

**EVALUATION OF FINANCIAL BURDEN VS FINANCIAL VIABILITY OF
ROAD PROJECTS ON BOT BASIS**

By

Shaheryar Ali Khan

2015-NUST-MS-CE&M-07

A synopsis submitted in partial fulfillment of

the requirements for the degree of

Masters of Science

in

Construction Engineering and Management



Department of Construction Engineering and Management

National Institute of Transportation (NIT)

School of Civil and Environmental Engineering (SCEE)

National University of Sciences and Technology (NUST),

Islamabad, Pakistan

(2019)

THESIS ACCEPTANCE CERTIFICATE

Certified that final copy of MS thesis written by Shaheryar Ali Khan (Registration No. NUST2015MSCE&M00000147510), of National Institute of Transportation (NIT) – SCEE has been vetted by undersigned, found complete in all respects as per NUST Statutes / Regulations, is free of plagiarism, errors, and mistakes and is accepted as partial fulfillment for award of MS/MPhil degree. It is further certified that necessary amendments as pointed out by GEC members of the scholar have also been incorporated in the said thesis.

Signature: _____

Name of Supervisor: Dr. Khurram Iqbal Ahmad Khan

Date: _____

Signature (HOD): _____

Date: _____

Signature (Dean/Principal): _____

Date: _____

This is to certify that the
thesis titled

**EVALUATION OF FINANCIAL BURDEN V/S FINANCIAL VIABILITY OF
ROAD PROJECTS ON BOT BASIS**

Submitted by

Shaheryar Ali Khan

(NUST2015MSCE&M0700000147510)

has been accepted towards the partial fulfillment
of the requirements for the degree of
Masters of Science in Construction Engineering and Management

Dr. Khurram Iqbal Ahmad Khan

Assistant Professor, Head of Department (HOD)

Department of Construction Engineering and Management

National Institute of Transportation (NIT)

School of Civil & Environmental Engineering (SCEE)

National University of Sciences & Technology (NUST), Islamabad

ACKNOWLEDGEMENTS

I, Shaheryar Ali Khan, am thankful to Allah Almighty, for giving me the strength to carry out the research work. I am obliged to my advisor, Dr. Khurram Iqbal Ahmad Khan, for his valuable guidance, time and encouragement. I am also obliged to my GEC member Sir Dr. Sohail Anwar Malik for guiding me like his own child and giving me time in his personal capacity out of his busy and hectic schedule. I also owe acknowledgements to my parents, Wife (Nadia Khan) and my brother like friends (Suqrat, Athal, Haroon & Zeeshan) for their patience, prayers, and support. Moreover, I am highly grateful to the esteemed faculty and administration of Department of Construction Engineering and Management (CE&M) of National University of Sciences and Technology (NUST), Pakistan, for giving the much needed technical inputs, assistance and resources for the thesis work.

Table of Contents

Chapter - 1	8
INTRODUCTION	8
1.1. Study Background	8
1.2. Problem Statement	9
1.3. Research Objectives	9
1.4. Advantages	10
1.5. Scope of Research	10
1.6. Research of Significance	11
1.7. Relevance to National Needs	12
Chapter - 2	13
LITERATURE REVIEW	13
2.1. Introduction	13
2.2. Construction Industry: Importance and Characteristics	14
2.3. Significance of Construction Sector in Pakistan	16
2.4. Common Project Delivery Modes in Pakistan	17
2.5. History of BOT across the Globe	19
2.6. History of BOT in Pakistan	21
2.7. Ongoing small & large-scale BOT Projects in Pakistan	22
2.8. Factors affecting sustainability of BOT Projects in Pakistan	22
2.9. Important Definitions for Understanding BOT Mode	24
2.10. Critical Success Factors (CSF) through literature review	25

Chapter - 3	26
RESEARCH METHODOLOGY	26
3.1. Introduction	26
3.2. Research Design	26
3.3. Data Source	27
3.4. Research Cash Flow Calculations	27
Chapter - 4	31
RESULTS AND DISCUSSION	31
4.1. Introduction	31
4.2. Research Methodology	31
4.2.1 Data Analysis	32
a. Reliability and Consistency Test - Cronbach's Coefficient Alpha Method	32
b. Relative Importance Index	33
4.3. Characteristics of Respondents to Questionnaire	33
4.3.1 Academic Qualification	33
4.3.2 Professional Experience	34
4.3.3 Organization Type	35
4.3.4 Organization Role	36
4.4. Top Five Critical Success Factors	36
4.5. Quantitative Sub Factors of Critical Success Factors (CSF)	38
4.6. Case Studies	39

Chapter - 5	42
CONCLUSION AND RECOMMENDATIONS	42
5.1 Conclusions	42
5.2 Recommendations	44
References	45

Chapter - 1

INTRODUCTION

1.1 Study Background

In the economic development of a country infrastructure has fundamental worth. In evolving and developing country which has inadequate infrastructure in every domain such as public health, waste management and road network. The insufficient amount of resources and funding provided by the government is the reason for lagging behind. Shortage of these resources make a developing country face loss in GDP.

At this point, to initiate the infrastructure development the government becomes powerless. However, government can still involve private sector for arrangement of funds for infrastructure development to meet the gap between this demand and supply (Kumaraswamy & Zhang, 2001). Contrasting other countries, this culture is not much popular in developing countries. There is need of improved and well-established infrastructure for sustainable and accelerating economic progress. Therefore, BOT projects are the most effective and efficient way to make developing countries progressive (Askar & Gab-Allah, 2002).

BOT projects have a history in Pakistan which has shown rapid progress in the construction industry. BOT Cash Flow Calculations is one of the most important privatization schemes used for construction of a nation's infrastructure. BOT improves efficiency and effectiveness of project implementation. Efficiency and effectiveness results from the incentive system created by the BOT Cash Flow Calculations. The BOT structure is especially attractive to host governments due to the ownership reversion feature. BOT is becoming commonplace for nations that intend to expand their infrastructure (Askar & Gab-Allah, 2002). Construction sector itself can be a source of enhancing our economy as it can provide employment opportunities to a large pool of people, boost the sales of steel, cement, concrete, bitumen, etc. and involve other stakeholders for the best interest of the project.

1.2 Problem Statement

1. Limited Government funding arrangements for infrastructure projects in developing country, hinders many projects which are essential for economic development of the country. Alternative funding arrangements needs to be explored which can initiate such projects.
2. BOT mode resolves the issue of funding arrangements for development of infrastructure projects by involving private parties. However, contractors lack knowledge & understanding about cash flow calculations of BOT projects. As a result, there are only limited contractors on BOT projects.
3. There is an unavailability of cash flow calculations which can act as a guide for the key stake holders particularly contractors to find out the financial viability of BOT projects.

1.3 Research Objectives

The objective of this study is to discover more possibilities and opportunities present in developing markets for road projects on BOT basis. It can get difficult for developing countries to give their sources and funding for road projects, as already mentioned the economic backbone of a developing country is not very strong. It will also bring more business to developing countries from local and international investors. Hence, to make road projects become possible in developing countries, it is important that we explore the opportunities and achieve the best interest of the developing countries. The objectives of research are:

1. To identify CSF affecting financial viability & financial burden of road projects on BOT basis.
2. To evaluate the financial burden v/s financial viability of road projects on BOT basis through calculations of different projects cash flows.
3. Propose cash flow calculations which can be used in future to find out the financial viability vs financial burden of BOT Project.

1.4 Advantages

After agricultural sector the second major industry that contributes to Pakistan's economy is the construction industry. There are many benefits of road projects on BOT basis. A glimpse of the advantages provided by BOT projects are as follows:

- Private organizations and investors can be hired as concessionaires to build the project, run it for a period of time and then handover it to the government for the best interest of the public, as our government does not have enough funds to facilitate important road networks which has huge demand in our country due to growing population.
- The development of infrastructure will keep on accelerating despite of reduced budget and sources. The Cash Flow Calculations on which BOT operates involves investors, sub-contractors, legal advisors, owners, construction equipment, material, skilled and unskilled labor. Due to BOT project, a lot of new job opportunities can be provided in the market and help a lot of citizens in refining their lifestyle.
- In BOT project, to get the projects completed and keep the government at ease, risks and overall responsibility of the project are transferred to the concession company.
- It is favorable for the Concession Company as well. As there is better management of risks because they are experts of their field and they can predict and treat the risks and problems which arise at early stages of the project.

