1.5.6 Scope and Limitations

The research was only limited to the Sri Lankan road construction field. Only type 'A' and 'B' roads are covered under research methodology. The research considered only the projects which are completed within the time period from year 2000 to 2015 and the projects which has a contract cost over five hundred million rupees.

1.6 Structure of the dissertation

1.6.1.1 Chapter One (Introduction):

- Give a background for the research
- Present the structure of the report
- Clarify the aim, objectives and methodology and scope

1.6.1.2 Chapter Two (Road construction, Debt finance, Interest rate and impact):

- Enclose the theoretical status and research issue through deep literature review
- Develop a theoretical platform to understand the relationship between the behavior of rate of interest of loans on road construction projects
- Review the literature for the reasons for the fluctuations of interest rate
- Review the literature related to linear and non-linear impacts of rate of interest on construction projects

1.6.1.3 Chapter Three (Research Methodology):

- Explain about the research methodology of the study.
- Enclose the important of the research through the design, reliability and validity.
- Discussion of the method

1.6.1.4 Chapter Four (Data Findings and Analysis):

- Present the found data
- Analyze the collected data using Minitab statistical software
- Interpret the obtain results

1.6.1.5 Chapter Five (Conclusion and Recommendations):

- Describe the practical implications of the research
- Address opportunities available for the further studies

Refer figure 1.1 for the further details of structure of the dissertation.

Chapter Break Down

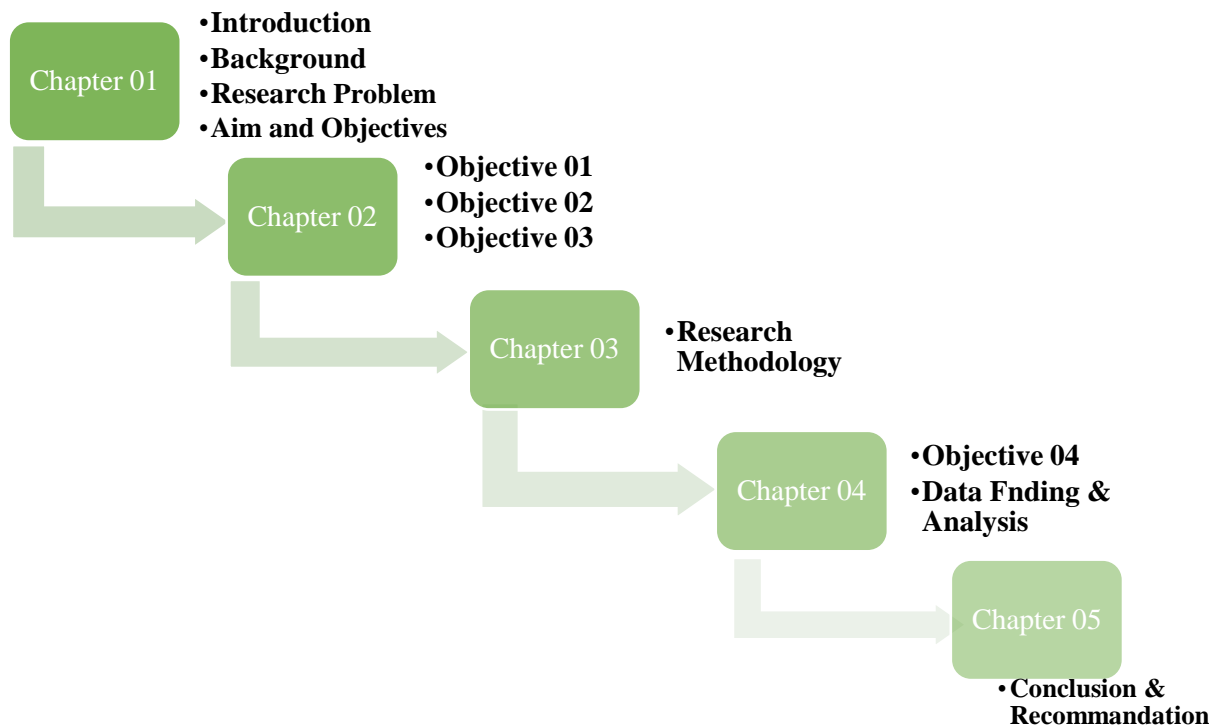


Figure 1-1: Structure of the dissertation Summary

This chapter summarized the subsequent chapters briefly by identifying the background to the research study strengthened by literature review. Further, aim and objectives within the defined scope and limitations for the research have been emphasized together with the research methodology in concise manner. Contents of each chapters is briefly explained which arranged scientifically creating relationship among each objective defined.

2 CHAPTER -LITREATURE REVIEW

2.1 Introduction

Debt money has been a reliable source of finance for the infrastructure projects. Especially in developing countries most of infrastructure projects financed through bank facilities. Both employer and the Contractor use line of credit facilities to maintain the cash flow the project as predicted. Therefor there is direct impacts of change in the rate of debt facility on construction projects. The relationship between two phenomenon is obvious.

There are many research studies done to review the relationship between the interest rate and the financial organizations such as banks or leasing companies. Further, it is noticed that the scarcity of research studies to emphasize the impact of interest rate on non-financial organizations such as construction companies. This situation becomes worse in local construction industry, which motivated myself to conduct this research as attempt to fill the gap of knowledge related to issue.

The research issue is well defined and substantiated in chapter one further certain objectives have been set up to guide the research toward the success. According to the set objectives, within this chapter two, it is tried to strengthen the objective number two with scientific literature resources.

This chapter reviews the literature to create a picture about the relationship between road construction industry and bank loans. It will be defined in this chapter that the interest rate as the cost of bank loans or any other loan facility that is ultimately becomes financial risk due to the unpredictability. It finds out the literature related to the two phenomenon separately to create detailed introduction on both. It discusses about construction industry, infrastructure construction, road construction industry and source of finance, fund categories, types of loans and finally, how the debt money used as a source of finance in road projects.

2.2 Construction Industry

Construction is a \$ 1.7 trillion industry worldwide amounting to between 5 and 7 percent of GDP of most countries. It accounts for a significant part of global gross capital formation (Charles Kenny, 2012). According to the Kulkarni. G.K., 2007 the construction industry is an essential contributor to the process of development of country. Construction involves large, complex, nonstandard activities in which the quantity can be very hard to assess. Projects can involve multitude of players such as clients, consultants, engineers, architects, financiers, contractors and sub-contractors which is illustrated in following figure 2.1 (Charles Kenny, 2011).

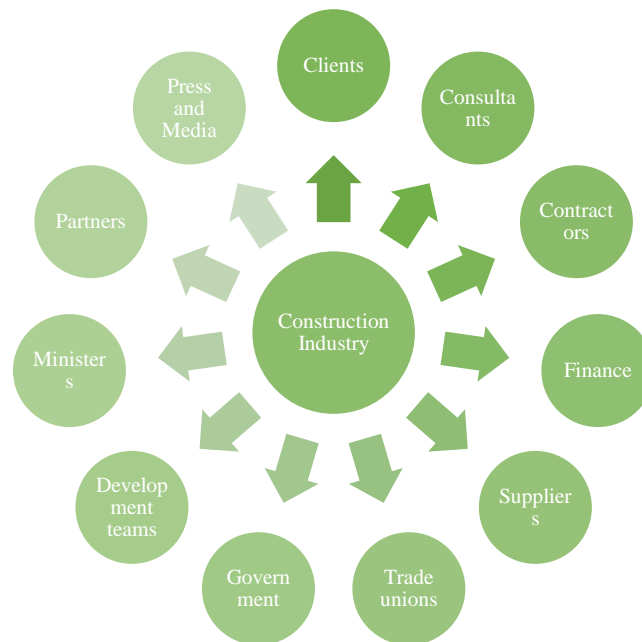


Figure 2-1 Stake Holders of Construction Industry (Source: Charles Kenny, 2011)

Kriaris (1987) has stated that Industry is a group of related economic classified in accordance with the output or services supplied. Thus, construction industry is a sector of economic activities, which erect, alter, repair and demolish a building, civil engineering works, and other similar structures. Further Kulkarni (2007) explains that roads, dams, irrigation works, school, houses, hospitals, factories and other construction works are the physical foundation on which development efforts and improving living standards are established. Faizal (2007) in his study has identified the characteristics of construction industry, according to his study it can be divided

based on its features of output, its size, government as a main client, nature of demand for construction output, nature of construction work, variety of construction technology, and structure of industry. Further he explains that features of construction output are durable or long lasting output such as house, building, road, large and heavy units, unique, immobile, complex process, and expensive.

Hongtao (2004) has stated his opinion about the construction industry in different a view. According to the Hongtao's view, the construction industry is capital goods industry. It also requires other industries to support them and contributes to gross domestic product of the country. According to his statement, many workers are required by construction industry. The main client of construction industry is the government regarding to their policy in infrastructure development. Faizal (2010) is supporting Hongtao's statement regarding the Construction industry by stating in his study that construction industry needs a lot of worker with many levels such as skilled labour or unskilled labour. Further, it requires many in civil construction activities. Among these activities, Kriaris (1987) has argued that road construction sector is very important for the country's economic development. It facilitates many economical activities within the country.

2.3 Local Construction Industry

According to the Central Bank of Sri Lanka (2009), Sri Lankan construction industry has contributed 6.6 % to GDP over the past year and responsible for more than 50% of the total Gross Domestic fixed capital formation. Further, it explains that employment generation by construction is about 7.4% of the total labour force of the country.

Weerathunga (2011) has stated that Sri Lankan construction industry produces wide range of products from individual houses to major infrastructure such as roads, bridges and power plants, but it was mostly limited to building projects in the end of year 2009. After the main product of construction did change in to infrastructure (Roads and bridges). According to the department of census and statistics (2013), number of infrastructure projects (Highways & Bridges) in Sri Lanka is 36% of total construction activities.

According to the study of Rameezden et al (2006) the Sri Lankan construction industry depends on mainly on manufacturing followed by services for its inputs and outputs

of construction, are primarily consumed by the services sector. He proved that construction industry could be regarded as a resource-producing sector for other sectors of the economy. Further Rameezdeen (2006) found in his study that the casual relationship between construction investment and Sri Lankan economy is unidirectional and construction investment causes economic growth not vice versa. Further, he concludes that Sri Lankan construction sector made a significantly small contribution to the economic development than in developed countries. Field & Ofori (1988) argued that construction industry is an essential and highly visible contributor to the process of economic growth and the driver of the economic growth especially in developing countries. According to the Rameezdeen (2006) and Field & Ofori (1988), it is understandable that local construction industry is a dominant factor in its own economic development further local industry must be developed and interconnected with economic development policies of the country.

Previous research studies prove that construction industry is a dominant factor in the Sri Lankan economy for its own development. Therefore, government policies must be adopted towards the development of construction industry. Following graph (figure 2.2) for the development of Sri Lankan construction industry emphasizes that the government policies have encouraged the industry towards the development that demanded by national economic development.

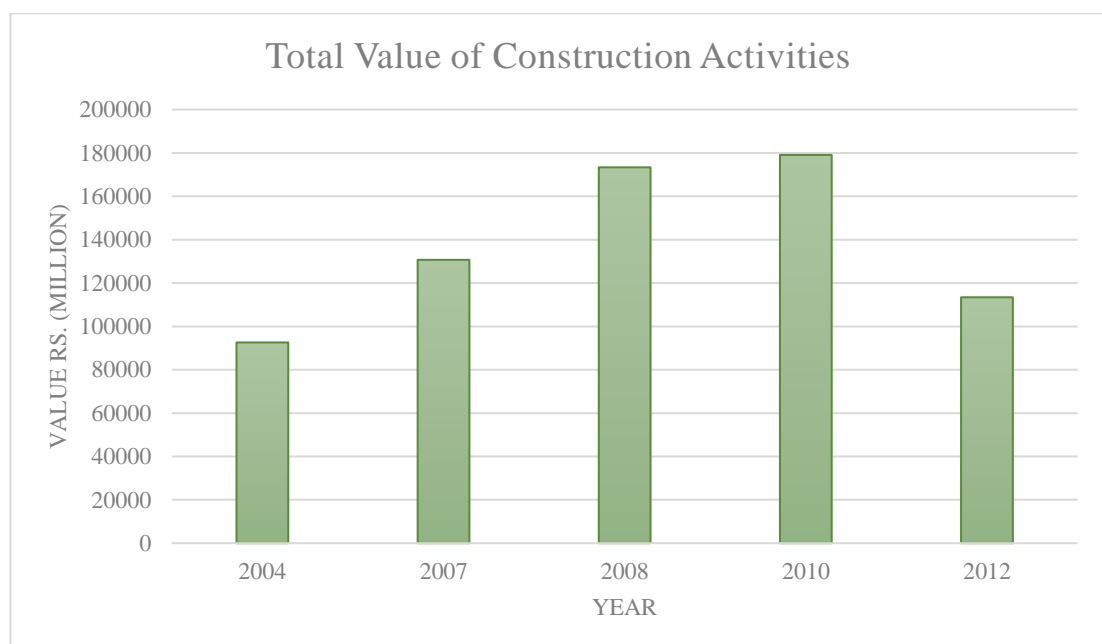


Figure 2-2 Total Value of Construction Activities (Local) (Source: Central Bank Report, 2013)

2.4 Infrastructure Construction

Infrastructure is the physical assets, facilities and systems that enable society to function. It includes transportation, energy and utilities, communication and social assets of society. Infrastructure are long-lived real assets that are costly and time consuming to replace (Faizal, 2010).

According to Gowda and Manatha (1997 cited Luiz 2010, P515), infrastructure can be categorized as following table 2.1.

Table 2-1 Infrastructure Construction (Source: Gowda and Manatha, 2010)

	Public utilities including power, telecommunication, drinking water supply, sanitation and sewage, solid waste collection and disposal , gas supply and storage
Infrastructure	Public work including roads, dams, canals, tanks for irrigation and drainage
	Other transport sector including roads, railways, ports and water ways and airports

Further the study of Gowda and Mamatha (1997 cited Luiz 2010) explains that infrastructure comprises activities which are not directly productive but which are necessary for the development of productive activities. According to Sharma and Sehgal (2010) the role of infrastructure is simulating output, efficiency and productivity growth and reducing production cost has received increasing attention from policy makers in emerging Asia. This fact is further evident by the statistics published by the World Bank in 2015. Statistics shown in following figure 2.3 explains that infrastructure development accounts for \$ 60 billion annual market for private infrastructure projects worldwide in the year of 2015 (World Bank, 2015).

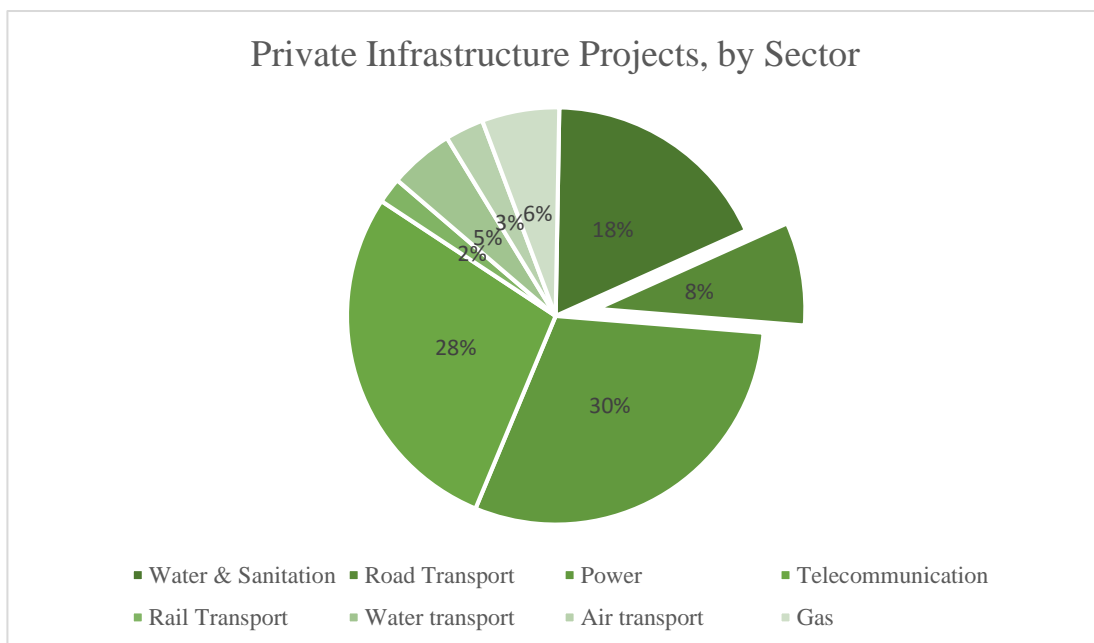


Figure 2-3 Private Infrastructure Projects by Sector (Source: World bank, private infrastructure data base, 2015)

As substantiated by above literature, the government of Sri Lanka has also shown a positive respond toward the infrastructure development of the country. The following graph (figure 2.4) explains a gradual improvement in government investment on infrastructure projects within the country.

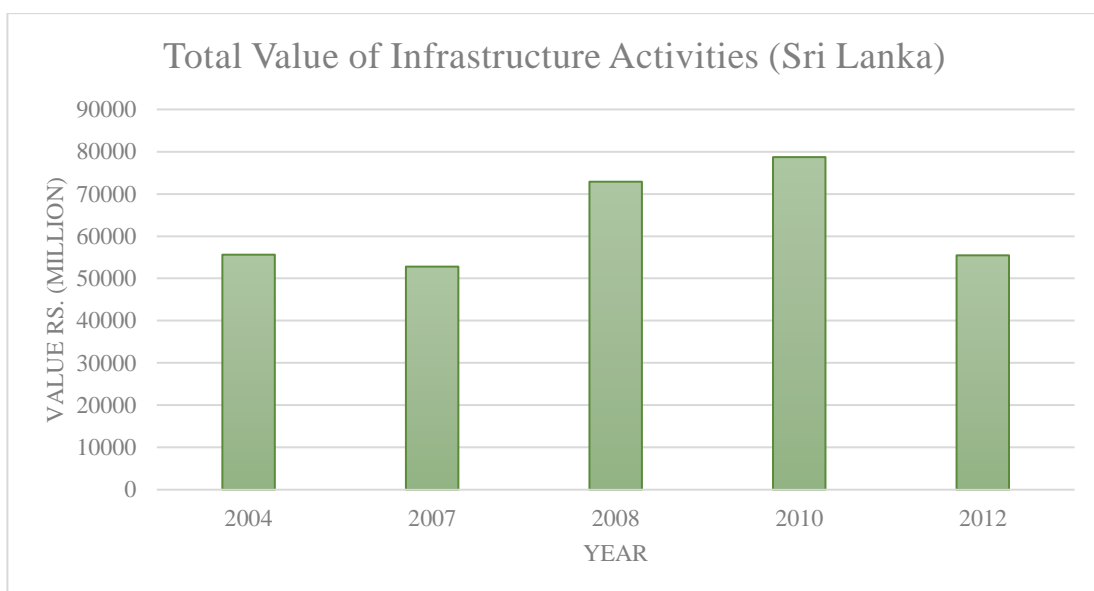


Figure 2-4 Total Value of Infrastructure Activities (Sri Lanka) (Source: Department of Census & Statistics of Sri Lanka, Survey of Construction)

2.5 Transport Infrastructure

As discussed, the construction industry has moved towards infrastructure development in worldwide. Most government policies support the infrastructure development. Among these infrastructure projects transport facilities has important place. It provides the mobility for all economic activities within the country. Mobility is an essential human need. Human survival and social interaction depend on the ability to move people and goods (Georg, 2007). Efficient mobility systems are essential facilitators of economic development. Cities could not exist and global trade could not occur without systems to transport people and goods cheaply and efficiently (WBCSP, 2002 cited Ribeiro et al 2007.p328). This fact is further evident by the statistics published by the World Bank in 2015. Statistics shown in above figure 2-3 explains that transport development accounts for 8% of \$ 60 billion annual market for private infrastructure projects worldwide in the year of 2015. Which has become fourth in line.

Among various developed transportation systems aviation, navigation and railway, the road transportation systems are oldest. It started with ancient human civilizations and now has developed in to high-speed expressways with multiple lanes (Heinemann, 1981). Follow literature will explain the detail history of the development of the road construction as an infrastructure facility.

2.6 History of Road Construction

The need of a road stems from the invention of the wheel some 5000 years ago, probably originating in Samaria (about 3000 B.C.) in Britain the earliest wheels' date back to Bronze Age. Some notes on early roads in various parts of the world are as following table 2.2,

Table 2-2 History of Road Construction (Source: Road Work, Institution of Works and Highways Technician Engineers, Heinemann: London, 1981, Pg-45)

Country	Note
China	One of the earliest and best known roads was the Chinese silk route which dates back 2600 B.C. the Chinese discovered the secret of silk weaving and sent this precious material by road to India and returned with ivory tusks.

Country	Note
Persian Empire	This was a great trading organization. Silk imported from china was re-exported to Europe along the roads they had built. They also sold Chinese porcelain and precious wood ware.
Britain	A log raft type of road have been discovered this crosses the Somerset peat bogs Glastonbury dating back to 2500 B.C. the Berkshire Ridgeway, was used to bring flint axes and weapons from grime graves in Norfolk over the Chiltern and Berkshire downs and Salisbury plain to Stonehenge.
Europe	In the low countries log, roads similar to the Somerset ones has been found and there is evidence of the same type of road existing in the Swis lakeside village and across the Pangola swamps in Hungary.
India	Their early civilization was centered on the Indus valley where archaeologists in 1922 discovered roads constructed of bricks and proper-piped surface water drainage system.
Mesopotamia and Egypt	Moving to the Middle East and forward in time to about 1100 B.C. Syrian troops constructed a new road through the mountain of the northern Mesopotamia. Streets paved in asphalt and brick have been found in the cities of Nineveh and Babylon. The Egyptians built roads to cart the stone required to construct the pyramids.
Great Britain	Even before Christ, the Liberians and Celts were quite active constructing track ways and a good example is the Wyche cutting which was part of the salt route from Droitwich to Walves. This crossed the Marvern Hills.

Country	Note
Roman	<p>The roman era was undoubtedly the greatest road building age not only in Britain but also throughout Europe. 50000 miles of their superb highways stretched from Cadiz on west coast of Spain through France, Germany, Italy, the Adriatic coast o Turkey, through Syria at the western end of Mediterranean, back along the north coast of Africa via Alexandria, Carthage and so on to Tangier to complete the loop.</p> <p>Their roads were renowned for their straightness but they were only straight in most cases between one hilltop and another, i.e. as far as the eye could see. There is less chance of ambush on a straight road and the use of four-wheel wagon posed no problems. (They had not learnt to pivot the front axle)</p>

2.7 Road Construction Industry

As described in details above the road construction has a long history, which is related with human kind since human started to move place to place using equipment (Anonymous, 2014). All civilizations used to travel to maintain life. According to Robert & Meurs (2007), the first “modern” concrete highway pavements appeared in the latter part of the 19th century.

Roads are classified based on various phenomenon. Functional classification is one of them, according to Wright (1996) it includes principal arterial, minor arterial, collector, local highways. Further local highways classified- as expressway and freeway. According to the UNESCAP (2002) classified Asian highways as shown in the following table 2.3.

Table 2-3 Classification of Roads (Source: UNESCAP, 2002)

Classification	Description	Pavement type
Primary	Access-controlled highways	Asphalt or cement concrete
Class I	4 or more lanes	Asphalt or cement concrete
Class II	2 lanes	Asphalt or cement concrete
Class III	2 lanes	Double bituminous treatment

Robert & Meurs (2007) has mentioned that different types of roads are used in different type of activities in a country’s economy to facilitate the social development of the

community. Further to that, they explain that roads have been used as an important infrastructure to improve the advance economic activities. As a result, the importance of reliable and effective transportation networks has been emerged. Kim *et al.* (2009) has confirm the Robert & Meurs’s statement by stating that unexpected network delays in transportation may lead to a critical loss of time for the economic development of the country. DFID (2002) stated that roads as an infrastructure facilitate the execution of market transactions by enabling interested parties to meet and by enabling the subsequent transport of traded goods to their place of usage. Many sectors rely on roads for their effective operation. According to statement of DFID a well-constructed road network system is very important for a country’s economic activities.

It has been proofed by the scientific literature that road transportation is a prominent infrastructure which is important for the economic development of a country.

2.8 Sri Lankan Road Construction Industry

Annual report of Central Bank of Sri Lanka (2014) explains that the construction of new roads and the rehabilitation of existing roads continued to be one of the development priorities in national development plan in line with the National Road Development Plan (2007-2017). Further, it is mention that several major highway projects and road and bridge development projects will continue to strength the regional development activities. Statistics published in annual report of central bank (2014) emphasizes that the rehabilitation of rural road in several districts under the Maga Naguma rural road development programme also continued during 2014 at a cost of Rs 7.0 billion and the extent of roads rehabilitation under this programme in 2014 was 687.5 km. The expenditure incurred by RDA for road development stood at Rs 120.0 billion (including bridges and flyovers). Following table 2.4 explains the development of road network within the country.

Table 2-4 Roads completed by RDA (Source: Road Development Authority,2015)

Class of Road	Length (Km)
A Class	4,215.05
B Class	7,994.73
Total	12,209.78
E Class (Express ways)	169.845

Further following graph (figure 2.5) which is developed based on data of Survey of construction industries published by department of Census and Statistics of Sri Lanka in 2015 explains the government investment policies toward the road construction sector has improved gradually. This information substantiates that government has identified that development of road transportation network is a necessity of country's economic development. Therefore, government as well as contractors have to arrange financial resources to meet the demand of the country's economic demands.