1.5 Scope of Research

BOT has a broad scope and it can implement to various nature of projects like:

- Small Roads
- Small Bridges
- Residential societies
- Hospitals
- High Rise Buildings

- Schools
- Recreational Parks
- Water supply and sewerage system
- Special Economic Zones
- Small Dams, etc.

Their main focus is towards infrastructural development project which are built for public and revenue can be produced in any form. They have minimal share of project launching entity which makes them very useful. BOT projects become useful for such organizations because they are precisely for those organizations or stakeholders who have limited budget and resources. In BOT projects more attention is given to economy, environment, and social impacts and works in the best interest of public. While in perspective of Pakistan our research is more inclined towards road projects on BOT basis. The study will be initiated through a literature review process for determining the level of research done on evaluation of financial burden vs financial viability of road projects on BOT basis and evaluation of Critical Success Factors (CSF) through literature review. Thereafter, questionnaire will be carried out to get the feedback on the Critical Success Factors (CSF). Data validation tests will be performed on the collected data. Afterwards, Cash Flow Calculations will be prepared incorporating those critical success factors and many other cash inflow & cash outflow factors. 5 x road projects realistic data will be incorporated to get the results of financial burden vs financial viability of road project on BOT basis. Validity of Cash Flow Calculations will be conducted by the field experts of BOT construction industry professionals from whom interviews were conducted.

1.6 Research Significance:

BOT is important for the development of country; it can't only develop a facility for general public but can also play a great role in improving the economy of the country. People related to construction industry needs to understand this mode of construction for proper implementation and strongly consider this option. By creating a reliable environment for financiers to participate in such ventures. The funding restriction for government can be dealt this way.

Many countries are unaware of the importance and significance of BOT projects as it adopts an advanced and modernized nature of project. Only very limited number of stake holders get a chance to understand its prominence. It is necessary to have clear understanding of such projects for better understanding of road projects on BOT basis and the workers involved with them.

1.7 Relevance to National Needs:

For a country like Pakistan, it becomes mandatory for us to adopt this way of construction projects because there is inadequate volume of budget for infrastructure development. As government has limited budget, different investors can be invited, local as well as foreigners to meet this country's infrastructural demand. Therefore, the economic growth and sustainability of our economy would be possible.

Chapter - 2

LITERATURE REVIEW

2.1 Introduction

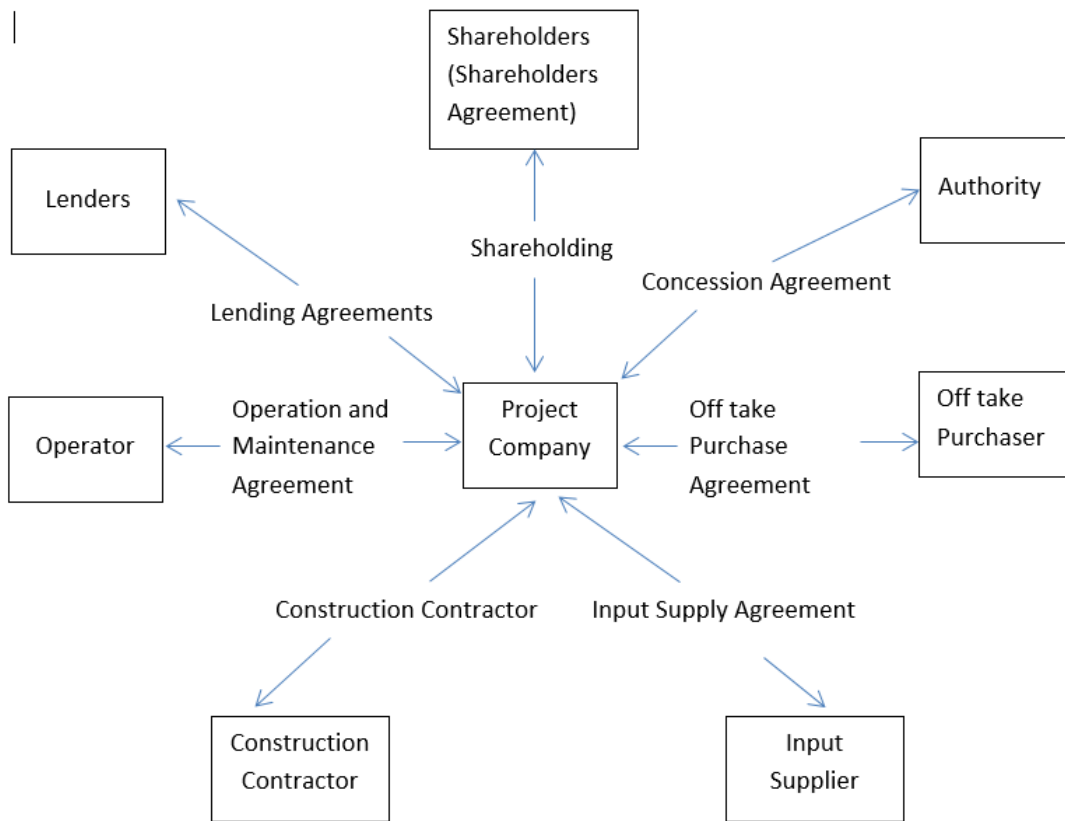
Build–operate–transfer (BOT) also known as build–own–operate–transfer (BOOT) is a type of project financing, wherein a private organization receives a concession from the private or public sector to finance, design, construct and operate a facility stated in the concession contract which later on permits the project proponent to recover its investment, operating and maintenance overheads in the project (Delmon, V. 2018)

The clients have access to funds for construction in the events of fund inadequacy, making it one of the major emerging projects financing system.

The payments of these projects are incrementally increased during the concession time period as they are financed on long term basis. A concession agreement is a contract which is confirmed after negotiation between two parties which can be in between a private entity and government or private entity with another private entity (Jamal, A. 2017). This contract allows the concessionaire to work on the project under jurisdiction of terms and conditions specified on the concession agreement. The proponent reaches a satisfactory internal rate of return for its investment as the rate of increase is often tied to a combination of internal and external variables. During this time period the project is transferred to the concessionaire for almost 20 to 30 years after its construction and later on it is handed over to the owner.

BOT projects are usually large scale, green-field infrastructure projects that solely cannot be financed by the government hence they hire a concessionaire for the job.

All around the Globe in Middle East, European, Western and Asian countries BOT Cash Flow Calculations are becoming a norm. The term might vary in some countries as build–own–operate–transfer (BOOT). First BOT project was started in 1979 for a Hotel in China by Hopewell Holdings Ltd (A Hong Kong listed conglomerate).



This figure shows a distinctive contractual structure of a BOT project which is based on lending agreement, shareholder's agreement, which will typically be between the Project company and a member of the project company consortium. Each project will be some version of this contractual structure depending upon its requirements.

2.2 Construction Industry: Importance and Significance

Construction industry is one of the growing businesses these days, that has a pronounced influence on the economy of any nation. Any part of infrastructure or real estate established around us is embarked on by segments under construction industry. The scope of construction industry is too immense and it is something that can't be unnoticed (HHI Equipment, 2018)

Any sort of changes in structuring properties are completed by a qualified construction industry. Construction can be general or based on civil engineering, for example construction of a dam, highway, offices, schools, hospitals, monument, wooden structure, real estate assets, etc. In most

of the countries construction industry is usually sponsored by governments as it is the type of business which demands high investments; hence it is an investment-led sector which has huge interest of the government. Governments make contracts with these construction companies for making enormous and expandable infrastructures like schools, offices, hospitals, houses, railways, airports, other modes of transportation, etc. Keeping in view the different nature of these infrastructures, the stakeholders or clients in this business are also very diversified. It would consist of clients from different and diverse backgrounds like property deals for constructing infrastructures like houses, material suppliers for supplying cement, steel, etc. and other contractors. All these stakeholders or clients play a major role for timely and efficiently completion of the project in order to make it successful.

New home construction is absolutely necessary. According to the Bipartisan Policy Center, residential house construction can account for 4.5 to 6.3 percent of the nation's gross domestic product (Metcalf, 2018). The impact is high enough to send the economy of a country into recession if this industry demolishes. Likewise, the economic recovery is also connected to the retrieval of the housing industry.

Another impactful advantage of construction industry is that it creates several jobs in the market. Survey teams and technical staff for site visit are required in the primary phase in construction. In the planning phase, architects and civil engineers are required for layout plans or the designs for infrastructures. Equipment, machinery, materials (cement, concrete, lumber, steel, etc.) are required in the construction phase along with the experts who can operate the machinery and that labor who can make use of the supplies and tools. The job creation impact goes beyond construction phase. After construction, maintenance of the infrastructure along with its management, more man power is required. In order to assist the infrastructure e.g. in case of offices, office furniture, IT equipment, appliances, etc. are needed, which will produce good business for other companies. Hence, the point being made is that, construction industry is the core of job creating process and it holds huge significance in the context of new job creations (Metcalf, 2018)

2.3 Significance of construction sector in Pakistan

Construction also plays a huge role in contributing to the country's GDP like in every other country. This sector is of crucial importance to the economic development of Pakistan. Recent (provisional) evaluations published in the Economic Survey of Pakistan determine that the industry cultivated 9.1% in FY17 and contributed 2.7% to the country's gross domestic product (GDP) (Husain, 2018).

According to BMI Research healthy growth outlook for the sector has been presented, putting it at 11.8% annually from 2016-20 and 9.1% over 2016-25. It is becoming one of the major concerns of the government to invest in this sector because of the progressive growth displayed through this industry. However, projects like CPEC are given high preferences for exponential growth of the country's economy. Countries such as China are investing greatly in construction projects and more countries are following suit due to the benefits shown through such projects (Farooqui, Ahmed and Lodi, 2018).

For foreign direct investments (FDI) the construction industry has been a significant recipient. From the numbers provided by the State Bank of Pakistan this can be supported as it shows that the construction industry received an inflow of \$35.7 million in August 2017 (Husain, 2018). From the statistics of current fiscal year July-August FY 2018 it can be determined that this industry has been even more attractive for foreign investments in FY 2018 where the industry received \$55.7 million compared to \$1.6 million in the same period of last year.

Our construction industry in the context of foreign investment is doing very well and it has not been overlooked in the local investments as well. Locally, mostly investments have been encouraged within the country through reduction in duties and taxes on building supplies i.e. steel, construction equipment, machinery, etc.

Regardless of the growing performance in construction industry over the past few years, risks still remain from political perspective, extensive corruption in the industry and underprivileged economic and business climate. As essential as it is for our economic development, these hurdles generate a negative effect on overall development and along with similar other factors are a threat to the construction industry of Pakistan (Farooqui, Ahmed and Lodi, 2018).

In foreign countries, many different types of Cash Flow Calculations are applied in the construction industry. In some Cash Flow Calculations, government entirely sponsors big projects, some are privately owned, some small projects are completed on BOT basis sponsored by small companies/investors. In foreign countries performance in the construction industry is a complete barometer for the economic growth of a country.

Conferences, seminars, lectures are conducted in foreign countries to highlight the encounters faced by construction industry and measure that could be taken to accomplish its full potential. The construction industry does not face any shortage of skilled labor and this is one of the major things most stressed upon in these seminars (Farooqui, Ahmed and Lodi, 2018).

These activities show how much important a construction sector of a country is, in the context of creating more jobs, increasing GDP, economic growth, FDI escalation, etc. Therefore, it is even more important for developing countries like Pakistan to pay attention on such sectors for exponential growth of the country.

Like any other industry in Pakistan, the construction industry is at developing stage. There is a dreadful need to eliminate bottlenecks like corruption and emphasize on transparency of the procedures.

2.4 Common project delivery modes in Pakistan

Pakistan being the 2nd largest sector in Pakistan's economy after agriculture is currently enjoying exponential growth in the construction industry. Also, very high percentage of the total employment is directly or indirectly associated with construction sector.

The most common construction project mode in Pakistan is 'Design, Bid and Build' specifically in public sector. The said mode is a traditional way of doing projects which has proven inefficient in providing desired project performance in terms of cost, time and quality. In design-bid-build the owner contracts separately with the designer and constructor under a single contract. Usually a design company is hired to make a complete design document.

BOT framework of project involves public participation and it evolved from Public private partnership (PPP) regime. This may include Build operate transfer (BOT), Build operate Own (BOO), Design finance Build operate transfer (DFBOT) and other modes. It mainly involves a third-party financing and such project can be executed with minimal financial input from

government agencies (Noor, 2012). It is useful in way that third party financing is involved during construction phase in form of debt which paid off during operation and maintenance phase of the project. Debt servicing is done through the revenue generated by the project itself during operation period in the form of toll or other sources. This is one of the most popular mode of project and widely used all across the world.

BOT mode of projects evolved in Pakistan in last decade and many large-scale project have successfully completed their construction phase. Few examples of such project are Lahore Islamabad Motorway (350 Km), Karachi Hyderabad Motorway (170 Km), Karachi Thatta Dual Carriageway (49 Km), etc. (Jamal, 2017). All the three above mentioned project have completed their construction phase and entered into their operation phase. So far BOT project is only limited to very few large-scale projects which are being executed by one of the largest construction company of Pakistan. Since BOT is new to Pakistan, so contractors neither have technical and financial understanding of BOT Projects nor they have expertise to bid for it. So, they are reluctant in one way or other to bid for such project. BOT project involves third part financing so financial and technical viability both need to be reviewed. In addition to that lack in contractual understanding also causes reluctance in opting BOT projects. Previous research highlights few factors particular to BOT but doesn't provide a brief guideline to help understand PPP regime. As far as BOT is concerned, no comprehensive study is available which can access its sustainability and its applicability to small scale projects (Jamal, 2017).

Non-traditional project delivery modes like BOT etc. have proven to be more efficient in terms of timely completion and overall efficiency of the project. If we consider the overall cost then not much difference has been observed in traditional and non-traditional project delivery modes (Comparison of Project Delivery Methods Used in Building Construction Projects, 2011).

It has been emphasized time and again in the past that 'Design, Bid and Build' projects are no more efficient and we should shift our mindset to a leaner way of doing things.

2.5 History of BOT across the Globe

The Benguet Province Mini Hydro plant also known as Amphohaw Hydro power plant lies in energy category which was started in Philippines and was financially closed in 1992. It is located in Sablan, Benguet province. Also, it is currently up and running and has a capacity of 22MW of electrical power at peak. Overall estimated cost for the project was 22 MN USD. It is a Greenfield project furthermore it is based on Build, Own and Operate (BOO) basis, for which a sponsor company from the same country Philippines named as Aboitiz Equity Ventures.

Another successful project under power category is Bohol provincial electrical system which is implemented through public private partnership. It is put into action through the partnership led by provincial government and also the joint association led by another company named as Salcon International Inc. The private company under this consortium supplies the electrical energy needed and also reduces the system losses by installing the mini power plants, upgrading the protection system and new installation of safer distribution system in province. As done by the private partner, fresh metering systems and maintenance of existing distribution network is also a vital scope. Build, Own and Transfer basis (BOT) carried out this type of implementing project and taking everything into account the estimated cost for this project was sorted out to be 5 MN USD.

An ACR card which is issued through Bureau of immigration, it is basically a microchip-based identification card with the size of a credit card. Its basic purpose is to register all those people who stayed in Philippines without getting notified for more than 59 days. To be updated electronically it has the integrated advanced chip bases technology which also allows keeping biometric data. This project was performed through Build, Own and Transfer basis for which a private company J. Serrano Trading Corporation based in Philippines which costs to 2.8 MN USD.

Water supplied 24/7 within the service area is committed by the Bohol Water Utility, Inc and also wants to expand municipal services to other nearby locations through water supply arrangement.