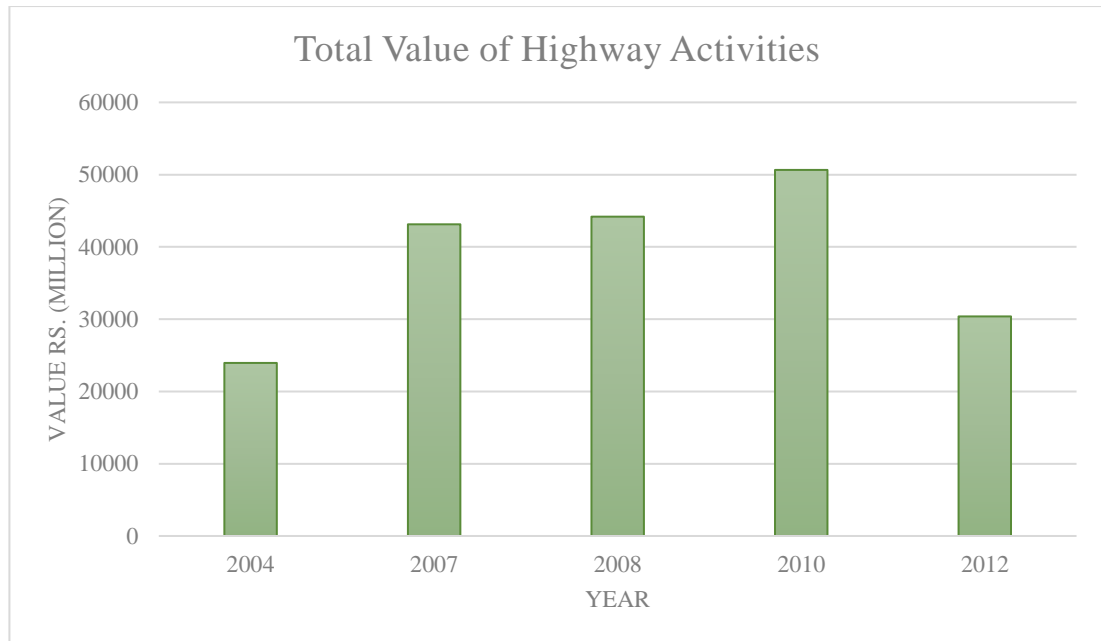


Figure 2-5 Total Value of Highway Activities (Sri Lanka) (Source : Department of Census & Statistics of Sri Lanka, 2015)

2.9 Construction Project Financing

Hendrickson (1998) explains that investment in construction project represent a cost in the short term that returns benefits only over the long term. Thus, costs occur earlier than the benefits, therefore owners of projects must obtain the capital resources to finance the cost of construction. A construction project cannot proceed without adequate financing, and the cost of providing adequate financing quite be large (Khamel & Zhao, 2015). For these reasons, attention to project finance is an important aspect of project management. Finance is also concerned to the other organizations involved in a project such as contractor and material suppliers (Hendrickson,1998).

2.10 Infrastructure Financing

The demand for infrastructure investment is likely to grow faster than output. A Mckinsey study estimates that the share of total infrastructure financing in GDP will need to increase from around 3.8% to 5.6% in 2020 worldwide (Mckinsey Global Institute, 2012). In emerging markets, the requirement would be even more pronounced. Analysis for the G20 suggests that developing countries will need to invest an additional \$1.0 trillion a year up to 2020 to keep pace with the demands of urbanization, the better global integration and connectivity (G20, 2013).

Ehler (2014) explains in his research that the key source of increasing infrastructure demand, such as the large infrastructure gap in developing economies or shift to renewable energy sources in developed economies will therefore require additional sources of financing from the private sector.

At the same time, institutional investors such as pension funds, insurance companies or sovereign wealth funds have a growing need for a diversified portfolio of long-term assets (World Bank Group, 2014). One recent study puts this investor base at about \$ 90 trillion globally (HSBC, 2013). According to the figures from the OCED(2013), the demand for the assets from this long-term investor base has also been increasing rapidly over the last decade. For OCED member countries, total assets of pension funds and public pension reserve funds stood at less than \$25 trillion in 2002 and increased over & 55 trillion by the end of 2012. Even so, portfolio allocation of pension funds to infrastructure debt and equity are small, at around 0.5% (Della Croce, 2012). While overall allocations for pension funds or insurance companies will remain small-given the financial risks involved- slightly higher allocation seems sensible. In

emerging markets, the development of such an investor base is still relatively early stages, but expected to proceed rapidly.

Ehlers (2014) describes the major reason for the demand and the supply of infrastructure finance is the lack of a pipeline of properly structures projects, infrastructure investment entail complex legal and financial arrangements, requiring a lot of expertise. Building up necessary expertise is costly, and investors will only be willing to incur these fixed costs if there is sufficient and predictable pipeline of infrastructure investment opportunities. Otherwise, the cost can easily outweigh the potential benefits of investing into infrastructure over other, less complex, asset classes.

2.11 Financial Sources

Asian development bank (2012) explains that most of time the available funding for infrastructure from traditional sources falls far short of the investment needs. Therefore different source of finance have used to maintain a positive cash flow of a project. Delmon (2011) and Daderkina (2013) have used the term 'sources of financing' and highlighted three of the most common sources of financing for infrastructure projects, such as shown in the following figure 2.6:

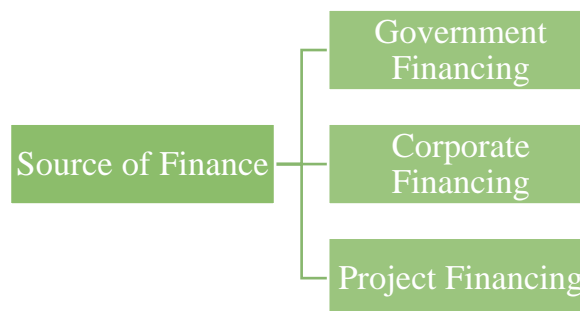


Figure 2-6 Source of Finance (Source: Delmon,2011)

Delmon (2011) stated that sponsors of the project, banks, pools of banks, international financial institutions, any counterparty of the project company, and the budgets of different levels could be sources of funds. They can provide for the project capital from different categories and use one or several financial instruments.

Karpov (2010) and Varnavsky (2005) noted that, at the present time in the world practice, there are known tools that allow companies created on the Public–Private Partnership basis, to raise funds from various financial institutions for implementation of large investment programs by means of complex financing schemes, insurance, cross-guarantees and redistribution of risks.

2.11.1 Government Financing

According to the explanation of World Bank (2016), the government financing is a mechanism which government choose to fund some or all of the capital investment in a project and look to the private sector to bring in expertise and efficiency. This is generally the case in a so-called Design-Build-Operate project, where the operator is paid a lump sum for completed stages of construction and will then receive an operating fee to cover operation and maintenance of the project. Another example would be the Government chooses to source out the civil works for the project through traditional procurement and then brings in a private operator to operate and maintain the facilities or provide the service (Cartlidge, 2009).

2.11.2 Corporative Financing

Leland in 1994 has explained that private operator may accept to finance some of the capital investment for the project and decide to fund the project through corporate financing – which would involve getting finance for the project based on the balance sheet of the private operator rather than the project itself. This is typically the mechanism used in lower value projects, where the cost of the financing is not significant enough to warrant a project financing mechanism or where the operator is so large that it chooses to fund the project from its own balance sheet (World Bank, 2016).

2.11.3 Project Financing

One of the most common - and often most efficient - financing arrangements for Public-Private Partnership (PPP) projects is “project financing”, also known as “limited recourse” or “non-recourse” financing. Project financing normally takes the form of limited recourse lending to a specially created project vehicle (special purpose vehicle or “SPV”) which has the right to carry out the construction and operation of

the project (Gatti,2008). It is typically used in a new build or extensive refurbishment situation and so the SPV has no existing business. The SPV will be dependent on revenue streams from the contractual arrangements and/or from tariffs from end users, which will only commence once construction has been completed and the project is in operation. It is therefore a risky enterprise and before they agree to provide financing to the project the lenders will want to carry out an extensive due diligence on the potential viability of the project and a detailed review of whether the project risk allocation protects the project company sufficiently. This is known commonly as verifying the project’s “bankability”. For more, go to Risk Allocation, Bankability and Mitigation (Brigham,2010).

2.12 Categories of Funds

According to the Khamel & Zhao (2015) explanation about the categories of funds. There are three categories of funds used for financing a project: equity, subordinated debt and senior debt. They have described them from the perspective of the risk degree and level of the expected income. It is visible that these are two diametrically opposite extreme categories of capital. Financial instruments being under the notion of subordinated debt are debt fund obligations that are paid after the senior debt and before the payment of dividends on common shares of the company. Financial instruments that are used for the accumulation of funds within the scope of each category is presented in Fig. 2-7.

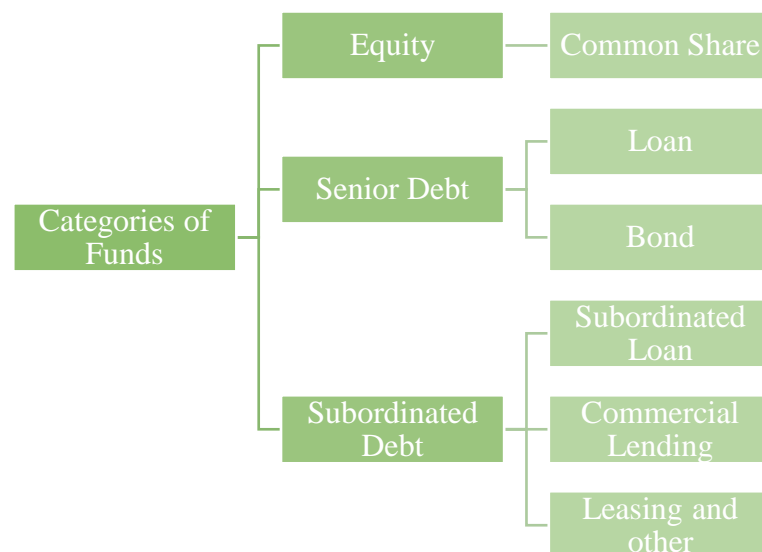


Figure 2-7 Categories of Funds (Source: Khamel & Zhao (2015))

2.12.1 Equity

Duncan Cartlidge (2009) in his book *Quantity Surveyor's Pocket Book* has a sound description for the equity as a source of finance in construction projects or property development. According to the Cartlidge the types of equity are categorized as shown in figure 2.8.

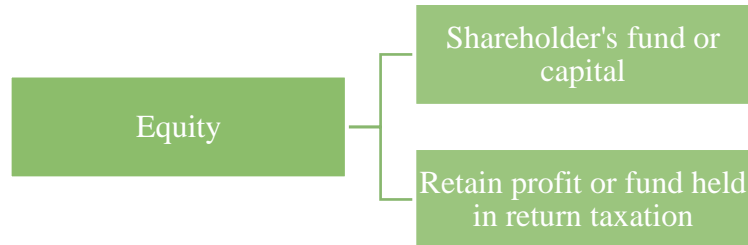


Figure 2-8 Categories of Equity

2.12.2 Sources of Equity

Cartlidge (2009) explains further about the available sources of equity used in development projects.

2.12.2.1 *Opportunity Cost*

If an investor decides to use his own capital to fund a property development, then the cost of the capital needs to be considered. Opportunity cost is the amount of interest forgone by taking capital of deposit and using it to fund a new (Cartlidge, 2009).

2.12.2.2 *Forward funding*

This funding method involves a financial institution for example: insurance company or pension fund purchase the site and provides the funds for the construction. At the completion of the project, it is sold and the developer paid. From the developer's point of view the disadvantage is that the funding institution will have a major influence in the direction of the development, the advantage includes the fact that the institution bears both the development and the disposal risk. In return, the developer's profit may be lower than the norm (Cartlidge, 2009).

2.12.2.3 *Joint Venture*

A joint venture between two or more financial institutions may be essential for very large projects or development and may be confined to UK institutions or cross border arrangements. The advantage includes the risk sharing and the potential to obtain additional expertise or local knowledge that may be essential for the successful completion of the development (Cartlidge, 2009).

2.12.2.4 Lease and lease back

The arrangement involves the developer leasing the site to a bank or other institution for a nominal rent. The bank then arrange for the construction of the project in accordance with the developer's instructions. On completion the bank lease the building to the developer at a rate, that includes construction and finance costs. This approach also has the potential for tax allowances.

Fisbar & Babbar (2014) has given example of a case study in their research study from Malaysia & Thailand, which could be identified as successful projects in equity financing. Malaysia has been successful in domestic financing of north-south expressway, a mega project which cost a total capital cost of \$ 3.192 billion. Out of this \$755 million (25% of total capital cost) comprised of shareholders' equity and convertible preference shares issued to the contractors, industrial groups, and institutional investors in Malaysia. The project was financed entirely on domestic markets: a generous government- support package and the capacity of domestic institutional investors, to take the large preference share issues, played an important role in the successful equity financing of the project.

2.12.3 Senior Debt

Procurement of long-term bank loans for financed toll highway projects is a critical issue in developing and transitioning economies. The longest tenure that a toll highway project company can obtain in a commercial bank loan in the East Asian countries is about 5 years, which is too far short to recoup the investment, where as in many developed countries such as in united states and United Kingdom, the tenure of commercial bank loan may extend to 15 to 30 years, i.e., matching the concession period. To address this issue various measures have been implemented in toll highway projects in developing countries. A straightforward, but difficult solution is to have a sufficient sound contract structure with a hedge mechanism for foreign exchange risk to attract long-term offshore debts (Khamel & Zhao, 2015).

2.12.4 Subordinated Debt

There are two important role for subordinated loans. There are to fill the gap between the equity and the senior loans in the original finance structure and to provide stand by financial support in case of revenue shortfall and cost overruns.

According to the Khamel & Zhao (2015) explanation, that any project regardless of its kind goes through certain development phases as follows:



Figure 2-9 Construction Project Phases (Source: Khamel & Zhao, 2015)

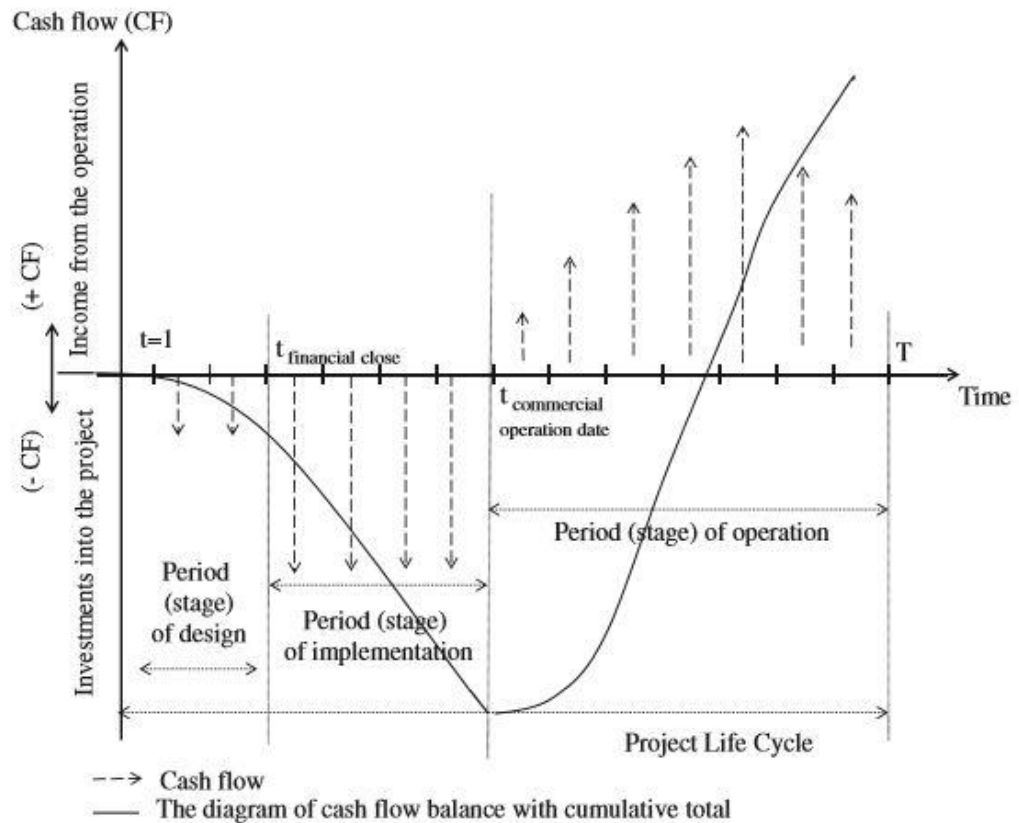


Figure 2-10 Cash flow of Project Life Cycle (Source: Khamel & Zhao, 2015)

Above figure (2-10) published by Khamel & Zhao (2015) emphasizes that the project life cycle and the requirement of funds at each stage. Each stage has its purpose and objectives and requires funds for its implementation. The financial strategy based on the project life cycle should provide capital to accomplish these purposes and objectives. Sources of funds and financial instruments are selected individually for each of them.

2.12.5 Design Phase

The project company must accumulate a certain amount of money at the design stage. Project development costs typically average about 5% of the total project cost (Asian Development Bank, 2012).

2.12.6 Implementation Phase

Khamel & Zhao (2015) stated that the capacity of capital is raised rapidly and potently in implementation phase of the project and the volume of attracted investments with a cumulative total reaches its maximum at the time of object commissioning. Gatti (2008) provides an economic standpoint regarding the implementation phase, which explains that the project does not yet generate revenue, costs are incurred and paid over several years and are capitalized in the cost of construction. From a financial viewpoint, during the implementation phase the project cannot generate revenue or cash inflows.

2.12.7 Construction Phase

Akintove & Beck (2009) explains about project financing in during the construction phase of a project, their viewpoint is that the cash flows generated by the project in the construction phase pay off debts and generate revenues. Further, they explain the clear-cut separation between sustaining capex and producing positive cash flows deriving from these capital expenditures is typical in Project Finance.

Above captioned scientific literature explains the demand of the finance for a road construction project to be completed successfully. Therefore, to meet the demand, variety of financial sources have been used in construction industry.

2.13 Different Financing Instruments for Different Phases of Infrastructure

Finance

The traditional question “are governments, banks or capital markets best placed to finance infrastructure?” is too simplest. Sorge (2004) has given a perfect answer for the question; it explains that a typical project has several distinct phases. Each phase exhibits different risk and return characteristics and each different incentive problems calls for a different role for governments, bank and capital markets. Hence, each phase requires different types of investors. Table 1 summaries for each phase the economic and contractual issues, the financial characteristics and the potential investors.

Table 2-5 Financial Characteristics of each Construction Phase (Source: BIS working paper No 454, Understanding the challenge for infrastructure finance, 2014)

Phase	Economic and contractual issues	Financial characteristics	Potential investors
Planning	Contracts are written in the planning phase and are crucial to the success of the projects. The planning phase can take a long time (10 to 30 months) and the involved parties may attempt to renegotiate contract commitments. Rating from rating agencies are important to secure the interest from debt investors, as are credit insurance or government guarantees.	The procuring authority needs to find equity investors. The equity sponsor needs to secure commitments by debt investors (mostly banks). Given the long planning periods, early commitments by debt investors come at a high cost. Leverage can be high (10:1)	Equity sponsors need a high level of expertise. They are often construction companies or governments. In rare cases, infrastructure funds (Australia, Asia) or direct investments by pension funds (Canada) may be involved. Debt investors are mostly banks through (syndicated) loans. Bond financing is rare, as projects carry high risk in the initial phase.
Construction	Monitoring incentives are essential. Private involvement (as opposed to purely public investment) can ensure this.	This is high phase unexpected events are likely due to the complexity of infrastructure projects. Default rate are relatively high. Initial commitments by debt- holders must extend far beyond this stage.	Refinancing or additional financing is very difficult and costly at this stage. Equity sponsors may have an incentive to provide additional finance if risks materialize.
Operational	Ownership and volatility of cash flows due to demand risks are key. Models such as flexible term present value contracts and availability based fees reduce volatility, risk and financing costs, but have adverse incentive effects.	Positive cash flows. The risk of default diminishes considerably.	Refinancing of debt (Bank loans) from the initial phase. Bonds are a natural choice, but they are not very common. Refinancing with bank loans or government funds is common.

2.14 Debt Financing

Brigham (2010) has stated that as a rule, the capital structure is presented by a combination of equity and debt. Debt capital has advantages (tax shield and fixed claim of debt holders) and disadvantages (financial distress caused by debt obligations). Due to the attractiveness of the borrowed funds, managers tend to include debt funds into the projects in highway infrastructure as much as possible (Khamel & Zhao, 2015).

Cuttareeand & Mandri-Perrott (2011) noted in their research that most strategies used in project financing aimed to maximize gearing of debt finance in their capital structure, because debt is typically cheaper than equity. Debt-to-equity ratios of 75:25 or 70:30 have been common. Further Khamel & Zhao (2015) has defined in their research study that the debt as the dominant type of capital in the PPP structure of the highway project. With reference to above captioned scientific literature the debt capital is more attractive than equity because of its cheaper cost.

Brigham (2010) has identified that bank lending is the most common source, widely used for investment projects financing. Further, he explains that in practice, the amount of funds attracted with the help of this source for different projects can vary significantly. Often the highway infrastructure projects are built in phases (Robert & Meurs, 2007), attracting capital by lending funds is suitable for such projects, because the funds can be disbursed in tranches for each stage of construction. Thus, it reduces the costs associated with interest payments on the loan (Hendrickson,1998).

By reviewing the above captures literature, it is substantiated that bank lending has been the most common and most used fund by clients and contractors for transportation infrastructure projects worldwide.

2.14.1 Bank Loans- Key Source of Financing in the Initial Phase

Inderst & Stewart (2014) identified that the bank loans usually supply the largest share of financing in the initial phase of an infrastructure project. Bank loans have some key advantages over bonds or other structured financing solutions, which particularly suits conditions of the initial phase. Advantages of debt financing are emphasized in following figure 2.11.

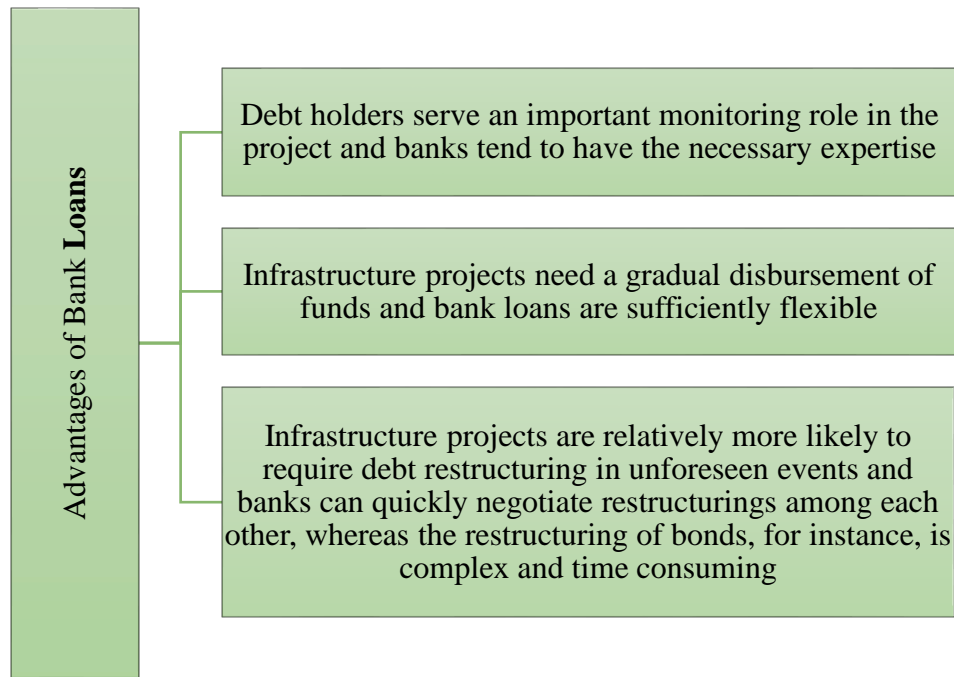


Figure 2-11 Advantages of Bank Loan (source: Inderst & Stewart, 2014)

Banks take a considerable risk with their loans, particularly in the initial phase (Figure 2-10). However, risks subside over the life cycle of a project. Hence, long-term infrastructure loans are not necessarily riskier, compared to shorter term ones (Sorge, 2004). The relatively long time between construction and the generation of positive cash flows requires unusually long term funding: infrastructure loans often have tenors exceeding 10 years. This sets a high bar for attracting debt financing. Even if a project endures the initial phase, cumulative risks are still higher than for loans to investment grade corporations (Sorge, 2004).

The risk banks take ensures they perform a crucial monitoring role in the process of setting up an infrastructure project that is valued by other potential debt investors. Banks can hence enable efficiency gains for infrastructure projects and often serve as an implicit insurance to other groups of investors with fewer monitoring capabilities (Inderst & Stewart, 2014).

2.14.2 Banks Are Shouldering Infrastructure Financing

As substantiated earlier, banks will remain important financiers, in particular in the early stages of the project. Currently the lion's share of growth in infrastructure financing is shouldered by banks. However, banks, which have mostly short-term liabilities, are not well placed to hold long-term assets on their balance sheets for an extended period of time (Ehlers, 2014). Therefore, a much broader group of investors

needs to be targeted. Bonds would be suitable instruments for large institutional investors, such as pension funds and insurance companies with their long term liabilities. Development banks and export credit agencies, which have a crucial role in financing infrastructure investments in both developing and developed countries, may be able to enhance the efficiency such as guarantees or mezzanine capital (Miller, Roger & Lessard, 2001).

2.14.3 Development in the Bank Loan Market: Syndicated Loans for Infrastructure Projects Finance

Bank loans for infrastructure projects are in many cases extended by a syndicate of bank rather than a single bank. According to the Ehlers (2014)'s explanation the syndicated loans are common for the debt- financing of larger projects, as it allow the diversification of the large risks of a single project across a group of banks. Note that syndicated project loans would typically only be a subset of all bank loans for infrastructure projects. That said syndicated project loans are likely to represent a major share of bank loan financing in terms of the overall volume, given that they are more likely for very large loans.

Further Ehlers (2014) describes that overall loan supply has been strong since the global financial crisis. To some extent, the volume for the years (2011-13) has shrunken compared to 2008-10. But insurance volumes in the last 2 years are still significantly higher than in the credit boom period 2005-07. Insurance also does not seem to be extremely critical, as volumes during the global financial crisis 2008-10 were the highest on record. Developing and adjustment to new global financial regulations by banks may have contributed to the recent short-term decline, but generally issuance volumes are clearly trending upward. In advanced economies, government budget restrictions are likely to have played a major role, as well as the deleveraging and shrinking of balance sheets in the banking sector.

Strikingly, private infrastructure finance with syndicated loans has picked up considerably in emerging markets and has surpassed the levels of advanced economies. In particular, emerging Asia (Excluding china) has become a major recipient of syndicated project loans for infrastructure related sectors. But issuance volumes have also increased considerably since 2008.

With reference to the above stated literature it is identified that cost of debt finance is the interest, which is paid over the time. According to the structure of the research study under following literature, objective 3 & 4 will be substantiated with scientific literature.

Objective 3 and 4 covers the characteristic behavior of the interest in local financial industry over the time. In addition, factors effects such a behavior of the interest rate. Further, it illustrates the impact created by the fluctuation of the interest rate on construction activities. It is noticed that many research studies have been completed to emphasizes the effect of interest rate risk on financial organizations but it is very few has completed to the substantiate the impact of interest rate risk on non- financial organizations. Therefor this chapter 3 structures the available literature in a scientific order to explain the impact of interest rate on non – financial organizations such as constructions organizations. Impact is explained in two categories. Which are direct and indirect.

2.15 Interest Rate (Cost of Debt Finance)

Interest rates measure the price paid by a borrower or debtor to a lender or creditor for the use of resources during some time intervals (Fabozzi and Modigliani, 2003). Goedhuys (1982), defined interest rate as the general level in financial assets and claims of all types which call loans or debentures, company shares or government bonds, bank overdraft or bill of exchange. According to Akpomiemie (2012), there are two type of interest rates, which are nominal and real interest rates. Further she describes that nominal interest rate is the rate not corrected for inflation. Nominal interest rate on loan relates the amount of interest on the loan to the amount of money lent, while real interest rate is that which incorporates the effect of inflation. It is measured in terms of purchasing power. A simple relation called Fisher Effect, which says that real interest rate is measured as nominal interest rate minus expected inflation rate, because an expectation about future inflations definitely affects market interest rate (Kaufman, 1986), connects the two rates. Further literature introduces various types of rates as described in following table 2.6.

Table 2-6 Type of Interest Rates (Source: Kaufman, 1986)

Type of Rate	Description
Treasury rate	The rate an investor earns on the instruments (Treasury bills and Treasury bonds) used by the Government to borrow from its own currency
Interbank borrowing and lending rate	(SABOR for South Africa, LIBOR for London): The rate at which banks lend and borrow from each other
Mortgage rate	The rate charge on mortgages, it can be fixed or floating rate
Deposit Rate	The rate at which depositors are compensated for saving money with the bank. It is also called funding rate
Prime Rate	The rate at which banks lend to their customers. It is also called the lending rate
Federal fund Rate	The rate on reserves traded among commercial banks for overnight use

Except above described rates there is another rate called **repo rate**. According to the description given in the SARB monetary policy review (2009), it is the discount rate at which central bank repurchase government securities from the commercial banks. The central bank uses it to maintain the level of money supply it wants in the country's monetary system. It is a benchmark for variable deposits and lending rates in South Africa. The deposit and lending rates fluctuate along with changes in the repurchase rate; lending rate at a margin above, and the deposit rate at a margin below the repurchase rate, depending on maturity, risk, liquidity, and prevailing economic conditions (SARB monetary policy review 2009).

Akpomiemie (2012) explains that all type of market interest rate largely depends on the supply and demand for credit, competition in the loanable market, and many economic factors.

2.16 Factors Determine the Level of Interest Rate

As explained changes in interest rate are determined by many factors, which include the supply and demand for credit, competition in the loanable market, and other economic factors, such as inflation rate, expectation of investors, monetary policy of the government etc. Explained further in following figure 2.12.

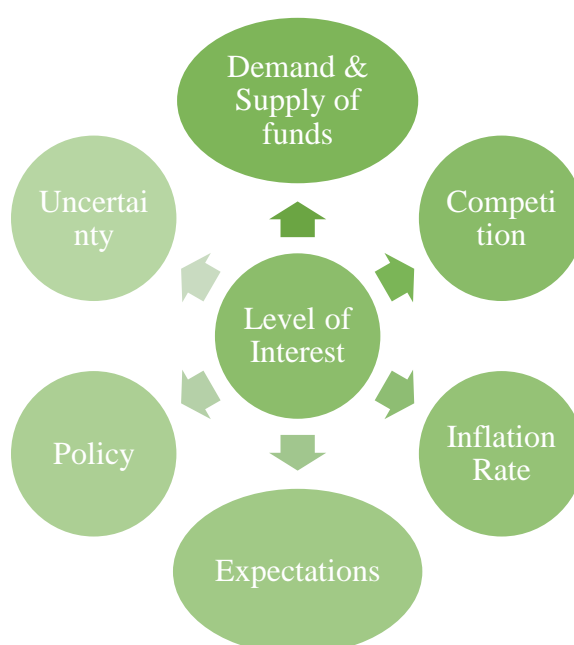


Figure 2-12 Factors Determine the Interest Rate (Source: Adopted from Akpomiemie, 2012)

2.16.1 Demand and Supply of Loanable Funds

In a free-market, system like the economy of the United States, interest rate is determined in the market place by the interaction of borrowers and lenders (Shetty et al, 1995). Such interaction results in an equilibrium interest rate, when preference of borrowers and lenders are successfully matched. An equilibrium interest rate is acceptable to both parties to the transaction, and it is the rate at which the loan transaction is completed (Rose et al 1995).

Akpomiemie (2012) has stated that the supply of funds depends on the preference of society for current versus future consumption, the lower the preference for current consumption and the stronger the incentive to accumulate funds. The demand for fund depends on the opportunities available for using borrowed funds efficiently and profitably, the more profitable the usage of funds the greater the demand for funds. If demand for funds increases/or the supply of funds declines, the interest rate will rise vise verse.

2.16.2 Inflation

Inflation affects interest rate because it affects the value of money promised in future, (Kohn, 2004). The rate of interest quoted in the financial market is sometimes contrasted with the real rate of interest, which is the observed market rate, corrected for the inflation (Goedhuys, 1982). According to Fisher, effect described by Kaufman, (1986), expectations of high inflation causes savers to require higher nominal interest rate, as it is the only way they can maintain the existing real rate of interest. Real interest rate is measured as nominal interest rate minus expected inflation rate, because an expectation about future inflations definitely affects market interest rate. Booth & Ciner, (2001), and Laatsch & Klein (2003) stipulated that there is one-for one relationship between expected inflation and nominal interest rate in the long run. Laatsch & Klein (2003) went further to clarify that nominal interest rate adjust one-for-one with the change in expected inflation supporting Fisher's hypothesis, but changes in nominal interest rate does not lead or lag changes in expected inflation.

2.16.3 Monetary Policy

One of the purposes of the Federal Reserve of the Central Bank of every country is to control the supply of money and credit in the country through the monetary policy. The implication of monetary policy is when money supply is targeted, the resultant interest rate has to be accepted, or vice versa. The increase in money supply by the

Central Bank leads to decrease in interest rate, this decrease in interest rate thereby increases demand for money (Blanchard, 2007). On the other hand, if monetary policy is used to fight inflation, the Federal Reserve sells securities (open market operations), raise reserve requirement of banks, and raises the discount rate. These actions reduce the supply of money, reduce banks' excess reserve, and increase the cost of credit (interest rates) (Mayo, 1989). Also, if the central bank wants to restrict banks' lending to the private sector because of one reason or the other, it increases the bank rate [discount rate (what it charges to banks)], this induces an increase in the rate of interest charge on bank loans (Page, 1993).

2.16.4 Investors' Expectation

The expectation theory argues that interest rates are functions of investors' expectations (Rose et al, 1995). If the investors' expectation is that the Federal Reserve will increase the money supply over the next period, the level of interest rate will increase. This is because the increase in money supply has not actually been implemented, while investors already reacted towards it.

2.16.5 Competition

Competition in the loanable market also affects the interest rate. Lowering the cost of deposit and raising the interest on loan by commercial banks will increase profit. But the ability to do so depend on how much competition faced in the industry. Even if there are few commercial banks to compete with, the non-bank substitute may be a problem, this leads to disintermediation. (Rose et al, 1995)

2.16.6 Uncertainty

Uncertainty about the future also plays a predominant part in the process of interest rate determination. Among more predominant types of uncertainty, include:

- a.** The term period over which funds are made available. The longer the term of the loan, the greater the uncertainty that circumstances may change, therefore the higher compensation demanded by the lenders of funds. Thus the longer the term of the loan the higher the interest rate charged.
- b.** The lender of funds will also be concerned about the ability of the borrower of funds to repay the loan. The higher the risk of default by the user or lower his/her credit rating, the higher the interest rate charged by the supplier of funds.

- c. During the period of low economic growth (measured by the GDP), banks narrow the spread between the deposit rate and repo rate, probably an attempt to attract deposits. This occurred between 2006 and 2008 when there was decelerating real economic growth (SARB monetary policy review 2009).

2.17 Fluctuation of Prime Rate –Sri Lanka

With reference to the above evidence gathered through published literature, it is obvious that fluctuation of prime rate is very unpredictable. It depends on many variables which makes the prime rate a liability. Following graph (figure 2.13) explains the fluctuation of weighted prime lending rate of Sri Lanka during the period of year 1995 to 2015. The graph is developed according to the data published by the Central Bank of Sri Lanka. It emphasizes many ups and downs with lot of variations, which explains the financial risk it generates towards the industries which depends on debt finance.

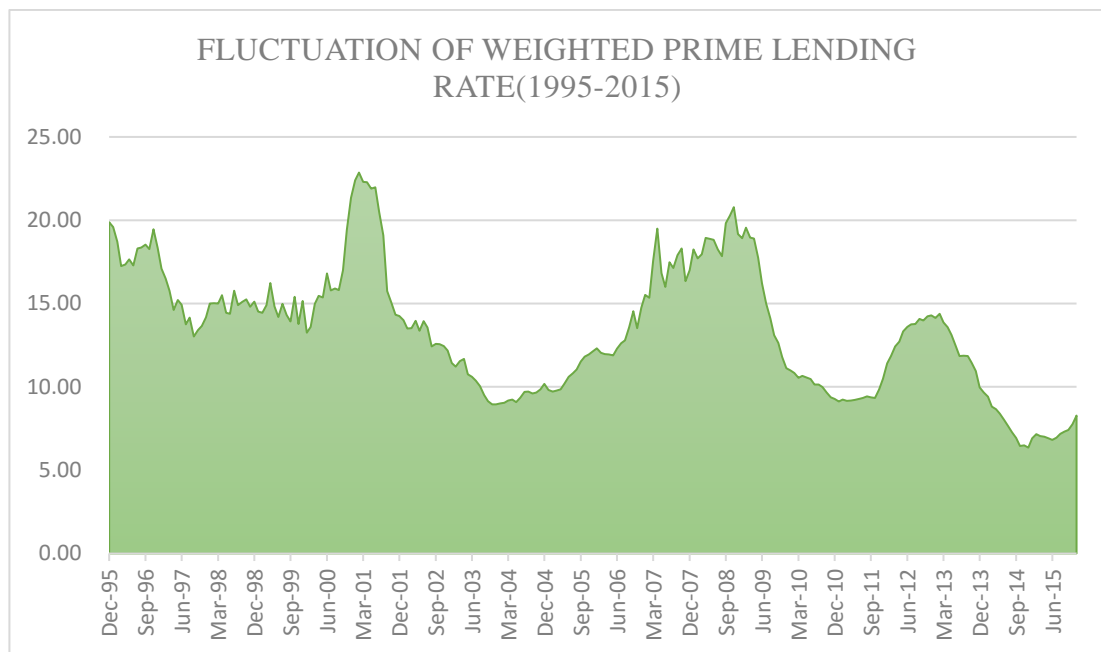


Figure 2-13 Fluctuations of Weighted Prime Lending Rate (1995-2015) (Source: Central Bank, 2016)

2.18 Impact of Interest Rate Risk

The economic interest rate exposure originates from the impact of unexpected interest rate changes on firm value. The resulting effects are traditionally of foremost interest to banks and other financial institutions, since they generate significant contributions to their earnings by successfully managing interest rate risk (Sohnke M. Bartram, 2002). Interest rate risk theoretically affects the value of non-financial corporations as well due to changes in the cash flow and the value of their financial assets and liabilities. Moreover, interest rate movements are closely related to changes in the business cycle of the economy, and they influence through the cost of capital, the investment behavior of firms. In addition, there may be indirect effects of interest rate risk on the competitive position of firms, affecting the size of their future cash flows and thus firm value (Sohnke M. Bartram, 2002).

According to the Dutta 2013, the direct effect of the interest rate fluctuations can be identified most easily for their financial assets and liabilities, which manifest as changes in market value and interest payments, respectively, or as opportunity cost. The specific characteristics of the asset determine the type and size of the impact. Apart from the effect on financial assets, an impact of interest rates movements on the value of real assets and project may occur. Further, according to the Emanuelsson (1997), the industries such as construction, industrial machinery, equipment, electrical equipment and raw material are perceived as cyclical and thus sensitivity to interest rate risk, while service companies are viewed as less sensitive to business cycles (Deutsche Bundesbank, 1996).

Further, to above the reactions of managers towards the interest rate risk emphasizes a clear picture about the impact of interest rate risk in organizational decision-making process. Research study done by Jajuga in 2009 has given three main attitudes of organizational managers towards the impact created by the interest rate fluctuations.

1. Risk aversion (managers expect additional, compensation for taking additional part of risk)
2. Risk neutrality (the size of the risk is indifferent when the decision is taken)
3. Risk seeking (manager can incur additional expenses when consider additional risk)

Bulski (2011) in his study explains that generally, risk aversion is the attitude prevailing in economic activities. In organizations such attitudes has an impact on following regions as shown in figure 2.14.

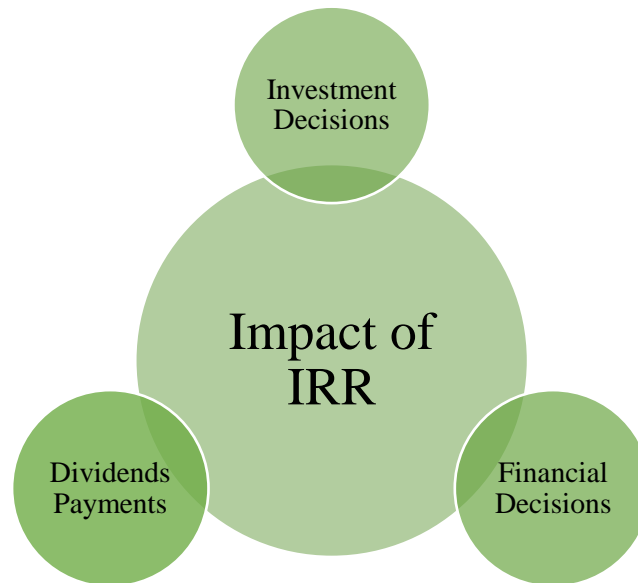


Figure 2-14 Impact of IRR (Source : Adopted from Bulski, 2011)

2.18.1 Investment Decisions

Investment activity is one of the most essential field in every organization. Decision undertaken within the investment area affect future economic situation of company. Such an activity has enormous impact on the other two:

1. Operational
2. Financial.

The first one from the perspective of non-financial company, determine the future operational activity. Business process complexity results, that every real investment must be proceeded by effectiveness account (Krzeminska, 2000). Generally, there are two kinds of gauges:

1. Discounted
2. Without taking into account the impact of interest rates

Generally, discounted method is preferred, because they take into to account. Following figure 2.15 empathizes the prevailing discounting method used to assess the effectiveness of the investment decisions.

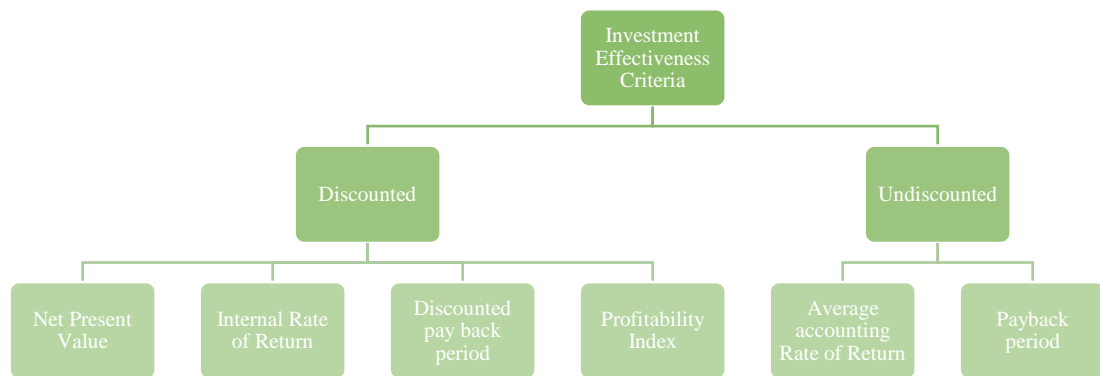


Figure 2-15 Investment Effectiveness Criteria (Source : Adopted from Bulshki, 2011)

There are few key factors, which are sensitive to the changes of interest rates in all above methods. First of all, company make necessary outlay: while capital expenditure are not limited only to fixed assets but also to net working capital (Rogowski, Michalczewski, 2005). Both current assets and liabilities are major components of company’s balance sheet, there for their size change, indirectly depended on the level of interest rates must be taken into account.

As explained by the Bulski (2011), interest rate has a huge impact on the investment decisions of an organization because all the methods used to discount value of assets, liabilities and money are depends on the rate of interest.

2.18.2 Financial Decisions

The next area of business activity for development by the manager in the context of risk: particular relevance here is the level of interest rate risk, conditioning the proportions of equity and debt.

The issue is considered in terms of financial liquidity risk. Organizations use debt to decrease the weighted average cost of capital (Fieria, 2008). Thereby organizations are exposed to the interest rate risk can accomplish higher rate of return on investment

capital. This rate of return can be even more enhanced when organizations use short-term debt capital to finance its investments. Then lower the interest rate can cause negative net working capital (Krzeminska, 2005). Thus decreasing the level of current ratio below one. Hence, the desire to achieve higher incomes, without regard the interest rate risk, can lead to loss of financial liquidity and bankruptcy.

2.18.3 Dividend payments

Taking a decision on allocation of net profit to pay dividends or retain company constitutes an essential concern in company: however, the decision is intrinsically linked to the risk that arises due to fluctuations of interest rate (Damodaran, 2009). As explained above aversion attitude managers tend to retain the profit as resource to earn more rate of return in time with higher growth rate of interest (Zadora, 2010)

Addition to the above studies regarding the interest rate risk, Alpa Dhanani in United Kingdom (UK) in 2008 has done an interesting study regarding the same subject relevant to UK firms. According to this study Interest rate risk (IRR), represent one of the key forms of the financial risk that companies encounter. In reason years, management of IRR has gained prominence in the corporate sector of UK firms. Dhanani has pointed out strong reasons for the situation.

1. Interest rate volatility has increased considerably in recent years, rates over the last few decades have fluctuated within large range in a short period of time. As an example within a decade interest rate in UK has fluctuated from high 15 % to lower 4 % (Dhanani, 2008) and within one and half decade interest rate in Sri Lanka has fluctuated from high 22 % to lower 6 % in Sri Lanka. (Central Bank, 2015)
2. There has been a dramatic increase in the use of corporate debt: increasingly, firms are using shorter-term borrowings facilities in place of equity. Previously it is mentioned that debt to equity ratio in infrastructure projects is averagely 80: 20, which marked high intensity to use debt finance for infrastructure projects, which support strongly the objective of this study.

Further according to the Dhanani's study in 2008, the interest rate risk is a form of risk that concerned with effect of movements in interest rates on the future financial performance of a firm and can manifest itself in four different ways as shown in following figure 2.16.

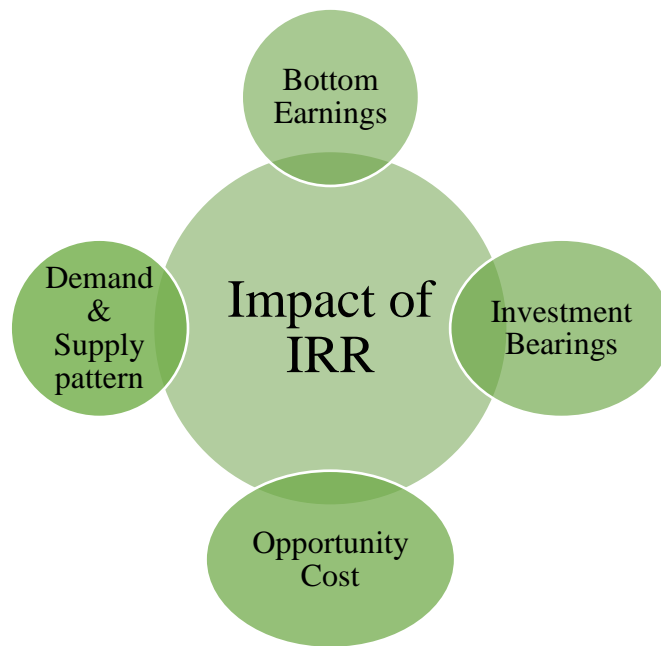


Figure 2-16 Impact of IRR (Source; Adopted from Dhananni, 2008)

2.18.4 Impact on Bottom Earnings

Variable interest rate debt may raise the funding cost for firm when interest rate rise and this may, in turn affect their bottom line earnings. Where the magnitude of such an interest rate rises are considerable, firms may suffer financial distress.

2.18.5 Impact on Investment Bearings

Yield on firm's interest-bearing investment will decline in period of falling interest rates and cash rich companies may find that decline interest rates prove costly to them

2.18.6 Impact on Opportunity Cost

High level of fixed rate funding during period of low, or decline, interest rates may result in an opportunity cost, where the companies with high fixed rate debt pay a higher rate of interest than their counter parts with low floating rate debt. Even though this risk may result in a considerable competitive disadvantage, it would never been reported in the annual financial statements of companies and may therefore fail to attract sufficient attention.

2.18.7 Impact on Demand and Supply Patterns of Industrial Inputs

A change in interest rate may adversely affect demand patterns of some firm's products and services and in turn, their operating cash flows.

With reference to the above reviewed literature, Dhananni (2008) and Bulshki (2011) have given their specific viewpoints related same subject, which is the impact of

interest rate risk on organizations. According to the Bulshki (2011)'s explanation, it has emphasized the linear impact of interest rate risk on decision-making procedure of an organization. While Dhananni (2008) explains the linear impact on operational stage of an organizations. Further as per the Dhananni's research, there are non-linear impacts of interest rate risk, which is identified as the effect on the demand and supply patterns of the industrial inputs. In the field of construction, the price of inputs has a large financial importance in the project cost. Following figure 2.17; explain both research viewpoints as a combination.

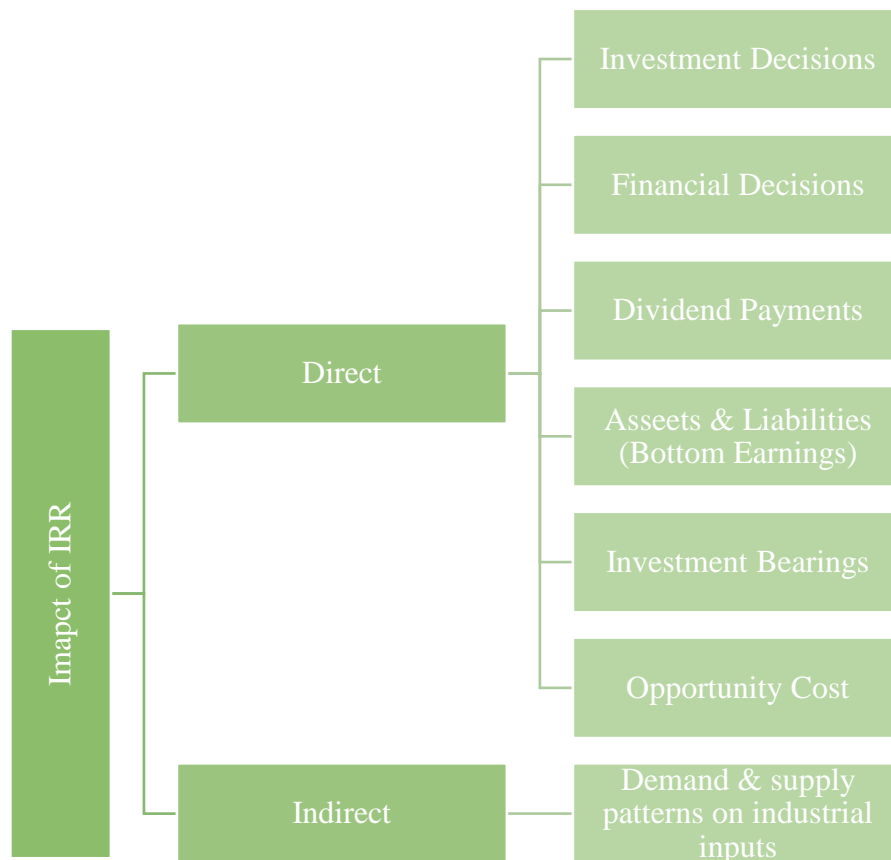


Figure 2-17 Impact of IRR (Source; adopted from Dhanannai, 2008)

Direct impacts of interest rate fluctuation has ability to create a greater financial distress on organizations. In the field of construction, financial distress on stakeholders creates directs impact on construction project cash flows which creates number of barriers to prevent the success of the project. Rahman,Wang,Takim & Wong (2010) have identified the specific barriers that initiated with the financial distress in construction industry. Following figure 2.18 will explain in details.