This work was taken forward by provincial government of Bohol and through public bidding the private company consortium led by Salcon International Inc won the bidding process in Tanday, Corella in 1998. In this joint venture rehabilitating, operating and maintaining the provincial water supply system is included. The estimated cost of this project is up to 14.4 MN USD and is carried out through Build, Own and Transfer (BOT).

Cogon Public Market is a project which is located under property development category. This project was carried out using Build, Own and Transfer (BOT) terms with private firm named as UKC builders, Inc. This project was completed under cost of 4 MN USD. Build, Own and Transfer (BOT) basis were used for Carmen Public Market which is another remarkable addition to property development projects. This project was also carried out by the same private firm named UKC builders, Inc under the cost of 2.36 MN USD.

Redevelopment of the City Slaughterhouse Project of the Cagayan de Oro City Government is one of the PPP projects being carried out by government in partnership with Mega Integrated Agro-Livestock Farm Corporation. 2.45 hectares modern Abattoir Complex containing a slaughterhouse for small and large animals was constructed. This includes facilities i.e. water treatment, livestock auction market, deep well water source, meat delivery vans, etc. This project has a cooperation period of 25 years and completed under Build, Own and Transfer basis under cost of 3 MN USD.

The construction of a multi-story building is included in this project which provides an integrated private wet market and supermarket. The Local Government of Quezon City carried out this project. Total cost of this project came out to be Php 37.20 MN. This project was done under Build-Operate-and-Transfer (BOT) terms and is currently operational.

The Public-Private Infrastructure Advisory Facility (PPIAF) is a multi-donor trust fund that makes technical assistance available to governments in developing countries in support of the enabling environment conducive to private investment, including the necessary policies, laws, regulations, institutions, and government capacity. The National Kidney and Transplant Institute

in the form of its Hemodialysis Unit was featured in the PPIAF's publication entitled, "Emerging Partnerships: Top PPP's in Emerging Markets". In 2003 through a PPP lease arrangement between NKTi and Fresenius Medical Care AG the procurement process was successfully concluded and in total cost of 1 MN USD.

2.6 History of BOT in Pakistan

There were very few private constructors in Pakistan to supervise construction industry of the country after independence in 1947 till 1971. Most of the construction was done by Provincial and Central works departments through contractors, even housing for the public sector was done by them. Entrepreneurs were also emerging at that time but they also completed BOT projects with the support of unqualified but skilled labor (Farooqui, Ahmed and Lodi, 2018).

Afterwards, different associations were established to revolutionize the infrastructure in the country but they dealt with several issues with respect to dealing with authorities due to new regulations for approval of building plans and designs, their sale prices, grant to house building loans, etc. (Farooqui, Ahmed and Lodi, 2018).

The Indus Basin Replacement Works, Warsak Dams were one of the few major construction projects from 1975s which were done by foreign contractors. A change in policies later on took place to give more heavy projects to the local contractors so that they can build their confidence, gain more field experience and help their industry prosper. As a result, different construction contracts emerged which made possible for contractors and owners to interact with one another and gain mutual benefit.

A helping hand in managing construction projects and getting a grip on different types of contracts was given by the Supervisors from foreign countries. In the earlier phases of construction industry an example of construction projects is Port Qasim where the local concessionaires and owners worked together in the best interest of the project.

2.7 Ongoing small and large-scale BOT projects in Pakistan

BOT projects in Pakistan mostly focus on big infrastructure projects related to highways, dams, road construction etc. A big scale BOT project is Karachi Hyderabad motorway which was sponsored by NHA and FWO was the concession company. This project was timely completed and made operational for public in 2 years. This motorway will be operated by the concession company for a period of 25 years and then will be transferred it to NHA.

A similar project is Lahore ring road project which was sponsored by LRRRA. It was completed in Dec 2017 and made operational for public (Husain, 2018). After completion of construction phase, all the maintenance and repair are done by the concession company, when the project enters operational phase.

Swat Motorway which starts from Islamabad and ends at Chakdara is an ongoing BOT projects in Pakistan. This motorway is 81 km long and has 6 interchanges. It is sponsored by Pakhtunkhwa Highway Authority (PKHA) and the concession company is FWO. According to expectations this motorway will be fully functional by May 2019 (Husain, 2018).

In Pakistan different concession companies have numerous more large-scale BOT projects going on which would later be transferred to the government. Progress on large BOT projects is increasing in our country. People in the construction industries are becoming aware of large BOT projects and they are ready to adopt this Cash Flow Calculations for big infrastructure project, as they see them succeed.

2.8 Factors affecting sustainability of BOT Projects in Pak

As already mentioned, the construction industry is the second largest sector supporting our economy after the agricultural sector and is a beacon of hope for Pakistan's weak economy. But there are a large number of factors that can be seen as a hurdle for progress in this industry.

The problem of corruption is the most crucial problem our country has been facing for more than a decade. Be it in politics, be it in the civil forces, be it in construction industry. The situation of our country is what it is today because of being sincere to only selfish means and failing to notice the overall gain. This has also been the case where the senior chairpersons and politicians in the construction industry have only cared for their favorable gains and compromising on important

sectors like railways, airways, etc. (Comparison of Project Delivery Methods Used in Building Construction Projects, 2011).

The construction at large has been in danger also sustainability of BOT projects in our country. The traditional way of thinking is another factor affecting the sustainability of BOT projects in Pakistan. People are more comfortable with old way of doing things which has been a general practice in our country. People who have been in this industry all their lives, have old school of thought such as documenting everything when we have computers, carrying cash in our pockets when we have plastic money, using tools and manual machinery when we have automated equipment, etc. They believe and follow old practices and are unwilling to open their mind to the new and well-organized ways of doing things. Construction contracts have the same case. Still mostly design-bid-build is used in Pakistan as already mentioned. Few large projects typically motorways, dams, airports, power plants, ports, telecommunication, warehouses, housing, markets, railways, transport systems, water supply and drainage, etc. are usually based on BOT by organizations like Frontier Works Organization (FWO). But traditionally design-bid-build is followed (Husain, 2018).

The long-term contractual obligation with BOT is the reason for preference on old methods and reluctance to BOT. The concessionaire and owner bond with each other for a very long period because usually a concession agreement for the concession period lasts for 20-25 years, sometimes more. This is another factor that affects sustainability of BOT projects in Pakistan as they have to do all the planning on long term basis, which is difficult commitment to make with different entities.

The involvement of multiparty in the agreement is another reason affecting the sustainability of BOT projects in Pakistan. Numerous more parties, aside from the concessionaire and the owner can be involved depending upon the requirements of the project and the owners. For example, concessionaire can do further hiring for the project. They may hire designers, sub-contractors for construction, quality assurance, legal entities, equipment / machinery procurement, insurance, etc. Micromanagement becomes very complex for the owners as all these parties also enter the agreement for the concession period. (Husain, 2018).

Our private sector is not developed enough to take mega infrastructure projects on their own making it difficult for sustainability of BOT projects. Hence lenders, owners, operators,

suppliers, consultants and sponsors are involved in the process with their specific functions. Financial risk is also incurred due to this reason.

2.9 Important Definitions for Understanding BOT Mode

The important definitions which will help in understanding BOT mode are as mentioned below:

Project IRR (Internal Rate of Return)

The internal rate of return (IRR) is a measure used in capital budgeting to estimate the profitability/ returns per year of potential investments (Equity + Debt).

Equity IRR (Internal Rate of Return)

Equity IRR means the profitability/ returns per year on the equity investment (excluding returns on debt).

NPV (Net Present Value)

Net present value (NPV) is defined as the sum of the present values of the individual cash flows (both incoming and outgoing) of a series of cash flows. In other words, it is the current worth of a future sum of money or stream of cash flows at a certain discount rate.

Payback period

Payback period in capital budgeting refers to the period of time required to recoup the funds expended in an investment, or to reach the break-even point.

Debt Equity Ratio

The debt-to-equity ratio is a financial ratio indicating the relative proportion of shareholders' equity and debt used to finance a company's assets.

Project Subsidy

Subsidy is money or grants given by the government to support a project, business or industry.

2.10 Critical Success Factors (CSF) through literature review

The literature available on different internet sources was collected. The road projects on BOT basis were further analyzed and following critical success factors were identified:

1. Stable Political & Economic Situation	8. Financial Market Availability	15. Sound Environment Impact	22. Experience with BOT Project by Public Sector
2. Project Identification	9. Favorable Legislation, Regulation & Legal Framework	16. Public Safety	23. Shared Authority & Responsibility Between Public and Private Sectors
3. Project Management	10. Concession period	17. Social Support	24. Acceptable Tolls/Tariff Levels
4. Relationship with Govt	11. Multidisciplinary & Multinational Team	18. Short Construction Period	25. Select suitable Project Agencies
5. Reasonable Risk Allocation	12. Quality Control & Supervision	19. Selection Procedure of Concessionaire	26. Standardization of EPC Contract
6. Govt Support	13. Training local Staff	20. Sufficient Long-Term Demand	27. Good Governance
7. Attractive financial Package	14. Technology Transfer	21. Sufficient net cash Inflow	28. Project Technical Feasibility

Chapter - 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter gives an insight into the multi-stage applied research undertaken for the study and development of guideline Cash Flow Calculations through identification of critical success factors (CSF) for the evaluation of financial burden vs financial viability of road projects on BOT basis. It will describe the utilization of literature and other research tools to meet the research objectives.

3.2 Research Design

Research design refers to the general plan of addressing the research questions (Saunders, et al., 2009). It involves deciding among research strategies for data collection and analysis, validation and output of results. It is a roadmap which guides the researchers throughout, for completion of the research program.

Before proceeding to research design for this study, the research objectives are reproduced here;

- 1.** To identify CSF affecting financial viability & financial burden of road projects on BOT basis.
- 2.** To evaluate the financial burden v/s financial viability of road projects on BOT basis through calculations of different projects cash flows
- 3.** Propose cash flow calculations which can be used in future to find out the financial viability vs financial burden of BOT Project

The research initiates through a literature review process for analyzing the status of research done on BOT regime in construction industry. Literature review presents the description of different success factors effecting the viability of BOT projects. Afterwards, the research objectives are targeted using the appropriate techniques, where the selection of technique is determined by the relationship among the research objective, type of data and analysis required on the data.

3.3 Data Source

Research is mostly based on two types of data sources, primary data source or secondary. Primary data is collected directly from the original source. It is obtained first hand from the organization or through its legal documents or eye witness source, accounts etc. Mostly primary data is linked with permission to view and publish anywhere. Permission need to be sought before quoting that data anywhere. It can either be obtained through its personal request or other available information sources.

While the secondary data is the one obtained from any source other than the original one. For example, it may be any organization, web link, Journal Paper or annul survey reports. Such type of data is already published on an open source and accessible to everybody. So, publishing such data doesn't involve any sort of permission from source agency for publication purposes.

Both primary and secondary data sources are employed to carry out analysis and deduce results in the subject research. Literature review is passed via information and information associated to the research topic available on public sources. Journal papers, seminar and conference articles, Web Data and reference books are secondary sources of the research. The study began with a detailed literature review on the BOT projects conducted all across the world and also in Pakistan. While data for certain projects under BOT regime is straight attained from organizations leading such projects. In addition to that primary data source is obtained through review reports from experts based on BOT framework and Cash Flow Calculations of our concerned small scale BOT Projects.

3.4 Research Cash Flow Calculations

The research methodology adopted for implementation of research objectives can be separated in to two phases i.e. identification of CSF through literature and proposing a guideline Cash Flow Calculations for the evaluation of financial burden vs financial viability of road projects on BOT basis.

Previous researches on BOT projects which are being executed all across the globe are consulted in order to identify critical success factors. To execute construction projects BOT regime is being followed all across the world both in developed and developing countries. It is particularly

obvious that such projects can be more benefiting for developing countries which lack funding at government level. In order to evaluate our Cash Flow Calculations based on these success factors all such road projects on BOT basis are reviewed and their success factors are identified.

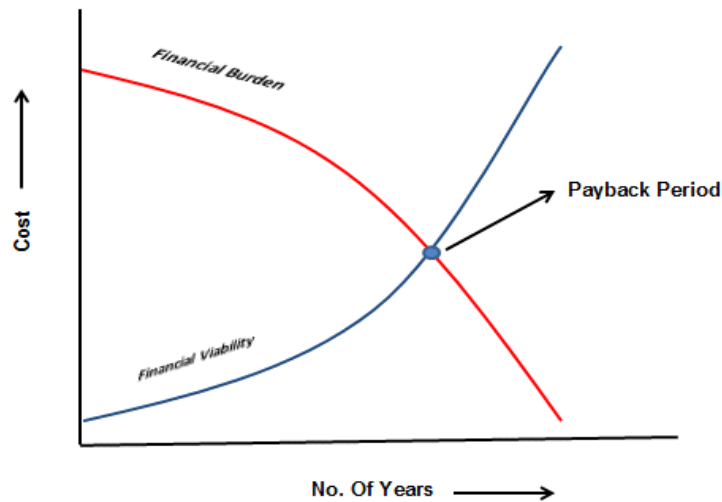
For the second phase, the proposed framework and Cash Flow Calculations for the road projects on BOT basis are formalized. Experts further review these Cash Flow Calculations and a review report is to be prepared based on the success factors identified through literature. These reports based on our Cash Flow Calculations are further analyzed and conclusion are made to access possibility and success of road projects on BOT basis in Pakistan.

The study is aimed to evaluate the financial viability of road projects on BOT basis in Pakistan. The major factors for the cash inflows and the cash outflows are as mentioned:

Sr. No	Cash Inflows	
1	Equity	By Concessionaire
		By Client
2	Debt (Via Project Financing)	
3	Viability Gap Fund (VGF)/ Client Equity	
4	Sub-ordinate Financing	
5	Tolling	During Construction
		Post Construction
6	Business Development	Advertisements
		Service Areas Rentals

Sr. No	Cash Outflows
1	Cost of Civil Works
2	Escalation
3	Contingencies
4	Design & Supervision Cost (Designer & QC)
5	Insurance Cost
6	SPVC Cost
7	Management Consultancy (IA,IE & Legal)
8	Financing Fee (Banks Fees)
9	Tax (Corporate Tax, Income Tax)
10	Inflation
11	Principal Debt Repayment
12	Interest (During & Post Construction)
13	Electronic Toll & Traffic Management Cost (ETTM)
14	Main Carriageway Routine Maintenance
15	Service Lane Routine Maintenance
16	Collection Losses
17	First Periodic Maintenance
18	Second Periodic Maintenance
19	Annual Cost Growth of Opex Cost
20	Periodic Cost Growth of Operation cost & Routine

The graph showing comparison between financial burden and financial viability is shown below. The point where two lines intersect (i.e. Curve of Financial burden and financial viability) is the pay back point. No. of years are plotted on X-axis and Cost is plotted on Y-axis.



In order to evaluate and access their viability above methodology is proposed. The above mentioned methodology is followed a research Cash Flow Calculations and it can be explained as below:

- For further review, literature available on different internet sources, webpages, journals and other sources is collected and projects related to our concern are shortlisted. These road projects on BOT basis are further examined in term of following to identify different success factors:
 - Net Present Value - NPV
 - Internal Rate of Return – IRR
 - Rate of Return on Equity
 - Interest rate optimization
 - Timely commencement and completion of construction projects
 - Expected Revenue generation during O&M period

4. Chapter - 4

RESULTS AND DISCUSSION

4.1. Introduction

Limited Government funding arrangements for infrastructure projects in developing country, hinders many projects which are essential for economic development of the country. BOT mode resolves the issue of funding arrangements for development of infrastructure projects by involving private parties. BOT Cash Flow Calculations is one of the most important privatization schemes used for construction of a nation's infrastructure. It improves efficiency and effectiveness of project implementation which results from the incentive based system created by the BOT Cash Flow Calculations. The BOT structure is especially attractive to host governments due to the ownership reversion feature. Nonetheless, there is no Cash Flow Calculations available which can be used for the evaluation of financial burden vs. financial viability of BOT road projects.