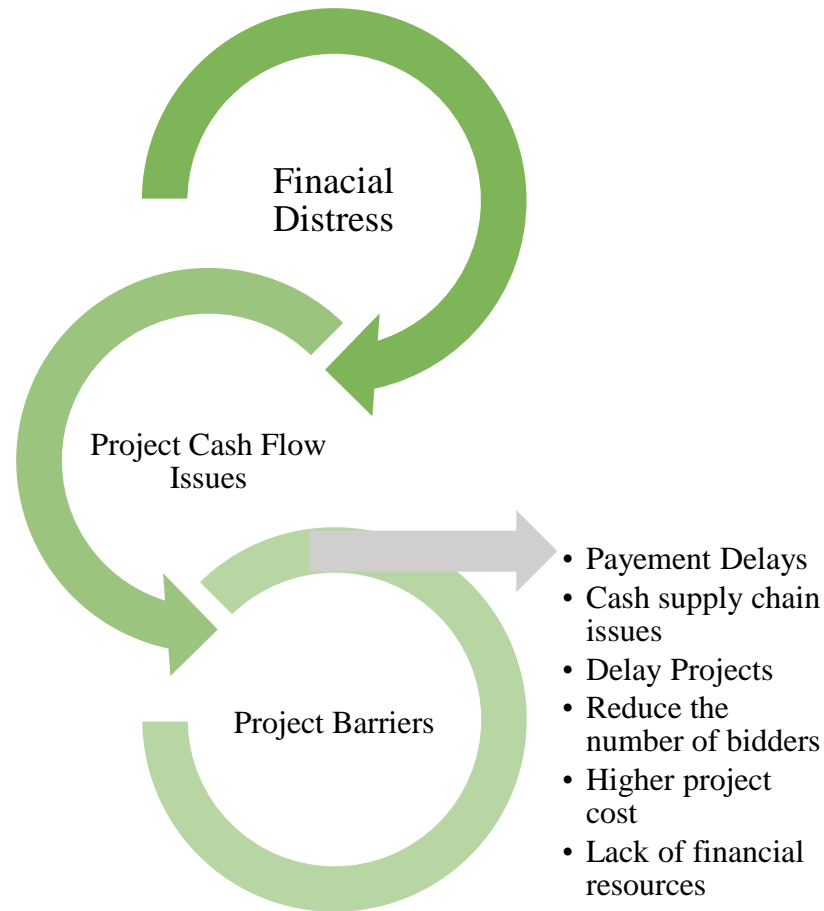


Figure 2-18 Impact on Construction Projects (Source: Adopted from Wang, Takin & Wong, 2010)

2.19 Direct Impact of Interest Rate Risk on Construction Projects

2.19.1 Payment Delays

Late payment is defined as failure of a paymaster to pay within the period of honoring of certificates as provided in the contract (Harris and McCaffer, 2003). The parties involved in the process of payment claim such as client, contractor, superintending officer, architect, quantity surveyor, banker and other construction players may cause a payment to be delayed. A delayed payment by a party who is involved in the process of payment claim may have an influence on the supply chain of payment in whole. According to the construction industry-working group on payment (2007), problems in payment at the higher end of the hierarchy will lead to series knock –on cash flow problems down the chain of contracts.

2.19.2 Cash Flow Issues

The most important aspect of cash flow management is to avoid extended cash shortages, which are caused by having too great a gap between cash inflows and out

flows. Cash flow management is defined as process of monitoring, analyzing and adjusting project cash flow. Cash flow is the lifeblood of the construction industry and ease of cash flow is an essential element in delivering a successful project. Thus, a well-managed cash flow is important to enable the delivery of a successful project by performing a cash flow analysis on a regular basis to identify the cash flow problems. In analysing the cash flow of a project, cash flow forecasting is an essential method to head off cash flow problems. Following next is to develop and employ strategies that will maintain an adequate cash flow will improve the project's cash flow and subsequently improve the timely performance of a project. Conversely, a poorly managed cash flow represents the opposite.

2.19.3 Financial Resource Issues

According to the Kaming et al. (1997), one of the most important factors causing delays of high-rise projects is shortage of resources. A survey by Ubaid (1991) concluded that the contractors' financial resources is one of the major measures on the contractors' performance that causes delays.

2.19.4 Delayed or Cancelled Projects

Gagllaher and Riggs (2006) have stated that in the world of private development, financial distress has been significant enough to cause many developers to rethink the numbers necessary to make a private development worthwhile. Delayed projects, reduced-in-scope projects, or cancelled projects have been the result. The same impact is being felt in the public construction sector.

2.19.5 Reduce Number of Bidders

In part because of the current level of activity in the construction industry, but also in part because of financial distress fears, owners are finding fewer bidders for their projects. States where asphalt supplies have been impacted are seeing fewer bidders for highway and paving projects. Owners are seeing more 'one bidder' projects and an overall reduction in the number of bidders for projects (Simension, 2008).

2.19.6 Higher Project Costs

Those projects that have not been scrapped or significantly delayed as a result of financial difficulties have frequently experienced higher project costs. Contractor and supplier fears regarding potential, future higher financial cost and the absence of

compensation for financial risk clauses in most construction contracts, often lead to higher contract prices and larger project costs (Gallagher and Riggs, 2006).

2.20 Indirect Impact of Interest Rate Risk

Further as per the Dhananni's research, there are indirect impacts of interest rate risk, which is identified as the effect on the demand and supply patterns of the industrial inputs. In the field of construction, the price of inputs has a large financial importance in the project cost.

According to the Survey of Construction 2013 published by Department of Census and Statistics of Sri Lanka, an amount of Rs (Millions). 38,741 of raw materials have been consumed by the Sri Lankan construction industry in year 2012. It is a considerable contribution to the GDP of the particular year.

Further, according to the report of Survey of Construction 2013, following table 2.7 explains the consumption of raw inputs by type of each construction.

Table 2-7 Value of Construction Raw Material (Sri Lanka) (source: Department of Census & Statistics)

Type of Construction	Value of Raw Material consumed (Rs. (million))	%
Building	15,972	41.2
Highway	14,108	36.4
Bridge	1,863	4.8
Water Sup & Drainage	528	1.4
Irrigation	3,618	9.3
Other	2,652	6.8
Total	38,741	100

Table 2.7 depicts that more than one fourth of the raw materials consumed by highway construction out of total consumption in the year 2012.

These statistics and literature prove the importance of the raw inputs of highway construction and its contribution to the value of the construction activities. Therefore it is significant to analyze the impact of interest rate on demand and supply patterns of the inputs of highway construction.

2.21 Construction Inputs

Institute of Construction Training and Development (ICTAD) in 1993 has identified the input components of a construction project. Those inputs are categorized as material, plant and labour, altogether in numbers it is 61. These inputs were identified and published in a bulletin in every month as an input data for a formula, which is used for reimbursement of price fluctuations of inputs. These inputs were used as basic input of a construction project for almost two decades in Sri Lankan construction industry.

According to the ICTAD (Present: CIDA- Construction Industry Development Authority) bulletin the recognized inputs for a construction projects are as in following table 2.8.

Table 2-8 Construction Inputs (Source: CIDA Bulletin, February 2017)

CIDA Reference No	Input
<u>Material</u>	
M1, M2, M3, M4	Cement
M5	Cement Blocks
M6	Rubble
M7	Metal
M8	Sand
M9, M10	Bricks
M11	Calicut tiles
M12	Lime
M13	Reinforcement Steel
M14	Structural steel
M15	GI Sheets
M16	Asbestos Roofing Sheets
CIDA Reference No	Input
M17	Asbestos ceiling sheets
M18, M19	Sanitary ware
M20	PVC Pipes
M21	Form work timber

CIDA Reference No	Input
M22	General timber
M23	Timber products
M24	Glass
M25	Door & Window fittings
M26	Electrical wire
M27	Wall Paint
M28	Wood paint
M29	Cadjon
M30	Bitumen
M31	Terrazzo
M32	Floor tiles
M33	Wall tiles
M34	Granite tiles
M35	Colour pigment
M36, M37	Aluminum door, window & partitions
M38	Electrical fittings
M39	Ready mix concrete
M40	High tensile steel wire
M41	Pre-stressed bridge beams
M42	Concrete lamp post
M43	Pre cast concrete products
M44	Hume pipes
M45	Earth
M46	Zink aluminum sheets
M47	Ductile iron pipe
M48	Aggregate base course
M49	Chain link
M50	Stainless steel
M51	Cement roof tiles
M52	Quarry dust

CIDA Reference No	Input
M53	Gabion boxes
M54	Geo textile
M55	Road marking paint
<u>Plant & Equipment</u>	
P1	Small Equipment
P2	Heavy equipment
P3	Fuel
<u>Labour</u>	
L1	Skill Labour
L2	Semi skill labour
L3	Unskill labour

Among these inputs of a construction project, Manamgoda (2011) has identified most common inputs for a road project. Which are given in following table.

Table 2-9 Inputs of Road Construction (Source : Manamgoda, 2011)

ICATD (CIDA) Reference No	Input	Average Percentage
P1, P2	Equipment	22.9%
M30, M30A, M30B, M30C	Bitumen	18%
M48	Aggregate Base Course	19%
P3	Fuel	9.5%
L1, L2, L3	Labour	9.0%
M4	Cement	5.1%
M13	Steel	5.1%
M8	Sand	1.3%

With reference to above literature and statistics, the relationship between the demand and supply patterns of highway inputs, which are recognized above in table 2.9, is

identified as a nonlinear character. Therefore the strength of the relationship will be assessed under the chapter 4 with regression analysis.

2.22 Summary

Among all literature resources, Brigham (2010) has stated that the bank loans are the most common financial source for infrastructure projects. Further, according to the research studies done by Khamal & Zaho (2015) and Cutterread & Mandri-Perrott (2011), it is strongly proved that debt financing through bank loans for infrastructure projects is becoming more common in worldwide and maximizing the debt component in project finance structure has been identified as most profitable strategy in project finance.

With above statement Indest & Stewart (2014) and Sorge (2004) has given more explanation about the application of bank loans in infrastructure projects. They emphasized that bank loan are most effective at initial stages of a project. Further, they have given more explanation regarding the financial application of each stages of a construction project with their suggestion of suitable financial source.

Ehler (2014) has given his view regarding large-scale infrastructure project financing structure. His research study explains about the concept of group of banks together financing large-scale projects in long time of period. Which is identified as syndicated loans. With related to Ehler (2014)'s concept Miller, Roger & Lesserdzeet (2001) introduced the concept of mezzanine capital which provides a guarantee for the banks who are financing the large-scale project on long period of time.

With viewpoints of all researches done related to above subject it is well substantiated that bank loans are the main source of finance in infrastructure project and at the beginning of the chapter it is explained that road construction as one prime infrastructure in a country's economic development. Therefore it is a convinced statement that road projects are mainly financed through bank loans.

Debt finance is used as a source of finance at a cost, which is called interest. This cost comes over the time at a rate which is identified as interest rate. Interest rates measure the price paid by a borrower or debtor to a lender or creditor for the use of resources during some time intervals (Fabozzi and Modigliani, 2003). With the available research studies, there are six factors identified which determine the behavior patterns of the interest rate. And according data given by central bank of Sri Lanka it was able

to graph the behavior of the interest rate in Sri Lankan industry for 15 years which explains the fact that interest rate behavior is unpredictable and it creates a risk.

With reference to research, studies in this chapter 2, which Dhananni (2008) publishes, and Bulshki (2011) have given their specific viewpoints related the impact of interest rate risk on organizations. According to the Bulshki (2011)'s explanation, it has emphasized the direct impact of interest rate risk on decision making procedure of an organization. While Dhananni (2008) explains the direct impact on operational stage of an organizations. As combination of the both research studies, there are seven impacts identified. Due those impacts on financial management of construction organizations, there are direct and indirect impacts on construction projects. There are six direct impacts have identified with in this chapter.

Further as per the Dhananni's research, there are indirect impacts of interest rate risk, which is identified as the effect on the demand and supply patterns of the industrial inputs. Ten inputs have been recognized as main industrial raw inputs for road construction projects.

3 CHAPTER -RESEARCH METHODOLOGY

3.1 Introduction

This chapter aims to set out the methodological frame work which was used to accomplish the aims and objectives of this research study, ‘The impact of behaviour of the rate of bank loans on road construction projects’. It describes the detail the research methodology used in completing this research including the research philosophy, research approach and research techniques used for data collection as well as data analysis. The research process in whole is also illustrated at the end of the chapter.

3.2 Research Design

Research methodology refers to the principles and procedures of logical thinking processes which apply to a scientific investigation (Fellows and Liu, 2003). According to Kagioglou *et al.* (2000), research design consists of following main components.

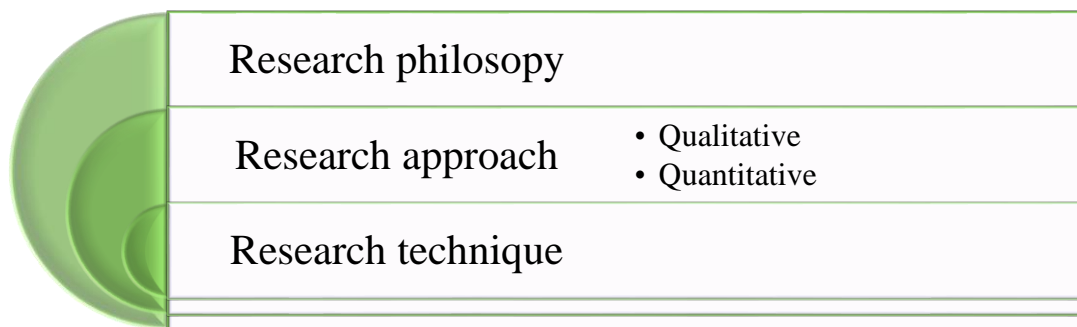


Figure 3-1: Components of Research study (Source: Kagioglon et al. 2000)

The final outcome of the research depends heavily on its research design. Therefore, it is of paramount important to develop the most appropriate research design for particular research study. Thus, the sub sections below describe in detail the research methodology of this research study.

3.2.1 Research Philosophy

Research philosophy is the basis belief system or worldwide that guides the investigator (Guba and lincon, 2000 cited Senarathna, 2005). Research philosophy is shaped by assumptions of ontological, epistemological and axiological foundations. Ontological describes what knowledge is and assumptions about reality while

epistemology describes how we know it and assumptions about how knowledge should be acquired and accepted. Axiology explains what researcher values go in to it and assumptions about value system (Senarathne, 2005).

This particular study is based on the philosophy of ontological, throughout the research trying to gather the knowledge on the relationship between road construction industry and behaviours interest rate of the bank loan and trying to develop assumptions about the impacts of the relationship on the road construction industry.

3.2.2 Research Approach

Research approach may be defined as the plan for moving from the research question to the conclusion (Tan, 2002). Easterby-Smith *et al.* (2002) stated that the research approaches helps in organizing the research activities, including the collection of data, in ways that are more likely to achieve research aims.

Research approaches are classified mainly into two categories as quantitative and qualitative. Quantitative approach tends to relate to positivism and seek to gather factual data. It studies relationships between facts and how such facts and relationships accords with theories and the findings of any research executed previously (Fellows and Lui, 2003). Survey researches and experimental researches are basically coming under quantitative approaches.

Using a qualitative approach the researcher will study the whole population as individuals or groups and will identify benefits, understandings, options and views of people and analyze them to find solution (Fellows and Lui, 2003). Case study research, ethnography, action research and grounded theory approach can be considered as qualitative research approaches.

Quantitative approach has been used in this study. It is a survey research which is trying to gather actual data related to the bank loan interest rate and road construction project costs, and developing a relationship between facts and the research question.

3.2.3 Applicability of Quantitative Research Approach

The analysis part of this research tends to relate to positivism and seek to gather factual data. It studies relationships between actual facts on trends of interest rate of bank loan and how such trends related to the road construction industry. This approach is

equivalent with the statement of Fellows and Lui (2003). It proves that the quantitative approach is the most applicable approach to the study.

The research problem of this study was “what is the impact of fluctuations of interest rate of bank loan on road construction projects?” Rudestan and Newton (2007) have suggested quantitative research approach for the researchers which have research problem like “what” type. Base on this statement the quantitative approach is proved to be the most suitable research approach for this study.

The research is considering the trends of interest rate of bank loans and road construction inputs during the year 2000 – 2015. The best approach to gather data is to use published documents related to the subject. Document survey is a technique comes under the survey technique which is categorized under the quantitative approach.

3.2.4 Research Techniques

According to the Tan (2002), research techniques comprise of data collection and data analysis methods. A variety of data collection techniques can be used in research such as interviews, questionnaires, document surveys, observation and participation.

The data analysis technique will act as the media to interpret the data collected and achieve a conclusion. Statistical analysis, content analysis, pattern matching and cognitive mapping are the commonly used techniques in data analysis. It is very important to identify the appropriate technique to be used in a research as a part of the research design. Thus, the data collection and analysis techniques employed are described below.

3.2.5 Literature review

A comprehensive literature survey was carryout to identify the evidence for the relationship between fluctuations of the interest of bank loans and road construction industry and direct and indirect impacts of fluctuations of interest rates on road construction industry. Books, journals, dissertations, web sites, articles have been referred to cover the objective.

3.2.6 Preliminary Interviews

Initially, *semi structured interviews* were conducted with financial specialists and road construction experts to verify the relationship between the rate of interest of bank loans

and road construction industry which is scientifically observed through the literature review. Main objective of this phase is to verify the applicability of the literature findings to the local context and to seek their assistance to design the questionnaire. Preliminary questionnaire was prepared to get expert view of point on the findings of the literature review (Refer Annexure 1).

3.2.7 Detailed Questionnaire Survey

Survey research involve collection of information from sample of individuals through their responses to questions. Survey researches owes its continuing popularity to its versatility, efficiency and generalizability (Miller & Salkind, 2002). In fact, survey research is often the only means available for developing a representative picture of the attitudes and the characteristics of a large population. As such, questionnaire survey was conducted through the selected sample of expert professionals from construction industry and bank financing.

Two types of detail questionnaires were prepared, (Refer Annexure 2 &3) consisted with three sections. Population is divided in two categories as construction sector and finance sector. Questionnaire type I was responded by the construction sector and questionnaire type II was responded by finance sector. Section I of both type of questionnaire gathered information about the respondent. Section II of questionnaire type I gathered information of the impact of bank interest rate on construction industry. Section II of questionnaire type II gathers information of the factors that determine the level interest. Section III of both questionnaire type I and II gathered information on the relationship between fluctuations of bank interest rate and the price level of road construction inputs. Detail questionnaire was given to 100 professionals related to construction industry and bank financing.

3.2.8 Document Survey (Data Collection from publications)

Document Survey technique is being used in this study to gather the required data which guides this research towards the conclusion. Documents used to collect data are been the publications of well recognized organizations which monitor construction industry and the finance sector of Sri Lanka.

The subject matter which is discussed in this study is well known factor but which is not proved thus data price levels of inputs of road construction industry is available in the indices developed by the CIDA. Further data of annual report published by the

Central Bank of Sri Lanka related to the fluctuations of loan interest rate was used as a primary data.

3.2.8.1 Limitations on the Publications

The whole island is not covered by the CIDA surveys. Moreover, all the construction activities carried out during the reference period are not covered by the construction activities in the island.

This survey covers all the construction activities carried out by the contractors registered with CIDA, Local authorities, Government and Semi Government agencies. Construction of roads and the rural sectors and urban sectors, as well as large scale construction activities carried out by the foreign organizations are not considered.

3.2.8.2 Data Collection from Organizations (Road Development Authority)

Details of input proportions calculated for each project which has contract amount more than Rs 500,000,000.00 were collected from road development authority. Input proportions were calculated according to the guide line published by the CIDA. Input proportions of selected road projects were calculated by Contractors' organizations which increase the character of realistic for the calculations.

3.2.8.3 Data Analysis Techniques

A statistical data analysis process was used in this research study to analyze the collected data. Two main types of statistics are normally in use; descriptive statistics and inferential statistics (Hooda, 2003).

In this study, descriptive statistics have been used for the data analysis. Descriptive statistics include the methods of organizing, summarizing and presenting data in an informative way. Percentages, weighted mean, relative importance and the correlation analysis were the descriptive statistical tools employed in this research study. The analysis was carried out using the software; Minitab 17 version English.

3.2.8.4 Analysis of Questionnaire

The Relative Importance Index (RII) was used to rank the direct impacts of interest rate on road construction industry and the factors determine the level interest of bank loans in Sri Lankan finance sector. Method of calculation of RII is; sum of weightings divided by the multiplication of highest weight and total number of respondents. This method has been earlier used by (Sivaramalingam&Perera, 2014; Ahamed,

Perera&Ilankoon, 2013; Sumithiran, 2009; El-Sayegh, 2008;Kamarazaly 2007; Sabasivan and Soon, 2007;Jeyamathan&Rameezdeen, 2006) as a data analysis method in this kind of studies.

RII facilitates evaluation of nonparametric sample by giving a RII value for each factor.

$$RII = \frac{\sum w}{A * N}$$

Where: RII= Relative Importance Index; w= weighting given to each factor by the respondents, A= Highest weight and N= Total number of respondents.

3.2.8.5 Regression and Correlation

This is a statistical method that is used to deal with paired data of two variables, which may relate in some way (Hooda, 2003). According to the Lindley (1987), knowing that relationship exists between any two variables is vital information that invites keen interest and concern. For, often this may be crucial for decision making in any given situation. For an example, it is very important for a contractor to know how the unit rate of asphalt concrete is related with the interest rate of the bank loans.

As states by Hooda (2003), in all such cases as, one is interested in:

1. Knowing the nature of relationship between any two characteristics of one's interest
2. Getting a definite idea about the degree of that relationship

Fox (1997) states that systematized knowledge on these two related aspects can be obtained by using appropriate statistical methods. Most specifically, the methods needed here relate to the following issues:

1. Bringing out the nature and the degree of relationship between any two variables, say X and Y
2. Measuring the rate of change in one (the dependent) variable associated with a given change in the other (the dependent) variable
3. Evaluating the predictive strength of the relationship that obtain, and assessing the reliability of an estimate derived from that relationship

Since these three issues are inter related by Fox (1997), regression and correlation, as two sides of single basic process, consist of methods of examining the relationship between two variables. Regression is mainly concerned with bringing out the nature of the relationship and using it to know the best approximate value of one variable corresponding to a known value of the other variable. Correlation, on the other hand, is concerned with quantifying the closeness of such relationship (Fox, 1997).

3.3 Applicability of Regression and Correlation Analysis

Identifying the relationship between interest rate of bank loans and the cost of road projects is an objective of this research study. Price of inputs of road construction project and the interest rate of bank loans are two variables concerned in the study to prove relationship between two industries. Different of interest rate level has been recognized as the independent variable and inputs has been recognized the dependable variables. Since the correlation analysis is illustrating the nature and the degree of relationship between any two variables, according to the circumstances the correlation analysis is considered as the best method to assess the relationship.

Measuring the rate of change in one input (the dependent) associated with a given change in the interest rate differences (the dependent) is another aspect of the research. Regression analysis is being very effective regarding this aspect because it provides the regression line (regression equation) related to the two variables. It provides a great deal of information about the two variables which is very helpful to understand how the prices of inputs of the road construction respond to the fluctuations of the interest rate of bank loans.

Evaluating the predictive strength of the relationship that obtain, and assessing the reliability of an estimate derived from that relationship is another important reason to use regression analysis in this study. It provides an evaluation about the regression equation obtained through the data, which is very helpful to understand the reliability of the prediction that would be made by using the equation.

3.4 Benefits of using 'Minitab EXPRESS'

'Minitab 15' is software which is very easy to learn and easy to use, it is not necessary to memorize complicated programming languages to work with Minitab. All regular statistical functionalities can be performed in Minitab by one or several clicks in the

pull-down menu. Besides, the menu is organized in a very intuitive way, such that it is not a difficult thing to remember where to find what.

Large number of statistical functionalities can be performed in Minitab, ranging from simple basic statistics to much more complicated multivariate analysis. However, what makes Minitab stand out among statistical software is its strength in statistical quality control. Minitab is equipped with almost all of the widely-used tools for process control, including analyzing methods, graphics, designs of experiments, etc.