The objectives of this research, as outlined in the first chapter of this study, encompasses the determination of critical success factors (CSF) for BOT road projects. Moreover, the development of guideline Cash Flow Calculations management framework for evaluation of financial burden vs. financial viability of BOT road projects.

4.2. Research Methodology

The details of research methodology adopted for accomplishing the objectives aforementioned are provided in the previous chapter. Briefly stating, the following tools and techniques are used in this study:

Literature review was conducted to identify critical success factors (CSF) and then content analysis was performed on the critical success factors (CSF) acquired through literature review. Content analysis was performed to shortlist the most critical success factors (CSF). Afterwards, the questionnaire was developed using Google Forms and responses were collected from the BOT professionals using web-based and actual office visits. The questionnaire is provided with this study as Annexure-A. Shortlisted critical success factors (CSF) were then floated through questionnaire to get the feedback. RII technique was used for data collection.

The responses were evaluated using statistical tools including MS Excel and SPSS. The reliability and normality tests were performed using SPSS, and data representation is done in MS Excel. The results of which are presented and discussed in this chapter. Then development of Cash Flow Calculations was undertaken incorporating those critical success factors (CSF) and many other cash inflows and cash outflows factors to evaluate the financial burden v/s the financial viability of BOT project. After the Cash Flow Calculations was prepared, 5 x projects realistic data was incorporated in the Cash Flow Calculations to get the results of financial burden v/s financial viability of BOT projects. Then Cash Flow Calculations prepared with realistic data were shared with field experts like team members of GM PPP (NHA), Director finance FWO and Independent Auditor Earnest and Young (E&Y). These expert team members raised some observations and recommended few changes. Those changes were made and observations were resolved and incorporated in the Cash Flow Calculations. After incorporation of changes and resolving observations Cash Flow Calculations were again shared with experts and guideline Cash Flow Calculations was finalized.

4.2.1 Data Analysis

Through the questionnaire survey, a total of 116 valid responses were obtained with a suitable mix of different sub-sector experts and with diverse educational qualification, associated organizations and nature of experiences. Before proceeding with drawing inferences from the data, the responses were evaluated using statistical tools including the reliability and consistency tests through IBM SPSS Statistics, and thereafter, data demonstration was carried out using Microsoft Excel.

a. Reliability and Consistency Test - Cronbach's Coefficient Alpha Method

The interpretation of the Cronbach's Alpha value is: data is reliable when value is more than 0.7, data is highly consistent when value is greater than 0.9. The collected data had value of 0.912, i.e. data was reliable as well as highly consistent.

b. Relative Importance Index

The questionnaire was then analyzed using the technique Relative Importance Index (RII) to consider every respondents' feedback towards the inquiries asked in the survey. The technique, RII, analyses the responses to Likert Scale using following equation:

RII = $\sum w / A * N$, where

w = weights assigned in Likert Scale (for 5-point Likert Scale, w = {1, 2, 3, 4, 5}),

A = highest weight assigned in the scale (for 5-point Likert Scale, A = 5),

N = total number of respondents (i.e. 116 for this study), and

RII ranges between zero to 1.

4.3. Characteristics of Respondents to Questionnaire

The questionnaire was initially circulated on the web using professional networking site LinkedIn among client, concessionaire, consultant and other related BOT professionals. Later on, the office visits were made to reach out to the BOT professionals.

A total of 116 responses were obtained with a suitable mix of different sub-sector experts with various types of qualification, associated organizations and nature of experiences. The details of the respondents are as follows:

4.3.1. Academic Qualifications

Responses were made by construction professionals having different academic backgrounds. *Figure below* explains the respondents' highest academic qualification: BOT professionals having professional engineering degree were 53.45%, with further masters were 37.07%. Moreover, those having doctorate level of engineering education were 6.90%. The BOT professionals at senior positions but with only Diploma of Civil Engineering were 2.59% of the total 116 respondents.

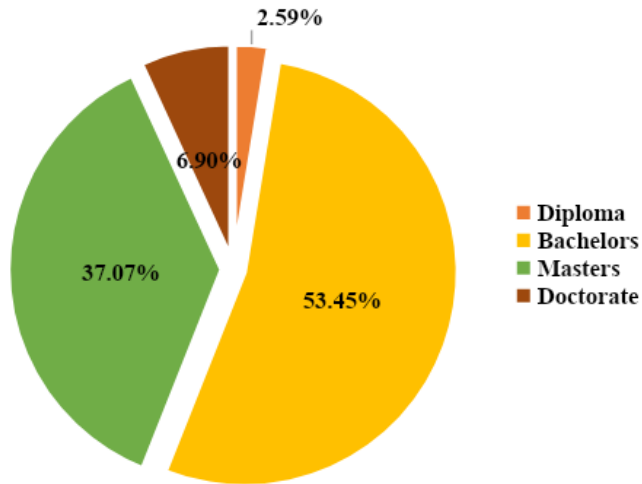


Figure: Academic Qualification of Respondents

4.3.2. Professional Experience

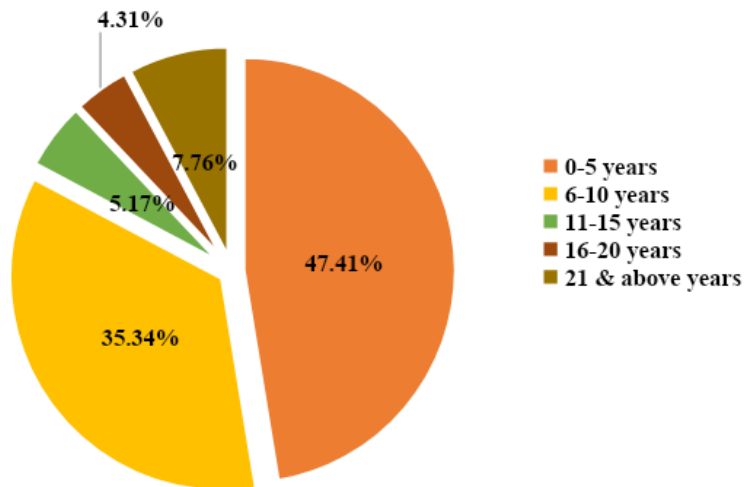


Figure: Professional Experience of Respondents

The respondents had varying years of professional experience. Fig. above demonstrates that 47.41% of respondents carried up to 5 years of experiences, while the next majority 35.34% had

between 6-10 years of experience. Moreover, 5.17% respondents had 11-15 years, 4.31% respondents had 16-20 years, and 7.76% respondents had more than 20 years of professional experience in the construction industry.

4.3.3. Organization Type

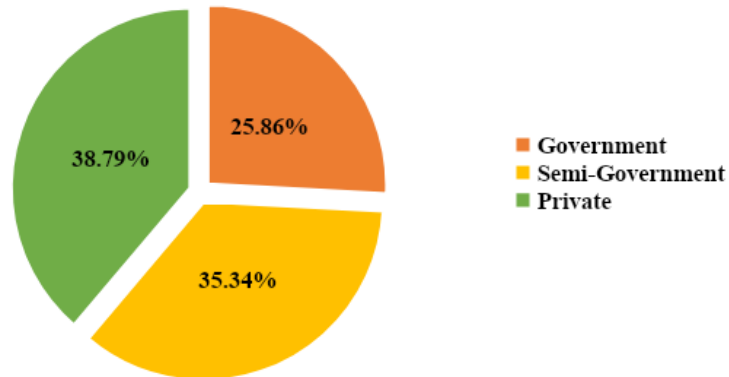


Figure: Organization Type of Respondents

Fig. above gives the classification of respondents based on their organization type. Out of total 116 construction industry professionals, 25.86% were from government organizations, with another 35.34% from the semi-government organizations. Respondents working in private organizations numbered 38.79% and made the majority of the total respondents.