Perfect graphing output is another benefit. Minitab users are impressed by the variety and quality of the graphs generated by the software. Minitab can produce many kinds of statistical graphs, and they are very easy to be edited and customized. The quality of the graphs is superior to that of other software.

Minitab software is being the most prominent package for the statistical activities. Due its high quality of functionalities and nice graphical output it is been used in the study.

3.5 Data Collection and Data Analysis Framework

The process of data collection and analysis using the above described techniques can be presented in a framework as follows (Figure 3.2).

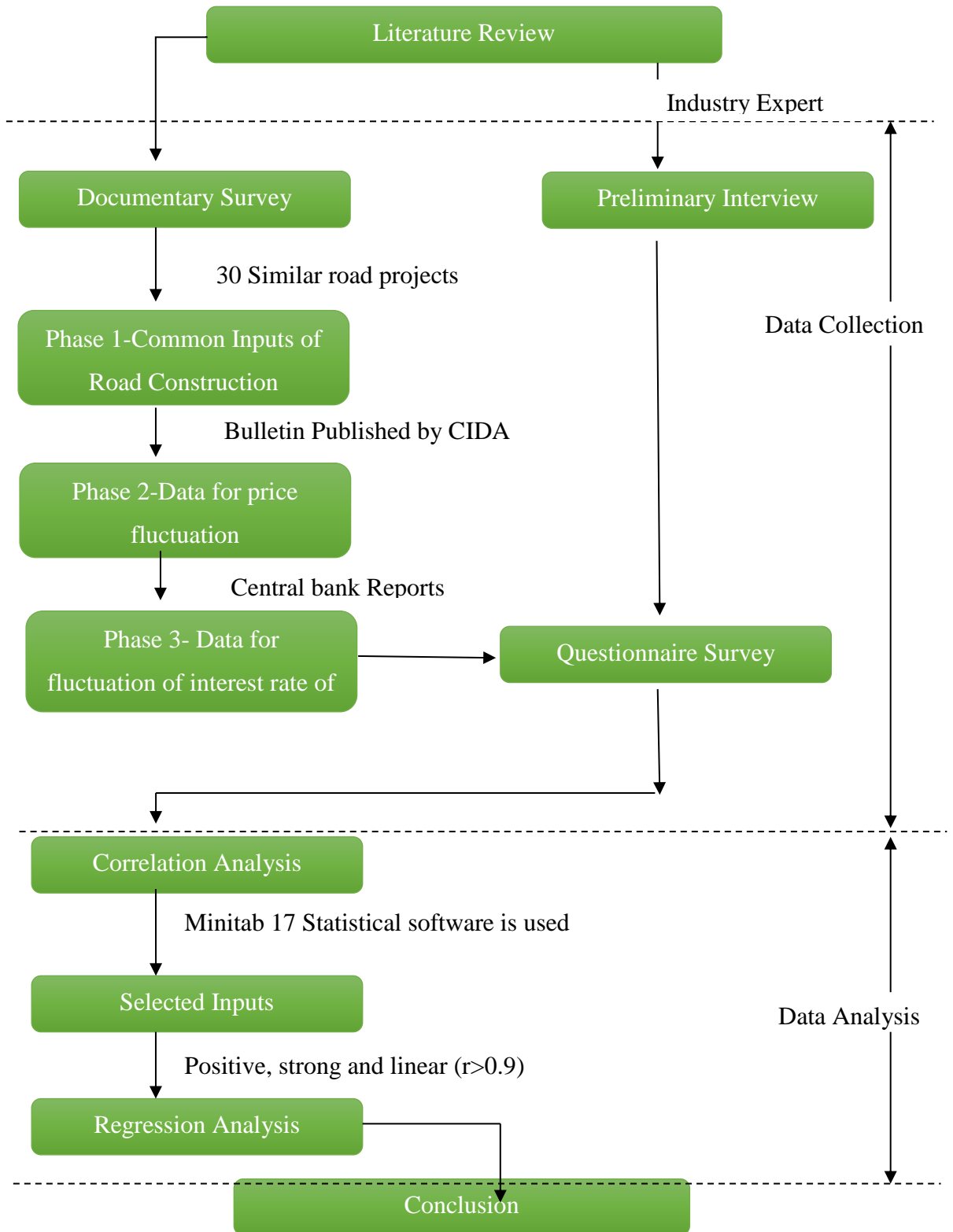


Figure 3-2 : Data Collection & Analysis Framework

3.6 Research Process

According to the above explained research methodology, the overall research process to achieve the objectives identified in chapter 1 can be illustrated as follows (Figure 3.3).

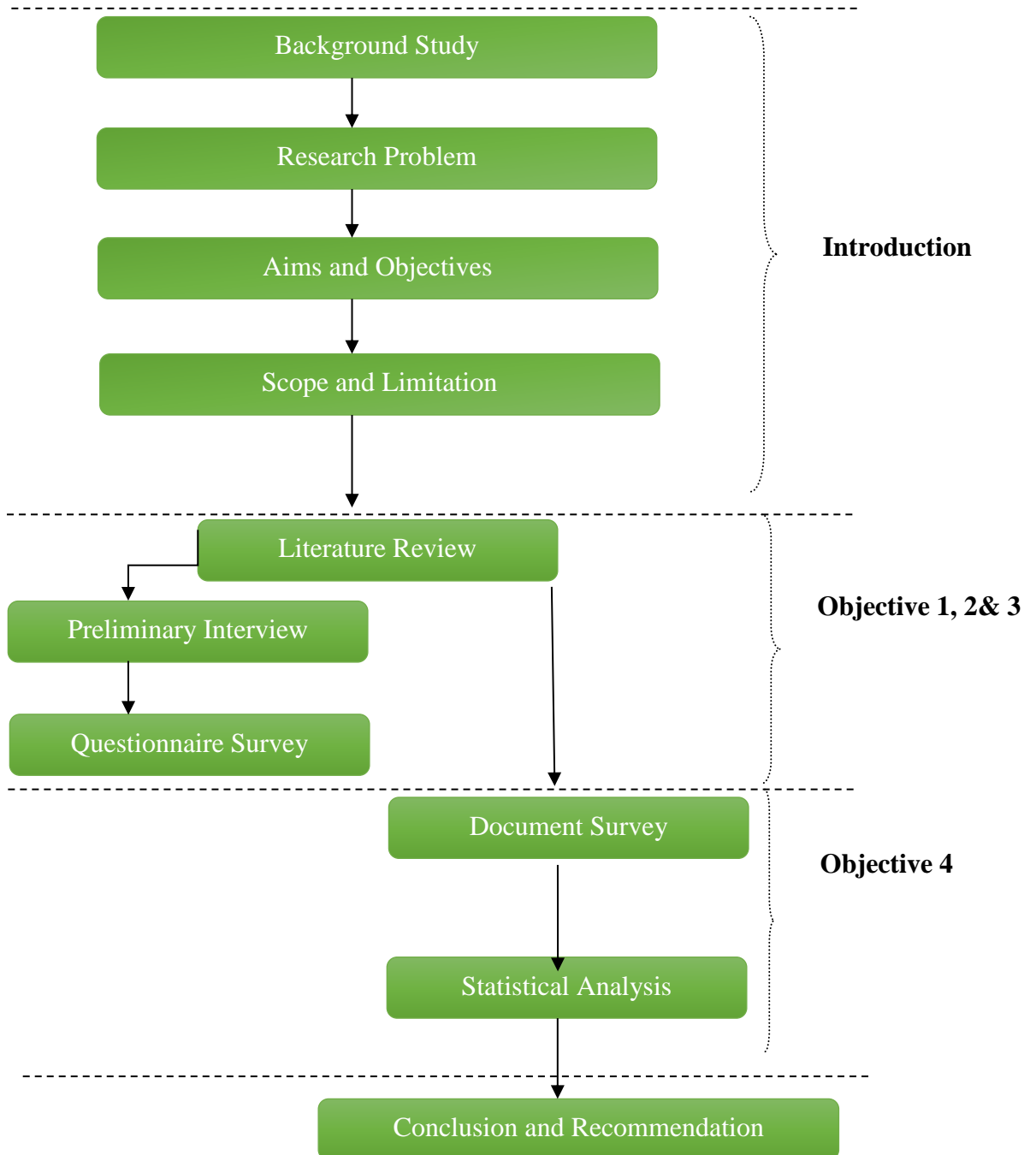


Figure 3-3 : Framework for research process

3.7 Summary

The objective of this chapter was to explain about the research methodology that was followed during this research. In order to achieve the aim and objective of the research the qualitative research approach as well as quantitative research approach were used. This method has been defined as pragmatic approach or mixed approach. The unstructured interviews were conducted with the professionals to obtain their ideas to develop the criteria to design the questionnaire. The data was collected through closed ended questionnaire and open-ended interviews. The questionnaire was emailed to 100 professionals to collect the data and the collected data was analyzed using the RII and correlation analysis and regression analysis technics.

4 CHAPTER-RESEARCH FINDINGS AND ANALYSIS

4.1 Introductions

Previous chapters illustrated the literature review regarding the research topic and the research methodology adopted for the achievement of research objectives. This chapter illustrates the findings of this research study together with the analysis and interpretation of those findings.

The findings of the data collected through preliminary interview, questionnaire and the document survey have been analyzed using basic statistics concepts such as rankings, correlation analysis and regression analysis. This chapter contains the details of the samples, statistical interpretation of responded the questionnaires, correlation analysis and regression analysis of relationship between fluctuations of interest of bank loan and identified inputs of road construction.

4.2 Preliminary Interview

4.2.1 General details of preliminary interviewee's

The preliminary interviews were carried out among four professionals with long term experience on road construction who were performing their duties in well-reputed contractor, consultant, client organizations and finance sector in Sri Lanka. A brief description of the interviewers is given in table 4.1.

Interviewee	Designation	Experience (Years)	Specialized Area
Interviewee 1 (I1)	Contractual Claim Specialist	20 Years	Road Construction
Interviewee 2 (I2)	Sectional Manager	14 Years	Bank Financing
Interviewee 3 (I3)	Former Secretary Ministry of Highway & Ports	35 Years	Road Construction
Interviewee 4 (I4)	Project Manager	15 Years	Road Construction

Table 4-1: General Details of preliminary interviewee's

Above explained experts were interviewed according to the preliminary interview guideline. Their opinion was used to conform the applicability of literature findings to the local road construction industry. Refer annexure 1 for the preliminary interview guideline.

4.2.2 Objective 1-Relationship between the interest rate of bank loans and road construction industry

Objective one of this research study is to recognize the relationship between the rate of interest of bank loan and the road construction industry. A comprehensive literature review was carried out in this regards as described in chapter 2. The applicability of bank loans in construction industry is discussed in details under the section 2.12 & 2.13.

Reviewed relationship between the rate of interest and the road construction industry is based on the published literature in various countries. Applicability in local context of reviewed facts by comprehensive literature review was confirmed by the local experts. Preliminary interviews were focused to collect the conformation or disagreement of the local experts on the defined relationship between the rate of interest of bank loans and the road construction industry. Experts' comment on literature findings is demonstrated in table 4.2.

Findings of Literature Review	Experts' Agreement/Disagreement			
	I-1	I-2	I-3	I-4
Bank loan the Key source of financing in capital structure in road construction industry	✓	✓	✓	✓
Bank loans are applied at Planning Stage	✓	✓	✓	✓
Bank loans are applied at Construction Stage	✓	✓	✓	✓
Bank loans are applied at Operational Stage	✓	✓	✓	✓
Bank loan market is a developing financial source for road construction industry	✓	✓	✓	✓

Table 4-2: Experts' Comment on Finding of Literature Review

Four experts agreed and confirm the applicability of the literature findings in contet of local road construction industry.

4.2.3 Objective 2-Impacts of fluctuations of rate of interest of bank loans on road construction industry- Part I

Objective number two is to identify the direct and indirect impacts of rate of interest of bank loans on local road construction industry. This part was carried out with the use of literature survey and the preliminary interviews. As per the literature review there are six direct impacts and one indirect impact identified as given bellow table 4-3:

Impact on road construction industry	
Direct	Indirect
Investment decisions	Price level of inputs
Financial decisions	
Dividends payments	
Bottom earnings	
Investment bearing	
Opportunity cost	

Table 4-3: Impacts of Interest Rate on Road Construction Industry

During the preliminary interviews, no additional direct or indirect impact was recommended by the interviewees but agreed with the impacts that are given in the table 4.4.

Impacts identified through the literature review	Experts' comment on Direct/Indirect			
	I-1	I-2	I-3	I-4
Investment decisions	Direct	Direct	Direct	Direct
Financial decisions	Direct	Direct	Direct	Direct
Dividend payments	Direct	Direct	Direct	Direct
Investment bearing	Direct	Direct	Direct	Direct
Bottom earnings	Direct	Direct	Direct	Direct
Opportunity cost	Direct	Direct	Direct	Direct
Impact on Price of inputs	Indirect	Indirect	Indirect	Indirect

Table 4-4: Short listed Impacts on Road Construction Industry

Experts' opinion regarding the literature findings which is shown in table 4-4 conforms the applicability of impacts of fluctuations of rate of bank loans to the Sri Lankan road construction industry.

4.2.4 Objective 2-Impacts of fluctuations of rate of interest of bank loans on road construction projects- Part II

Further, under Objective number two, the impact of rate of interest of bank loans on road construction projects were identified as given table 4.5. This part was carried out with the use of literature survey and preliminary interviews. As per the literature review there are five direct impacts identified as given bellow table 4.6.

Impacts on road construction projects	
Impact	Direct/Indirect
Payment delays	Direct
Project cash flows	Direct
Project financial resources	Direct
Number of bidders	Direct
Project cost	Direct

Table 4-5: Impacts of Interest Rate on Road Construction Projects

During the preliminary interviews one additional impact was recommended by the interviewees but agreed with the impacts that are given in the table 4.6.

Impacts identified through the literature review	Expert's Comment			
	I-1	I-2	I-3	I-4
Payment delays	Direct	Direct	Direct	Direct
Project cash flow	Direct	Direct	Direct	Direct
Financial resources	Direct	Direct	Direct	Direct
Number of bidder	Direct	Direct	Direct	Direct
Project cost	Direct	Direct	Direct	Direct
Interest Claims	Direct	Direct	Direct	Direct

Table 4-6: Adopted list of Impacts of Interest Rate on Road Construction Projects

The table 4.5 & 4.6 show the findings of the literature survey and the preliminary interviews. Concluded view of interviewees was that listed direct and indirect impacts of rate of interest of bank loans on local construction industry are most applicable for the local construction industry.

4.2.5 Objective 3-Factors determine the level of rate of interest of bank loans in Sri Lankan finance sector

Under objective number three, the factors that determine the level of rate of interest of bank loans in Sri Lankan finance sector are identified. This part was carried out with the use of literature survey and preliminary interviews. As per the literature review there are five factors are identified as given bellow:

1. Demand and Supply of funds
2. Competition
3. Inflation rate
4. Expectations
5. Policy
6. Uncertainty

During the preliminary interviews, no additional factor was recommended by the interviewers but agreed upon the impacts that are given in the table 4.7.

Factor identified through the literature review	Expert's Agreement/Disagreement			
	I-1	I-2	I-3	I-4
Demand & Supply of funds	✓	✓	✓	✓
Competition	✓	✓	✓	✓
Inflation rate	✓	✓	✓	✓
Expectation	✓	✓	✓	✓
Policy	✓	✓	✓	✓
Uncertainty	✓	✓	✓	✓

Table 4-7: Factors determine the Rate of Interest

The table 4.7 shows the findings of the literature survey and the preliminary interviews. Concluded view of interviewees was that listed factors cause to determine the level of rate of interest of bank loans on local finance sector.

4.3 Questionnaire Survey

Questionnaire survey was carried on under two types of questionnaires. Two types of questionnaires targeted separate sample populations as construction industry and finance sector in Sri Lankan context. Responded questionnaires were analyzed separately as explained below.

4.4 Questionnaire Type I

Questionnaire type I targeted the population from construction sector. Objective of the part-I is to rank the direct impacts of bank interest rates on road construction industry and the objective of part-II is to rank the direct impacts road construction projects.

4.4.1 Frequency distribution of the study sample by the party to the contract

The questionnaire type I were emailed to the sixty (60) professionals and forty-seven (47) were responded. Hence the response rate for this questionnaire survey was 78.3%. Table 4.8 and figure 4.1 describe the respondents in terms of the party to the contract, their work experience in terms of number of years and number of projects.

Party to the contract	No	Percentage (%)
Employer	9	19.1
Consultant	15	31.9
Contractor	23	48.9
Total	47	100

Table 4-8: Frequency distribution of the sample by the party to the contract

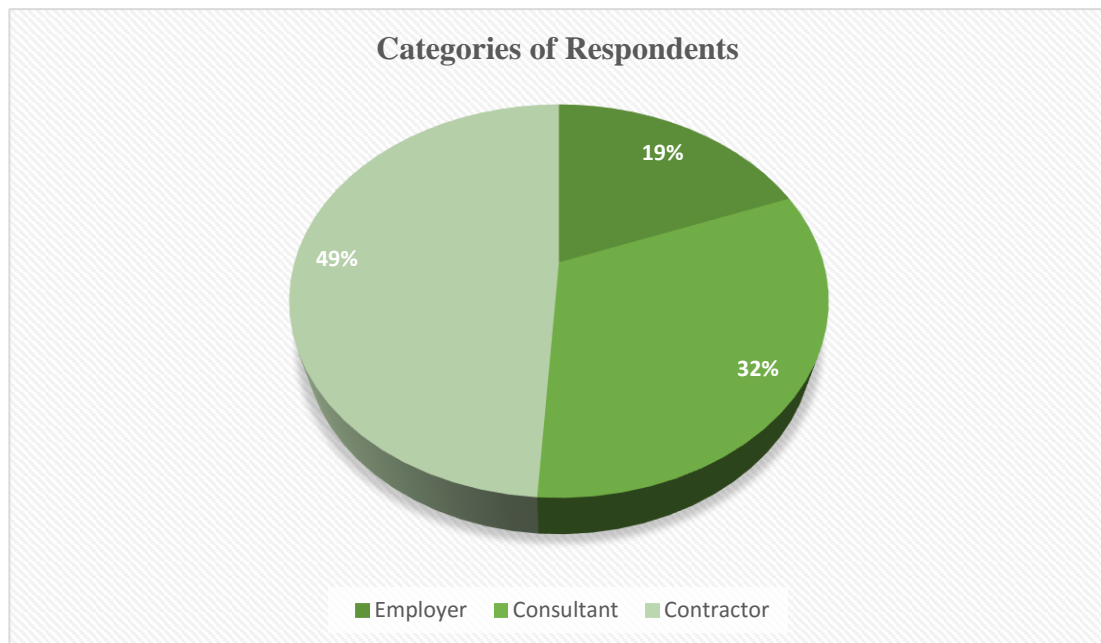


Figure 4-1: Distribution of respondents according to the party to the contract

4.4.2 Frequency distribution of the study sample by work experience in years

Table 4.9 and figure 4.2 describe the respondents in terms of their work experience in road construction industry.

Work Experience (years)	Number	Percentage (%)
<5	10	21.3
6-10	11	23.4
11-15	15	31.9
16-20	13	27.7
>20	08	17.0
Total	47	100

Table 4-9: Frequency distribution of the study sample by work experience in years

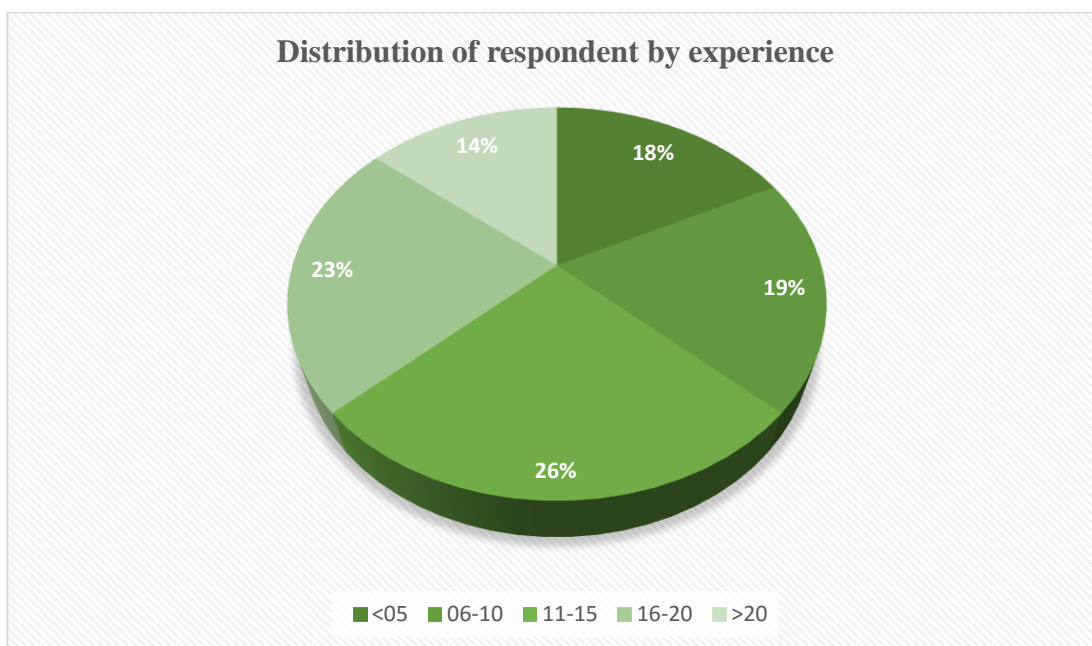


Figure 4-2: Distribution of participants by work experience

The table 4.9 and figure 4.2 show that more than 76.60% of the respondents had a work experience of more than ten years in road construction industry of Sri Lanka. The work experience of a person in the related subject is a significant in obtaining reliable and accurate information on that particular subject (Eagly & Chaiken, 1993).

4.4.3 Frequency distribution of the study sample by number of projects

Table 4.10 and figure 4.3 describe the respondents in terms of their work experience in number of road construction projects.

No. of projects worked	Number	Percentage (%)
1	9	19.1
2	5	10.6
3	10	21.3
4	9	19.1
5	7	14.9
>5	6	12.8
Total	47	100

Table 4-10: Frequency distribution of the sample by number of projects worked

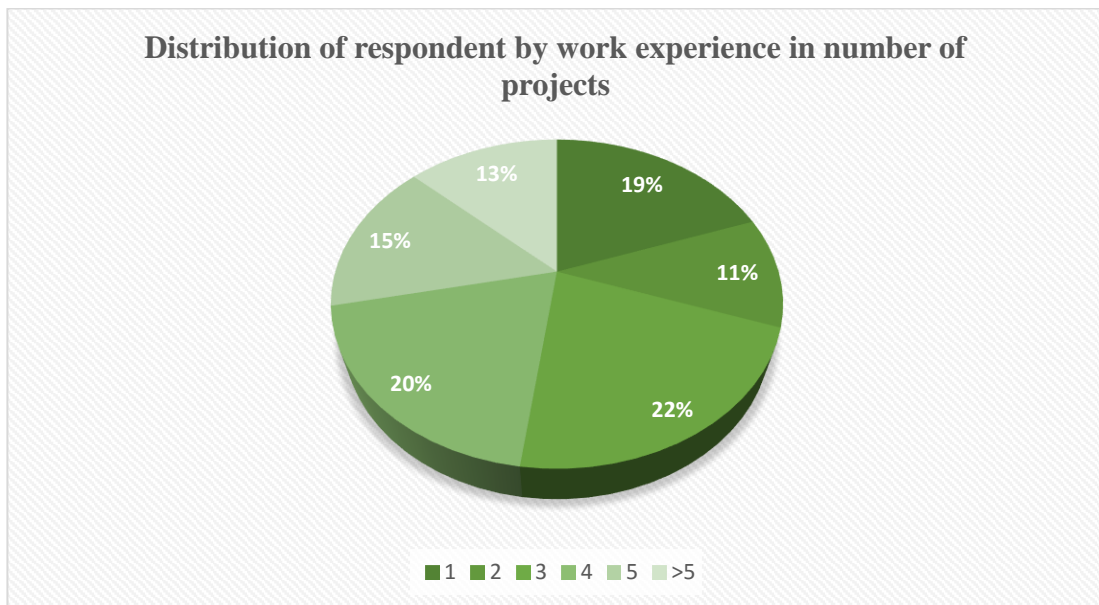


Figure 4-3: Distribution of respondents by work experience in number of projects

The table 4.10 and figure 4.3 show that more than 68.1% of the respondents had worked in more than 3 road construction projects. The number of projects that a person has worked is imperative in obtaining reliable and accurate information (Eagly&Chaiken, 1993).

4.4.4 Questionnaire type I-ranked direct impacts of rate of interest on local road construction industry- Part I

The direct impacts of rate of bank loan interest on road construction industry that were identified by the literature review and the preliminary interviews were requested to rank in the questionnaire type I. The responses were analyzed to obtain the rank the factors which have most impact on the local road construction industry as given in the table 4.11. It describes the ranking of the impacts by the participants considering the present application on road construction industry in Sri Lanka.

Impacts	Relative Importance (%)	Rank
Financial Decisions	68.0	1
Investment Decisions	63.0	2
Opportunity Cost	61.0	3
Investment Bearings	60.0	4
Bottom Earnings	55.0	5
Dividend payment	40.0	6

Table 4-11: Ranked direct impacts of interest rate on road construction industry

The table 4.11 shows that “financial decisions “of road construction industry is the factor which is most impacted by the fluctuations of rate of interest of bank loans. It has been ranked as first by 68% of RII value. “Investment decisions” has been ranked as second by 63 % of RII value. The table 4.11 shows that investment decisions, opportunity cost and investment bearing are the factor which are second most impacted by the fluctuations of rate of interest of bank loans. It has been ranked very closely in a range of 63% to 60% vof RII value. Therefor top four factor are recognized as most impacted by the fluctuations of rate of interest of bank loans.

Further the population has indicated a less respond to the effect on “bottom earnings” and “dividend payment”. According to the RII index value the “dividend payment” is ranked as last by 40% of RII value. **Refer annexure 4 for calculations.**

4.4.5 Questionnaire type I-Ranked direct impacts of rate of interest on local road construction projects- Part II

The direct impacts of rate of bank loan interest on road construction projects that were identified by the literature review and the preliminary interviews were requested to rank in the questionnaire. The responses were analyzed to obtain the rank the most impact on the road construction projects as given in the table 4.12. It describes the ranking of the impacts by the participants considering the present application on road construction projects in Sri Lanka.

Impacts	Relative Importance (%)	Rank
Interest claims	68.0	1
Project Cash flow	67.0	2
Financial resources	65.0	3
Payment Delays	64.0	4
Project Cost	56.0	5
Number of bidders	54.0	6

Table 4-12: Ranked direct impacts of interest rate on road projects

The table 4.15 shows that “Interest claims” and “project cash flow” of road construction project is the factors which are most impacted by the fluctuations of rate of interest of bank loans. “Interest claims” has been ranked as first by 68 % of RII value. The table 4.15 shows that project cash flow of road construction project is the factor which is second most impacted by the fluctuations of rate of interest of bank loans. It has been ranked as second by 67% of RII value. Only second by 1%. Further

the population has indicated a high respond to the effect on interest claims, project cash flow, payment delays and financial resources. As per the RII index value all those four factors ranked in the range of 64% to 68%.

Therefor effect of fluctuations of rate of interest of bank loans on interest claims, project cash flow, financial resources and payment delays are very critical. Likewise, the “project cost” is ranked as fourth and “number of bidders” as last. **Refer annexure 4 for calculations.**

4.5 Questionnaire Type II

Questionnaire type II was targeted to collect information from local finance sector. Objective of the questionnaire type II is to rank the factors that determine the level of bank interest rate.

4.5.1 Frequency distribution of the study sample by sector

The questionnaire type II were emailed to the 60 professionals in local finance sector and forty-one (41) were responded. Hence the response rate for this questionnaire survey was 68.3%. Table 4.13 and figure 4.4 describe the respondents in terms of the party to the Sector, their work experience in terms of number of years.

Party to the contract	No	Percentage (%)
State	19	46.3
Private	22	68.2
Total	41	100

Table 4-13: Frequency distribution of the study by sector

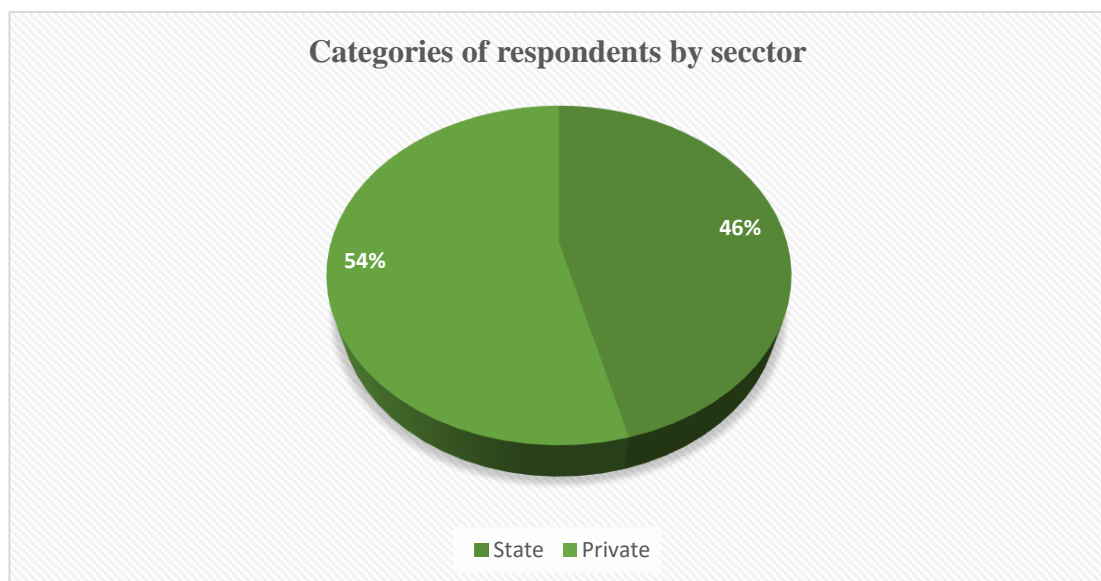


Figure 4-4: Distribution of respondents according to the sector

The table 4.13 and figure 4.4 show that 54% for the private sector while 46 % for state sector. These proportions represent the current local finance sector in real time. As per the central bank annual reports, currently majority of local finance sector is represented by the private financial organizations. Therefor justified representation of population increases the reliability of the sample information.

4.5.2 Frequency distribution of the study sample by work experience in years

Table 4.14 and figure 4.5 describe the respondents in terms of their work experience in local finance sector.

Work Experience (years)	Number	Percentage (%)
<5	7	17.0
6-10	13	31.7
11-15	10	24.3
16-20	08	19.5
>20	03	0.07
Total	41	100

Table 4-14: Frequency distribution of the study sample by work experience in years

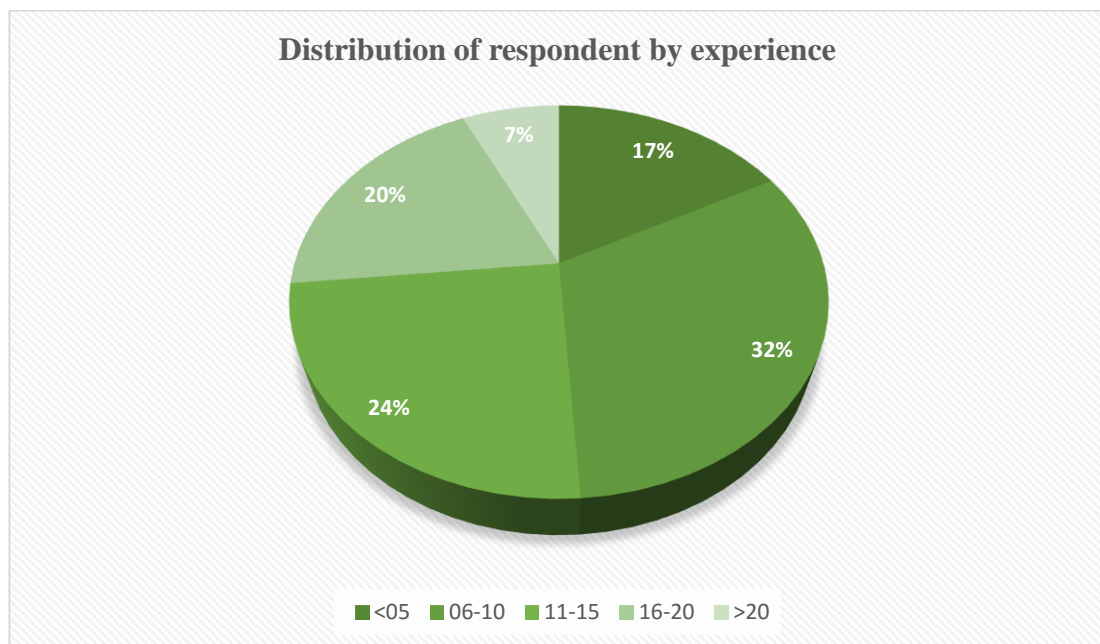


Figure 4-5: Distribution of participants by Work Experience

The table 4.14 and figure 4.5 show that more than 51.20% of the respondents had a work experience of more than ten years. The work experience of a person in the related subject is significant in obtaining reliable and accurate information on that particular subject (Eagly & Chaiken, 1993).

4.5.3 Fréquence distribution of the sample by number of years worked related to construction sector

Table 4.13 and figure 4.6 describe the respondents in terms of their work experience in related to the financial activities in construction sector.

No. of years	Number	Percentage (%)
<3	12	29.2
4-7	14	34.1
8-11	10	24.3
>12	5	12.1
Total	41	100

Table 4-15: Distribution of respondents by work experience in related to construction sector

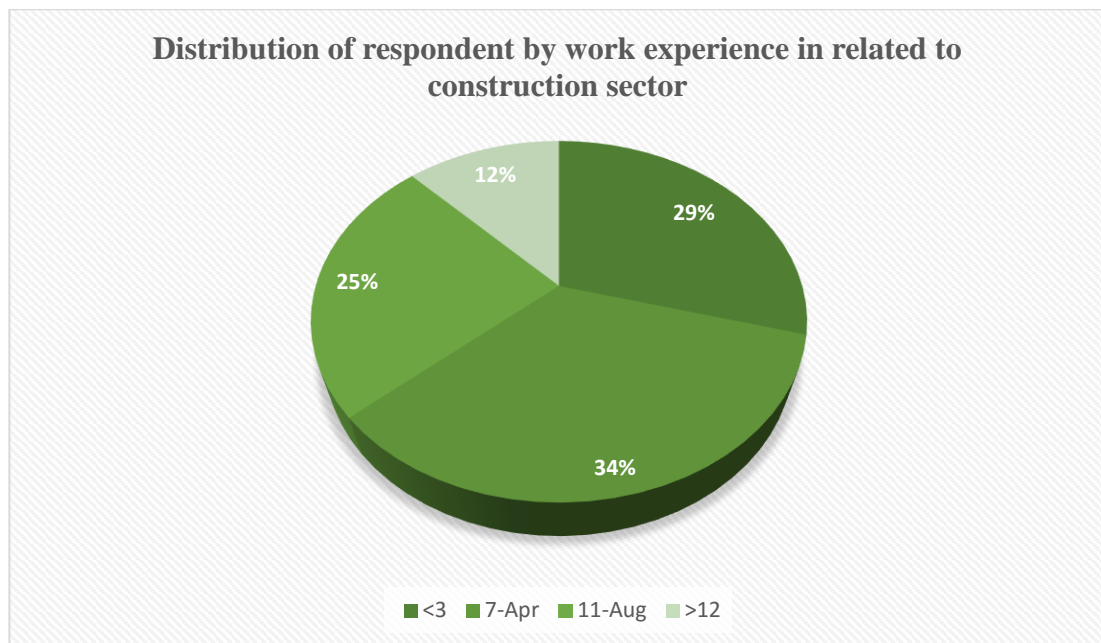


Figure 4-6: Distribution of respondents by work experience in related to construction sector

The table 4.13 and figure 4.6 show that more than 70.7% of the respondents had worked in more than 3 years in related to construction industry. The number of projects that a person has worked is imperative in obtaining reliable and accurate information (Eagly & Chaiken, 1993).

4.5.4 Questionnaire type II-Ranked factors of rate of interest in local finance sector

The factors determine the level of rate of interest of bank loans in Sri Lankan finance sector were identified by the literature review and the preliminary interviews were

requested to rank in the questionnaire. The responses were analyzed to obtain the rank the most impacted factor on the level of rate of interest rate as given in the table 4.16. Table 4.16 describes the ranking of the factors affecting the level of rate of interest rate by the participants considering the present application on Sri Lankan finance sector.

Factors	Relative Importance (%)	Rank
Demand & Supply of funds	74.0	1
Government Policy	71.0	2
Inflation rate	65.0	3
Expectation	59.0	4
Competition	57.0	5
Uncertainty	57.0	5

Table 4-16: Ranked factors of rate of interest rate in local finance sector

The table 4.16 shows that “demand and supply of funds” is the factor which has most impact on the fluctuations of rate of interest of bank loans. It has been ranked as first by 74 % of RII value. The table 4.16 shows that “government policy” is the factor which has secondly most impact on the fluctuations of rate of interest of bank loans. It has been ranked as second by 71 % of RII. Therefore, as per RII values the respondents have ranked “demand and supply of funds” and government policy” at top while indicated a moderate respond to the effect of inflation rate, expectation, competition and uncertainty on the level of rate of interest of bank loans. Therefor the impact of “demand and supply of funds” on rate of interest is very critical. Refer annexure 4 for calculations.

4.5.5 Responded indirect relationship between the price level of inputs and the level of rate of interest of bank loans

The indirect impacts of rate of interest of bank loan interest on road construction projects that were identified by the literature review and the preliminary interviews were requested to confirm the questionnaire. As per the chapter 2, it is recognized that price level of inputs of road construction are indirectly impacted by the level of interest rate of bank loans. Respondents were given the opportunity to conform the indirect relationship between the interest rate of bank loans and price of inputs of road construction projects.

Table 4.17 describes the indirect relationship by the participants considering the present application on road construction projects in Sri Lanka.

Input	Indirectly impacted	
	Yes (%)	No (%)
A.B.C.	91	9
Equipment	85	15
Steel	78	22
Bitumen	68	32
Earth	66	34
Metal	53	47
Sand	33	67
Fuel	20	80
Cement	19	81
Labour	8	92

Table 4-17: Indirect impact on price of inputs

According to the response price levels of equipment, bitumen, A.B.C., earth, metal and steel are indirectly effected by the level of rate of interest of bank loans while price levels of labour, cement, sand and fuel are not. **Refer annexure 5 for calculations.**

4.6 Objective 4-Statistical Analysis for the relationship between rate of interest of bank loans and price of road construction inputs

The objective number four of the research is to recognize the relationship between the rate of interest of bank loans and the price level of inputs of road construction projects. Correlation and regression analysis has been the technique used to analyze the data to achieve the objective four of the research. Technique required two variables directly related to the subject matter. Literature review, experts' preliminary interview and the response to the questionnaire has identified and proved that price level of inputs of road construction is being indirectly effected by the fluctuations of the rate of interest of bank loans.

Inputs of the road construction and the rate of interest of bank loans has been used as two variables to fulfill the objective the analysis process. Primary survey being carried to identify the common inputs used in Sri Lankan road construction industry, Input percentages of certain inputs of each project is been studied to identify the common inputs to proceed the analysis.

4.6.1 Detail of Samples

Document survey is focused only in identifying the common inputs of road construction. Twenty-one road construction projects have been observed to identify the common inputs used in Sri Lankan context. Common factors of concerned road projects are:

- At least 12 months of the project construction period is within the year 2012 and 2015
- CIDA Price fluctuation formula is used for the Cost escalations
- Length is more than 5 km
- Constructed by Sri Lankan Contractors
- Estimated contract amount is more than 500 Million

Details of twenty-one road projects are shown in following table 4.18

Table 4-18: Details of road projects

No	Name	length	Amount (Rs. Millions)	Duration In Months
1	Improvements to Galagedara- Horana Road	9.2	850	12
2	Rehabilitation of Pannala-Kuliyapitiya Road (5+000-16+280 Km)	11.28	1400	18
3	Rehabilitation & Upgrading of Narammala-Dankotuwa-Giriulla Road From 0+000 to 16+030 Km	16.03	1800	18
4	Rehabilitation & Upgrading of Ampara-Uhana-Mahaoya Road (13+000-30+000 Km)	17	1950	18
5	Rehabilitation and Upgrading of Meepe-Ingiriya Road (0+000 -18+130 Km)	18.13	1680	18
6	Rehabilitation of Nagoda_Neboda Road (B207) (2+700-15+900Km) & Avittawa-Lewwanduwa Road (B114) (9+830-27+200 Km)	30.57	2600	24
7	Construction of Kegalle Bypass Road Stage III	2.34	900	18
8	Rehabilitation & Upgrading of (B300) Muttettugala-Hiripitiya Road (0+000-18+500 Km)	18.5	1950	24
9	Rehabilitation & Improvements to Kurunegala-Narammala-Madampe Road (22+260-40+870 Km)	18.61	2100	24
10	Rehabilitation & Upgrading of Hasalaka-Hadungamuwa- Hettipola Road (B484) (0+000-20+000 Km)	20	2300	24
11	Rehabilitation & Improvements od Seeduwa-Katunayake Road (0+000-3+900 Km) & Seeduwa-Udugampola Road (0+000-11+700 km)	15.6	1460	18
12	Rehabilitation & Improvements to Polonnaruwa-Higurakgoda Road (2+000-13+650 km)	11.65	1400	18
13	Rehabilitation of Kirinda-Palatupana-Yala Road (0+000-12+500 Km)	12.5	1200	18

No	Name	length	Amount (Rs. Millions)	Duration In Months
14	Widening and Improvements to Kelanimulla-Mulleriyawa_Koswatta Road Phase 1, Construction of VIA Duct and Approach		750	15
15	Rehabilitation & Improvements to Thalduwa-Meewitigamma Road (0+000-17+300 Km)	17.3	2100	24
16	Rehabilitation & Upgrading of Kadawalagedara-Withikuliya Road (0+000-14+000 Km)	14	1650	18
17	Widening & Improvements to Tangalle-Kadurupokuna-Beliatta and Kadurupokuna-Dedduwawala Road (0+000-12+760 Km)	12.76	1300	18
18	Rehabilitation & Upgrading of Weligatta-Bundala-Kirinda Road (0+000-19+200 Km)	19.2	2200	24
19	Rehabilitation & Improvements to Kotte-Bope Road from 0+000-3+700 Km & Battaramulla-Pannipitiya Road (0+000-3+500 Km)	7.2	550	12
20	Rehabilitation & Improvements to Old Colombo Galle Road from Cross Junction to Walana Junction (17+500-25+200 Km)	7.7	600	12
21	Rehabilitation & Improvements to Matale-Wattegama Road (0+000-13+000 Km)	13	1400	15

Project No	Input (%)																							
	M1	M3	M4	M6	M7	M8	M13	M14	M21	M30A	M30C	M39	M41	M43	M45	M48	M52	L1	L2	L3	P1	P2	P3	
1		3.5			4.4	1.8	3.8		1.1		36.1				6.5	7.2		2.3	3.1	1.1	0.2	9.5	9.4	90
2		2.17			6.9	1.8					28.48				5.15	16.02	3	2.08	1.57			14.16	9.29	90
3			1.51		6.17						33.49			1.19	3.02	4.66				3.54		21.59	14.83	90
4					6.38		2.73		4.9	18.01					8.29	16.21				6.24	16.21	4.67	6.36	90
5		6.54			7.5	2.92	3.89		1.42		19.75			1.07	3.23	6.9		5.89	2.7	2.88	1.17	11.37	12.77	90
6		2.39		1.33	2.76		1.2				17.61			1.8	6.49	13.5		1.71	1.02	5.09		17.25	17.85	90
7		7.34		1.74	2.03	2.81	9.5		1.61		3.31		6.1		3.57	8.09		2.87	2.82	2.17	1.31	28.68	6.05	90
8			1.76		7.58	1.05	1.09				28.85			0.5	1.26	14.22		0.98	1.25	2.24	0.43	20.21	8.58	90
9			1.92		7.76	1.05	2.94		2.44	3.18	20.55				2.09	11.68		2.65	3	2.37	0.6	9.11	18.66	90
10		1.04		2.48	1.33						24.5				13.26	9.66				1.14		14.7	21.89	90
11		3.99			10.2	1.24	3.26		1.91		19.31			0.77	2.53	17.94		1.84	1.82	1.88	0.96	14.25	8.1	90
12		1.04			7.88						20.05				3.95	18.05	2.66		3.87	5.99		8.01	18.5	90
13					10.8		2.42				21.71				7.83	14.76	4.58					17.8	10.1	90
14			17.1		6.2	3.3	17.9		2.5		1.2		6.5		5.1			3.1	2.1	4.5	2.6	7	10.9	90
15			1.94		6.07	1.04				2.06	18.92				1.92	4.75			0.99	2.37	6.28	23.87	19.79	90
16			5.2		4.92	1.56	1.85		1.15		24.95				1.8	14.1		1.08	1.04	3.25		14.85	14.25	90
17					11.67		3.23				23.85				7.06	14.79	5.12					15.57	8.71	90
18		2.18		1.79	3.61	1.95	3.1		1.08		20.74				5.27	14.96		1.51	2.23	2.09		14.83	14.66	90
19		9.88			6.02						20.23					1.13	5.83	2.6	3.38		2.7	20.36	17.87	90
20	3.32				0.53	1	9.15		3.26	2.16	11.95	4.46		1.36	0.75	24.32		4.54		5.77		13.17	4.26	90
21		7.03		0.34	8.12	4.43	7.25	2.2	1.51	2.05			6.95		13.4	2.14		4.53	2	14.8	3.96	3.29	6	90
Avg	0.16	2.24	1.40	0.37	6.13	1.21	3.49	0.10	1.09	1.31	18.84	0.21	0.93	0.32	4.88	11.19	1.01	1.79	1.62	3.16	1.73	14.49	12.32	***

Table 4-19: Input percentages of Road Projects

4.6.2 Common Inputs of Sri Lankan Road Construction Context

Twenty-three common inputs have been identified by the primary survey and the **average input percentages** were calculated using available data of projects which is shown in table 4-19. Calculations are shown in annexure 4. Common inputs are given in following table 4-20.

Input factor	Input percentage (%) (average)
Bitumen 60/70 (M30 C)	18.84
Heavy Equipment (P2)	14.49
Fuel (P3)	12.32
A.B.C. (M48)	11.19
Metal (M7)	6.13
Earth (M45)	4.88
Steel (M13)	3.49
UnSkill Labour (L3)	3.16
Cement –Local Market Price (M3)	2.24
Skill Labour (L1)	1.79
Small Equipment (P1)	1.73
Semi Skill Labour (L2)	1.62
Cement –Bulk (M4)	1.40
Bitumen 80/100 (M30 A)	1.31
Sand (M8)	1.21
Form Work Timber (M21)	1.09
Quarry Dust (M52)	1.01
Pre-Stressed Conc Beams (M41)	0.93
Rubble (M6)	0.37
Pre-cast Concrete Items (M43)	0.32
Ready mix Concrete (M39)	0.21
Cement (Factory) (M1)	0.16
Structural Steel (M14)	0.10
Total percentage	90.0

Table 4-20: Common Inputs of a Road Project

Among these identified inputs only selected inputs were used to continue the correlation and regression analysis to define the relationship between fluctuations of rate of interest of bank loans and price of those inputs.

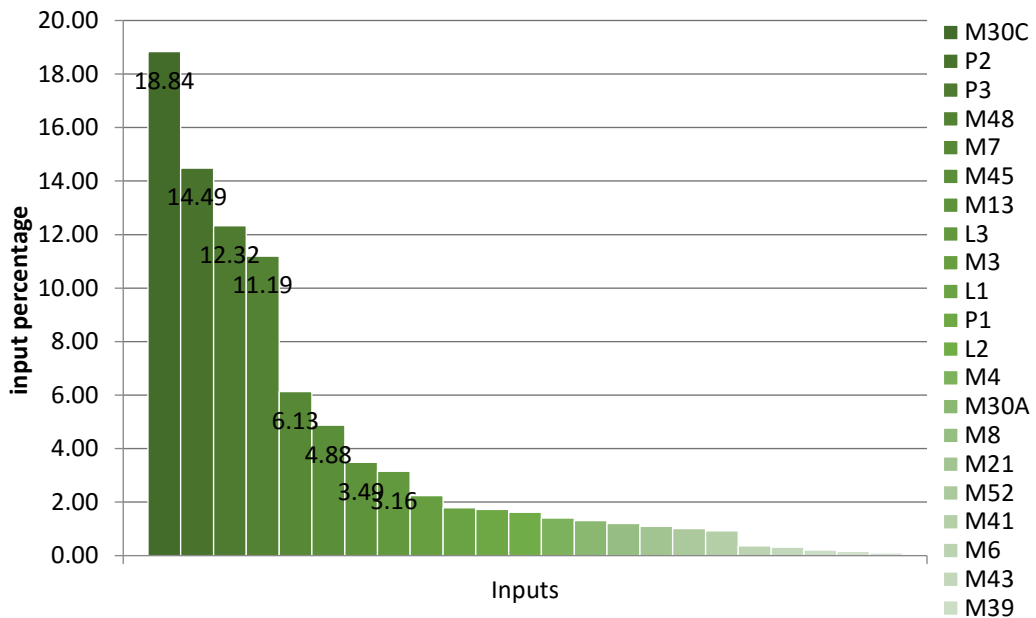


Figure 4-7: Average Input Percentages

4.6.3 Selected Inputs

Only inputs which have more than 4% of significance to the final cost are selected for the correlation analysis. Table 4.21 shows the selected inputs.

Input Factor	Input Percentage (%)
Bitumen 60/70 (M30 C)	18.84
Heavy Equipment (P2)	14.49
Fuel (P3)	12.32
A.B.C. (M48)	11.19
Metal (M7)	6.13
Earth (M45)	4.88

Table 4-21: Selected Inputs

Selected six inputs shown in above table 4.21 represent 67.85 % of total inputs of a road project.

4.6.4 Document Survey for the Price of inputs (CIDA Bulletin (Price index))

The objective of the document survey was to gather required data for the two variables that are needed for the analysis. Difference price level of identified inputs and the difference price level of fuel are the two variables used. The main document used to gather information is bulletin of price indices published by the CIDA

Price index has several potential applications. Particularly broad index can be used to measure the cost of living index and the price level of the economy. Narrower price index can help producers with business plans and prices. Sometimes they can be useful in helping to attract investment. Not a representation of reality, all types of products depending on the selected item is difficult because of different construction methods and materials available for various tasks to include the amount and ratio of each year.