4.3.4. Organization Role

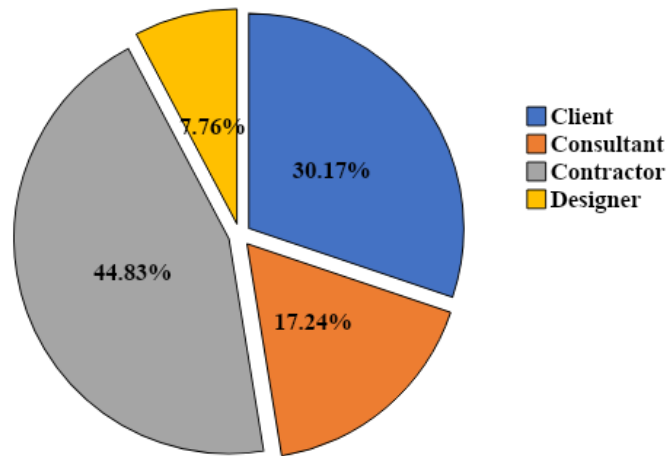


Figure: Organization Role of Respondents

Another classification considered for the 116 respondents was their organization's role in the construction industry. Fig above shows that 30.17% respondents belong to client organizations, 17.24% to consultant, and 44.83% to contractor organizations. Remaining respondents are designers 7.76%.

4.4. Top Five Critical Success Factors

The results from literature review and questionnaire were then used to calculate the normalized score of each critical success factor (CSF) using 60/40 Technique. The critical success factors (CSF) were then arranged on the basis of their normalized score from high to low i.e. the critical success factor (CSF) with the highest normal score was the top most critical success factor (CSF). The top five critical success factors (CSF) with their normalized score are mentioned below:

Sr. No	CSF	Score
1	Favorable Legislation, Regulation & Legal Framework	0.08
2	Favorable Investment Environment	0.07
3	Financial Market Availability	0.06
	Reasonable Risk Allocation	0.06
	Stable Political & Economic Situation	0.06
	Project Identification	0.06
	Relationship with Govt	0.06
4	Project Management	0.05
	Attractive financial Package	0.05
	Experience with BOT Project by Public Sector	0.05
	Shared Authority & Responsibility Between Public and Private Sectors	0.05
5	Govt Support	0.04
	Selection Procedure of Concessionaire	0.04

4.5. Quantitative Sub Factors of Critical Success Factors (CSF)

Critical Success Factors (CSF) were discussed with experts and following quantitative sub factors were identified through focused group discussion so that they can be used.

CSF	Sub Factors
•Favorable Legislation, Regulation & Legal Framework	•Management consultancy (IAIE & legal consultants)
•Financial Market Availability	•Enough traffic count/tolling •Business development opportunity
•Reasonable Risk Allocation	•Operating cost growth •ETTM cost growth •Routine maintenance cost growth •Periodic maintenance cost growth
•Stable Political & Economic Situation	•Escalation •Inflation
•Project Identification	•Tolling •Business development •VGF •Debt via project financing
•Govt Support	•Viability gap fund (VGP) / client equity •Subordinate financing
•Favorable Investment Environment	•Tolling •Business development •Concession period
•Project Management	•Cost of civil works •Contingencies •Design & supervision cost •Construction period
•Attractive financial Package	•Project IRR •Equity IRR
•Experience with BOT Project by Public Sector	•Construction cost •Operation cost •Maintenance cost •Collection losses
•Selection Procedure of Concessionaire	•Low project cost in bid
•Shared Authority & Responsibility Between Public and Private Sectors	•Concrete concession agreement/Legal framework

4.6. Case Studies

5 x projects real data through concession agreements (CA) was acquired and incorporated in guideline Cash Flow Calculations. The findings of each Cash Flow Calculations is mentioned below:

Case Study (Project-1)

- The Project Internal Rate of Return (IRR%) through Cash Flow Calculations comes out to be 13.43%.
- The Project Equity Internal Rate of Return (IRR%) through Cash Flow Calculations comes out to be 15.06%.
- The value of Equity NPV in Million Pkr is 2,288.
- The Pay Back Periods of the project is 11.31 years.

Results	
Project IRR (%)	13.43%
Equity IRR (%)	15.06%
Equity NPV (Mn Pkr)	2,288
Pay Back Period (Years)	11.31

Case Study (Project-2)

- The Project Internal Rate of Return (IRR%) through Cash Flow Calculations comes out to be 12.96%.
- The Project Equity Internal Rate of Return (IRR%) through Cash Flow Calculations comes out to be 15.07%.
- The value of Equity NPV in Million Pkr is 8,768.
- The Pay Back Periods of the project is 11.2 years.

Results	
Project IRR (%)	12.96%
Equity IRR (%)	15.07%
Equity NPV (Mn Pkr)	8,768
Pay Back Period (Years)	11.2

Case Study (Project-3)

- The Project Internal Rate of Return (IRR%) through Cash Flow Calculations comes out to be 14.72%.
- The Project Equity Internal Rate of Return (IRR%) through Cash Flow Calculations comes out to be 16.57%.
- The value of Equity NPV in Million Pkr is 13,768.
- The Pay Back Periods of the project is 8.5 years.

Results	
Project IRR (%)	14.72%
Equity IRR (%)	16.57%
Equity NPV (Mn Pkr)	13,768
Pay Back Period (Years)	8.5

Case Study (Project-4)

- The Project Internal Rate of Return (IRR%) through Cash Flow Calculations comes out to be 11.57%.
- The Project Equity Internal Rate of Return (IRR%) through Cash Flow Calculations comes out to be 21.43%.
- The value of Equity NPV in Million Pkr is 13,153.
- The Pay Back Periods of the project is 7.5 years.

Results	
Project IRR (%)	11.57%
Equity IRR (%)	21.43%
Equity NPV (Mn Pkr)	13,153
Pay Back Period (Years)	7.5

Case Study (Project-5)

- The Project Internal Rate of Return (IRR%) through Cash Flow Calculations comes out to be 12.94%.
- The Project Equity Internal Rate of Return (IRR%) through Cash Flow Calculations comes out to be 13.12%.
- The value of Equity NPV in Million Pkr is 8,768.
- The Pay Back Periods of the project is 10.3 years.

Results	
Project IRR (%)	12.94%
Equity IRR (%)	13.12%
Equity NPV (Mn Pkr)	8,768
Pay Back Period (Years)	10.3

Chapter - 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusions

Infrastructure has the fundamental significance in economic development of the country and for sustainable and accelerating economic progress, there is need of improved and well established infrastructure. To meet the gap between this demand and supply of improved and well established infrastructure, Government can involve private sector for arrangement of funds for infrastructure development.

BOT Cash Flow Calculations is one of the most important privatization schemes used for construction of a Nation's infrastructure. BOT improves efficiency and effectiveness of project implementation and efficiency and effectiveness results from the incentive system created by the BOT Cash Flow Calculations. The BOT structure is especially attractive to host governments due to the ownership reversion feature and it is becoming commonplace for nations that intend to expand their infrastructure.

Limited Government funding arrangements for infrastructure projects in developing country, hinders many projects which are essential for economic development of the country. Alternative funding arrangements needs to be explored which can initiate such projects. BOT mode resolves the issue of funding arrangements for development of infrastructure projects by involving private parties. However, contractors lack knowledge & understanding about Cash Flow Calculations of BOT projects because of unavailability of Cash Flow Calculations. As a result, there are only limited contractors on BOT projects.

The critical success factors (CSF) affecting financial viability of road projects on BOT basis through literature review and questionnaire survey are as under:

CSF	Sub Factors
•Favorable Legislation, Regulation & Legal Framework	•Management consultancy (IAIE & legal consultants)
•Financial Market Availability	•Enough traffic count/tolling
•Reasonable Risk Allocation	•Business development opportunity
	•Operating cost growth
	•ETTM cost growth
	•Routine maintenance cost growth
•Stable Political & Economic Situation	•Periodic maintenance cost growth
	•Escalation
•Project Identification	•Inflation
	•Tolling
	•Business development
	•VGF
•Govt Support	•Debt via project financing
	•Viability gap fund (VGP) / client equity
•Favorable Investment Environment	•Subordinate financing
	•Tolling
	•Business development
•Project Management	•Concession period
	•Cost of civil works
	•Contingencies
	•Design & supervision cost
•Attractive financial Package	•Construction period
	•Project IRR
•Experience with BOT Project by Public Sector	•Equity IRR
	•Construction cost
	•Operation cost
	•Maintenance cost
•Selection Procedure of Concessionaire	•Collection losses
•Shared Authority & Responsibility Between Public and Private Sectors	•Low project cost in bid
	•Concrete concession agreement/Legal framework

To evaluate the financial burden vs. the financial viability of road projects on BOT basis a Cash Flow Calculations was prepared and then validated that Cash Flow Calculations through experts by incorporating 5 x projects real data in that Cash Flow Calculations and preparing 5 different realistic Cash Flow Calculations.