Price index, the normalized mean is the price within a certain category of goods or services in a specified area during a specified time interval. It is these prices as a whole is designed to compare the statistics or to adjust prices between periods and geographical locations. These are combination of real wage rates, materials, equipment and overhead costs. These rates are calculated to measure changes in the cost of the contract using the CIDA price fluctuation formula (formula exceeding 5 million).

Representative or typical choice is difficult because of wide variations in construction methods and materials that can be used. Other problems include the amount of data that must be collected to provide statistical confidence in order. However, in terms of the need to limit the amount of costs associated with collecting data. These indices, namely, planning, forecasting, price fluctuations, comparisons between the cost prices on the market conditions, evaluation costs, have been used for several purposes.

Considering that, if the measure of price changes is used to calculate the cost of construction increases or decreases based on the type of contract variations. This type of construction under the contract change, it is possible to assess these costs. CIDA as a formal organization in Sri Lanka, respectively, cement, sand, reinforcement has published a monthly index for input and steel contraction. These indicators are only increments of costs.

4.6.5 Sample Details

Whole secondary analysis is done using the CIDA price indices.

Table 4-22: Sample Details

Input	Reference No	Time Period	Base year
Bitumen 60/70	M30 C	2012-2015	1990
Heavy Equipment	P2	2012-2015	2000
Fuel	P3	2012-2015	1990
A.B.C.	M48	2012-2015	1990
Metal	M7	2012-2015	1990
Earth	M45	2012-2015	1990

4.6.6 Correlation Analysis for the Selected Inputs

This is a statistical method that is used to deal with paired data of two variables, which may relate in some way (Hooda, 2003). Correlation analysis is concerned with quantifying the closeness of such relationship (Fox, 1997).

The relationship between any two variables may be linear or non-linear. It may be described by means of straight line or a curve. If the relationship is best explained by a straight line, it is said to be linear. On the contrary if it is described more appropriately by a curve, the relationship is said to be non-linear (Hooda, 2003). Following table 4-23 explains numerical scale of coefficient of correlation.

Correlation of Coefficient (r)	Type of Relationship
If $r = +1$	Positive and perfect
If $0.75 \leq r < 1$	Positive and very strong
If $0.50 \leq r < 0.75$	Positive and strong
If $0.00 \leq r < 0.50$	Positive and weak
If $r = 0.00$	No correlation
If $r = -1$	Negative and perfect

Table 4-23: Relationship between Variables

In this study, the Correlation of Coefficient is calculated by using the software called Minitab version EXPRESS English. Application of the software is well explained in the chapter of research methodology. **Refer the annexure 07 to annexure 12 for the graph and the calculations.**

Input Factor	Correlation of Coefficient (r)	Relationship
Bitumen 60/70	0.71	Positive, Strong
Heavy Equipment	-0.06	Negative, Weak
Fuel	0.42	Positive, Weak
A.B.C.	-0.74	Positive, Strong
Metal	-0.83	Negative, Very Strong
Earth	-0.90	Negative, Very Strong

Table 4-24: Coefficient of Correlation

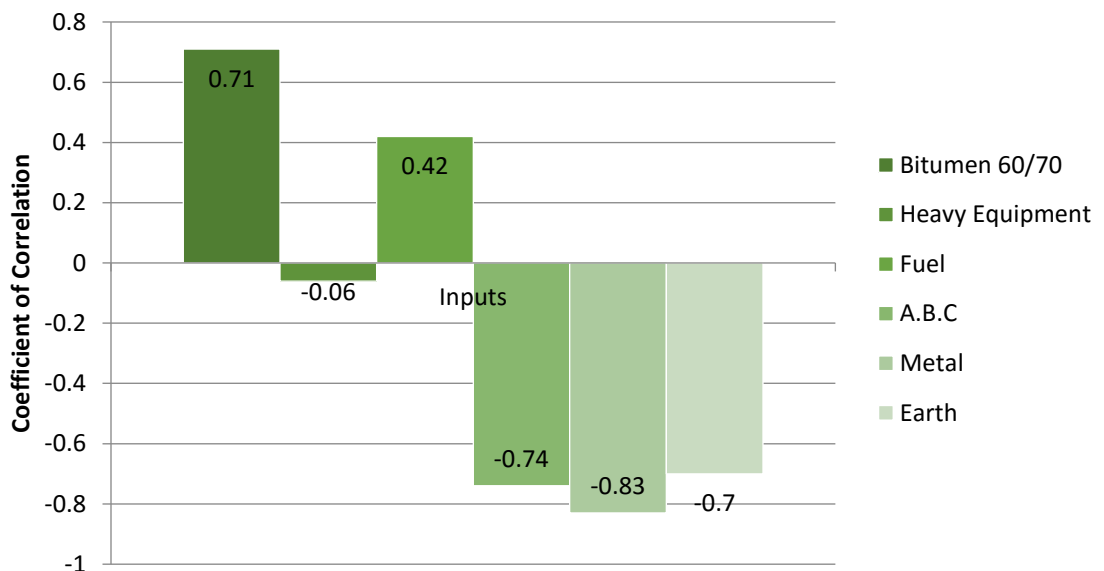


Figure 4-8: Graph for Coefficient of Correlation

4.6.7 Evaluation on Result of Correlation Analysis

Analysis results are able to create good picture about the relationship between price levels of inputs and the fluctuations of rate of interest of bank loans. This relationship is clearly visible in day to day economic activities but is not conformed by proof and interpretation. Above results help to prove this relationship with evidence derived by sound statistical background. It is a numerical scale to interpret the relationship. Coefficient of correlation of Bitumen 60/70 is 0.71 which explains a very strong and positive relationship between the interest rate. Supply of bitumen is a very highly capital-intensive business. Its production cost is extremely high and requires expensive investment at the beginning of the business. Main business client is the Sri Lankan government and it caused to delay the payments which creates cashflow issues toward

the business. This situation caused to use debt money or bank loans to maintain the positive cashflow. Therefore once the bank loan interest rate increases then the price of bitumen also increases.

Coefficient of correlation of heavy equipment is -0.06 which is very weak and negative. Most of the heavy equipment are imported. Business is highly active with used machines rather than new machines. Most of equipment and machines are imported from China. Nature of this business highly depends on the market conditions of a foreign country and the government tax policy against the imported machines. Under these circumstances price level has very less impact of local bank loans.

A.B.C., Metal and Earth are main inputs of a road project. Coefficients of correlation of those inputs are negative but show very strong relationship. Main client of those business are private contractor organizations. As explained before contractors are highly impacted by the interest of bank loans. When the interest rate increases it creates cash inflow issues to construction projects which cause to decrease the demand for the inputs of road projects such as earth, metal and A.B.C. according to the economic theory when demand decreases the price level also decreases. This concept is clearly explained by the results of correlation analysis.

Coefficient of correlation of heavy equipment (-0.06) is the weakest compared to the other inputs but still it has a strong relationship with fluctuations of rate of interest. While fuel shows a very weak relationship by indicating a 0.42 of coefficient of correlation. These two variables will be not considered for the regression analysis due to weak relationship with rate of interest.

4.6.8 Regression Analysis for the Selected Inputs

Since a linear relationship is a straight-line relationship, linear regression deals with methods of fitting a straight line, often called the regression line. Lindley (1987) has concerned with the form of the relationship between the variables. This can be summarized by an equation that enables us to predict or estimate the values of one variable (Y - the dependent variable) given values of the other variable (X - the independent or explanatory variable).

According to the chapter of research methodology, the software called Minitab has been used to derive the regression line between two variables. Minitab is highly developed statistical software which is used worldwide for the statistical analysis.

Only selected inputs shown in table 4-25 have been used for the regression analysis. Inputs which have very strong, positive/negative and linear ($+/-1 < r > +/-0.50$) relationship with fluctuations of interest rate of bank loans are selected and other inputs have been not selected for the regression analysis. **Refer annexure 7 to annexure 12 for the regression graphs and the calculations.**

Inputs	R
Bitumen	0.71
ABC	-0.74
Metal	-0.83
Earth	-0.70

Table 4-25: Selected Inputs for Regression Analysis

4.6.9 Regression Lines for the Selected Inputs

The certain inputs were selected after correlation analysis that are been confirmed about linear relationship with fuel price difference levels. Regression analysis helps to predict the most likely value of the dependent variable corresponding to a given, known, value of the independent variable. This is achieved through the predictive function of regression equation. **Refer annexure 7 to annexure 12 for the regression graphs and the calculations.**

Y (dependent)	X (independent)	Equation
Bitumen	Interest rate	$Y = 500.4 + 0.13X + 1.399X^2 - 0.07X^3$
ABC	Interest rate	$Y = 86.16 + 29.99X - 3.07X^2 + 0.09X^3$
Metal	Interest rate	$Y = 238.48 + 38.94X - 3.79X^2 + 0.10X^3$
Earth	Interest rate	$Y = 996.1 - 21.21X + 0.89X^2 - 0.01X^3$

Table 4-26: Regression Equations

4.6.10 Analysis on P (Probability) Values

The p (probability) values for the constant (a) and X, actually the slope of the line (b). These values measure the probability that the values for “a” and “b” are not derived

by chance. These 'p values' are not a measure of 'goodness of fit' of the line; but they state the confidence that one can have in the estimated values being correct, given the constraints of the regression analysis (linear with all data points having equal influence on the fitted line). **Refer annexure 7 to annexure 12 for the regression graphs and the calculations.**

(Y)	(X)	P Value (regression)
Bitumen	Interest rate	P<0.0001
ABC	Interest rate	P<0.0001
Metal	Interest rate	P<0.0001
Earth	Interest rate	P<0.0001

Table 4-27: P Values

This p value gives an idea on reliability of prediction of dependent variables in derived model. P value is compared to alpha level (typically 0.05). If the p value is less than alpha level then prediction is reliable and if the p value is greater than alpha level then there is no significant statistical relationship between two variables.

According to the regression analysis, p values of all the selected inputs are well below the alpha level (0.05). It means there is a significant statistical relationship between prices of inputs and fluctuations of rate of interest of bank loans.

P values of all inputs prove that regression equations which are derived from the regression analysis are reliable and prediction of these would be made much reliable. A.B.C, metal, earth and bitumen have better reliability compared to the other inputs.

4.6.11 Analysis on Coefficient of Determination (R-sq)

The R-squared and adjusted R-squared values are estimates of the 'goodness of fit' of the line. They represent the % variation of the data explained by the fitted line; the closer the points to the line, the better the fit. Adjusted R-squared is not sensitive to the number of points within the data. **Refer annexure 7 to annexure 12 for the regression graphs and the calculations.**

(Y)	(X)	R-Sq (%)	Adjusted R-Sq (%)
Bitumen	Interest rate	66.03	63.71
ABC	Interest rate	60.74	58.07
Metal	Interest rate	73.00	71.17
Earth	Interest rate	82.18	81.81

Table 4-28: Coefficient of Determination

R-sq is the proportion of the variance in the dependent variable which can be predicted from the independent variable. This value indicates that percentage of the variance in dependent variable can be predicted from the independent variable. Note that this is an overall measure of the strength of association, and does not reflect the extent to which any particular independent variable is associated with the dependent variable.

As predictors are added to the model, each predictor will explain some of the variance in the dependent variable simply due to chance. One could continue to add predictors to the model which would continue to improve the ability of the predictors to explain the dependent variable, although some of this increase in R-square would be simply due to chance variation in that particular sample.

The adjusted R-square attempts to yield a more reliable value to estimate the R squared for the population. When the number of observations is small and the number of predictors are large, there will be a much greater difference between R-square and adjusted R-square. By contrast, when the number of observations is very large compared to the number of predictors, the value of R-square and adjusted R- square will be much closer.

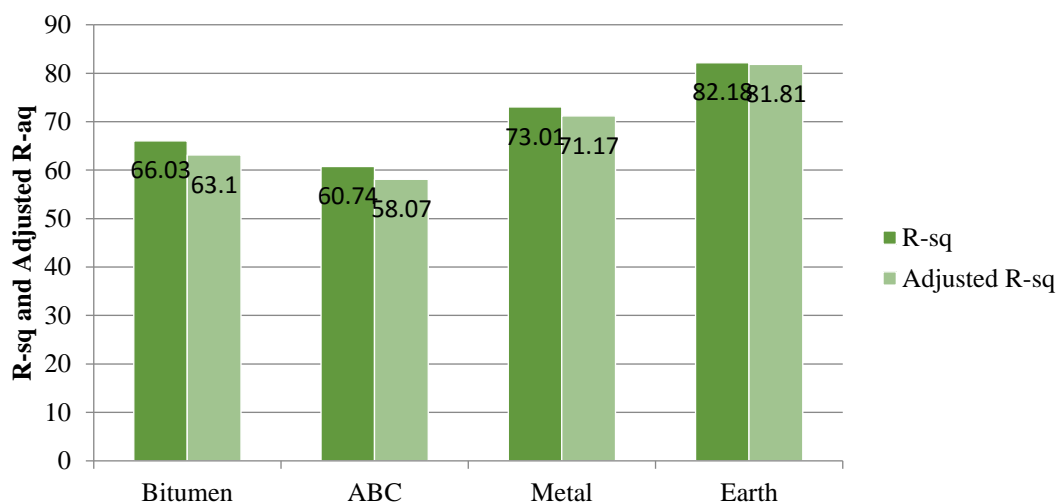


Table 4-29: R-Sq against Adjusted R-Sq

According to the histogram (Figure 4-29), all concerned inputs have been well above the 60% of coefficient of determination. According to these results, regression lines derived from the indices are predictable. Its predictable level is very much reliable. According to the histogram, earth has the highest reliability among the other inputs.

4.6.12 Analysis on Standard Error (S)

Standard error measures the closeness of the observed Y values and the estimated Y values. It also serves as a measure of the reliability of an estimate, the greater the closeness between the observed and estimated values, the lesser the error then more reliable the estimate. **Refer annexure 7 to annexure 12 for the regression graphs and the calculations.**

(Y)	(X)	Standard Error (S)
Bitumen	Interest rate	8.08
ABC	Interest rate	3.14
Metal	Interest rate	6.07
Earth	Interest rate	9.91

Table 4-30: Standard Error

Above table 4-30 shows the results for the standard error derived from the regression analysis. Standard errors of all inputs are less than 25. Compared to the inputs of regression equation the impacts of the error can be excluded. Lesser error means the higher reliable estimate.

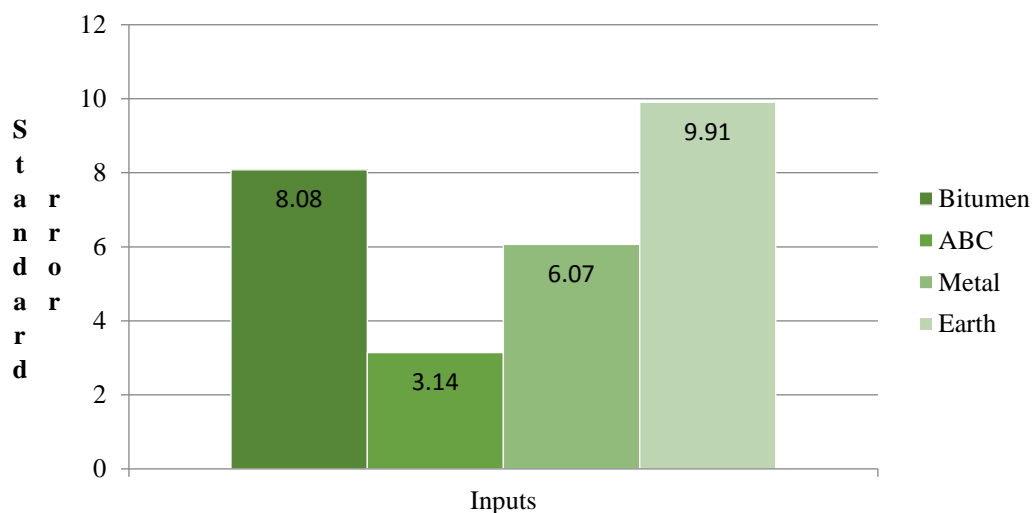


Figure 4-9: Standard Error

As shown in above figure 4.9, earth has the highest Standard error(S) but still it is well less than 25. This results for standard error (S) conform the reliability of the regression lines which are derived for selected inputs.

4.6.13 Analysis on Unusual Observations

Data points that are unusually far from the fitted line (compared to the other points) are pointed out as unusual observations. Such data points are worthy of special attention, as they may be spurious, due to recording error, for example, and could cause a dodgy regression line to be fitted. There is some justification for removing such points from the data before attempting regression analysis, but there must be very strong evidence that the data is unreliable. **Refer annexure 7 to annexure 12 for the regression graphs and the calculations.**

(Y)	(X)	Nr Of Unusual
Bitumen	Interest rate	9
ABC	Interest rate	1
Metal	Interest rate	5
Earth	Interest rate	8

Table 4-31: Unusual Residuals

Above table (Table 4.31) shows the results for the unusual observations for each input. According to the results there are few unusual observations have been found compare to the sample of data. It indicates that data set used for the analysis is reliable.

4.7 Summary

Initially, semi structured interviews were conducted with financial specialists and road construction experts to verify the relationship between the rate of interest of bank loans and road construction industry which is scientifically observed through the literature review. In the chapter two, six impacts on construction industry of interest rate were identified. All six impacts were agreed by the experts in preliminary interview. Furthermore, there were six impacts of rate of interest on road construction project which were identified through the literature review. In the preliminary interview experts added another impact which is impact on interest claims and agreed to all other six impacts. Similarly, there were six factors which determine the level of rate of

interest which were identified in literature review. Experts in the preliminary interview agreed to all six factors.

Two types of questionnaires were used to gather the information from two separate populations. Questionnaire type I was used to rank the impacts of rate of interest of bank loans on road construction industry and road projects. Relative importance index was used to rank the impacts. According to the results of the analysis, it was proved that “financial decisions” of the construction industry is highly impacted by the fluctuations of the rate of interest of bank loans. Further as per the RII index value, there is high impact of fluctuations of rate of interest of bank loans on “interest claims” of a road project.

Questionnaire type II was used to rank the factors which determine the level of rate of interest. Similarly, RII index value use to rank. As per the calculations it is shown that “demand and supply of funds” has been recognized as the highest determination factor of the rate of interest of the bank loans by the population. Both questionnaires had a common section which gathered information on indirect relationship between the fluctuations of rate of interest and the price level of road inputs. As per the respond it is shown that price of equipment, bitumen, A.B.C., earth and metal have an indirect relationship with level of rate of interest.

This chapter has emphasized to analyze the impact of fluctuations of interest rate of bank loans on road construction inputs. Primary survey was done to identify the common inputs used in road construction in Sri Lankan construction industry. There were twenty-three common inputs and five inputs were selected due its significant on total input cost. Selected inputs were analyzed to identify the relationship with fluctuation of interest rate. CIDA price indices were used to analyze. Coefficients of Correlation were checked by using Minitab Express software. Four inputs (Bitumen, Metal, Earth, and A.B.C.) have very strong, positive/negative relationship with fluctuations of rate of interest of bank loans. Further regression analysis was done with selected inputs. Regression equations for each input were derived and the reliability was checked by using Minitab-Express software. Based on these equations the impacts of interest rate on these inputs were calculate.

5 CHAPTER-CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Roads are the backbone of the transportation system. Majority of investments in Sri Lankan construction industry has drawn towards the road construction. Currently, the prevailing government has recognized that a serviceable road network system facilitates the socio economics development of a country in the form of speedy transport of both people and cargo. **Periodically use of bank loans to finance the road construction projects has largely occurred at the discretion of the stakeholders of the local road construction industry.** Timely the debt money has been a reliable and main source of finance for the industry. **The interest against the debt money is the cost of the debt facility. There is a high intendency to fluctuate the rate of interest in Sri Lanka finance sector, which creates a financial risk against the local road construction industry.**

Chapter one of this report details the back ground of the study, problem statement, aim, objectives, summary of the research methodology and chapter break down. Chapter two describes the literature review of the subject. Although substantial amount of publications on this subject is available from other countries, only few publications are available for local context. Both quantitative and qualitative methodologies were used in this study and comprehensive account on research methodology is described in the chapter 3 of the report. The chapter four is to explain the findings of the research. The conclusions and recommendations along with future studies are given in chapter five.

Objective one of this research study was to recognize the relationship between the bank loan and the road construction industry. This objective was covered with comprehensive literature publications and preliminary interviews with experts. According to the literature, it is strongly proved that debt financing through bank loans for infrastructure projects is becoming more common in worldwide and maximizing the debt component in project finance structure has been identified as most profitable strategy in project finance. **Most strategies used in project financing aimed to maximize gearing of debt finance in their capital structure, because debt is typically cheaper than equity. Debt-to-equity ratios of 75:25 or 70:30 have been**

common. It emphasized that bank loans are most effective at initial stages of a project and can be very useful at operational stage of the project. Inderst & Stewart (2014) identified that the bank loans usually supply the largest share of financing in the initial phase of an infrastructure project. Bank loans have some key advantages over bonds or other structured financing solutions, which particularly suits conditions of the initial phase. **The applicability to the Sri Lankan road construction industry of the phenomenon that the “debt finance or bank loans has been a main source of financing the road construction projects” is substantiated by the expert professionals in local construction industry.**

The objective two of the research is to recognize the direct and indirect impact of the fluctuation of the rate of interest of bank loans on road construction industry. This objective was covered with comprehensive literature publications and questionnaire survey. According to the literature, **it has emphasized that there are direct impacts of interest rate risk on decision making procedure of an organization and the operational stage of a project.** The identified regions that have a direct impact of rate of interest on decision making procedure are **financial decisions, investment decisions, dividend payments, bottom earnings, investment bearings and opportunity cost.** These regions were substantiated by the local experts in Sri Lankan construction industry. And professionals in Sri Lankan construction industry were asked to rank the regions through the questionnaire type I. **As per the analyzed response, the population has ranked “financial decision” as the first of six regions (RII Value 68%).** It is proved that there is a direct impact of rate of interest of bank loans on the “financial decisions” of local road construction industry.

Further it identified that the direct impact of rate of interest on construction organizations has the ability to create **greater financial distress which causes project barriers.** As per the literature there were five barriers. Namely, **payment delays, cash flow issues, financial resources, lack of number of bidders and high project cost.** These impacts of rate of interest on road construction projects were substantiated by the local experts in Sri Lankan construction industry and **one more impact was added which is the effect on “Interest Claims”.** Professionals in Sri Lankan construction industry were asked to rank the impacts on road construction projects through the questionnaire type I. **As per the analysis, the population has ranked “interest claims” as the first of six impacts (RII Value 68%).** It is proved that there is a direct

impact of rate of interest of bank loans on the local road construction projects. Further there are indirect impacts of interest rate risk on road construction industry, which was identified as the effect on the demand and supply patterns of the industrial inputs. Ten inputs have been recognized as main industrial raw inputs for road construction projects. There are labour, equipment, A.B.C., cement, sand, bitumen, earth, metal, steel and fuel. Opinion of the professionals were asked about the impact of rate of interest on the level of price of above mention inputs of road projects. According to the analysis of both questionnaires, the populations' opinion is **that only the price level of equipment, bitumen, A.B.C, earth and metal is indirectly effected by the rate of interest of the bank loans.**

The objective three of the research is to recognize the factors cause to fluctuate the rate of interest of bank loans. Interest rates measure the price paid by a borrower or debtor to a lender or creditor for the use of resources during some time intervals (Fabozzi and Modigliani, 2003). With the available research studies, six factors were identified which determine the behavior patterns of the interest rate. Those are **government policies, demand and supply of funds, inflation, expectations, competition and uncertainty.** Professionals in Sri Lankan finance sector were asked to rank the factors which determine the level rate of interest through the questionnaire type II. **As per the analyzed response, the population has ranked “demand and supply of funds” as the first of six impacts (RII Value 74%).**

The objective four of the research is to identify the relationship between fluctuations of interest rate of loans and price of inputs of road projects. Data finding and data analysis has identified six common inputs in Sri Lankan road construction industry. Twenty one road construction projects have been observed to identify the common inputs used in Sri Lankan context. Common factors of concerned road projects are at least 12 months of the project construction period is within the year 2012 and 2015, CIDA Price fluctuation formula is used for the Cost escalations, length is more than 5 km, constructed by Sri Lankan Contractors, estimated contract amount is more than 500 Million. The calculated common inputs are **bitumen (18.89%), equipment (14.49%), Fuel (12.32%), A.B.C. (11.19%), Metal (6.13%) and earth (4.88 %).** bitumen is been the most prominent input in the industry. Correlation coefficient between fluctuations of rate of interest of bank loans and road construction inputs is derived by using the price indices published by the CIDA. It proved that there is **strong**

and linear relationship between fluctuations of interest rate and price level of bitumen, A.B.C., metal and earth. Further regression analysis is used to develop a regression equation between selected inputs and fluctuations of rate of interest. Following table shows the derived equations.

Y (dependent)	X (independent)	Equation
Bitumen	Interest rate	$Y = 500.4 + 0.13X + 1.399X^2 - 0.07X^3$
ABC	Interest rate	$Y = 86.16 + 29.99X - 3.07X^2 + 0.09X^3$
Metal	Interest rate	$Y = 238.48 + 38.94X - 3.79X^2 + 0.10X^3$
Earth	Interest rate	$Y = 996.1 - 21.21X + 0.89X^2 - 0.01X^3$

The aim of the research study was to identify the impact of behaviour of the interest rate of local bank loans on Sri Lankan road construction industry. As described above there were four objectives to accomplish the set aim of the research study. According to the covered objectives it is substantiated that bank loan is a main source of project financing in road construction industry and bank loans are mostly utilized at initial stage and at the operational stage. Cost of debt finance (bank loans) is recognized as the interest paid over the time in the research. Fluctuation in the level of rate of interest of bank loans has created risk against the construction industry. It has its own direct and indirect impacts of rate of interest on Sri Lankan road construction industry. Impacts are more critical at process of financial decision in a construction organization while there are impacts at level of project operations.

5.2 Recommendations

According to the master plan of the RDA, the enormous investment of public and foreign funds on construction and rehabilitation/improvements of roads in Sri Lanka had been proposed. In large scale projects like Central Expressway and Ruwanpura Expressway (Ratnapura) will be commenced to enhance the national transportation system. According to the findings of this research it was obvious that fluctuation in the level of rate of interest of bank loans has created risk against the construction industry. It has its own direct and indirect impacts of rate of interest on Sri Lankan road construction industry. Outcome of the research study has been able to prove the strong, positive/negative and the linear relationship between road input price movements and interest rate movements. Therefore, practitioners are recommended to take measures to consider the financial risk of debt financing in developing capital structure for road construction project.

Further the study has been able to develop regression equations for the common inputs of the road construction industry. Those equations are much more useful to predict the future price movements of those inputs. Practitioners are recommended to study the interest rate movements of very deeply and predict the future movements of it. Movements of interest rate is defined as the independent variable(X) of the equations, if future movements of interest rate are predicted and it is reliable. Those predicted movements of interest rate can be used in the equation to predict exact price movements of road construction inputs which is defined as the dependent variable (Y). Reliability level of those equations is well proved in the study. This process will provide information to make well informed financial decisions in the local road construction industry.

5.3 Recommendations for academic researchers

This study is exposing a good research area for the academic researchers who are interested in road construction industry. This subject is not assessed sufficient in the local industry. This study is a perfect notification of the financial risk of movements of interest rate on road construction industry. Therefore, following recommendations are offered to the academic researches to continue the further research.

- Most appropriate mitigation procedure to minimize the impact of fluctuations of rate of interest of bank loan on road construction industry
- What is the best type of Contract that minimize the financial risk at construction industry with in the contract?
- Develop a reliable mechanism to predict the future level of rate of interest of bank loan

5.4 Limitations of the Research Study

1. The research was only limited to the Sri Lankan road construction field. Only type 'A' and 'B' roads are covered under research methodology. The research considered only the projects which are completed within the time period from year 2000 to 2015 and the projects which has a contract cost over five hundred million rupees
2. The whole island is not covered by the CIDA surveys. Moreover, all the construction activities carried out during the reference period are not covered by the construction activities in the island.
3. This survey covers all the construction activities carried out by the contractors registered with CIDA, Local authorities, Government and Semi Government agencies. Construction of roads and the rural sectors and urban sectors, as well as large scale construction activities carried out by the foreign organizations are not considered.
4. Monitoring mechanism use to produce the price levels of road inputs by CIDA is outdated. It is noticed that actual price differences of inputs is not captured by the bulletin.
5. Further monthly price levels given in the bulleting is not sensitive enough to capture the small price differences.

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ANNEXURE 01-Preliminary Interview Guide Line

ANNEXURE 02-Questionnaire Type I

ANNEXURE 03- Questionnaire Type II

ANNEXURE 04- Calculations for RII Index

ANNEXURE 05-Calculations for Indirect Relationship

ANNEXURE 06-Details of Input Percentages of Road Projects

**ANNEXURE 07-Calculations for Correlation and Regression
(Bitumen)**

ANNEXURE 08-Calculations for Correlation (Equipment)

**ANNEXURE 09-Calculations for Correlation and
Regression(A.B.C.)**

ANNEXURE 10-Calculations for Correlation (Fuel)

ANNEXURE 11-Calculations for Correlation and Regression(Metal)

ANNEXURE 12-Calculations for Correlation and Regression(Earth)

ANNEXURE 13- Correlation & Regression Analysis

Regression and Correlation

This is a statistical method that is used to deal with paired data of two variables, which may relate in some way (Hooda, 2003). According to the Lindley (1987), knowing that relationship exists between any two variables is vital information that invites keen interest and concern. For, often this may be crucial for decision making in any given situation. For example it is very important for a contractor to know how the unit rate asphalt concrete is related with the fuel prices.

In the same stream, a farmer is well advised if he knows the relationship between crop yield and the quantum of fertilizer used. Likewise, a physical instructor would do better if he knows that a relationship exists between the weight and height of students at different levels in his school (Hooda, 2003).

As states by Hooda(2003),in all such cases as, one is interested in:

3. Knowing the nature of relationship between any two characteristics of one's interest
4. Getting a definite idea about the degree of that relationship

Fox (1997) states that systematized knowledge on these two related aspects can be obtained by using appropriate statistical methods. Most specifically, the methods needed here relate to the following issues:

4. Bringing out the nature and the degree of relationship between any two variables, say X and Y.
5. Measuring the rate of change in one (the dependent) variable associated with a given change in the other (the dependent) variable.
6. Evaluating the predictive strength of the relationship that obtain, and assessing the reliability of an estimate derived from that relationship

Since these three issues are inter related by Fox (1997), regression and correlation, as two sides of single basic process, consist of methods of examining the relationship between two variables. Regression is mainly concerned with bringing out the nature of the relationship and using it to know the best approximate value of one variable

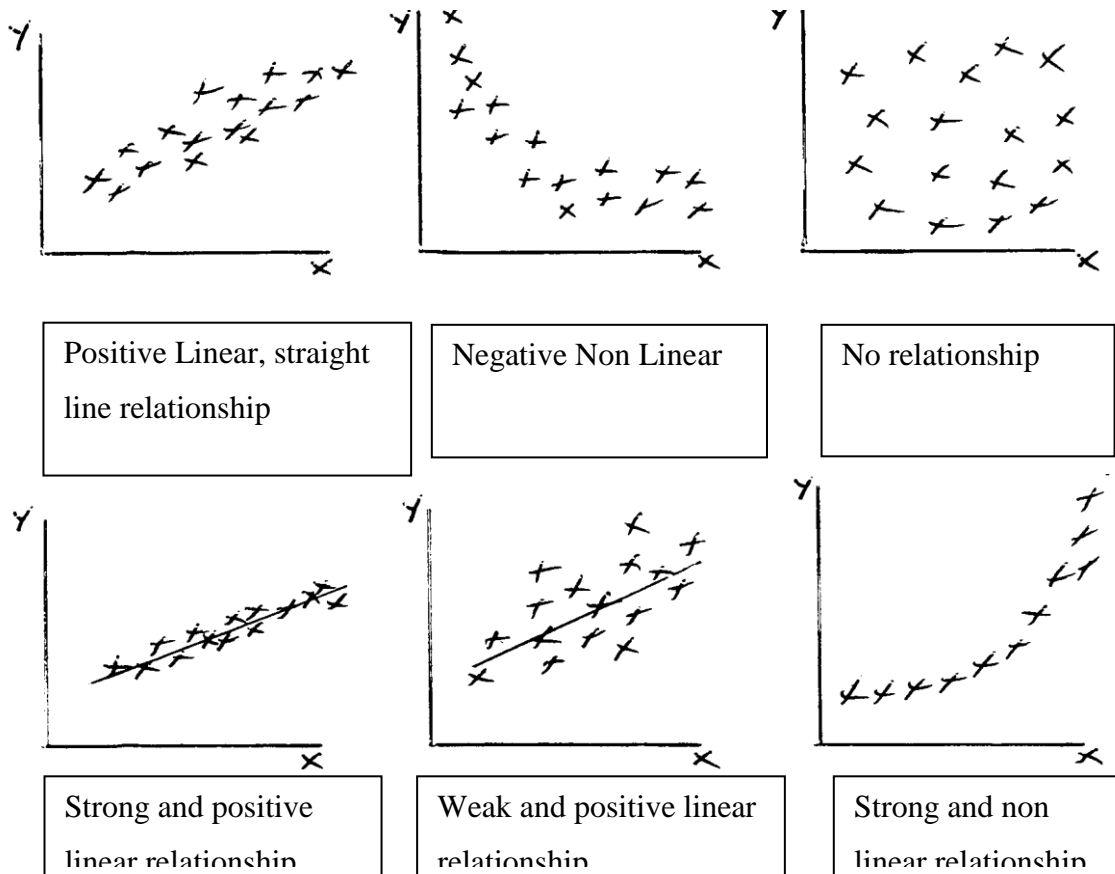
corresponding to a known value of the other variable. Correlation, on the other hand, is concerned with quantifying the closeness of such relationship (Fox, 1997).

Typed of Relationships

The relationship between any two variables may be linear or non-linear. It may be described by means of straight line or a curve. If the relationship is best explained by a straight line, it is said to be linear. On the contrary if it is described more appropriately by a curve, the relationship is said to be non-linear (Hooda, 2003).

According to Hardle (1990), the linear relationship implies a constant absolute change in the dependent variable in response to unit changes in the independent variable. It is extensively used for its better predictive strength and greater reliability of an estimate base thereon. A non-linear implies varying absolute change in dependent variable with respect to changes in the independent variable. Its predictive value is limited and, consequently, the reliability of estimate more doubtful.

Following images create a better picture on the relationship between two variables (Linear Regression, 2007).



The Coefficient Correlation

The strength of a relationship can be measured by a correlation coefficient. One of the most widely used is Pearson's Product Moment Correlation Coefficient, denoted r , which provides a measure of the strength of linear association (Hooda, 2003).

This measure is independent of scale and always lies in the range -1 to $+1$;

- -1 if there is a perfect negative linear relationship
- $+1$ if there is a perfect positive linear relationship.

Some illustrations showing scatter diagrams together with values of r are (Linear Regression, 2007).

Calculation of r

Hooda (2003) stated three methods to calculate r either:

- Use the computational formula for hand calculations - see the example in section
- Use a package such as Minitab or a spreadsheet such as Excel
- Use the correlation button (usually labeled r) available on some calculators

Interpretation of r

Hardle (1990) has given a sound interpretation for r :

1. r measures the LINEAR relationship between 2 variables. If a relationship is non-linear, r can be very misleading.
2. A high value of r (close to $+1$ or -1) does not imply any casual link between the variables. It just means that if one variable is relatively high in value then the other tends to be relatively high as well (or low if r is negative). There may be a third variable which is causing the changes in both X and Y . Examples of these so-called spurious correlations are given below (Hardle, 1990).

X: milk consumption per capita

Y: incidence of cancer

Common factor: Degree of development

Regression Analysis

The Dependent Variable and the Explanatory Variable

Lindley (1987) has concerned with the form of the relationship between the variables. This can be summarized by an equation that enables us to predict or estimate the values of one variable (Y - the dependent variable) given values of the other variable (X - the independent or explanatory variable). The first thing to do then is to decide which variable is which. To summarize:

“Regression analysis is concerned with how the values of Y depend on the corresponding values of X. The variable that is eventually to be predicted or estimated should be labeled Y (Lindley, 1987).”

Finding the Best-Fitting Line

Lindley (1987) stated that in practice, most relationships are not exact - there will be a certain amount of scatter about a line. We require the equation of the line that fits the data best. This could be done by fitting a line by eye but a better approach is to use the Method of Least Squares. This is a mathematical technique that gives the slope and the intercept of the best-fitting line in the sense that it minimizes the errors involved in using the line to predict values of Y.

In order to find the slope, b, and the intercept, a, of this least-square regression line which is general is denoted:

$$Y = a + b X$$

- Use the computational formulae for hand calculations
- Use a package such as Minitab or spreadsheet such as Excel
- Use the regression buttons (usually labeled a and b) available on some calculator

Interpretation of a and b

Slope (b)

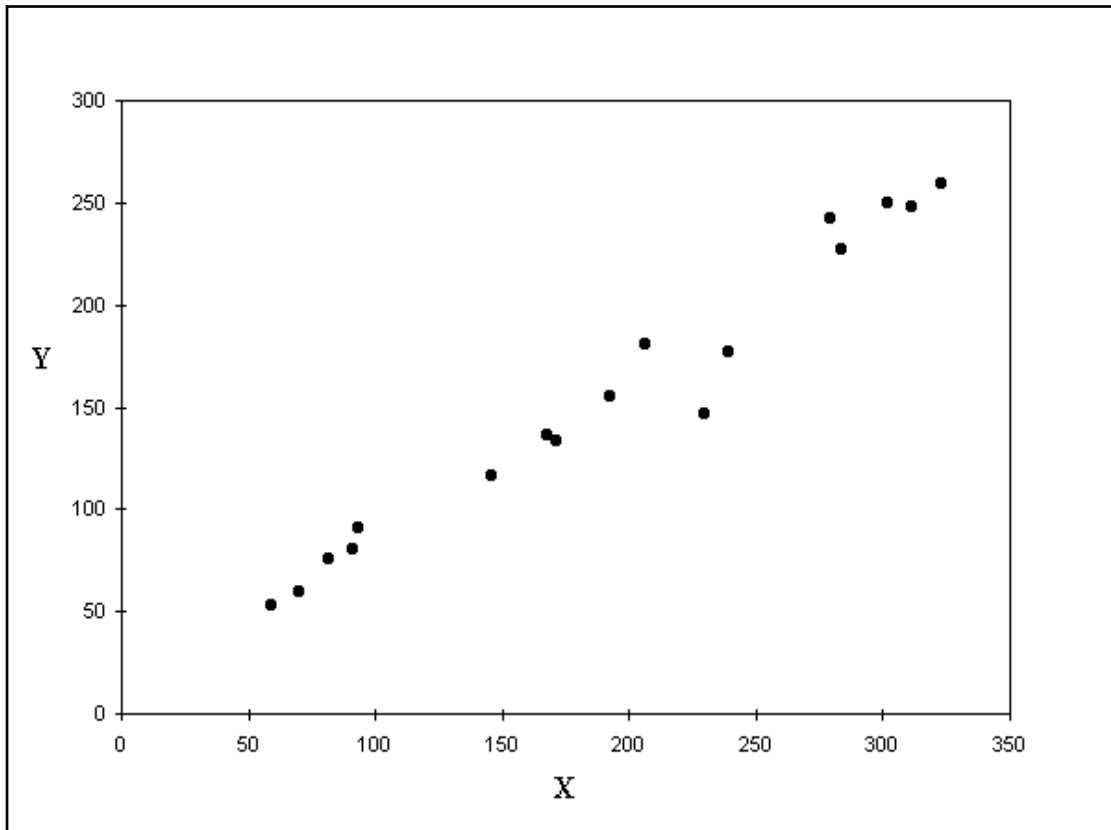
In general this tells us how we expect Y to change, on average, if X is increased by 1 unit (If the slope were positive, we would expect Y to increase as X increases.)

Intercept (a)

This is the value of Y predicted for $X = 0$.

Correlation and Regression versus Minitab

Correlation coefficients can suggest where causes may lie but to show that changing one variable causes changes in the other variable requires a controlled experiment



(useminitab, 2011).

Figure A: 0-1 Scatter plot for X and Y

By looking at this scatter plot, it can be seen that variables X and Y have a close relationship that may be reasonably represented by a straight line. This would be represented mathematically as:

$$Y = a + b X + e \quad (\text{useminitab, 2011})$$

It further describes that the line crosses the y-axis, b describes the slope of the line, and e is an error term that describes the variation of the real data above and below the line. Simple linear regression attempts to find a straight line that best 'fits' the data, where the variation of the real data above and below the line is minimized.

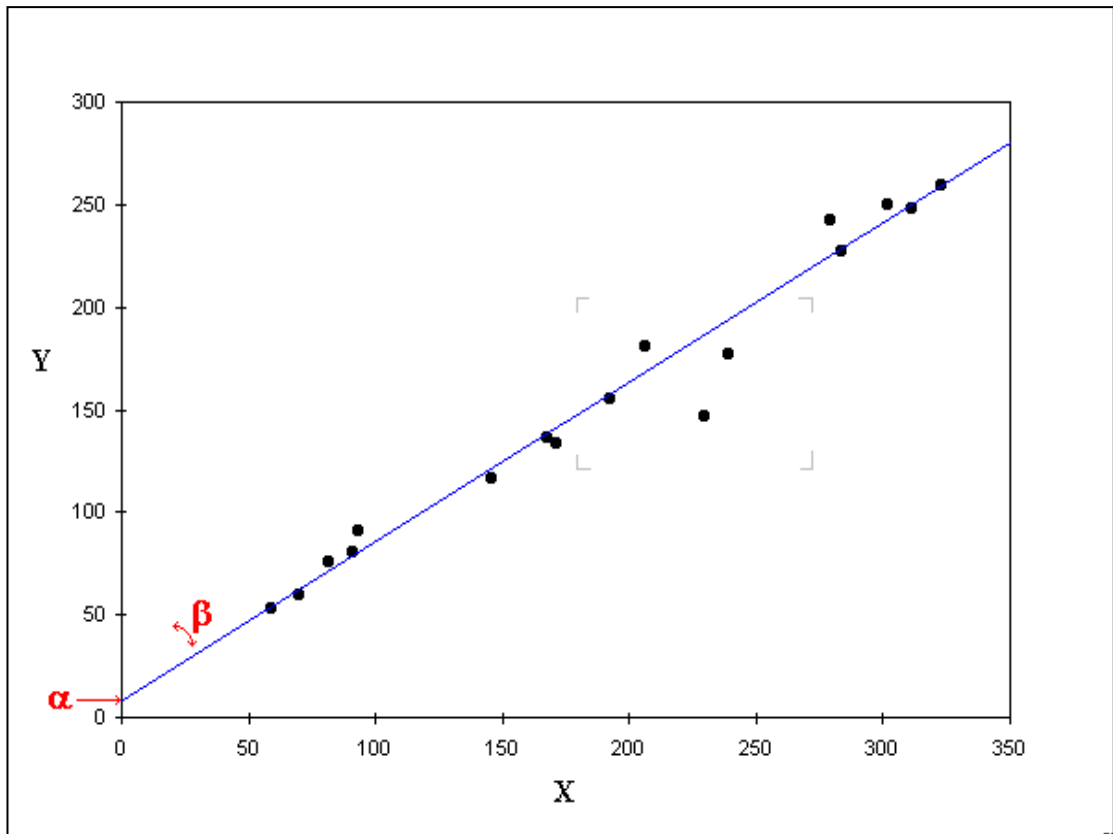


Figure A:0-2 Regression Line for X and Y

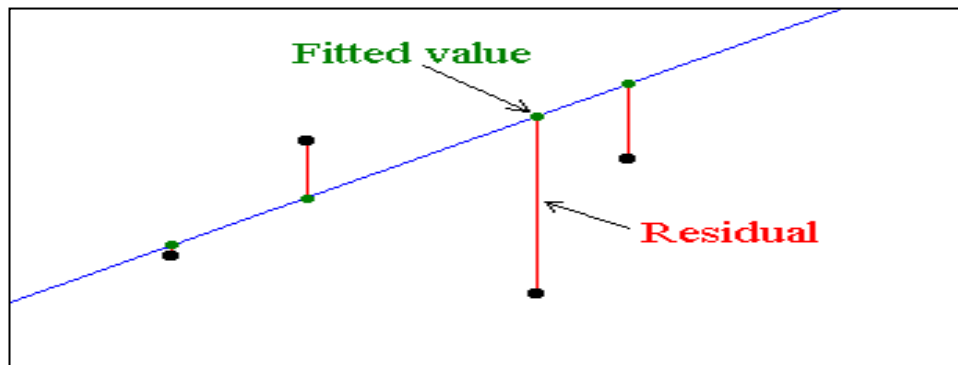


Figure A:0-3 Fitted line and Residuals

Assuming that variation in Y is explained by variation of X, we can begin our regression. In Minitab it would look like this.

The command, regr 'Y' 1 'X', instructs Minitab to regress Y onto just 1 explanatory variable, X. Useminitab (2011) describes that this output tells us several things: the output tells us the equation of the fitted line and gives us important formal information regarding the association of the variables and how well the fitted line describes the data.

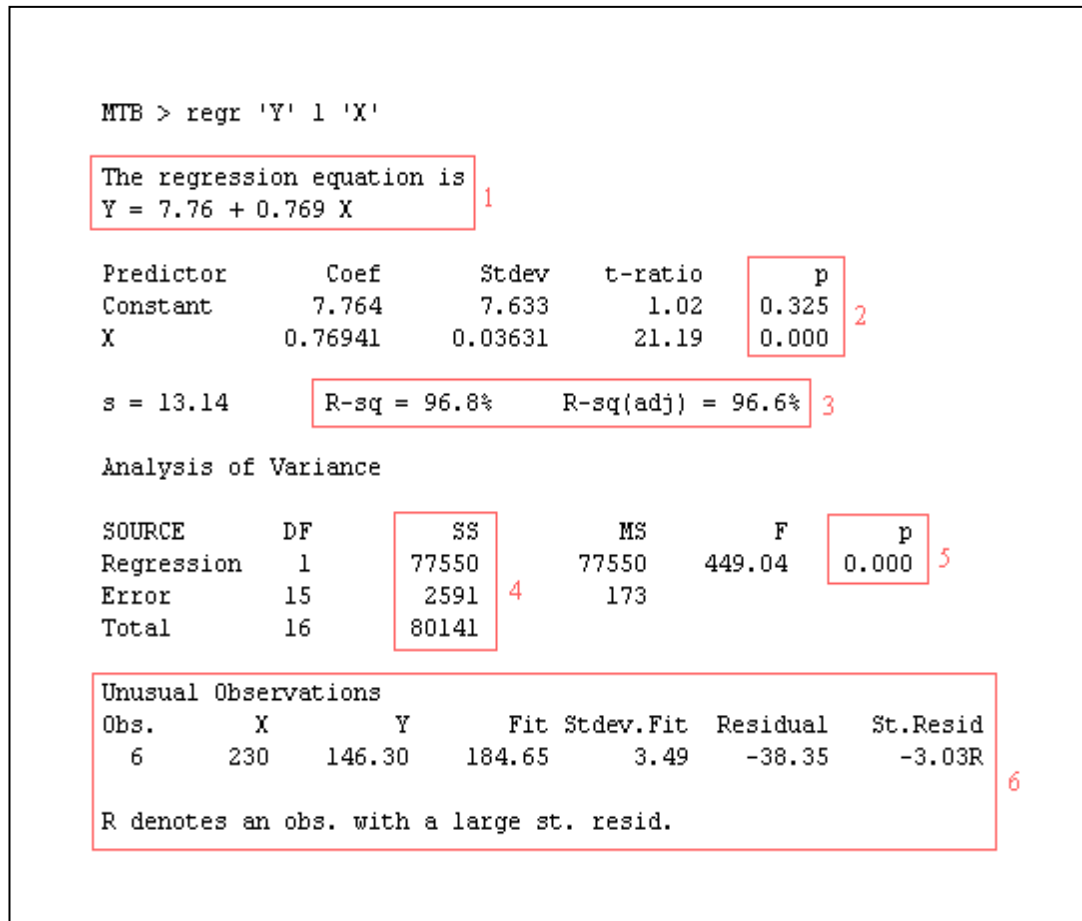


Figure A:0-4 Output of Regression Analysis

Following table describes the output of the regression analysis. It is explaining the information about regression equations derived by the Minitab software. Most important information is highlighted by a box and a reference number is given to the each box. Table describes the information related to the reference number.

Table A: 0-1 Explanation of Regression Output

Number	Explanation
1	<p>The fitted line has $a=7.76$ and $b=0.769$ and now that we know the equation, we can plot the line onto the data (e is not needed to plot the line); see Fig 2.1 below. This is the mathematical model describing the functional response of Y to X.</p>
2	<p>The p (probability) values for the constant (a) and X, actually the slope of the line (b). These values measure the probability that the values for a and b are not derived by chance. These p values are not a measure of 'goodness of fit' per se, rather they state the confidence that one can have in the estimated values being correct, given the constraints of the regression analysis (ie., linear with all data points having equal influence on the fitted line). The p(X) value of 0.000 is a little misleading as Minitab only calculates p values to 3 decimal places, so this should be written as:</p> $P(X) < 0.001$
3	<p>The R-squared and adjusted R-squared values are estimates of the 'goodness of fit' of the line. They represent the % variation of the data explained by the fitted line; the closer the points to the line, the better the fit. Adjusted R-squared is not sensitive to the number of points within the data. R-squared is derived from</p> $R\text{-squared} = 100 * SS(\text{regression}) / SS(\text{total})$ <p>For linear regression with one explanatory variable like this analysis, R-squared is the same as the square of r, the correlation coefficient.</p>

Number	Explanation
4	<p>The sum of squares (SS) represents variation from several sources.</p> <p>SS (regression) describes the variation within the fitted values of Y, and is the sum of the squared difference between each fitted value of Y and the mean of Y. The squares are taken to 'remove' the sign (+ or -) from the residual values to make the calculation easier.</p> <p>SS (error) describes the variation of observed Y from estimated (fitted) Y. It is derived from the cumulative addition of the square of each residual, where a residual is the distance of a data point above or below the fitted line (sees Fig 2.2).</p> <p>SS (total) describes the variation within the values of Y, and is the sum of the squared difference between each value of Y and the mean of Y.</p>
5	This is the same as the p(X) value in highlight 2
6	<p>Data points that are unusually far from the fitted line (compared to the other points) are pointed out to the user in Minitab and Genstat. Such data points are worthy of special attention, as they may be spurious, due to recording error, for example, and could cause a dodgy regression line to be fitted. There is some justification for removing such points from the data before attempting regression analysis, but there must be very strong evidence that the data is unreliable.</p>