The expert team members of BOT professionals raised some observations and recommended few changes. Those changes were made and observations were resolved and incorporated in the Cash Flow Calculations. After incorporation of changes and resolving observations, Cash Flow Calculations were again shared with experts and guideline Cash Flow Calculations was finalized.

The guideline Cash Flow Calculations will provide the following information to the investor/ concessionaire:

- Project IRR (%)
- Equity IRR (%)
- Equity NPV (Million Pkr) of the project
- Payback period (years) of the project
- Detail visibility of cash inflows
- Detail visibility of cash outflows
- Link cash inflows and outflows with exact period of time in project life cycle
- Clear visibility of forecasted profit from the project
- Clear visibility of forecasted expenditure

5.2 Recommendations

This study has provided the critical success factors (CSF) which are to be kept in mind while deciding either to bid for the project or not. It has also provided a guideline Cash Flow Calculations which can be used to find out whether this project is viable on BOT basis or not. It also provides that if project is not viable, then how much amount of Viability Gap Fund (VGF) will be required from the Government (client) to make the project viable on BOT basis.

Future studies can focus on the methodology for calculating the input value of Growth Factors used in the Cash Flow Calculations. The Cash Flow Calculations used 6 factors of cash inflow and 20 factors for cash outflow for calculating Project IRR (%), Equity IRR (%) Equity NPV and Pay Back Period of the project. Additional factors can be incorporated to cater for more complexity and diversity in the nature of construction projects and BOT mode. Also, this Cash Flow Calculations can be developed as a standalone feature in some software.

References

1. Kumaraswamy, M. M., & Zhang, X. Q. (2001). Governmental role in BOT-led infrastructure development. *International Journal of Project Management*, 19(4), 195-205.
2. Toan, N. T., & Ozawa, K. (2008, January). Stakeholders' perception on risks of BOT infrastructure projects in Vietnam. In *CIB W107 Construction in Developing Countries International Symposium* (pp. 16-18).
3. Zou, W., Kumaraswamy, M., Chung, J., & Wong, J. (2014). Identifying the critical success factors for relationship management in PPP projects. *International Journal of Project Management*, 32(2), 265-274.
4. Lu, Y. C., Wu, S., Chen, D. H., & Lin, Y. Y. (2000). BOT projects in Taiwan: Financial Model risk, term structure of net cash flows, and project at risk analysis. *The Journal of Structured Finance*, 5(4), 53-63.
5. Askar, M. M., & Gab-Allah, A. A. (2002). Problems facing parties involved in build, operate, and transport projects in Egypt. *Journal of Management in Engineering*, 18(4), 173-178.
6. Gupta, A., Chandra Gupta, M., & Agrawal, R. (2013). Identification and ranking of critical success factors for BOT projects in India. *Management Research Review*, 36(11), 1040-1060.
7. Li, B., Akintoye, A., Edwards, P. J., & Hardcastle, C. (2005). Critical success factors for PPP/PFI projects in the UK construction industry. *Construction management and economics*, 23(5), 459-471.
8. Dumanska, I. (2018). Public-private partnership in financing innovative process of agrarian sector Ukraine. *European Cooperation*, 8(39), 7-14.
9. Rajabi, M. (2017). *New decision support systems for Public Private Partnership projects* (Doctoral dissertation, University of Edinburgh).
10. Saunders, M. L., & Lewis, P. (2009). P. & thornhill, a.(2009). *Research methods for business students*, 4.

11. Gupta, A., Chandra Gupta, M., & Agrawal, R. (2013). Identification and ranking of critical success factors for BOT projects in India. *Management Research Review*, 36(11), 1040-1060.
12. Qiao, L., Wang, S. Q., Tiong, R. L., & Chan, T. S. (2001). Framework for critical success factors of BOT projects in China. *The Journal of Structured Finance*, 7(1), 53-61.
13. Hsueh, C. M., & Chang, L. M. (2017). Critical success factors for PPP infrastructure: perspective from Taiwan. *Journal of the Chinese Institute of Engineers*, 40(5), 370-377.
14. Al-Saadi, R., & Abdou, A. (2016). Factors critical for the success of public-private partnerships in UAE infrastructure projects: experts' perception. *International Journal of Construction Management*, 16(3), 234-248.
15. Li, B., Akintoye, A., Edwards, P. J., & Hardcastle, C. (2005). Critical success factors for PPP/PFI projects in the UK construction industry. *Construction management and economics*, 23(5), 459-471.
16. Olusola Babatunde, S., Opawole, A., & Emmanuel Akinsiku, O. (2012). Critical success factors in public-private partnership (PPP) on infrastructure delivery in Nigeria. *Journal of facilities management*, 10(3), 212-225.
17. Ismail, S. (2013). Critical success factors of public private partnership (PPP) implementation in Malaysia. *Asia-Pacific Journal of Business Administration*, 5(1), 6-19.
18. Qiao, L., Wang, S. Q., Tiong, R. L., & Chan, T. S. (2001). Framework for critical success factors of BOT projects in China. *The Journal of Structured Finance*, 7(1), 53-61.
19. Tiong, R. L., Yeo, K. T., & McCarthy, S. C. (1992). Critical success factors in winning BOT contracts. *Journal of construction engineering and management*, 118(2), 217-228.
20. Zhao, Z. Y., Zuo, J., Zillante, G., & Wang, X. W. (2010). Critical success factors for BOT electric power projects in China: Thermal power versus wind power. *Renewable Energy*, 35(6), 1283-1291.
21. Zhang, X. (2005). Critical success factors for public-private partnerships in infrastructure development. *Journal of construction engineering and management*, 131(1), 3-14.
22. Chan, A. P., Lam, P. T., Chan, D. W., Cheung, E., & Ke, Y. (2010). Critical success

factors for PPPs in infrastructure developments: Chinese perspective. *Journal of Construction Engineering and Management*, 136(5), 484-494.

23. Ismail, S. (2013). Critical success factors of public private partnership (PPP) implementation in Malaysia. *Asia-Pacific Journal of Business Administration*, 5(1), 6-19.
24. Jefferies, M., Gameson, R. O. D., & Rowlinson, S. (2002). Critical success factors of the BOOT procurement system: reflections from the Stadium Australia case study. *Engineering, Construction and Architectural Management*, 9(4), 352-361.
25. Osei-Kyei, R., & Chan, A. P. (2015). Review of studies on the Critical Success Factors for Public-Private Partnership (PPP) projects from 1990 to 2013. *International journal of project management*, 33(6), 1335-1346.
26. Cheung, E., Chan, A. P., Lam, P. T., Chan, D. W., & Ke, Y. (2012). A comparative study of critical success factors for public private partnerships (PPP) between Mainland China and the Hong Kong Special Administrative Region. *Facilities*, 30(13/14), 647-666.
27. Tiong, R. L. (1996). CSFs in competitive tendering and negotiation Cash Flow Calculations for BOT projects. *Journal of Construction Engineering and Management*, 122(3), 205-211.
28. Meng, X., Zhao, Q., & Shen, Q. (2011). Critical success factors for transfer-operate-transfer urban water supply projects in China. *Journal of Management in Engineering*, 27(4), 243-251.
29. Cheung, E., Chan, A. P., & Kajewski, S. (2012). Factors contributing to successful public private partnership projects: Comparing Hong Kong with Australia and the United Kingdom. *Journal of Facilities Management*, 10(1), 45-58.
30. Chen, W. T., & Chen, T. T. (2007). Critical success factors for construction partnering in Taiwan. *International journal of project management*, 25(5), 475-484.